Technical Report

NetApp DataMotion for vFiler with NetApp Data ONTAP 7.3

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June 2012 | TR-3814

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 with NetApp Data ONTAP® 7.3.

1.1 Scope

This document discusses the following topics:

- Overview of 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: MultiStore®, SnapMirror®, and Provisioning Manager. For information about DataMotion for vFiler with NetApp Data ONTAP 8.1, refer to TR-4072: NetApp DataMotion 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 Data ONTAP
- Overview of NetApp SnapMirror, MultiStore, and Provisioning Manager

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

2 Overview of NetApp DataMotion for vFiler

2.1 Business Challenge

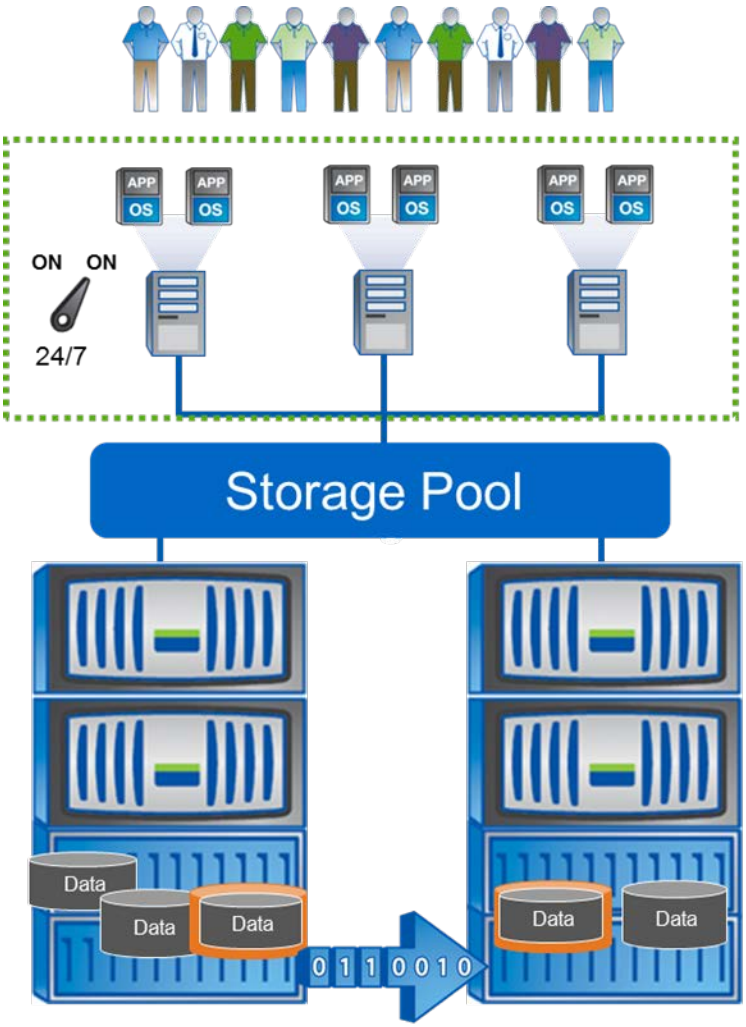
As customers and service providers begin to consolidate more and more applications and workloads onto shared storage infrastructures, it becomes increasingly difficult to coordinate outages for planned downtime for activities such as hardware refreshes. This is because many different users, groups, or customers use 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, MetroCluster™, and V-Series storage systems. It is the data mobility component of NetApp's cloud solutions.

DataMotion for vFiler is capable of moving 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 NetApp DataMotion for vFiler

NetApp 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 expansion

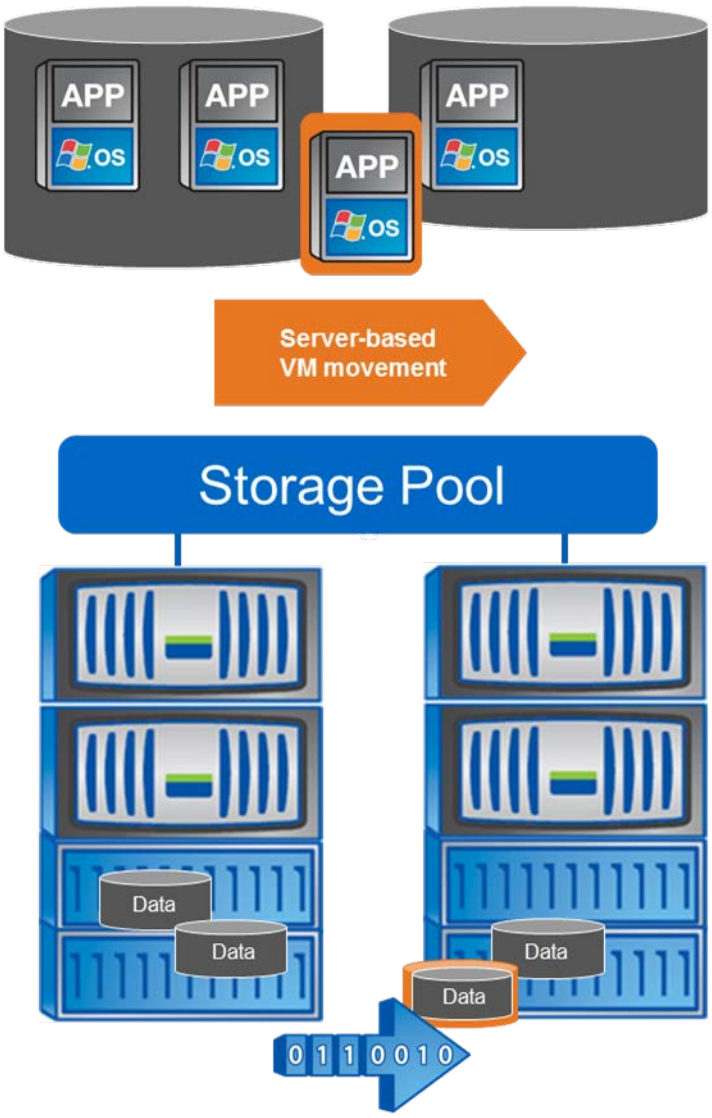
  - Scheduled maintenance outages
  - Technology refreshes
- Improved service-level agreement (SLA) flexibility
  - On-demand load balancing
  - Adjustable storage tiers
- Application transparency
  - No performance impact
  - Transaction integrity

3 Use Cases for DataMotion for vFiler

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 costs saving 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 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 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 provides 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 a different 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

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 might 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

NetApp 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 subsections 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 at the level of individual customers, departments, or application data sets that need to be isolated and secure.

Technology Refresh

For simplified lifecycle management, new storage technology changes can be accomplished without the need for planned downtime. Installation of new storage controllers and higher capacity disk drives or shelves can all be done nondisruptively.

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

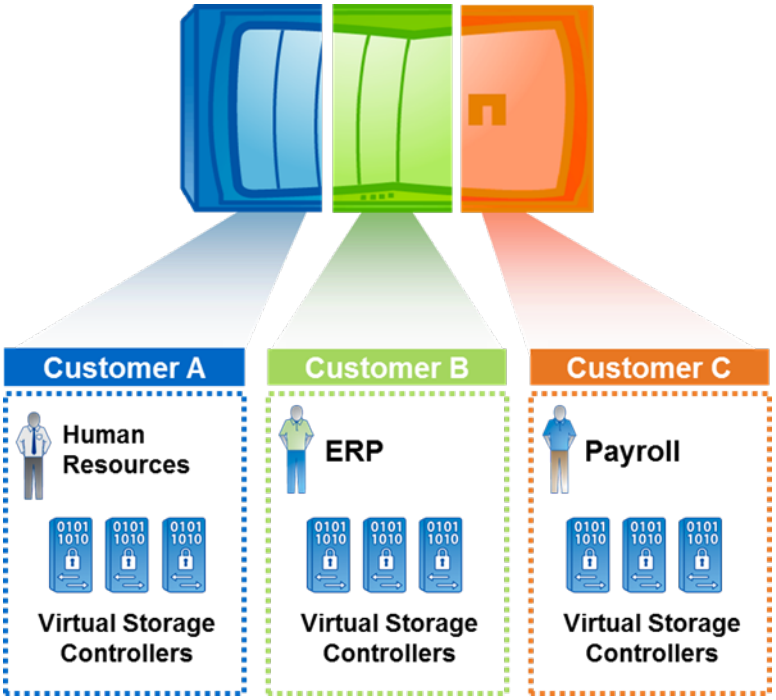
NetApp DataMotion for vFiler is a solution enabled by the combination of features from three NetApp products:

- **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.
- **Provisioning 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 semi-synchronous mode of transfer.

4.1 MultiStore

NetApp MultiStore software provides 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 NetApp Provisioning Manager

Provisioning Manager is a feature in NetApp Operations Manager that is activated with a license key. Provisioning Manager 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.

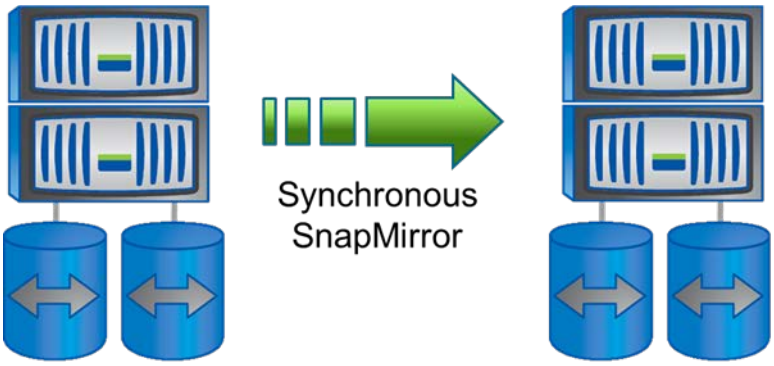
Provisioning Manager is responsible for the end-to-end workflow of DataMotion for vFiler processes.

For more information about NetApp Provisioning Manager, refer to the product documentation available 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 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

5.1 Software Requirements

DataMotion for vFiler software requirements include:

- Data ONTAP 7.3.3
  - Contains vFiler migration enhancements and APIs required by NetApp DataMotion for vFiler
- Supported protocols
  - NFS or iSCSI

    Note: There is no FCP or FCoE support at this time.

  - CIFS requires clients to reconnect after the migration
- Data ONTAP licenses
  - NFS/iSCSI
  - MultiStore
  - SnapMirror, SnapMirror Sync
- Provisioning Manager 4.0
  - Operations Manager 4.0

5.2 Hardware Requirements

The following storage systems are supported by DataMotion for vFiler:

- FAS 20X0A
- FAS 30X0A
- FAS 31X0A
- FAS 60X0A
- NetApp MetroCluster platforms
- NetApp V-Series systems: V6000 and V3100

6 DataMotion for vFiler Workflow and Process

NetApp Provisioning Manager provides the user interface for the NetApp DataMotion for vFiler process and also controls the entire workflow. For an end-to-end DataMotion for vFiler scenario, refer to NetApp DataMotion for vFiler Process.

Although Provisioning 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. Operations Manager and Provisioning Manager automatically detect any preexisting vFiler units in the environment or vFiler units that were created with other tools or processes.

The advantages of using Provisioning Manager for DataMotion for vFiler workflow control include:

- **Enforcement.** Provisioning Manager automatically enforces NetApp 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 might disrupt a manual online migration process, which can be avoided by using Provisioning Manager:
  - Too much load on the systems involved

- Configuration changes made between the SnapMirror initialize and the cutover (for example, new networks or volumes added)
- Other SnapMirror relationships performing transfers and using transfer queues

6.1 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.

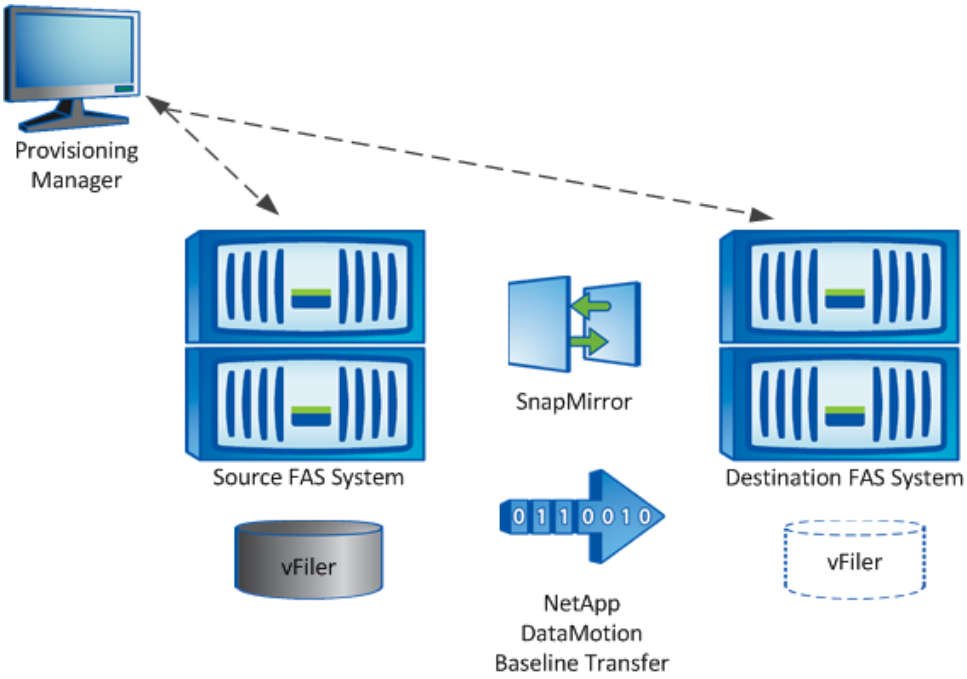
While starting the initial baseline transfer process from Provisioning Manager, there is an option to cut over automatically after data transfer. This option enables one-step migration of the vFiler unit where the NetApp storage system automatically performs the cutover operation after the initial baseline 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 baseline transfer phase:

- The DataMotion for vFiler process is initiated from the Provisioning Manager interface.
- Provisioning 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 baseline completes, migration status is set to Cutover Required.

Figure 5) Baseline transfer.



After the initial baseline transfer is complete and the migration status is changed to Started, cutover required, user has the option perform an update before proceeding to the next state, which is the cutover phase. The migration update feature should be used if there is a long gap between the time when initial baseline transfer was completed and the time when the cutover phase is initiated.

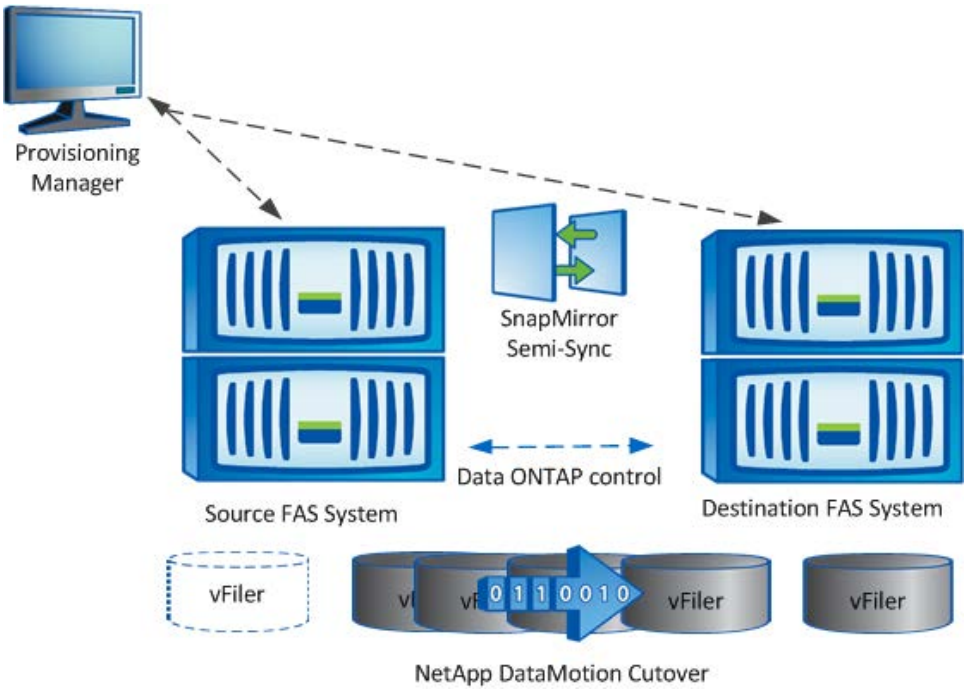
Cutover Phase

During the cutover phase, the following actions occur:

- Either the cutover is initiated manually from Provisioning Manager or it is started automatically (if the automatic cutover option is selected at the start of the DataMotion for vFiler process).
- Provisioning Manager then performs the following steps:
  - Verifies that systems meet DataMotion for vFiler requirements.
  - Checks the vFiler unit for configuration changes since migration start.
  - 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, 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. This fencing continues until cutover is complete.
- Cutover process is managed by Data ONTAP:
  - During the cutover, the migration must complete within the 120-second window. The two Data ONTAP 7.3.3 systems negotiate with each other to perform the migration. Provisioning 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 vFiler 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, Provisioning 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 might take some time to complete. Effectively, the cutover job in Provisioning Manager might 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 continues for the entire duration of the cutover process.

Clients might 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 the clients must reconnect.

Note: FCP clients are not supported by DataMotion for vFiler at this time.

Upon successful completion of NetApp DataMotion for vFiler cutover, Provisioning Manager automates the following postmigration tasks:

- Migrates any Protection Manager relationships.
- Modifies Provisioning Manager dataset memberships.
- Migrates Operations Manager history.
- Network Data Management Protocol (NDMP) backups from vFiler unit (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.

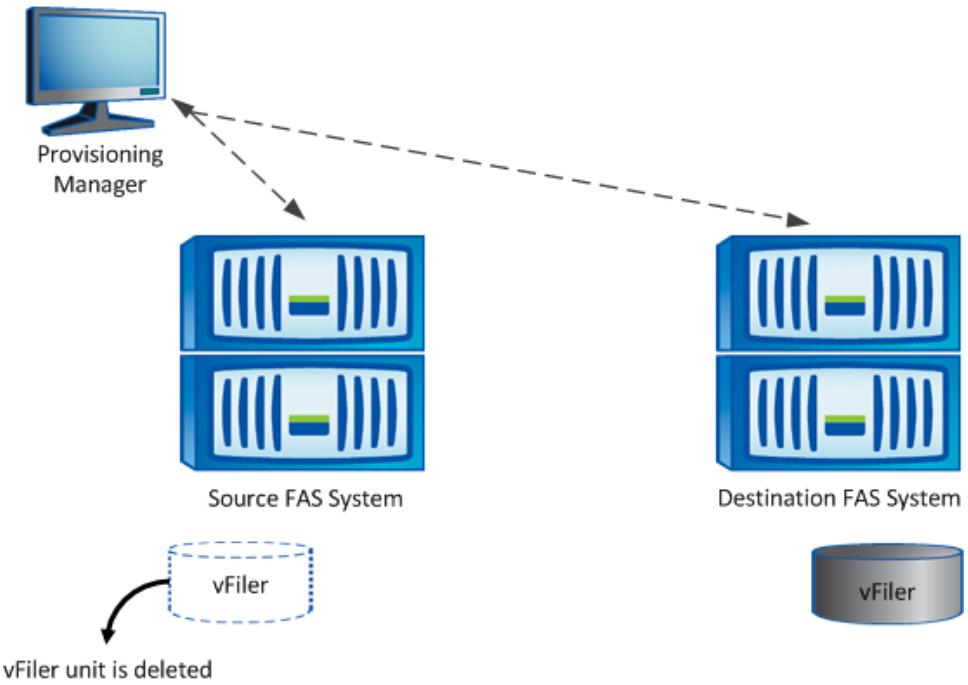
If the NetApp DataMotion for vFiler cutover fails:

- Data ONTAP makes sure that the original vFiler unit is brought back online.
- Provisioning Manager performs these postfailure steps:
  - SnapMirror relationships are maintained for cutover retry.
  - SnapMirror relationships are set back to asynchronous mode.
  - User can later retry the cutover from Provisioning Manager.
  - If migration is canceled after failure, Provisioning 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 Provisioning Manager. During this phase, Provisioning Manager automatically removes all source FlexVol volumes.

Figure 7) Cleanup phase.



Rollback Feature (Optional)

The rollback feature of DataMotion for vFiler provides 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.

Note: As mentioned in the Supported Configurations section, DataMotion for vFiler is supported only between similar system models (systems having the same size NVRAM) or from a low-end system model to a high-end model (a system with a smaller size NVRAM to a system with a larger size NVRAM). This rule applies to the rollback feature, too, which means that a vFiler unit can be rolled back after cutover only if the migration is between two similar system models (or systems with same size NVRAM). In other words, for a NetApp DataMotion for vFiler migration

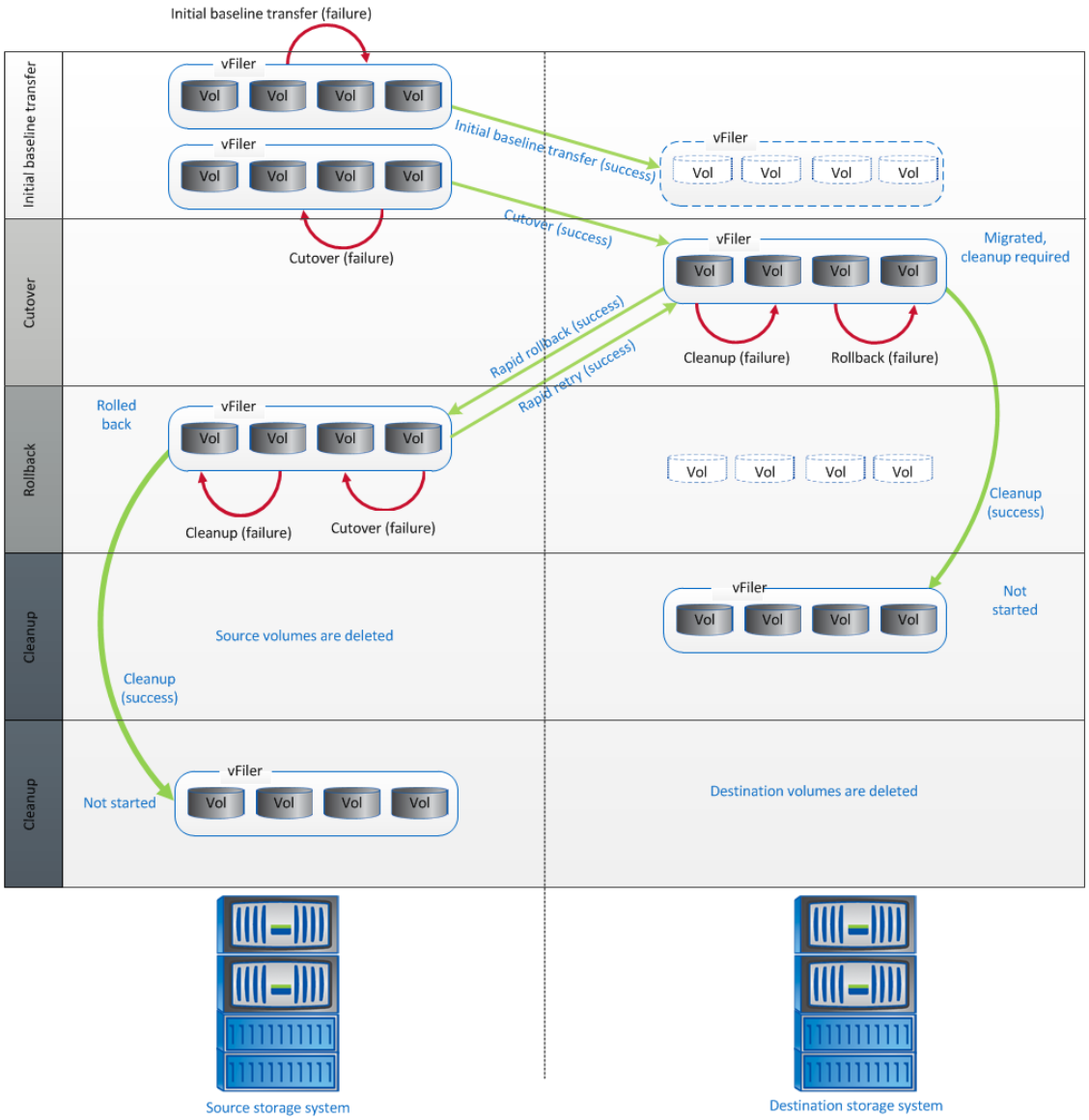
from a low-end system to a high-end system, the rollback feature is not available. DataMotion for vFiler is supported only between disks of the same RPM speed or from slower to faster disks. This rule also applies to the rollback feature, which means that a vFiler unit can be rolled back after cutover only if the migration is between disks of the same RPM speed.

Other Features of NetApp DataMotion for vFiler Workflow

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.

Figure 8) vFiler migration status.

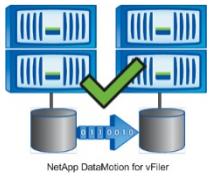
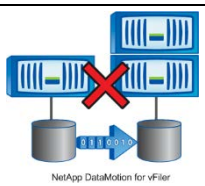
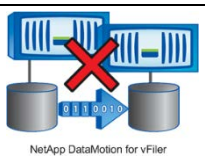


7 Supported Configurations

7.1 Supported Migration Scenarios

Note: NetApp 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 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 Provisioning 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 Provisioning Manager.
- DataMotion for vFiler migration from a single controller head to another single controller head (neither of which is part of the any high-availability pair) is not supported.

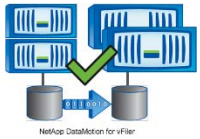
Note: Although Provisioning Manager does not prevent the execution of this scenario, NetApp does not recommend this migration scenario.

- 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 Provisioning Manager does not prevent the execution of these scenarios, NetApp does not recommend these migration scenarios.

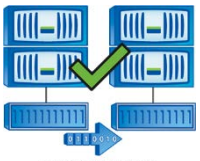
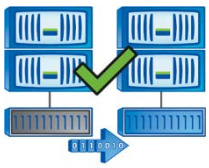
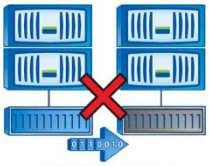
As shown in Table 3, DataMotion for vFiler is supported only between similar system models (that is, between systems having the same amount of NVRAM) or from a low-end system model to a high-end system model (that is, from a system with smaller NVRAM to a system with larger NVRAM).

Table 3) Supported migration scenarios: NVRAM considerations.

Migration Scenario	Description	Supported
	Between two high-availability pairs having the same NVRAM	Yes
	From a high-availability controller having smaller NVRAM to a high-availability controller having larger NVRAM	Yes
	From a high-availability controller having larger NVRAM to a high-availability controller having smaller NVRAM	No

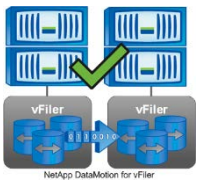
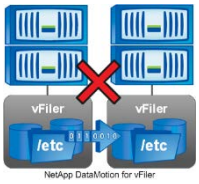
As shown in Table 4, DataMotion for vFiler is supported only between same speed drives or from slower to faster speed drives.

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	No

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 owning FlexVol volumes where an owned FlexVol volume might contain qtrees	Yes
	• vFiler units owning qtrees whose owning FlexVol volumes reside outside the vFiler unit • vFiler units owning traditional volumes	No

7.2 Supported vFiler Configurations

NetApp 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 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) FlexVol volumes per vFiler unit.

Platform	FlexVol Volumes per vFiler Unit
20X0A	4 FlexVol volumes
30X0A[1]	8 FlexVol volumes
31X0A	8 FlexVol volumes
60X0A	20 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.

[1] NetApp DataMotion for vFiler supports 4 FlexVol volumes for FAS3050 platform.

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 within FlexVol volumes owned by the vFiler unit are migrated as part of DataMotion for vFiler. However the CIFS sessions are terminated, and clients need to 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. Users should be instructed to end their sessions before the cutover.

Support for Deduplication and File or LUN FlexClone

Best Practice
DataMotion for vFiler should be performed in off-peak periods or periods of lower load for fastest migration times and to minimize impact. In this initial release, NetApp recommends that customers actively monitor the system performance during DataMotion for vFiler cutover operation for systems that have dedupe or FlexClone at the file or LUN level (on either the source or destination system). If excessive load is encountered during the migration, DataMotion for vFiler can be aborted by the storage administrator while maintaining access to data.

- 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 can happen only if DataMotion for vFiler is performed under high load (greater than 60%). Therefore, DataMotion for vFiler should not be attempted under such conditions.
- For details of the recommended monitoring during the DataMotion for vFiler cutover period for systems running dedupe or FlexClone at the files or LUN level, refer to the following NetApp Support site article: https://now.netapp.com/Knowledgebase/solutionarea.asp?id=kb56838.
- 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 will be full-size independent volumes at the destination. 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

DataMotion for vFiler supports LUN clones contained inside the volumes that are members of the vFiler unit being migrated.

7.4 Using NetApp 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
Operations Manager	Yes	Provisioning Manager feature in Operations Manager controls the work flow of DataMotion for vFiler.
SnapDrive® for UNIX® and Linux® v4.x	Yes	
SnapDrive for Microsoft® Windows® v6.1	Yes	
FlexVol volumes	Yes	
Fractional reservations	Yes	
FlexClone volume	Partial	For more information, refer to the Support for Volume FlexClone and LUN Clone section.
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® 3.0.3	Yes	Using NFS v3

NetApp Products	Supported for NetApp DataMotion for vFiler	Comments
SnapManager for SAP® 3.0.3	Yes	
SnapManager for Virtual Infrastructure (SMVI) 2.0	Yes	
SnapManager for Hyper-V™	Yes	
Deduplication	Partial	For more information, refer to the Support for Deduplication and File or LUN FlexClone section.
File or LUN FlexClone volumes	Partial	For more information, refer to the Support for Deduplication and File or LUN FlexClone section.
NDMP/dump	Yes	Operation is fenced during cutover phase.
PAM I	Yes	The working set that is cached in the PAM card of source storage system for the vFiler volumes is not transferred to the destination storage system during DataMotion for vFiler. So after DataMotion for vFiler completes, the working set needs to be populated again on the destination storage system (that is, PAM cache will need to be "warmed" back up), and throughput might degrade during this time.
PAM II	Yes	
Volume SnapMirror Sync	Partial	Only in default vFiler interfaces. Also operation is fenced during NetApp DataMotion for vFiler cutover.
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 5.0 for Microsoft Exchange	Yes	
SnapManager 5.0R1 Microsoft SQL Server®	Yes	
SnapManager 2.0 for Microsoft Office SharePoint® Server	Yes	
Thin provisioning	Yes	

8 IP Networking Requirements for NetApp DataMotion for vFiler

With the vFiler unit being 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 7.3.3 MultiStore Management Guide available on the NetApp Support site.

There are several ways to assign network addresses to vFiler units. A vFiler unit has interfaces assigned to it as part of the provisioning process. These interfaces can be any of the following: physical interfaces, IP aliases, VLANs, or virtual interfaces (VIFs) using either the default or a nondefault IP space. NetApp does not recommend using physical interfaces, because the system will quickly run out of available interfaces. Table 9 illustrates the different network configuration options for vFiler. NetApp recommends the vFiler network configuration options for DataMotion for vFiler shown in columns 4 and 8.

Table 9) vFiler network configuration options.

Options	1	2	3	4	5	6	7	8
Physical interface	X		X		X		X	
VIF		X		X		X		X
IP alias	X	X	X	X	X	X	X	X
VLAN			X	X			X	X
IP space	Default	Default	Default	Default	Nondefault	Nondefault	Nondefault	Nondefault

Using IP Aliases

When assigning IP addresses to the vFiler units, multiple IP aliases are created on a network interface of the physical FAS system, and each vFiler unit is assigned an IP alias. All clients of the vFiler unit must make the request on this IP alias. NetApp recommends this method for situations in which vFiler units do not require physical or logical network separation.

Using VLANs and VIFs

Both VLANs and VIFs can be assigned to a vFiler unit. Although you can assign an IP address directly to a VIF, this is not the method used in most MultiStore deployments. A VIF is created, and a VLAN is attached to that VIF. The VLAN is then assigned to an IP space, and a vFiler unit is created in that IP space. Refer to Network Configuration Best Practices for DataMotion for vFiler for more information.

Using the IPSpace Feature

- MultiStore introduces the concept of an IPSpace to support secure multi-tenancy.
- IPSpaces are distinct IP address spaces with private routing tables in which vFiler units reside. Each vFiler unit can reside in only one IPSpace; however, one IPSpace can have multiple vFiler units.
- Each network interface (physical, VIF, or VLAN interface) of the FAS system can belong to only one IPSpace; however, one IPSpace can have multiple network interfaces.
- IPSpaces are created when vFiler units need to have their own secure storage, administration, and routing leading to secure multi-tenancy.
- IP addresses defined for an IPSpace are accessible only within the network of that IPSpace.
- A distinct routing table is maintained for each IPSpace. No cross-IPSpace traffic is routed. Also, each IPSpace has a unique loopback interface assigned to it. The loopback traffic of each IPSpace is completely isolated from the other IPSpaces.
- All IPSpace names on a storage system must be unique. However the IPSpace names on active-active configuration partners must be the same.

There can be a maximum of 101 IPSpaces per storage system. One IPSpace, named Default IPSpace, is created by default when the MultiStore license is enabled, so the remaining 100 IPSpaces can be created by the user. However, considering the fact that one physical network interface can belong to only one IPSpace, dedicating at least one physical interface per IPSpace limits the number of IPSpaces that can be set up on a storage system to the number of physical interfaces available on the storage system. VLAN tagging can be used to overcome this limitation.

- Using VLAN tagging, more than one IPSpace can share the same physical network interface so that more IPSpaces can be set up.
- VLAN tagging with IPSpaces makes sure that network packets are forwarded to the appropriate IPSpace and securely delivered to the vFiler unit contained inside the IPSpace.

NetApp recommends using VLAN tagging with IPSpaces with DataMotion for vFiler.

For a step-by-step procedure, refer to Network Configuration Best Practices for DataMotion for vFiler. This section also covers network configuration best practices for network switches, storage systems, and vFiler units.

Note: VLAN tagging can be used without IPSpaces. Additional IPSpaces other than the default are not required, but NetApp recommends using them for any situation that requires a unique routing table.

8.1 Network Configuration Example

The following steps illustrate a high-level process of configuring the network of a vFiler unit in a nodefault IPSpace. For a detailed description of this process, refer to Network Configuration Best Practices for DataMotion for vFiler.

1. Configure VIF on the storage controller. In this example, a VIF named `smvif36` is used.
2. Create two VLANs (1 and 2) over the VIF.

```
vlan create smvif36 1 2
```

3. Enable the VLANs in the corresponding network switches.
4. Create the IPSpace where the vFiler unit will reside using the Data ONTAP system CLI.

```
ipspace create ipspace1
```

5. To assign an interface to the IPSpace, make sure that the interface does not have a configured IP address. In the following example, the VLAN 1 interface over the VIF that will be assigned to the IPSpace is cleared in case it already has a configured IP address.

```
ifconfig smvif36-1 0.0.0.0
```

6. Assign the interface to the IPSpace. In the following example, the single-mode VIF is assigned to the IPSpace created in step 1.

```
ipspace assign ipspace1 smvif36-1
```

7. Check the available IPSpaces and the corresponding interfaces.

```
ipspace list
```

8. Create the vFiler unit in the IPSpace created.

```
vfiler create vfiler_test -n -s ipspace1 -i 10.73.66.139 /vol/vfiler_test
```

9. Configure the VIF interface used with the IP address of the vFiler unit.

```
ifconfig smvif36-1 10.73.66.139 netmask 255.255.255.0
```

10. Add the default route to the vFiler unit.

```
vfiler run vfiler_test route add default 10.73.66.1 1
```

11. To create another vFiler unit in the same IPSpace, follow the same procedure as shown in step 5.

```
vfiler create vfiler_test_1 -n -s ipspace1 -i 10.73.66.173 /vol/vfiler_test_1
```

12. Add the IP address of the new vFiler unit as an alias to the VIF.

```
ifconfig smvif36-1 alias 10.73.66.173 netmask 255.255.255.0
```

13. Add the default route to the second vFiler unit.

```
vfiler run vfiler_test_1 route add default 10.73.66.1 1
```

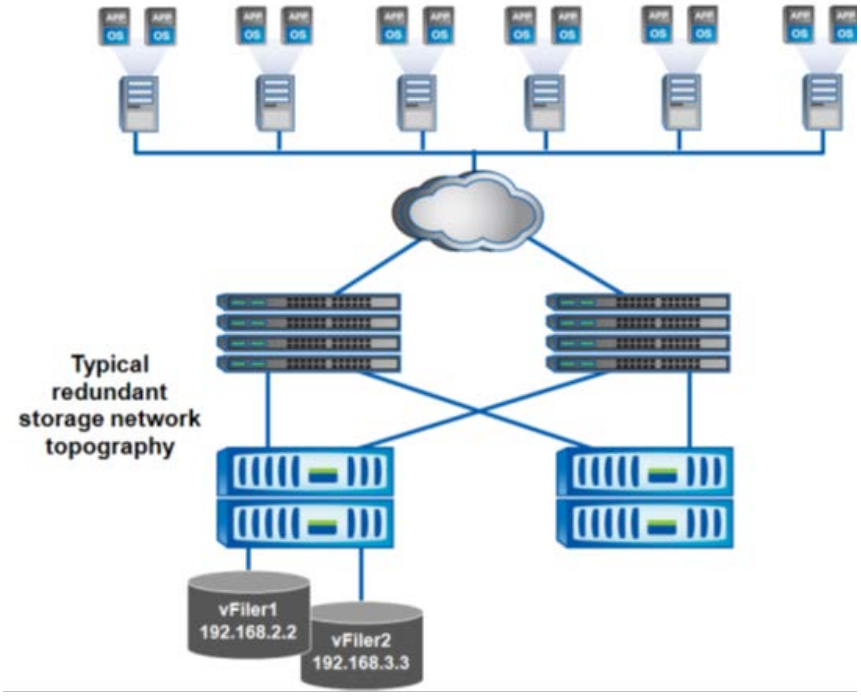
Note: For the network configurations to persist across reboots, add the `ifconfig` and the `route` commands used in steps 9, 10, 12, and 13 to the `/etc/rc` file. Optionally, if the hosting storage system is part of a high-availability configuration, edit the `/etc/rc` file in each partner of the HA configuration to define a partner interface for each interface that the vFiler unit uses.

8.2 Network Configuration Scenarios for NetApp DataMotion for vFiler

vFiler Units Using IP Aliases

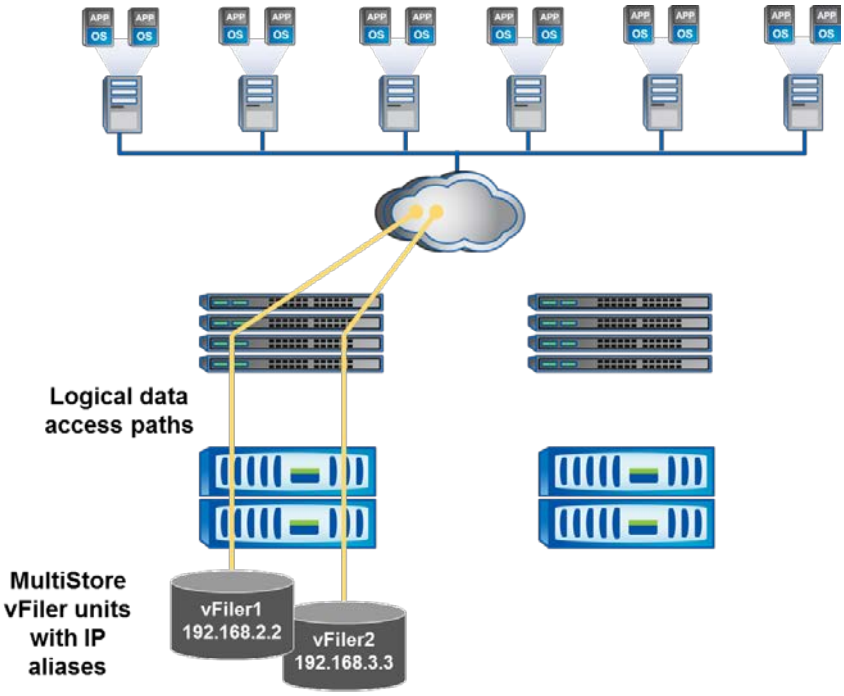
Consider a typical IP storage infrastructure supporting DataMotion for vFiler. Each NetApp array is connected to each of two switches to provide switch-level redundancy in the environment. The storage array on the left contains two vFiler units.

Figure 9) Sample topography of an IP storage infrastructure.



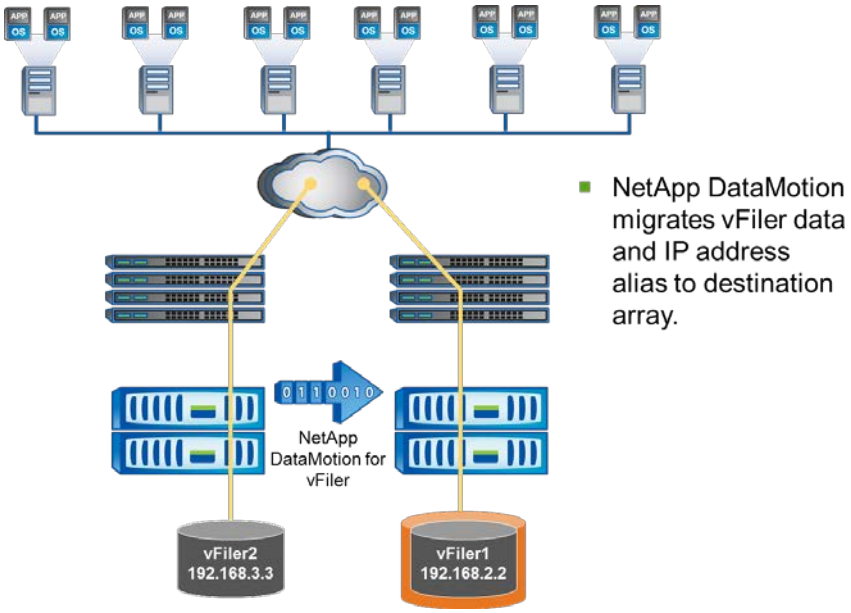
In this example, IP aliases are assigned to the vFiler units on the NetApp array. Each one is on a different network: one on the 192.168.2.0 subnet and the other on the 192.168.3.0 subnet. Yellow lines represent the data paths that are used by the clients above to access the vFiler units.

Figure 10) Network configuration for DataMotion for vFiler.



When a DataMotion for vFiler migration is performed, the vFiler unit is migrated to the destination array, and the IP alias is also created on the destination storage array. The clients are able to access data in the new location. From the network's perspective, movement of the IP address is very similar to how an IP address would move when a link in a single-mode VIF fails and the IP address is moved to another port on the network.

Figure 11) Network configuration for DataMotion for vFiler.

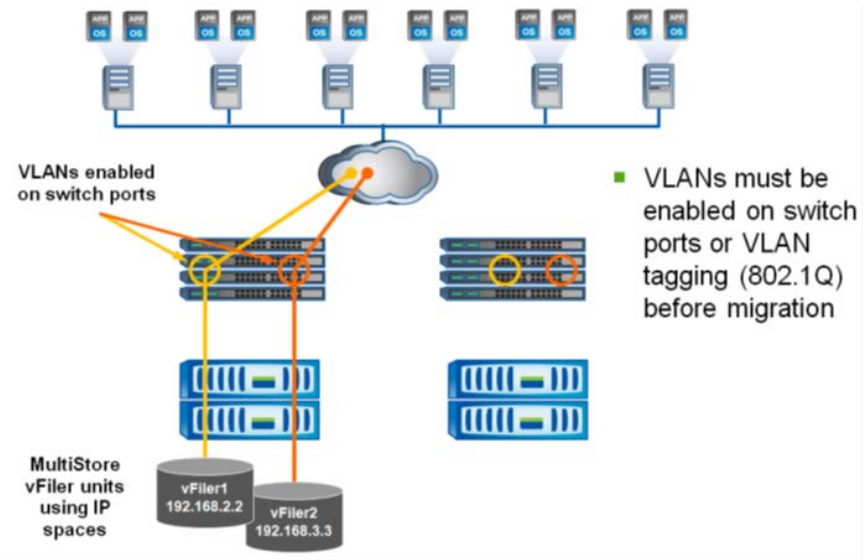


vFiler Units Using VLAN Tagging and IPSpaces

In this example, the vFiler units are configured using IPSpaces and VLAN tagging on the storage controllers. vFiler1 is on subnet 192.168.2.0 VLAN. vFiler2 is on 192.168.3.0 VLAN. These VLANs might share the same physical ports on the network switch. This setup requires that the network switches have trunked the appropriate VLANs across all physical switch ports that might require access to those VLANs.

The setup shown in Figure 12 is the network configuration for DataMotion for vFiler recommended by NetApp. Refer to Network Configuration Best Practices for DataMotion for vFiler for an end-to-end process of configuring the network for DataMotion for vFiler. Network Configuration Best Practices for DataMotion for vFiler covers network configuration best practices for network switches, storage systems, and vFiler units.

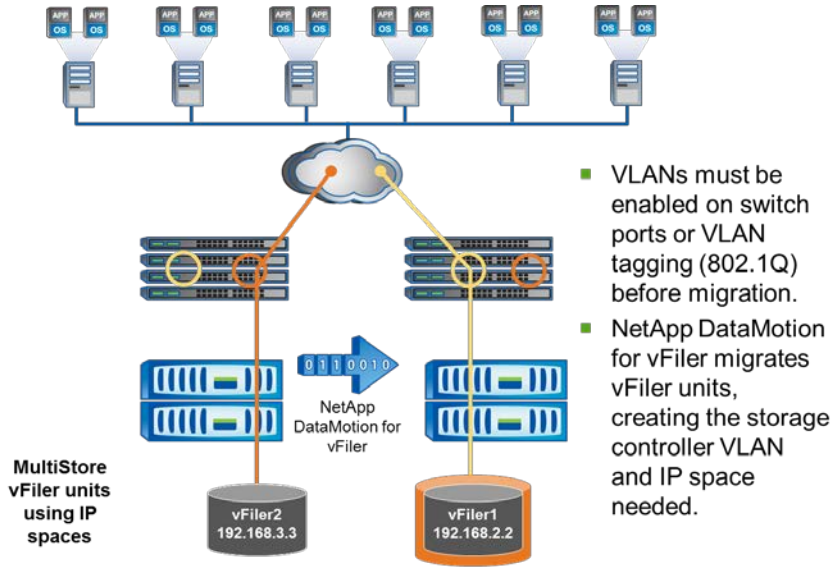
Figure 12) vFiler units using VLAN tagging and IPSpaces.



Best Practices
• Both 802.1q (VLAN tagging) and 802.3ad (trunking) standards should be used together to enable VLANs to move without disruption. • When using IPSpaces and VLAN tagging, special attention must be given to 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 DataMotion for vFiler 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 connected to the destination array, the DataMotion for vFiler migration will complete; however, the clients will not be able to access the vFiler unit at the new location, and this could cause an application outage.

Figure 13) vFiler units using VLAN tagging and IPSpaces.



8.3 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 NetApp DataMotion for vFiler Best Practices

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

Best Practices

- Do not make any configuration changes until the NetApp DataMotion for vFiler cutover phase completes. If any configuration changes related to the vFiler unit have been made 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 Provisioning Manager, do not make any manual modifications to any configuration related to the vFiler units or SnapMirror (for example, the `snapmirror.conf` file).
- Before starting the cutover process from Provisioning Manager, NetApp recommends refreshing the source and the destination storage systems in the Operations Manager by using the `dfm host discover` command.

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

9.2 Process-Level Best Practices

Best Practices

- If there is a long gap between initial baseline transfer phase completion and the subsequent cutover initiation, NetApp recommends first performing 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. If something goes wrong, you can always revert to the stable state.
- The current release of NetApp DataMotion for vFiler supports cutover or rollback only between same speed disk drives or from slower to faster speed disk drives. If you plan to do rapid rollback or rapid cutover type of operations after successful migration, NetApp recommends carefully checking the disk type of the source and destination aggregates between which the vFiler migrates. Rapid rollback or rapid retry after a successful migration is only possible between the aggregates having the same speed disk drives.
- The current release of NetApp DataMotion for vFiler supports cutover or rollback only between similar storage system models or from smaller to larger storage system models. If you plan to do rapid rollback or rapid cutover type of operations after successful migration, NetApp recommends carefully checking 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 only possible between the similar storage system models.

9.3 Performance Considerations

When the cutover phase is initiated, Provisioning Manager uses a built-in algorithm to decide whether the cutover can be successful. Various dynamic factors such as CPU utilization in the destination and source storage systems, disk I/O on the aggregate of the destination system, and so on are taken into account for that decision-making process. If Provisioning Manager decides that the cutover cannot be completed successfully, it does not proceed with the cutover process. In such a case, the migration status is left at the cutover required state. In that scenario, DataMotion for vFiler cutover needs to be reinitiated from Provisioning Manager.

Best Practices

- NetApp recommends that during DataMotion for vFiler cutover the CPU and disk I/O load on the source and destination storage systems should be in low to medium range. Since semi-sync SnapMirror is involved in the cutover phase, additional headroom should be kept for the CPU and disk I/O load before initiating cutover.
- While choosing a DataMotion for vFiler destination, make sure that it'll be able to handle the workload being migrated.
- In this initial release of DataMotion for vFiler, it is recommended that customers actively monitor the system performance during DataMotion for vFiler cutover operation for systems that have dedupe or FlexClone volumes at the file or LUN level (on either the source or destination system). If excessive load is encountered during the migration, DataMotion for vFiler can be aborted by the storage administrator. For details and recommended monitoring methods during migration where dedupe or FlexClone volumes at the file or LUN level exist on either the source or destination system, refer to the Support for Deduplication and File or LUN FlexClone section.

9.4 IP Network Configuration Best Practices

Best Practices

- NetApp recommends using VLAN trunking on the network switches of any storage system that might be a source or 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 connected to the destination array, the migration will complete; 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 should be configured inside an IP space associated with a VLAN interface over a VIF created on the storage system.
- Use a separate IPSpace per vFiler unit (corresponding to different tenants, departments, or applications).

For more information, refer to IP Networking Requirements for NetApp DataMotion for vFiler and Other Networking Considerations.

Network Configuration Best Practices for DataMotion for vFiler describes a step-by-step networking best practices implementation.

9.5 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
- Synchronous SnapMirror.

For a complete list of hardware and software requirements, see Supported Platforms and Requirements.

Support for Deduplication and File and 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 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 details, refer to Volume FlexClone Support.

Disk Type Support: FC, SATA, and SAS

DataMotion for vFiler supports migration between disks with the same speed or from slower to faster disks. Table 10 shows the supported configurations.

Table 10) Supported DataMotion for vFiler migration configurations.

Source Aggregate Disk Type	Destination Aggregate Disk Type	NetApp DataMotion for vFiler
FC	FC	Allowed
SAS	SAS	Allowed
SATA	SATA	Allowed
ATA	ATA	Allowed
BSAS	BSAS	Allowed
FC	SAS	Allowed
SAS	FC	Allowed
ATA	SATA	Allowed
ATA	BSAS	Allowed
SATA	FC	Allowed
ATA	FC	Allowed
BSAS	FC	Allowed
SATA	SAS	Allowed
ATA	SAS	Allowed
BSAS	SAS	Allowed

SnapDrive and SnapManager Best Practices

Best Practices

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

Host Operating System Disk Timeout Settings

Best Practices

- 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, VMware ESX®, Linux, and so on) for the procedure.
- Sample disk timeout values include 190 seconds for a guest operating system running on ESX, 120 seconds for a standalone Windows host without MPIO, and 20 seconds or 60 seconds for HUK v5.1 and later with MPIO.

CFO

DataMotion for vFiler does not support cutover during a clustered failover when a 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 (CFOD). If the takeover event happens after the cutover operation has started, the cutover fails.

9.6 Best Practices for Supporting Server Virtualization Environment

VMware

Best Practices

- Set the disk timeout values in the guest operating systems running on a VMware ESX server by using the NetApp HUK.
- If Provisioning Manager is used to create and assign storage volumes (NFS) to vFiler units, those NFS volumes are exported as qtrees. When VMware datastores are created that correspond to these NFS exports, due to a limitation in Provisioning Manager 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 Provisioning Manager to export the root of the FlexVol volume instead (that is, the name of the dataset) and mount that on the VMware ESX server. The NetApp best practice recommendation for VMware VI3 and vSphere is to use FlexVol volumes instead of qtrees for VMware NFS datastores. This leads to 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.

Appendix

NetApp DataMotion for vFiler Process

Objective of This Exercise

Use NetApp DataMotion for vFiler to perform an online migration of a vFiler unit that is serving live host and application data.

Tasks

Table 11) Performing online migration.

Step	Procedure
1	Create a vFiler unit and provision storage: • Method 1: Using NetApp storage system CLI • Method 2: Using NetApp FilerView® interface • Method 3: Using NetApp Provisioning Manager
2	Assign the storage from the vFiler unit to the hosts and applications.
3	Perform online migration of the vFiler unit using Provisioning Manager.

Create vFiler Unit and Provision Storage

There are three ways in which the vFiler unit can be created and assigned storage. Use one of these methods according to the environment and your requirements.

Method 1: Using the NetApp Storage System CLI

The NetApp storage system CLI offers a rich set of commands for creating and configuring vFiler units. Users can perform the following management tasks from the CLI:

- Enable and disable the MultiStore license
- Allow and disallow protocols to be run on a vFiler unit
- Create a vFiler unit
- Set up a vFiler unit
- Start and stop a vFiler unit
- Destroy a vFiler unit
- Move resources to and from a vFiler unit
- Monitor the status of a vFiler unit

Table 12) vFiler command set.

vFiler Command	Description
`vfiler help`	Help for vFiler command
`vfiler context`	Set the vfiler context of the CLI
`vfiler create`	Create a new vFiler unit
`vfiler rename`	Rename an existing vFiler unit

vFiler Command	Description
`vfiler destroy`	Release vFiler unit resources
`vfiler dr`	Configure a vFiler unit for disaster recovery
`vfiler add`	Add resources to a vFiler unit
`vfiler remove`	Remove resources from a vFiler unit
`vfiler migrate`	Migrate a vFiler unit from a remote filer
`vfiler move`	Move resources between vFiler units
`vfiler start`	Restart a stopped vFiler unit
`vfiler stop`	Stop a running vFiler unit
`vfiler status`	Provide status on vFiler unit configuration
`vfiler run`	Run a command on a vFiler unit
`vfiler allow`	Allow use of a protocol on a vFiler unit
`vfiler disallow`	Disallow use of a protocol on a vFiler unit
`vfiler limit`	Limit the number of vFiler units that can be created

For details on the procedure to create vFiler units and provision storage using NetApp storage system CLI, refer to the MultiStore Management Guide that corresponds to your version of Data ONTAP.

Method 2: Using the NetApp FilerView Interface

The NetApp FilerView GUI supports the creation and configuration of vFiler units. Users can perform the following management tasks from the FilerView GUI:

- Enable and disable the MultiStore license
- Allow and disallow protocols to be run on a vFiler unit
- Create a vFiler unit
- Set up a vFiler unit
- Start and stop a vFiler unit
- Destroy a vFiler unit
- Move resources to and from a vFiler unit
- Monitor the status of a vFiler unit

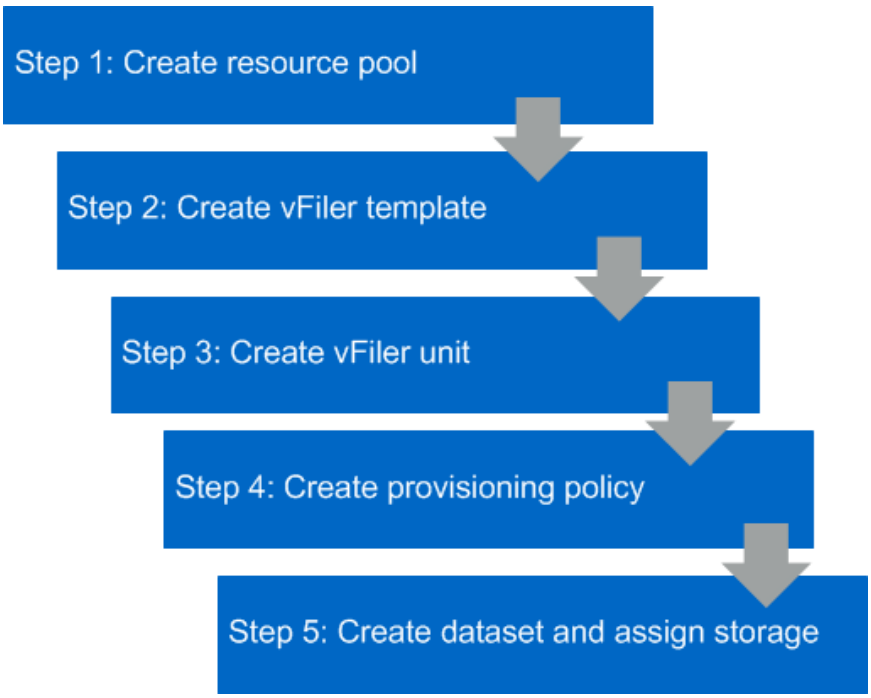
For details on the procedure to use the NetApp FilerView GUI and to use it to create vFiler units and provision storage, refer to the System Administration Guide and MultiStore Management Guide that corresponds to your version of Data ONTAP.

Method 3: Using NetApp Provisioning Manager

NetApp Provisioning Manager automates the process of vFiler unit creation and storage provisioning. Refer to the Provisioning Manager 4.0 Workflow Guide and Provisioning Manager and Protection Manager Printable Help for a detailed description of vFiler unit management using Provisioning Manager.

Figure 14 depicts the high-level steps in the automated creation and provisioning of vFiler units using Provisioning Manager.

Figure 14) Steps to create and provision vFiler units.



Assign the Storage from the vFiler Unit to the Hosts and Applications

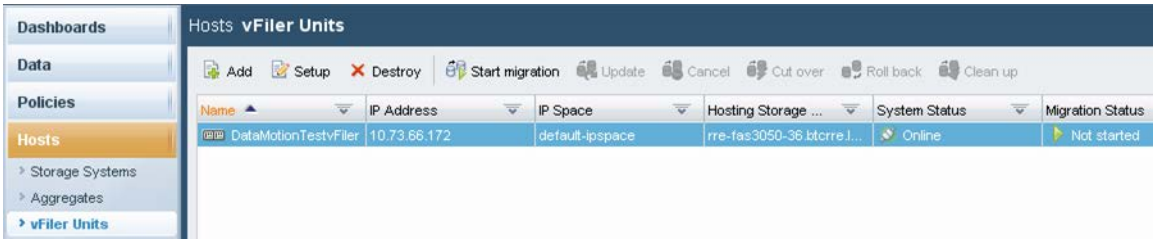
After the vFiler unit has been created and configured, the storage (volumes and LUNs) assigned to the vFiler unit can be mapped to the hosts and to the applications, as well as to any NetApp storage system. For details, see the MultiStore Management Guide, File Access and Protocols Management Guide, and Block Access Management Guide that correspond to your version of Data ONTAP.

vFiler Unit Online Migration Using Provisioning Manager

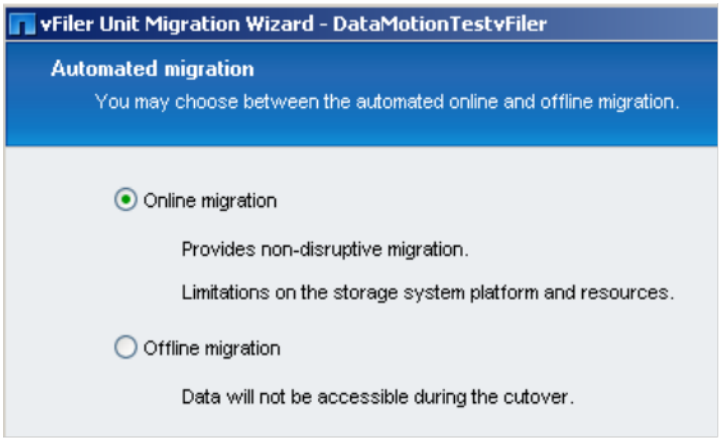
Initiate the online migration of the vFiler unit using NetApp Provisioning Manager.

Initial Baseline Transfer

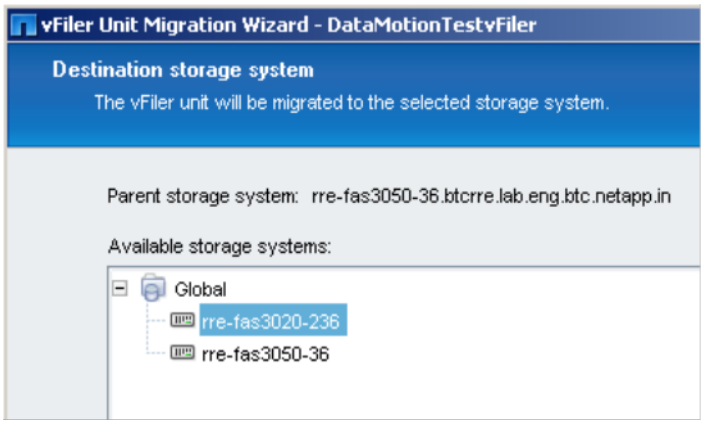
1. Select the vFiler unit and click Start migration from Hosts > vFiler Units.



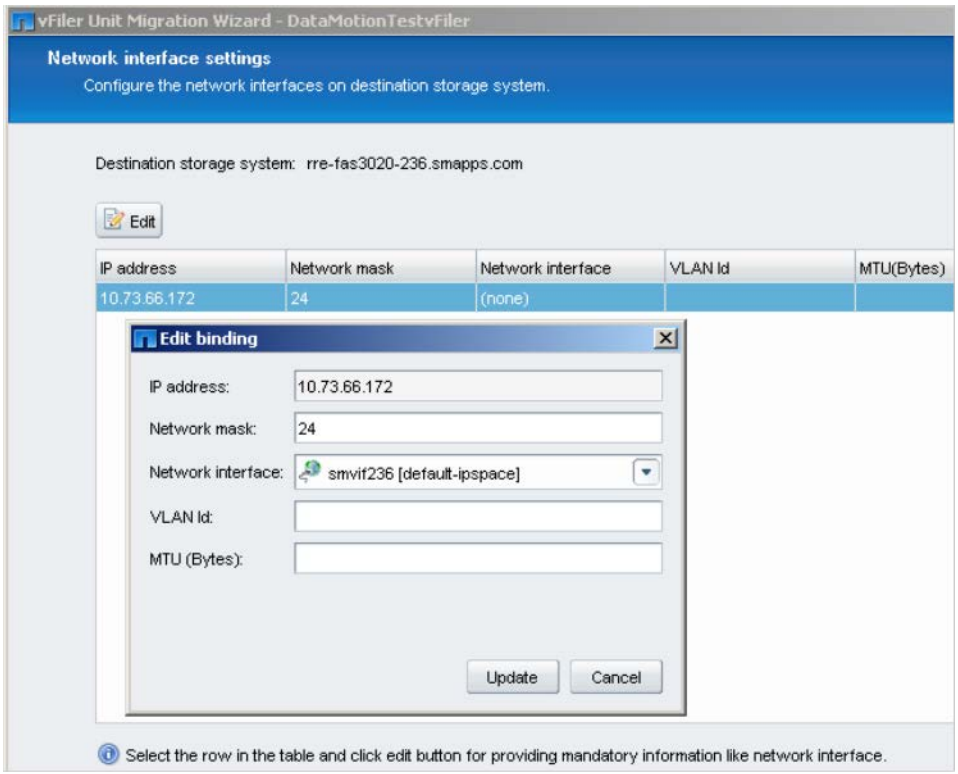
2. Select Online Migration.



3. Select the destination FAS system to which the vFiler unit should be migrated.

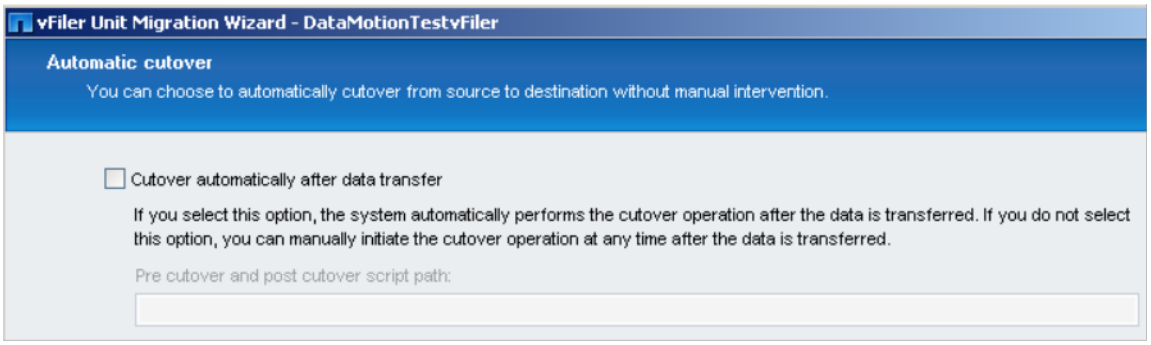


4. The network interface on the destination FAS system should be configured carefully for online migration. Select the network interface to use and the VLAN ID, if any.

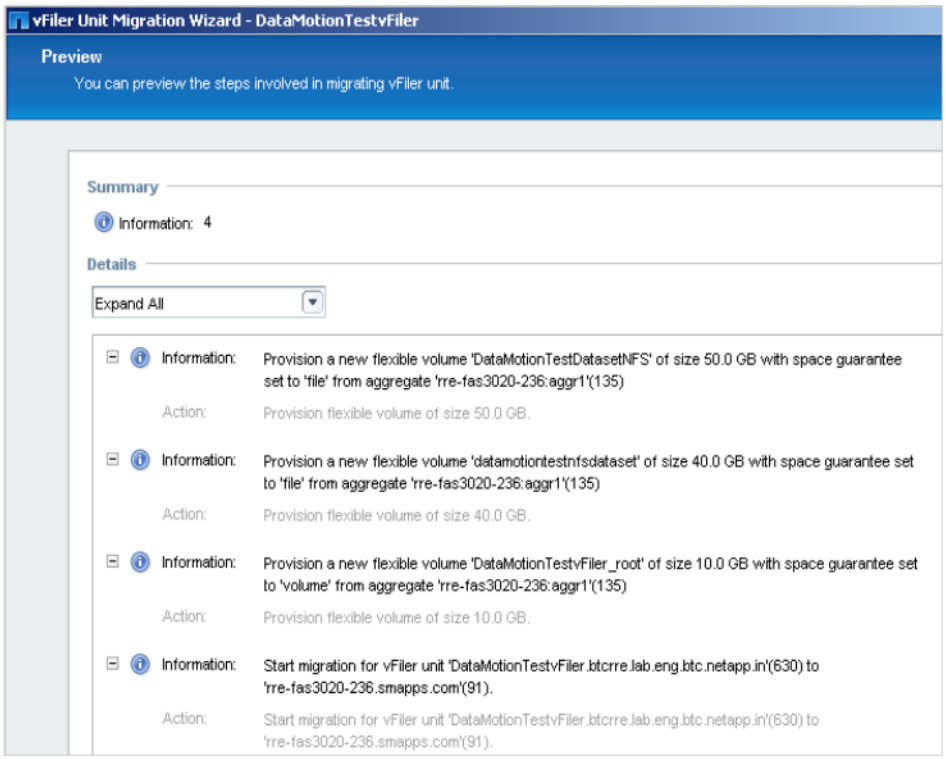


5. (Optional) Select the throttle value to be used for the network bandwidth for the initial baseline transfer.

6. There is also an optional feature to cutover to the destination FAS system automatically after initial data transfer. This feature provides the option of one-step migration. In this example, this option is not selected.

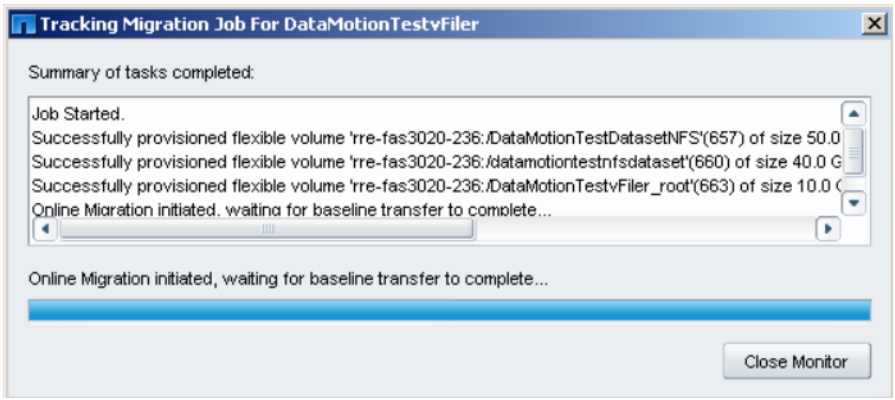


7. Preview the steps that will be automated by Provisioning Manager for the vFiler migration process.

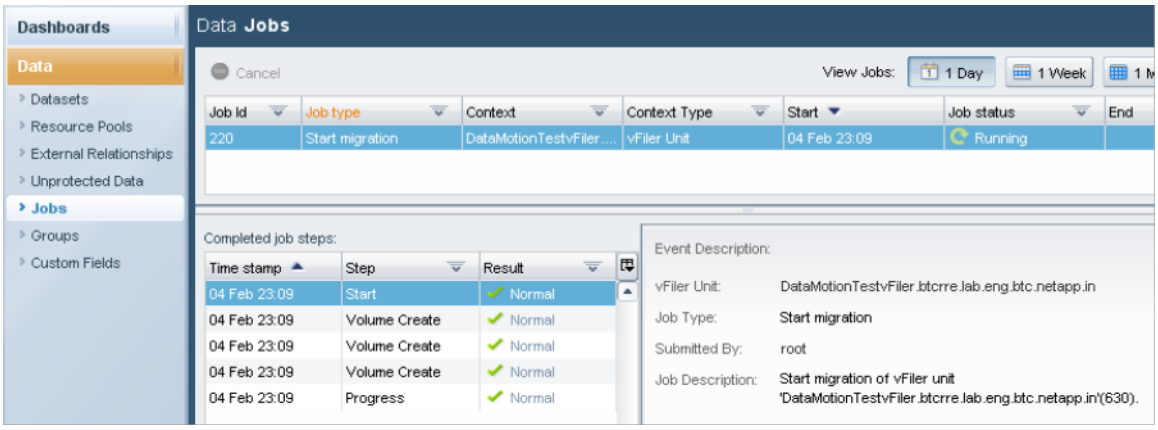


8. Complete the vFiler Unit Migration wizard.

A window appears that displays the status of the migration job.



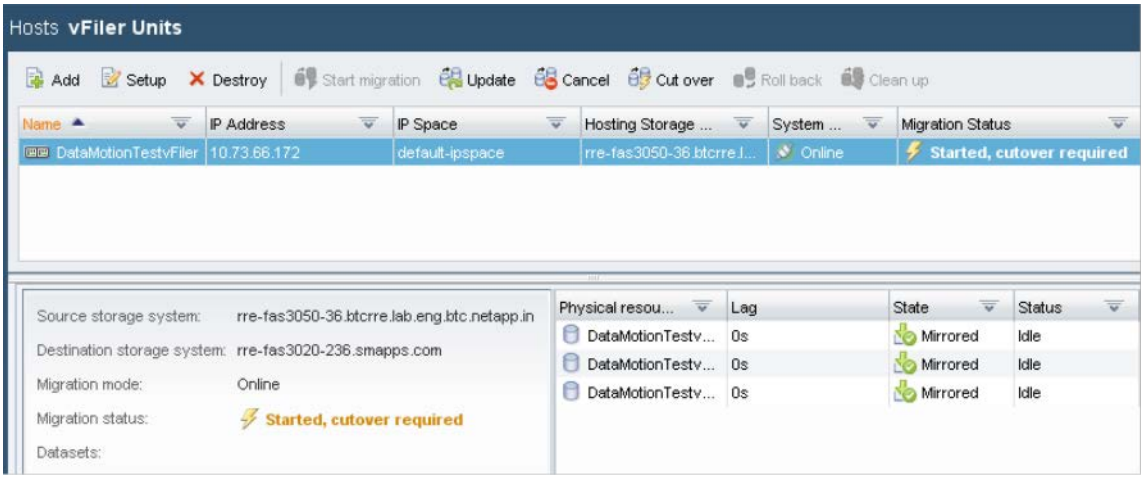
9. The status of the migration job can also be viewed from Data > Jobs.



When the baseline transfer of the data is complete, the migration status of the vFiler unit changes to Started, Cutover Required.

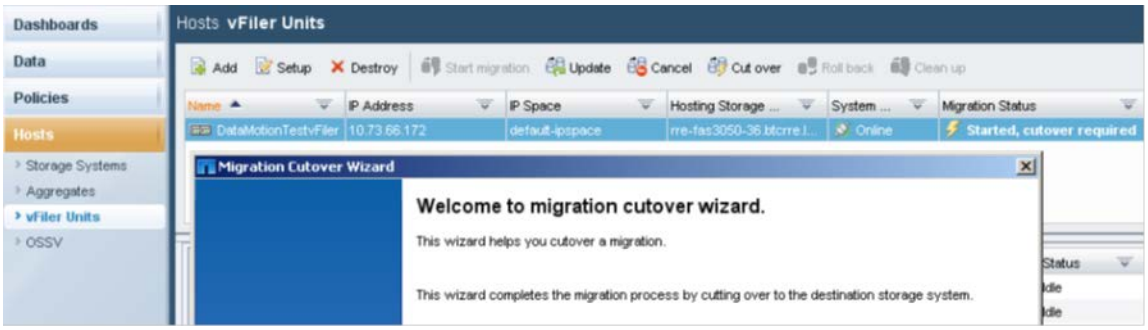
At this point, the user has three options:

- Update the baseline created in the destination system (NetApp recommends this option if there is a long gap between the time when the baseline transfer was completed and the time when the cutover process is started).
- Cancel the DataMotion for vFiler process.
- Start the cutover process to migrate the vFiler unit to the destination system.

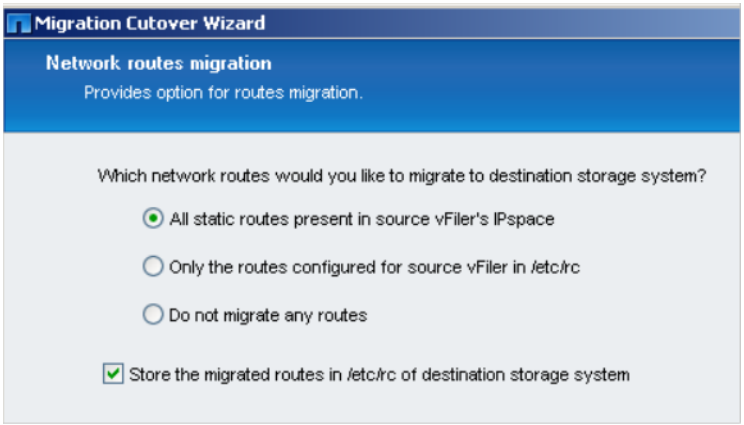


Cutover

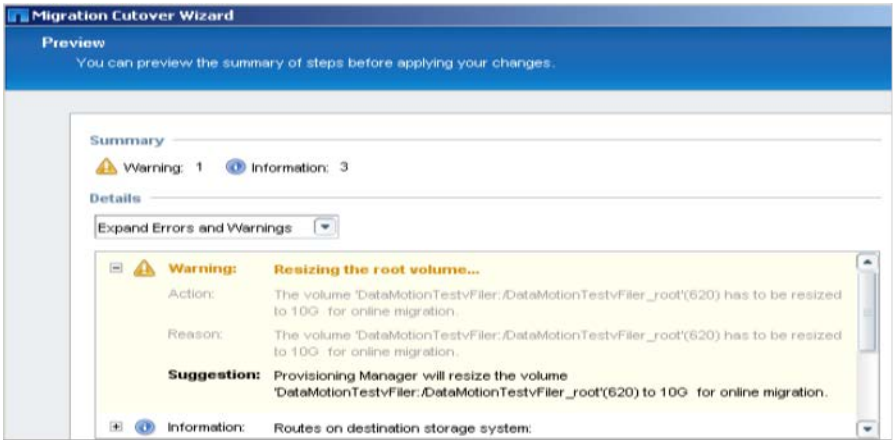
1. To start the cutover process, select the vFiler unit from Hosts > vFiler Units and click Cut over.



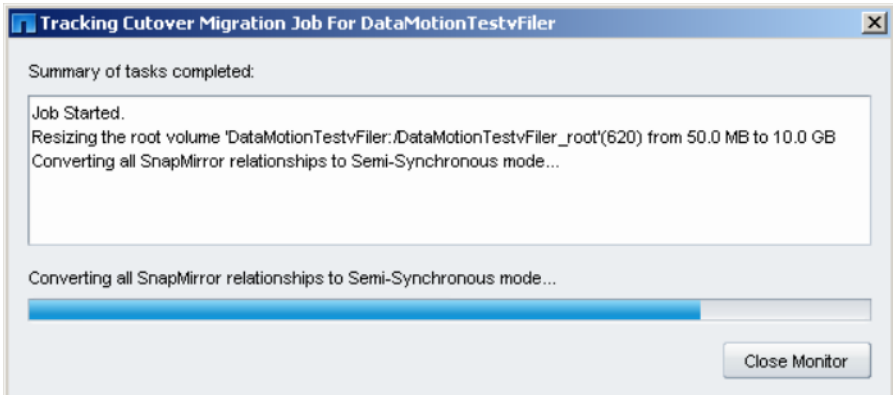
2. (Optional) Provide the path of the script to run before and after cutover.
3. Select the network routes migration option. Review the summary of cutover steps that are automated by Provisioning Manager.



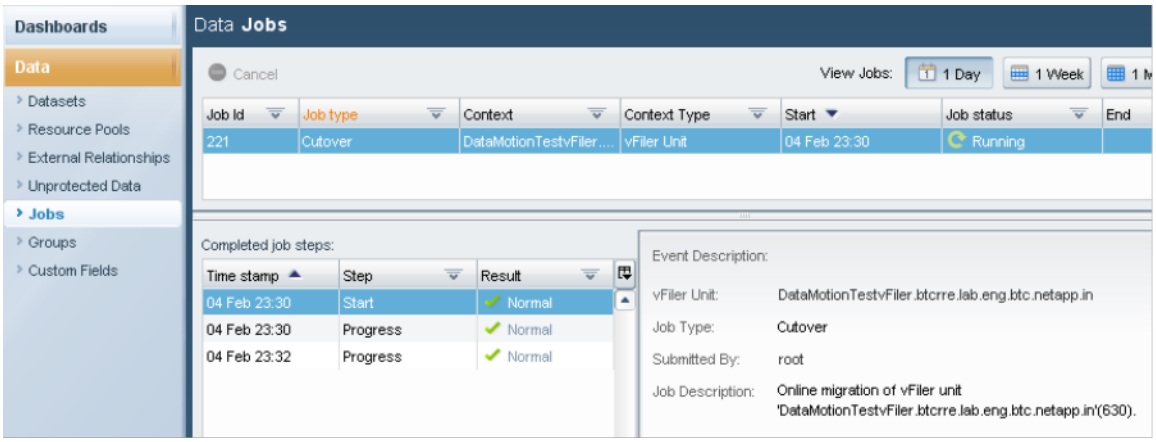
4. Complete the Migration Cutover wizard.



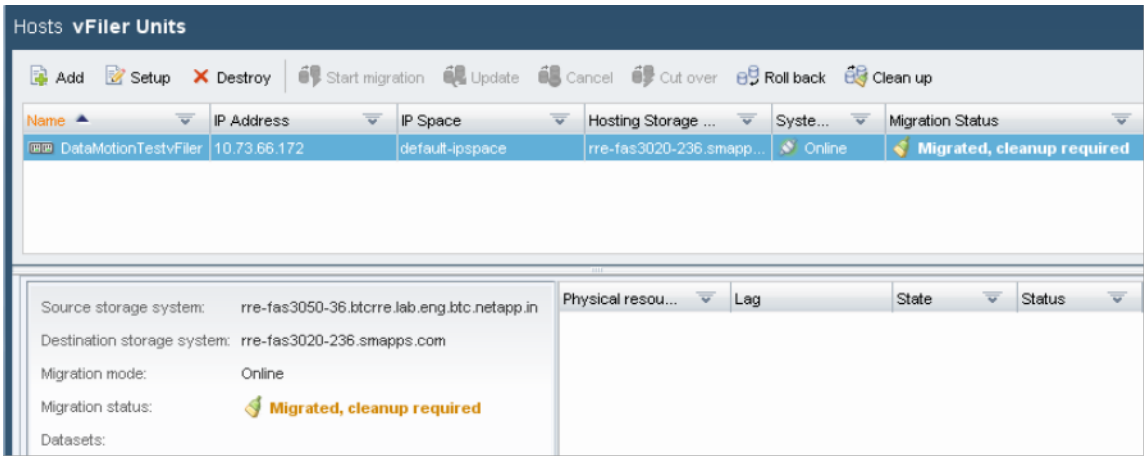
A window appears that displays the status of the cutover job.



5. The status of the cutover job can also be monitored from Data > Jobs > Job Type: Cutover.

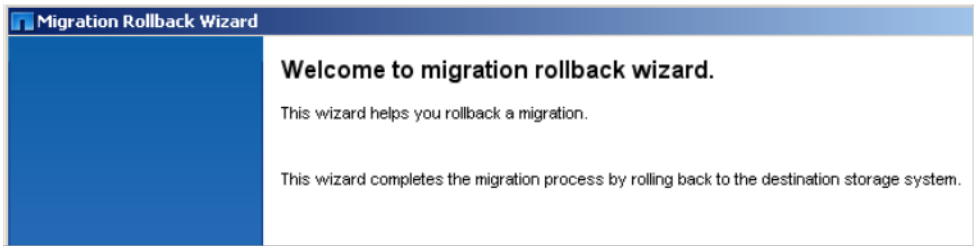


When the cutover has completed successfully, the migration status of the vFiler unit changes to Migrated, Cleanup Required. At this point, the user has the option to either roll back the vFiler unit to the source storage system or clean up the vFiler unit resources from the source storage system.

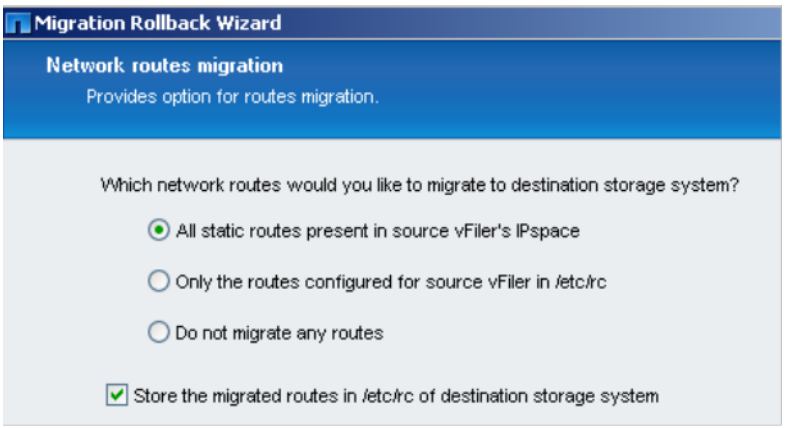


Rollback

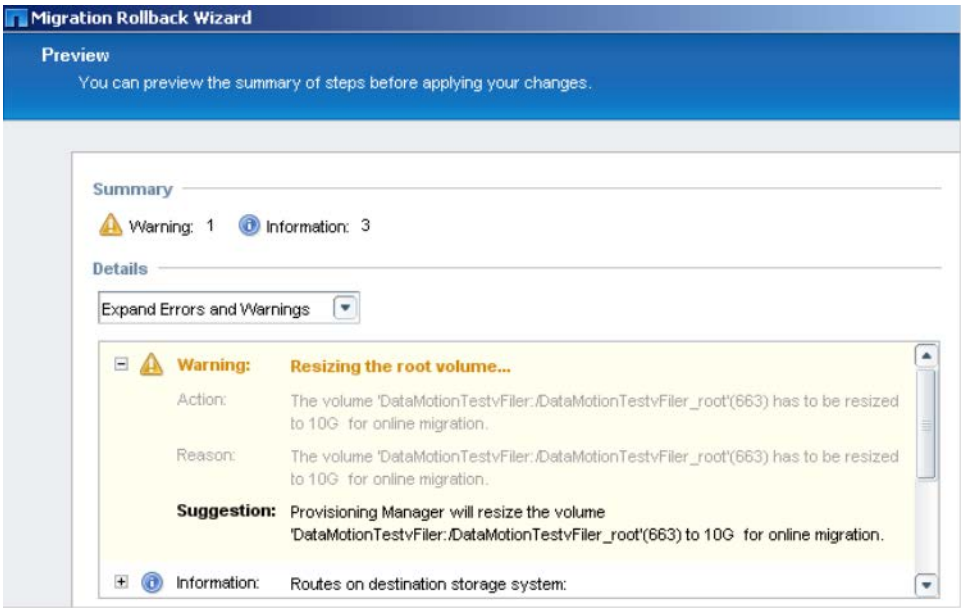
1. If the user chooses to roll back the vFiler unit to the source storage system, use the rollback option in Hosts > vFiler Units.



2. (Optional) Provide a path of the script that must be run before and after rollback.
3. Select the network routes migration option.

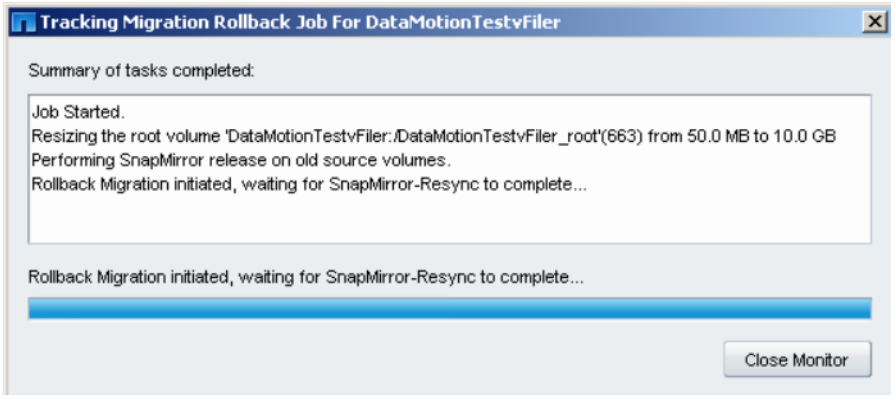


4. Review the rollback steps that are automated by the Provisioning Manager.

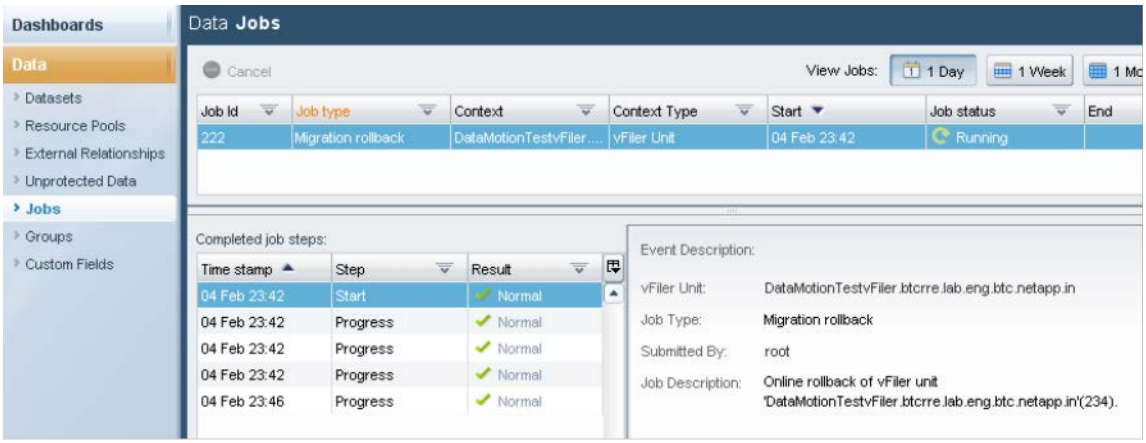


5. Complete the Migration Rollback wizard.

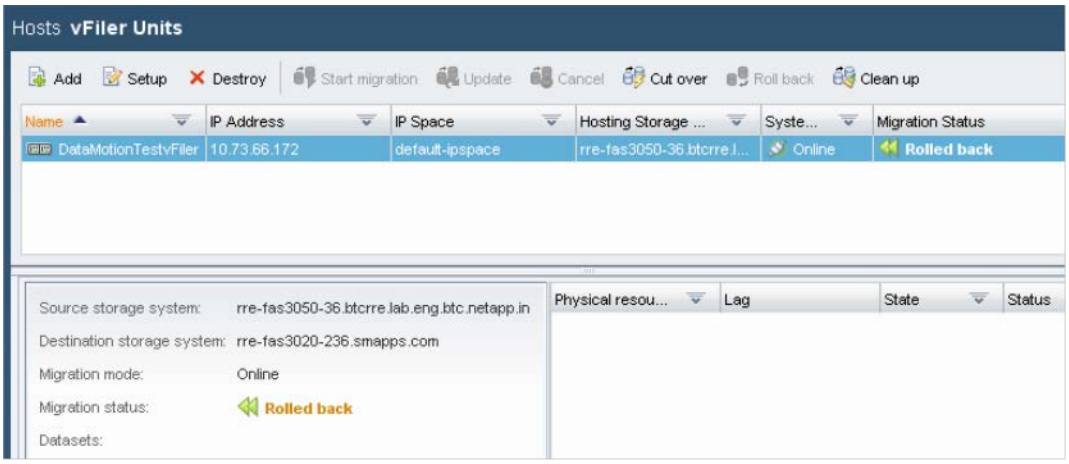
   A window appears that displays the status of the rollback job.



6. The status of the rollback job can also be monitored from Data > Jobs > Job Type: Migration rollback.

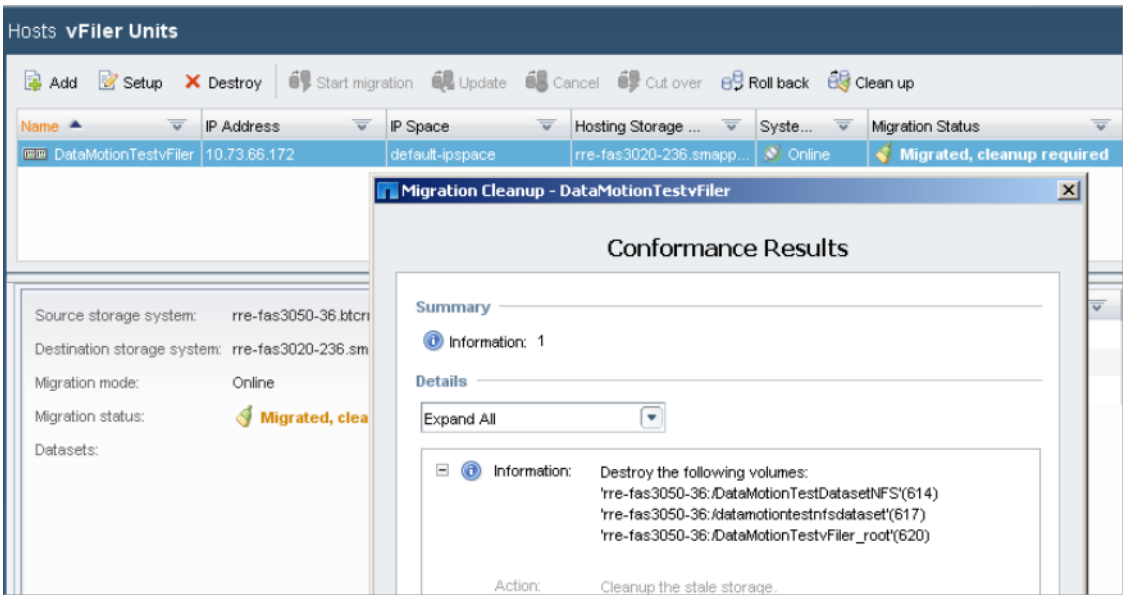


When the rollback is completed successfully, the migration status of the vFiler unit changes to Rolled back. At this point, the user has the option to either cut over the vFiler unit to the destination storage system or to clean up the vFiler unit resources from the destination storage system.

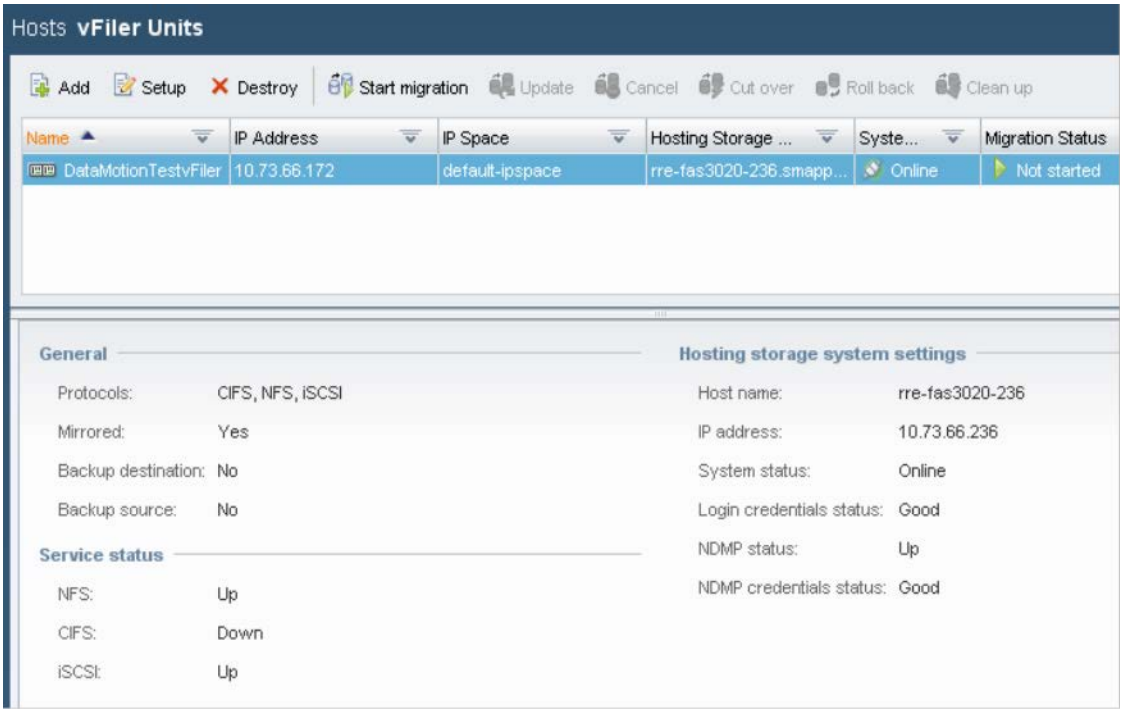


Cleanup

1. After a successful cutover to the destination storage system or after a successful rollback to the source storage system, the vFiler unit and its resources from the source or destination storage system can be cleaned up using the cleanup option in Hosts > vFiler Units.



2. The following screenshot shows the changes to the storage system settings after cleanup.



Network Configuration Best Practices for DataMotion for vFiler

Properly configuring the storage network is very important for the successful and secure execution of DataMotion for vFiler. This section describes an example setup that has been implemented according to the DataMotion for vFiler networking best practices.

Figure 15 shows a sample setup. There are two high-availability pairs: FAS1 and FAS2 and FAS3 and FAS4. The vFiler unit called vFiler1 running on FAS1 must be migrated to FAS3 by using DataMotion for vFiler.

Figure 15) Network setup.

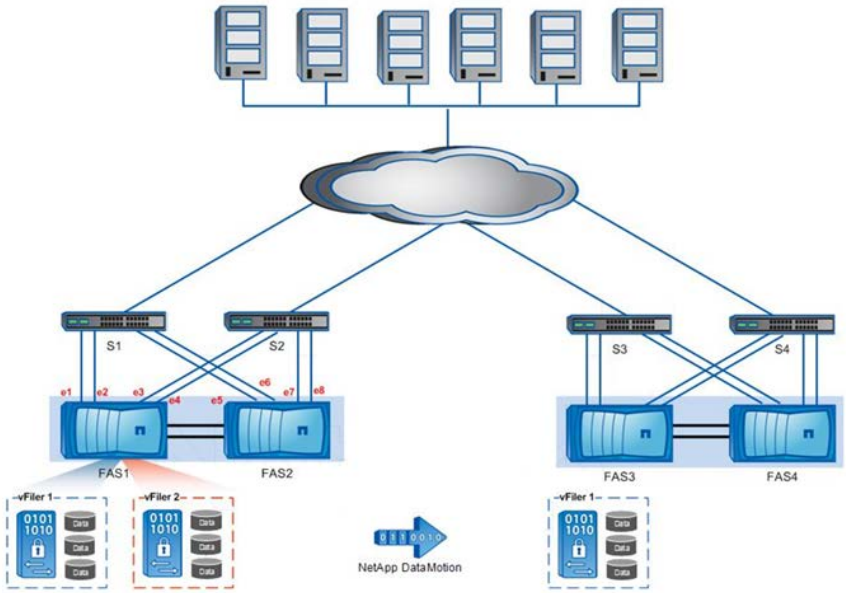


Table 13 describes the recommended method to configure networking on the storage systems and to configure network switches for DataMotion for vFiler.

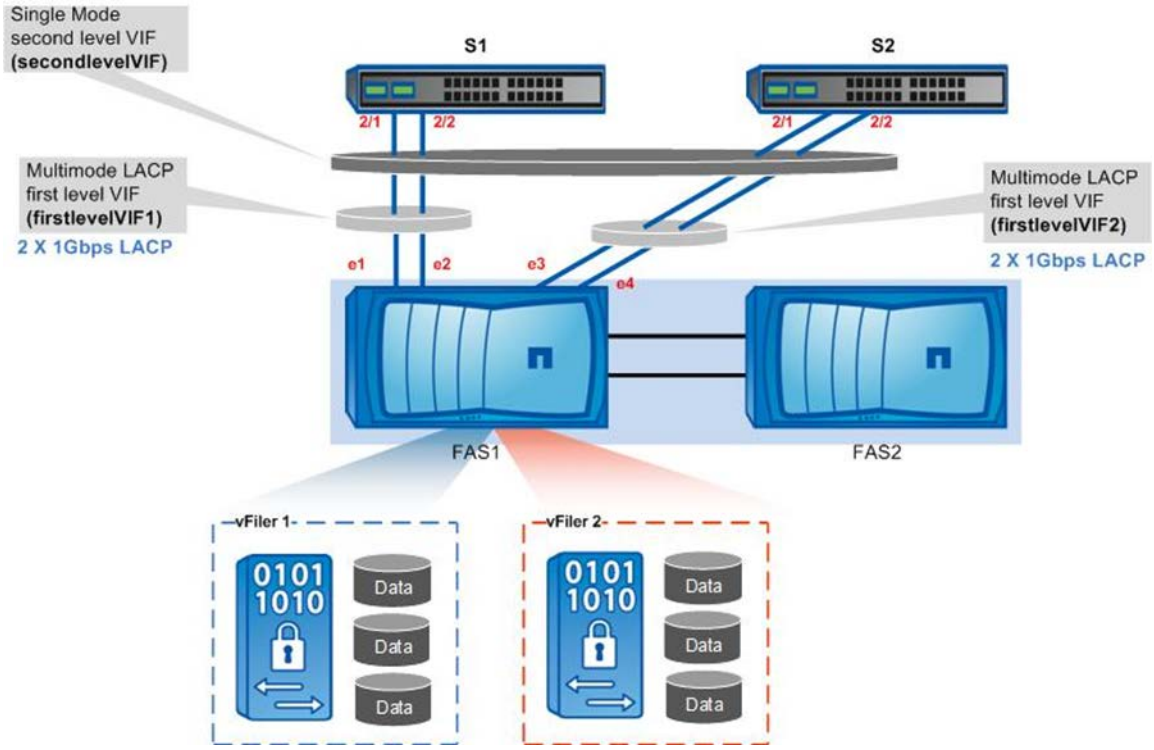
Table 13) Configuring networking on the storage system and network switches for DataMotion for vFiler.

Step	Procedure
1	Configure VIF on the storage controller.
2	Create VLAN over the VIF.
3	Enable the VLAN in the corresponding network switches.
4	Create IPSpace.
5	Assign the appropriate VLAN interface over the VIF to the IPSpace.
6	Create the vFiler unit in the IPSpace with the associated VLAN interface over the VIF.
7	Assign IP address to the appropriate VLAN interface over the VIF.
8	Add default route to the vFiler unit.

Step 1: Configure VIF on the Storage Controller

For simplicity, Figure 16 shows the connection between just one NetApp storage controller and the network switches. However, the same configuration must be repeated for all of the storage controllers and the corresponding switches in the system.

Figure 16) Connection between network switches and a NetApp storage controller.



In this example, the four 1Gbps links from the storage controller to the two network switches have been configured as a multilayered VIF. e1 and e2 form a first-level multimode LACP VIF; e3 and e4 form another. These two first-level multimode LACP VIFs are then combined to form a second-level single-mode VIF.

```
vif create lacp firstlevelVIF1 –b ip e1 e2
vif create lacp firstlevelVIF2 –b ip e3 e4
vif create single secondlevelVIF firstlevelVIF1 firstlevelVIF2
vif favor firstlevelVIF1
```

Step 2: Create VLAN over VIF

Two VLANs (1 and 2) are created over the second-level VIF using the following command:

```
vlan create secondlevelVIF 1 2
```

Step 3: Enable the VLANS in the Corresponding Network Switches

Assuming that you are using Cisco® network switches running Cisco IOS® Software, a configuration must be made in the switch to convert the switch ports from standard access ports to a VLAN trunked interface to support the VLAN defined.

In the S1 switch, the configuration might look like this:

```
interface Port-channel1
description LACP Channel for NetApp e1-e2 2x 1Gbps LACP 802.1q Trunk
switchport
switchport trunk encapsulation dot1q
switchport trunk allowed vlan 1-2
switchport mode trunk
switchport nonegotiate
spanning-tree guard loop
```

```
spanning-tree portfast trunk
mtu 9216

interface GigabitEthernet 2/1
description NetApp e1 2x 1Gbps LACP 802.1q Trunk
switchport
switchport trunk encapsulation dot1q
switchport trunk allowed vlan 1-2
switchport mode trunk
switchport nonegotiate
spanning-tree guard loop
spanning-tree portfast trunk
channel-protocol lacp
channel-group 1 mode active
mtu 9216

interface GigabitEthernet 2/2
description NetApp e2 2x 1Gbps LACP 802.1q Trunk
switchport
switchport trunk encapsulation dot1q
switchport trunk allowed vlan 1-2
switchport mode trunk
switchport nonegotiate
spanning-tree guard loop
spanning-tree portfast trunk
channel-protocol lacp
channel-group 1 mode active
mtu 9216
```

Step 4: Create IPSpace

Create the IPSpace where the vFiler unit resides.

```
ipspace create ipspace1
```

Step 5: Assign the Appropriate VLAN Interface over the VIF to the IPSpace

To assign an interface to the IPSpace, make sure that the interface does not have a configured IP address. In the following example, the VLAN 1 interface over the second-level VIF that will be assigned to the IPSpace is cleared in case it already has a configured IP address.

```
ifconfig secondlevelVIF-1 0.0.0.0
```

Now assign the interface to the IPSpace. In the following example, the single-mode VIF is assigned to the IPSpace created in step 1.

```
ipspace assign ipspace1 secondlevelVIF-1
```

Check the available IPSpaces and the corresponding interfaces.

```
ipspace list
```

Step 6: Create the vFiler Unit in the IPSpace with the Associated VLAN Interface over the VIF

Create the vFiler unit in the IPSpace that you just created.

```
vfiler create vfiler1 -n -s ipspace1 -i 192.168.1.10 /vol/vfiler1
```

Step 7: Assign IP Address to the Appropriate VLAN Interface over the VIF

Configure the VLAN interface over the VIF with the IP address of the vFiler unit.

```
ifconfig secondlevelVIF-1 192.168.1.10 netmask 255.255.255.0
```

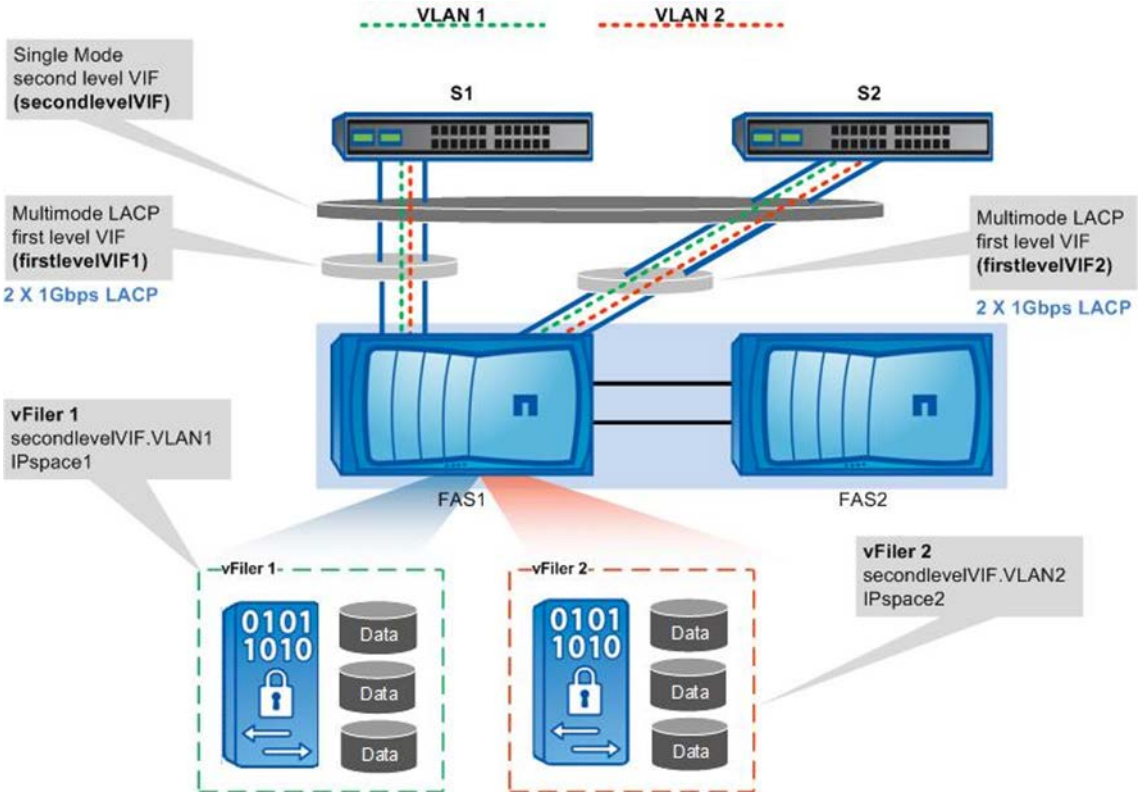
Step 8: Add Default Route to the vFiler Unit

Add the default route to the vFiler unit.

```
vfiler run vfiler1 route add default 192.168.1.1 1
```

The setup now resembles Figure 17.

Figure 17) Setup.



To create another vFiler unit in the same IPSpace, follow the same procedure shown in step 6.

```
vfiler create vfiler_test -n -s ipspace1 -i 192.168.1.11 /vol/vfiler_test
```

Add the IP address of the new vFiler unit as an alias to the VLAN interface over VIF.

```
ifconfig secondlevelVIF-1 alias 192.168.1.11 netmask 255.255.255.0
```

Add the default route to the second vFiler unit.

```
vfiler run vfiler_test route add default 192.168.1.1 1
```

To create another vFiler unit (`vFiler2`) in a different IPSpace, follow a procedure similar to the procedure shown in steps 4 through 8 and associate the newly created IPSpace (`ipspace2`) with VLAN 2 over the VIF (`secondlevelVIF-2`).

```
ipspace create ipspace2
ifconfig secondlevelVIF-2 0.0.0.0
ipspace assign ipspace2 secondlevelVIF-2
```

```
vfiler create vfiler2 -n -s ipspace2 -i 192.168.2.10 /vol/vfiler2
ifconfig secondlevelVIF-2 192.168.2.10 netmask 255.255.255.0
vfiler run vfiler2 route add default 192.168.2.1 1
```

The sample setup described in this section uses a Cisco Catalyst® switch with 2 x 1Gbps multimode VIFs to the first switch and the same to a second switch with single-mode VIF on top.

Some other possibilities include:

- 2 X 10Gbps single-mode VIF for Cisco Catalyst switch
- 2 X 10Gbps multimode VIF for Cisco Nexus® switch running VPC

Steps to enable VLAN on the switch vary depending on the type of network switch selected. For a Cisco Nexus switch, the following is a sample configuration:

```
interface Port-channel1
  description LACP Channel for NetApp e1-e2 2x 1Gbps LACP 802.1q Trunk
  switchport mode trunk
  switchport trunk allowed vlan 1,2
  spanning-tree port type edge trunk
  spanning-tree guard loop

interface Ethernet1/1
  description NetApp e1 2x 1Gbps LACP 802.1q Trunk
  switchport mode trunk
  switchport trunk allowed vlan 1,2
  channel-group 1 mode active
  spanning-tree port type edge trunk
  spanning-tree guard loop
  speed 10000

interface Ethernet1/2
  description NetApp e1 2x 1Gbps LACP 802.1q Trunk
  switchport mode trunk
  switchport trunk allowed vlan 1,2
  channel-group 1 mode active
  spanning-tree port type edge trunk
  spanning-tree guard loop
  speed 10000
```

Note: Cisco Nexus 5000 does not require an administrator to identify the VLAN trunk encapsulation type of 802.1q; it is enabled by default.

References

The following references were used in this technical report:

- Data ONTAP 7.3.3 MultiStore Management Guide
  http://media.netapp.com/documents/tr-3446.pdf
- MultiStore Management Guide
  http://now.netapp.com/NOW/knowledge/docs/ontap/rel733rc1/pdfs/ontap/vfiler.pdf
- NetApp Storage Best Practices for VMware vSphere
- http://media.netapp.com/documents/tr-3749.pdf
- NetApp and VMware Virtual Infrastructure 3 Storage Best Practices
  http://media.netapp.com/documents/tr-3428.pdf
- Nondisruptive Operations Group
  http://communities.netapp.com/groups/non-disruptive-operations
- Provisioning Manager 4.0 Workflow Guide
  http://now.netapp.com
- SnapMirror Async Overview and Best Practices Guide

http://media.netapp.com/documents/tr-3446.pdf

SnapMirror Sync and SnapMirror Semi-Sync Overview and Design Considerations
http://media.netapp.com/documents/tr-3326.pdf

- Storage Virtualization and DR Using MultiStore (vFiler)
  http://media.netapp.com/documents/tr-3462.pdf

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