Technical Report

SAN Migration Using Foreign LUN Import

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Abstract

This guide is intended to assist customers, SEs/CSEs, PSEs/PSCs and channel partner engineers in planning for and migrating data using a five-phase data migration process designed to handle the most complex migration scenarios while heeding specific customer needs and making sure the right migration strategy is executed for each specific environment.

The document describes the steps necessary for a successful SAN data migration from a foreign array or a NetApp® 7-Mode array to a NetApp clustered Data ONTAP® array.

Data Classification

Public

Version History

Version	Date	Document Version History
Version 2.2	September 2016	Added new FLI IMT info including Appendix G.
Version 2.1	May 2016	Minor updates including adding a support note about persistent reservations.
Version 2.0	October 2015	Version update covering enhancements to FLI.
Version 1.0	February 2015	First version, covering clustered Data ONTAP 8.3 FLI offline methodology.

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1 Overview

Foreign LUN import (FLI) is a tool added to the data migration portfolio with clustered Data ONTAP 8.3. Clustered Data ONTAP 8.3.1 saw enhancements to FLI, including both online and 7-Mode to clustered Data ONTAP transition workflows. The data migration program was established to create data migration solutions that make it easier for customers to migrate to NetApp storage and/or migrate LUNs from NetApp 7-Mode to clustered Data ONTAP. The program enhances productivity by providing the necessary tools, products, and service collateral required for successful data migration. By providing the proper skills and knowledge to perform data migrations, this program aims to accelerate the adoption of NetApp technologies.

1.1 Audience

This document is intended for NetApp customers who either are interested in migrating data from a foreign array to clustered Data ONTAP or are interested in transitioning LUNs from NetApp 7-Mode arrays to clustered Data ONTAP. Other audiences for this document are customers of NetApp's heterogeneous storage area network (HeSAN) migration service, NetApp sales engineers (SEs), consulting sales engineers (CSEs), professional services engineers (PSEs), professional services consultants (PSCs), and channel partner engineers.

Readers of this document should have a familiarity with SANs and common SAN concepts and processes including zoning, LUN masking, the host OSs whose LUNs need to be migrated, clustered Data ONTAP, and of course, the source third-party array.

1.2 What's in This Document

FLI supports the following three types of migrations and a transition workflow:

- Foreign LUN import offline (available from clustered Data ONTAP 8.3 onward)
- Foreign LUN import online (available from clustered Data ONTAP 8.3.1 onward)
- Foreign LUN import for transitioning from Data ONTAP operating in 7-Mode to clustered Data ONTAP (available from clustered Data ONTAP 8.3.1 as both offline and online workflows)
- Foreign LUN import offline or online using WFA (available from clustered Data ONTAP 8.3.1 onward)

All four of these workflows will be covered in this technical report. The report is broken into general sections that detail common processes and individual sections that provide specific examples of each of the three migration variants, a chapter covering transition from Data ONTAP operating in 7-Mode to clustered Data ONTAP, and follow-on common processes. There are appendixes cover several ancillary topics pertinent to running Foreign LUN Imports including ESX CAW/ATS remediation, clearing persistent reservations, multipath verification, zoning for imports, host remediation links, an example test migration, and a example Site Survey and Planning worksheet. Finally, there is a references section at the end of the document that provides links to additional related information.

1.3 Data Migration and Transition Defined

Data migration is the process of transferring data from a third-party array source to a NetApp clustered Data ONTAP destination. Transition is the process of transferring data from a NetApp Data ONTAP 7-Mode system to a clustered Data ONTAP storage system. The data is copied during migration/transition; depending on the FLI variation, the existing systems are redirected to the new data location on the NetApp storage, either at the time the import relationship (more on this later) is created or after the migration is completed.

1.4 Data Migration Challenges

Some of the challenges posed by data migration are extended downtime, potential risk, scarce resources, and inadequate expertise. Data availability requirements have become increasingly demanding and downtime unacceptable, such that business operations drive the data migration process. Risk factors such as performance impacts on production systems, potential data corruption, and loss are a concern in any data migration process.

1.5 Data Migration Solution

NetApp and partner professional services use a time-tested methodology to guide a migration through all major phases. State-of-the-art technologies such as NetApp foreign LUN import (FLI) and third-party data migration software along with proficiency in data migration allow professional services to execute data migration projects successfully worldwide. By utilizing NetApp and partner professional services, customers free up internal resources, minimize downtime, and abate risk. With clustered Data ONTAP 8.3.1, a professional services run migration is no longer mandatory. However, NetApp still strongly recommends a professional services or partner professional services engagement to scope and plan the migration as well as to train customer personnel in how to perform data migrations using FLI.

1.6 NetApp Data Migration Service

The Data Migration Service for heterogeneous SAN environments was created to provide NetApp and partner professional services with comprehensive migration solutions. The goal is to provide tools, products, software, and services to reduce error, increase productivity, and promote consistent delivery of data migrations.

1.7 Methodology

The data migration process consists of five phases:

1. **Discover.** Information about hosts, storage, and fabrics in the environment is collected.
2. **Analyze.** The collected data is examined, and the appropriate migration approach for each host or storage array is determined.
3. **Plan.** Migration plans are created and tested/piloted, destination storage is provisioned, and migration tools are configured.
4. **Execute.** Data is migrated, and host remediations are performed.
5. **Verify.** New system configurations are validated, and documentation is provided.

1.8 Which Data Migration Solution Should You Use?

It is important while discussing data migration solutions to make clear there are alternative approaches to migrating your data, including:

1. Data transfer appliance (DTA), a NetApp branded appliance that is connected to the SAN fabric, is licensed on per TB data migrated and supports both offline and online migrations.
2. Host OS or application-based migration options. Some of these might include:
    1. VMware Storage vMotion
    2. Logical volume manager (LVM) based solutions
    3. Application-based solutions such as DD, xcopy, robocopy, and so on

Some of these solutions may be performed non-disruptively and therefore might be preferable to using FLI. FLI may be the best choice for other migrations. Regardless of the procedures and tools chosen, you can and should use the data migration methodology to scope, plan, and document your migration choices and tasks. The point is to choose the right tool for each of your migrations. All of these tools can be used for the parts of your migrations to which each is best suited.

1.9 NetApp Data Migration Service Tools

This section provides an overview of the service tools and peripheral collateral required for data migrations. These tools provide a standardized method for scoping and documenting a data migration engagement.

1.10 Level of Effort Estimates

For effort estimates, refer to Benchmarks for Estimating Migration Durations.

1.11 NetApp Data Migration Tool Chest

The tools listed in this section are used in different phases of the migration process. A comprehensive set of discovery and analysis tools provides an efficient means to collect information about the customer's environment.

1.11.1 nSANity Data Collector

nSANity Data Collector is a NetApp tool to collect configuration information from hosts, storage, and fabric devices. nSANity is designed to perform remote data collection utilizing a variety of network protocols and native authentication mechanisms. nSANity binaries are available for Windows, Mac OS X, and Linux platforms. The Windows version of nSANity can communicate with all component types without exception. Only Windows systems can collect data from other Windows hosts.

nSANity generates gzip'd XML files that contain the output of commands run against local or remote components (hosts, switches, NetApp storage).

nSANity can be downloaded from http://support.netapp.com/NOW/download/tools/nsanity/.

1.11.2 NetApp Data Center Planner

NetApp Data Center Planner (NDCP) provides a simple mechanism to extract configuration information from several data collection formats. The primary NDCP inputs used for data migration purposes are nSANity and EMC SP Collect output files. NDCP provides an easy way to determine host configuration information such as HBAs, LUNs, and file systems as well as in-depth information about storage and fabrics.

NetApp Data Center Planner can be downloaded from http://support.netapp.com/NOW/download/tools/ndcp/.

1.11.3 Solaris Relabeler

Solaris Relabeler is a command-line utility that provides the ability to update the ASCII label on VTOC disks post-migration. During the initial VTOC disk initialization routines, the Solaris format command performs a SCSI inquiry against the disk and writes vendor-specific information (manufacturer, product, and revision) to the disk label. All further inquiries are directed to the disk label and not to the actual device. Block-level migration copies this disk label to the new disk, and old SCSI inquiry data is still visible in the system tools and logs. The relabeler updates the disks post-migration with new inquiry data.

The Solaris Relabeler utility can be downloaded from http://support.netapp.com/NOW/download/tools/solaris_relabeler/.

1.12 Foreign LUN Import Overview

FLI is a feature built into clustered Data ONTAP, starting with 8.3, it allows users to import data from foreign array LUNs to NetApp LUNs in a simple and efficient manner. All FLI migrations operate at the LUN level. FLI is a strictly block-based tool; file, record, NFS, and CIFS-based migrations are not supported. For a discussion of other migration methodologies for file-level protocols such as NFS and CIFS/SMB, review Data Migration Tools: Quick Reference.

FLI leverages NetApp FlexArray® technology to discover the foreign RAID array LUNs and pull data from them. FlexArray allows a NetApp clustered Data ONTAP controller to act as an initiator in front of one or more third-party arrays. FlexArray can mount LUNs from those arrays as back-end storage and then present the space from those LUNs as NetApp unified storage (allowing FCP, FCoE, iSCSI, NFS, and CIFS/SMB protocol access) to hosts in your SAN/NAS environment.

FLI doesn't require a FlexArray license. FLI leverages FlexArray technology to not simply stand in front of a foreign LUN but also to copy the foreign LUN to a NetApp clustered Data ONTAP array and then allow the hosts and applications consuming that LUN to be pointed at the NetApp array that is now hosting the LUN in question. The first iteration of FLI, delivered in clustered Data ONTAP 8.3, supported offline FLI and required a NetApp or partner professional services engagement. Clustered Data ONTAP 8.3.1 adds online FLI and 7-Mode to clustered Data ONTAP transitions. Clustered Data ONTAP 8.3.1 no longer requires a professional services run migration, although we do strongly recommend professional services involvement in scoping, planning, and training for all but the simplest migrations.

FLI was developed to provide a free toolset to migrate SAN LUNs to clustered Data ONTAP. FLI is free and has no licensing requirements. It was designed to provide solutions for a range of migration requirements, including but not limited to the following:

- Migrating data between heterogeneous storage arrays from EMC, Hitachi, HP, and other vendors to NetApp as supported by FlexArray technology, source array interoperability must be checked against the FLI IMT
- Simplifying and accelerating block data migrations during data center relocation, consolidation, and array replacements
- Consolidating migration and LUN realignments into a single workflow.
- The new 7-Mode to clustered Data ONTAP transition, is able to convert from 32-bit to 64-bit aggregates, fix alignment problems, and migrate LUNs as a single operation.

Foreign LUNs to be imported will be discovered by the NetApp storage that is solely intended for use by FLI for data migration. The foreign LUNs will be shown as disks on the NetApp storage and will not have any ownership assigned to them automatically so that the user data should not be overwritten by mistake. The disks that contain foreign array LUNs need to be marked as foreign. The basic rules for configuring array LUNs currently must be strictly adhered to for the purpose of FLI on NetApp storage.

Table 1) FLI basics.

FLI Basics
• Fibre Channel only. • No iSCSI support: iSCSI LUNs can be migrated using FLI. However, in order to do this, the LUN type would need to be changed to FC, and the migration could then occur. After the migration is complete, the LUN would need to be changed back to an iSCSI LUN. • All migrations are at the LUN level.

Figure 1) FLI offline overview.

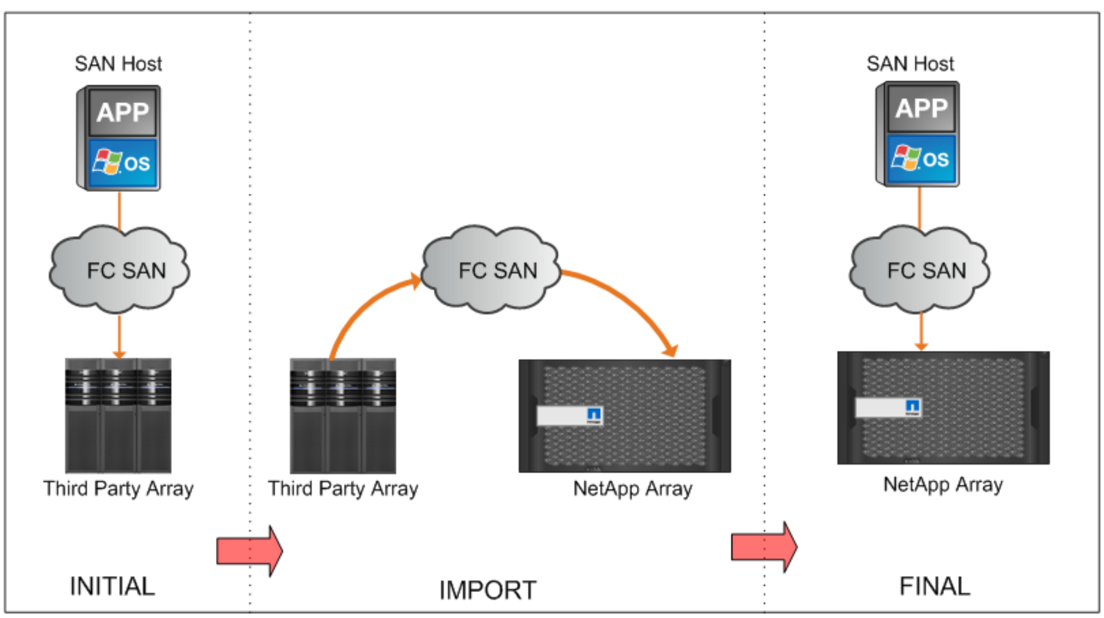
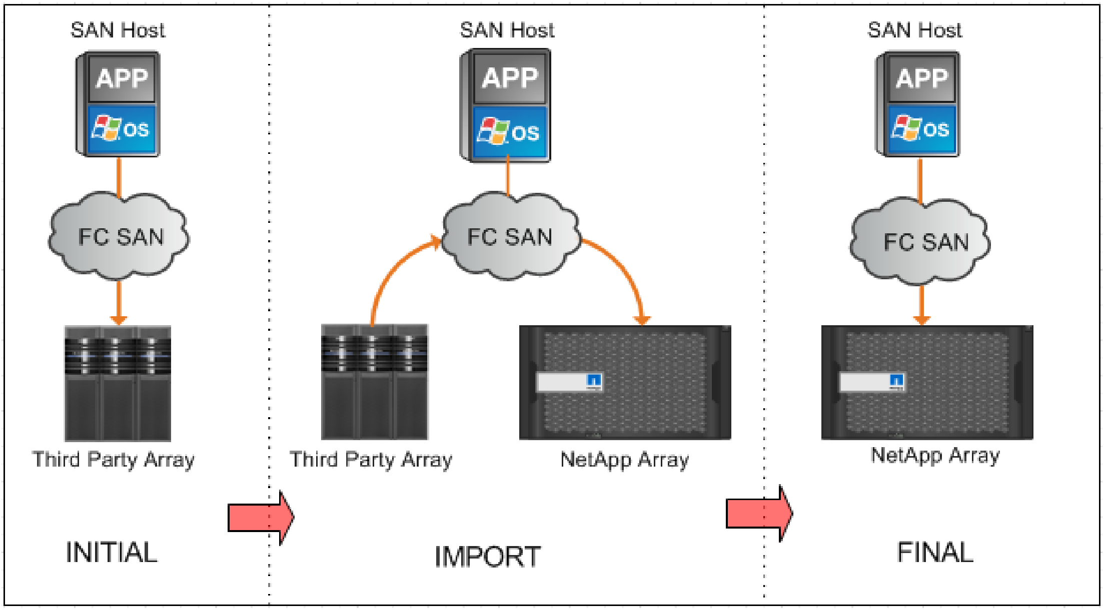


Figure 2) FLI online overview.



1.13 Features and Benefits

FLI provides the following features and functionalities:

- Supports both online and offline migrations.
- Provides operating system independence. Block-level data migration does not rely on volume managers or OS utilities.
- Provides Fibre Channel fabric independence. Fully compatible with Brocade and Cisco FC fabrics.
- Supports most Fibre Channel storage arrays. The support matrix is available at http://support.netapp.com/NOW/products/interoperability/.
- Supports native multipath and load balancing.
- Provides CLI-based management.

The FLI-based solution has numerous benefits to offer and is a preferred choice for SAN data migration from third-party SAN storage to clustered Data ONTAP 8.3 systems.

Table 2) FLI benefits.

Benefits of FLI-Based Solution
• FLI feature is built into clustered Data ONTAP 8.3 and requires no additional licensing. • FLI leverages FlexArray technology but does NOT require a FlexArray license. • Requires no additional hardware appliance for data migration and eliminates associated cost. • FLI-based solution supports data migrations from varied configurations of third-party storage platforms that are listed in the FLI IMT to clustered Data ONTAP. • FLI automatically aligns LUNs. • FLI can migrate a LUN hosted in a 32-bit aggregate to a 64-bit aggregate hosted on a clustered Data ONTAP array. This makes FLI 7-Mode to clustered Data ONTAP an excellent choice for customers that transition 7-Mode hosted LUNs that are hosted on 32-bit aggregates and/or are misaligned.

This document will present all of the shared procedures, requirements, and steps and then break into each of the various FLI workflows individually in subsequent sections.

Table 3) FLI requirements.

FLI Requirements
• FLI will require at least one FC port on each controller you want to migrate LUNs directly to be in Initiator mode. These ports will be used to connect to the source array and are the ports that will need to be zoned and masked in order to be able to see and mount the source LUNs. • Foreign LUN must be marked foreign on the destination array to prevent assignments from Data ONTAP. • Foreign LUN must be in an import relationship before starting import. • NetApp LUN should be brought offline before creating a relationship.

Following are some of the limitations of an FLI-based migration solution.

Table 4) FLI limitations.

FLI Limitations
• The LUN must be the same size as the foreign LUN and must have the same disk block size. Both of these requirements are taken care of during the LUN creation steps. • The LUN must not be expanding or contracting. • The LUN must be mapped to at least one "igroup." • To create an import relationship, the NetApp LUN should be brought offline. However, after the LUN relationship is created, it can brought back online in case of online FLI.

1.13.1 Licensing

Foreign LUN import is built into clustered Data ONTAP 8.3 or later and requires no additional hardware appliance or licensing.

1.13.2 NetApp Initiator Ports

FLI will require at least one physical FC port on each controller you want to migrate LUNs directly to be in Initiator mode. Two ports, one to each fabric are much preferred but a single port can be used. These ports will be used to connect to the source array and are the ports that will need to be zoned and masked in order to be able to see and mount the source LUNs. If you need to change port personalitly from target to iniator, please review the information on page 54 of the FlexArray Virtualization Installation Requirements and Reference Guide for a review of the process of converting a FC port from target to initiator.

1.13.3 Supported Configurations

Making sure that the FLI environment is deployed in a supported manner is essential for proper operation and support. To ensure supported configurations, review the NetApp interoperability Matrix Tool (IMT).

- There are two related activities that must be performed here: You need to verify that FLI is supported with the current infrastructure. For purposes of using FLI to import LUN(s). For more information on the FLI IMT review Appendix G: The FLI Interoperability Matrix Tool (IMT).
- You need to verify that once the import is complete and all LUN(s) have been migrated to NetApp controllers that configuration including the new NetApp controllers are in a supported configuration.

1.13.4 Storage Arrays

FLI supports data migration from most block-based Fibre Channel storage. For a list of supported arrays, refer to the NetApp Interoperability Matrix Tool.

Support Note
NetApp clustered Data ONTAP 8.3 and later versions are the only supported destination storage. Migrations to third-party storage are not supported.

1.13.5 Fibre Channel Switches for Back-End Connectivity

FLI supports most block-based Fibre Channel switches. For a list of supported switches and firmware, refer to the NetApp Interoperability Matrix Tool.

1.14 FLI Concepts

This section provides an overview of several key FLI concepts. Understanding the implementation of these concepts helps in proper operation and decreases the initial configuration effort.

1.14.1 Foreign Array

A foreign array is a storage device that does not run clustered Data ONTAP. This is also referred to as a third-party array or source array. In the case of a 7-Mode to clustered Data ONTAP transition, the foreign array would be an array produced by NetApp running Data ONTAP 7-Mode.

1.14.2 Foreign LUN

A foreign LUN is a LUN containing user data hosted on a third-party array using that array's native disk format.

1.14.3 FLI LUN Relationship

An FLI LUN relationship (or LUN relationship) is a persistent pairing between source and destination storage for the purpose of data import. The source and destination endpoints are LUNs.

1.14.4 LUN Import

LUN import is a process of transferring the data in a foreign LUN from its third-party format into a native NetApp format LUN.

1.15 Tools and Utilities

Table 5 lists the tools referenced in this TR along with their access links.

Table 5) Tools and utilities.

Tool/Utility	Description	Link
nSANity	NetApp nSANity tool is used to gather information about the hosts, storage systems, and fabrics that will be involved in the data migration.	nSANity
NDCP	NetApp Data Center Planner (NDCP) is used to parse the data collected by nSANity and retrieve specific details.	NDCP
Interoperability Matrix Tool (IMT)	IMT is a NetApp web-based utility that is used for interoperability checks for NetApp, FlexArray, and third-party software components.	Interoperability Matrix Tool
FLI Interoperability Matrix Tool (IMT)	The FLI IMT is very similar to the IMT discussed above, hoever it it specific to FLI Interoperability before and during the LUN Imports, where the IMT above is used primarily to verify that the end-state is supported.	FLI Interoperability Matrix Tool
OnCommand® System Manager	Remote storage management of NetApp FAS systems using a graphical user interface (GUI).	OnCommand System Manager
OnCommand Workflow Automation (WFA)	WFA is a software solution that enables you to create storage workflows and automate storage management tasks such as provisioning, migrating, decommissioning, and cloning storage.	OnCommand Workflow Automation

2 Implementation Basics

The initial configuration of the NetApp storage initiator ports and source storage prepares the environment for migration. This section provides an overview of the physical wiring, zoning, and initiator record creation steps that are performed for each new migration engagement. The examples in this section use an HDS AMS array, and therefore the foreign array commands will differ depending on the third-party array from which you are migrating.

2.1 Physical Wiring

Foreign LUN import wiring has the same requirements as NetApp FlexArray. NetApp storage initiator ports are connected to the fabric where source storage target ports are connected. Follow FlexArray best practices while connecting source storage to NetApp storage.

The storage arrays used during migration must have a primary path from each controller (in use) present in both fabrics. This means that the source array and the destination array nodes being migrated to, must be in a common zone on both fabrics. It is not necessary to add other controllers in the NetApp cluster, only those actually importing/migrating LUNs. While you could use indirect paths for the migration, the best practice is to use active/optimized paths between the source and destination arrays. Figure 3 shows both the HDS AMS2100 and NetApp clustered Data ONTAP storage having a primary (active) path present in both fabrics.

Figure 3) Storage wiring for dual fabrics.

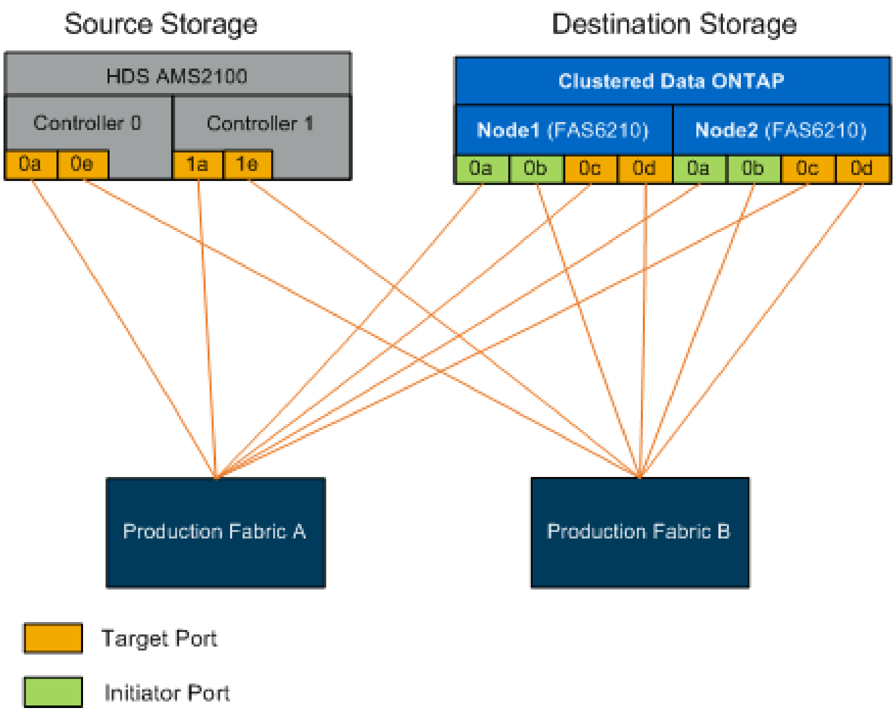


Table 6) Wiring best practices.

Wiring Best Practices
• Follow NetApp FlexArray best practices for wiring source and destination storage. For more information about this, review the "Planning for paths to array LUNs" section of the FlexArray Virtualization Installation Requirements and Reference Guide. • Clustered Data ONTAP storage requires free initiator ports to connect to fabric. Configure initiator ports if free ports do not exist.

2.2 Zoning

FLI migration requires source storage LUNs to be accessed by NetApp storage. This is achieved by zoning target ports of source storage with initiator ports of destination storage (zone 1 and zone 2). The existing source storage to host zones are not modified and are deactivated post-migration. Host to destination storage zones are created to enable access of migrated LUNs from destination storage by the host (zone 3 and zone 4).

A standard migration scenario using FLI requires four distinct zones:

- Zone 1: source storage to destination storage (production fabric A)
- Zone 2: source storage to destination storage (production fabric B)
- Zone 3: host to destination storage (production fabric A)
- Zone 4: host to destination storage (production fabric B)

Table 7) Zoning best practices.

Zoning Best Practices
• Do not mix source storage target ports and destination storage target ports in the same zone. • Do not mix destination storage initiator ports and host ports in the same zone. • Do not mix destination storage target and initiator ports in the same zone. • Zone with at least two ports from each controller for redundancy. • NetApp recommends single initiator and single target zoning. • After zoning the source storage target ports with the destination storage initiator ports, source storage will be visible in destination storage using the “storage array show” command. When the storage array is discovered for the first time, the NetApp controllers might not show the array automatically. Fix this by resetting the switch port where clustered Data ONTAP initiator ports are connected.

2.2.1 Zone 1: Source Storage to Destination Storage (Production Fabric A)

Zone 1 should contain all destination storage initiators on all the nodes and all the source storage target ports in fabric A. Refer to Table 8.

Table 8) Source storage to destination storage (production fabric A) zone 1 members.

Zone	Members
Zone 1	Clustered Data ONTAP – Node1 – 0a Clustered Data ONTAP – Node2 – 0a AMS2100 – Ctrl0 – 0a AMS2100 – Ctrl1 – 1a

2.2.2 Zone 2: Source Storage to Destination Storage (Production Fabric B)

Zone 2 should contain all destination storage initiator ports on all the nodes and all the source storage target ports in fabric B. Refer to Table 9.

Table 9) Source storage to destination storage (production fabric B) zone 2 members.

Zone	Members
Zone 2	Clustered Data ONTAP – Node1 – 0b Clustered Data ONTAP – Node2 – 0b AMS2100 – Ctrl0 – 0e AMS2100 – Ctrl1 – 1e

2.2.3 Zone 3: Host to Destination Storage (Production Fabric A)

Zone 3 should contain the host HBA port 1 and the destination controller ports in production fabric A. Refer to Table 10.

Table 10) Host to destination storage (production fabric A) zone 3 members.

Zone	Members
Zone 3	Clustered Data ONTAP – lif1 Clustered Data ONTAP – lif3 Host – HBA0

2.2.4 Zone 4: Host to Destination Storage (Production Fabric B)

Zone 4 should contain the host HBA port 2 and the destination controller ports in production fabric B. Refer to Table 11.

Table 11) Host to destination storage (production fabric B) zone 4 members.

Zone	Members
Zone 4	Clustered Data ONTAP – lif2 Clustered Data ONTAP – lif4 Host – HBA1

2.3 Initiator Group Configuration

Proper LUN masking configuration is critical for correct operation. All initiator ports (on both nodes) in clustered Data ONTAP storage must reside in the same igroup.

FLI migration requires source storage LUNs to be accessed by NetApp storage. To enable access apart from zoning, creating initiator groups on the source storage using WWPNs of the initiator ports of the destination storage is required.

Always enable ALUA on initiator groups for NetApp arrays.

Initiator groups go by different names depending upon the vendor and product. For example:

- Hitachi Data Systems (HDS) uses “host group.”
- NetApp E-Series uses “host entry.”
- EMC uses “initiator record” or “storage group.”
- NetApp uses “igroup.”

Regardless of nomenclature, the purpose of an initiator group is to identify initiators (by WWPN) that share the same LUN mappings.

To define initiator groups, review your array documentation for how to set up LUN masking (igroups/host groups/storage groups, and so on). You can also review the FlexArray Virtualization Implementation Guide for Third-Party Storage for coverage of third-party storage configuration requirements.

2.4 Perform Test Migrations

A test or “dry run” migration is performed before production migrations to verify proper storage and fabric configuration. Another reason to perform several test migrations is that you can use the amount of time they take to complete to extrapolate how long your production migrations may take and the throughput that can be expected. Otherwise, the number of variables that will factor into how long migrations will take will make it very difficult to accurately estimate. Refer to Appendix F: Test Migration Example Using Hitachi AMS2100 for a detailed example test migration workflow.

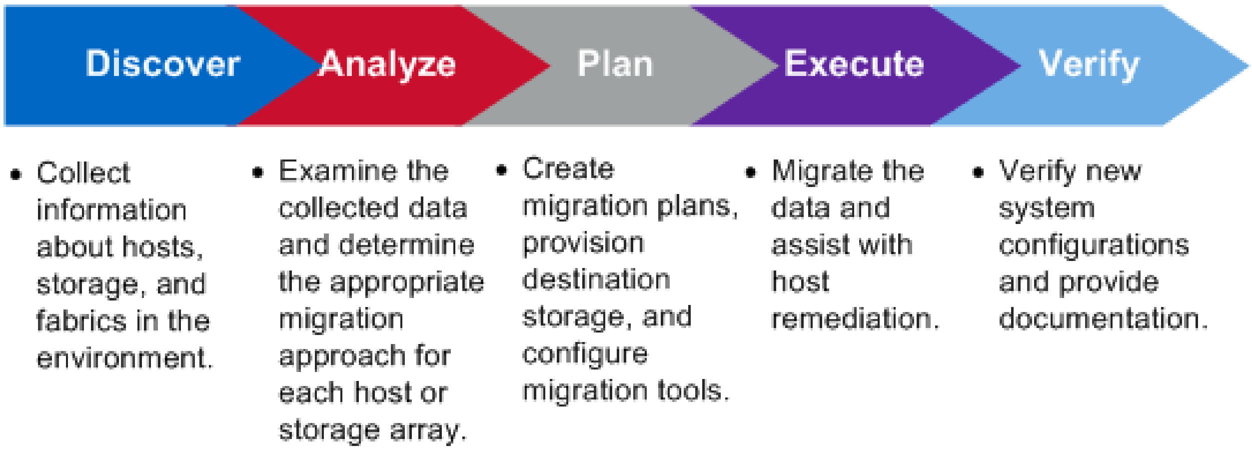
Support Note
The test migration should be performed a minimum of one week prior to beginning the production data migrations. This will allow enough time to resolve possible issues such as access, storage connectivity, and licensing.

3 Migration Overview

This chapter provides a high-level overview of a migration. Examples and discussions about specific FLI migration types will be discussed in greater depth in their respective sections of this report.

The steps presented in this section align with NetApp's five-phase methodology for migrations, as shown in Figure 4. These phases provide a general framework to help identify where common tasks are performed throughout the entire migration process.

Figure 4) Migration phases.



3.1 Migration Overview

This section provides a brief overview of the migration process. Swim lane charts indicate the tasks that can be performed in parallel in each of the five major components of migration: host, fabric, destination storage, and source storage. Specific types of migration are covered individually in sections that follow.

Tables 12 through 17 and Figures 5 through 9 break down the major tasks performed in a typical migration, utilizing the NetApp foreign LUN import methodology.

3.1.1. Discover Phase

The discover phase focuses on collecting information used for host remediation and creating migration plans in the later steps. The collection of most information is automated using the nSANity data collection tool (see Figure 5 and Table 12).

Figure 5) Discover workflow

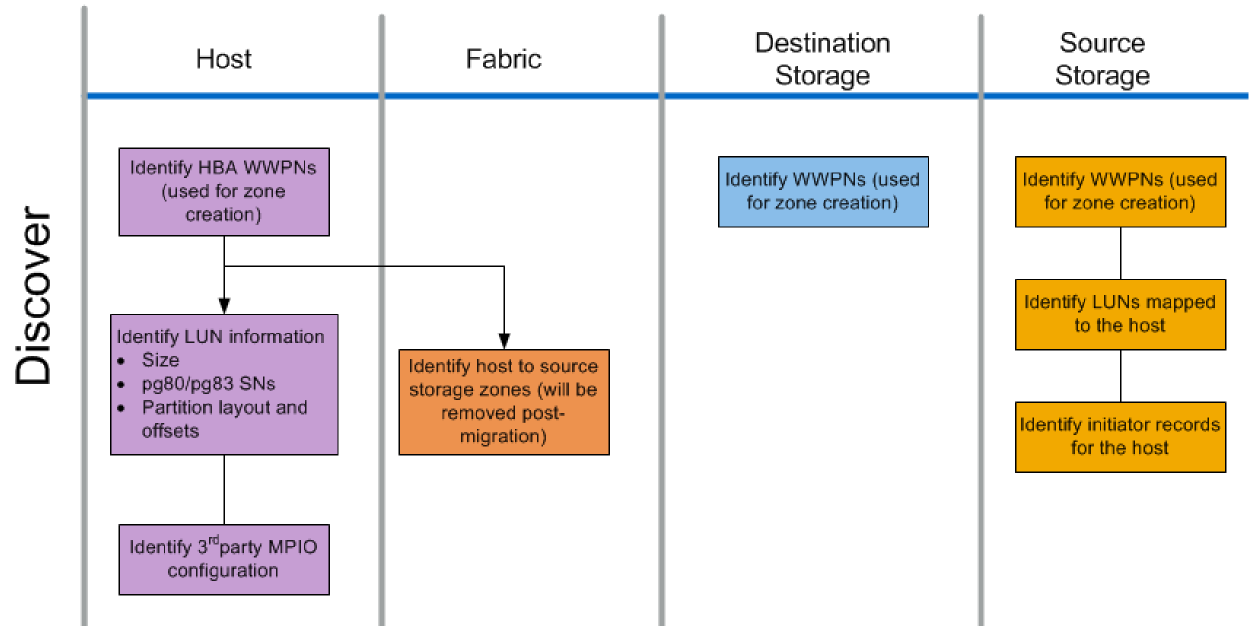


Table 12) Discover tasks.

Component	Tasks
Host	• Identify HBA WWPNs (used for zone creation). • Identify LUN information (size, serial numbers, partition layouts, and offsets). • Identify third-party MPIO configuration, host operating system, HBA/CNA models and firmware, and so on.
Fabric	• Identify host to source storage zones (will be removed post-migration).
Destination storage	• Identify the WWPNs for the ports that will be used for initiator/target usage.
Source storage	• Identify WWPNs (used for zone creation). • Identify LUNs mapped to the host. • Identify initiator records for the host.

3.1.2. Analyze Phase

The analyze phase focuses on items that must be addressed before migration planning (see Table 13). Host configuration specifics that fall outside of the [NetApp Interoperability Matrix (IMT)](https://mysupport.netapp.com/matrix) must be identified.

For each host, a target configuration (post-migration) is identified, and a gap analysis is performed to identify specific components that are not supported. The host analysis should be reviewed immediately upon completion. Required updates might break compatibility with applications running on each host.

Usually required host changes are often not made until the actual migration event. This is due to the common need to schedule maintenance windows, but it is often less risky to do host changes in advance where possible (system patching, HBA updates, and so on). In addition, system updates are frequently done in coordination with application updates utilizing the same maintenance events. Typically, any changes made to the MPIO configuration before migration will affect the support of the current storage as well. For example, removing PowerPath from a host and reconfiguring it to use native MPIO (dm-mp and ALUA on Linux) might not be supported by the current storage configuration.

Delaying MPIO reconfiguration until after the migration simplifies the process for rollback if required.

Table 13) Analyze tasks.

Component	Tasks
Host	1. Perform a gap analysis for each host. Identify required hot fixes/patches, OS updates, HBA driver, and firmware upgrades required to match the selected target configuration on the NetApp IMT. In addition, requirements for other NetApp software to be installed on this host (SnapDrive®, SnapManager®) should be taken into consideration. 2. Determine a target configuration (post-migration) for each host (OS configuration, MPIO, HBA details, Host Utility Kit version). 3. Determine additional NetApp product requirements (SnapDrive, SnapManager).

3.1.3. Plan and Prepare Phase

The plan and prepare phase focuses on tasks required to create detailed migration plans and to make sure that everything is ready for the actual migration (see Table 14 and Figure 6). The majority of migration work is the planning performed during this phase. The planning phase is where you develop a remediation plan using the host gap analysis information gathered in the analysis phase. Use the host remediation information in [Appendix B: Host Remediation](#) while planning. After end-to-end connectivity is verified, a test migration is performed to make sure everything is properly configured before beginning production migrations.

Figure 6) Plan and prepare workflow.

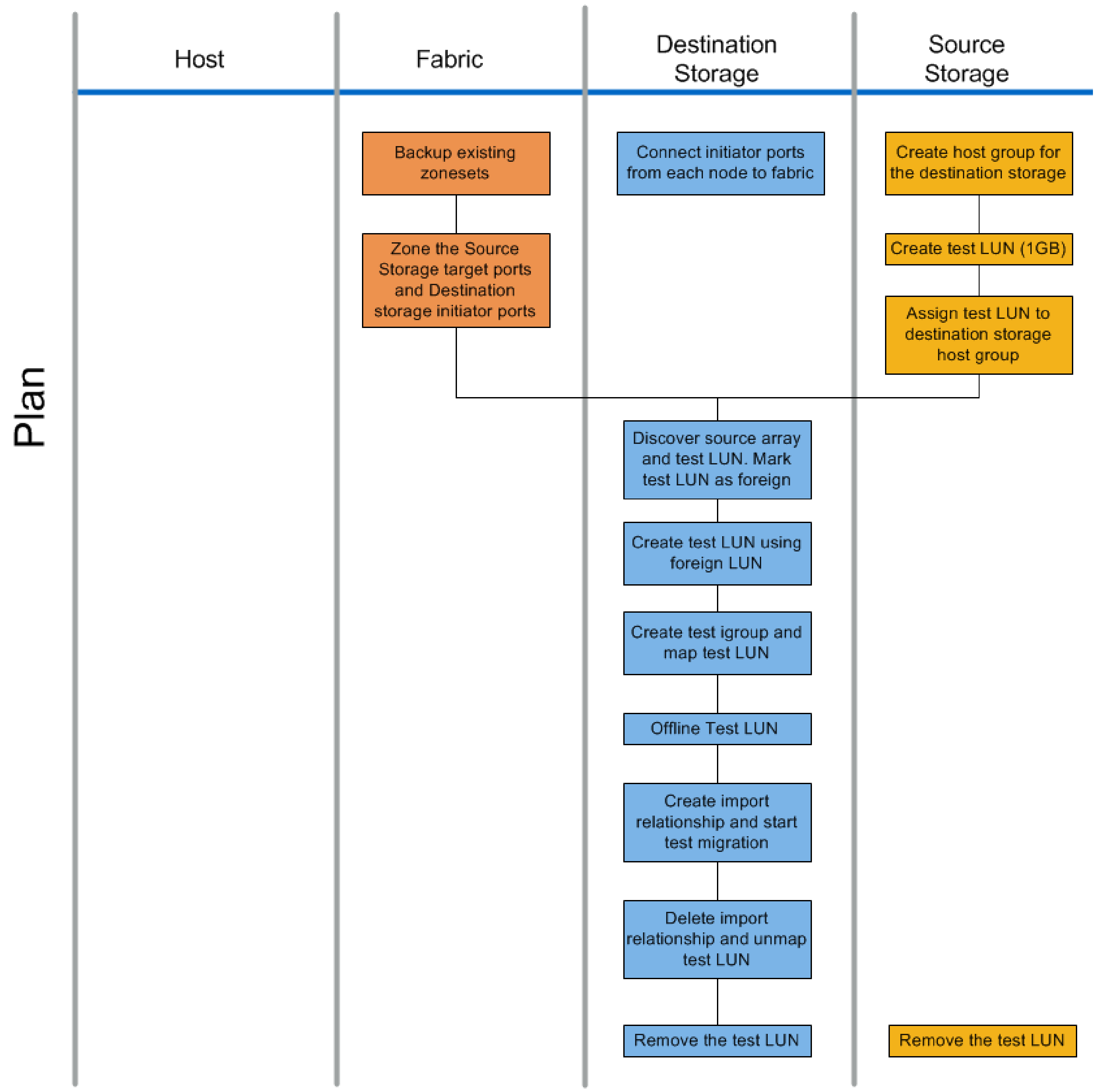


Table 14) Plan and prepare tasks.

Component	Tasks
Fabric	1. Back up the existing zonesets. 2. Zone the source storage to destination storage.
Destination storage	1. Connect initiator ports to fabric. 2. Discover source storage and test LUN. Mark the source LUN as foreign. 3. Create test LUN using foreign LUN. 4. Create test igroup and map test LUN. 5. Offline test LUN. 6. Create import relationship and start test migration. 7. Delete import relationship and unmap test LUN. 8. Remove the test LUN.
Source storage	1. Create host group for destination storage using initiator port WWPNs. 2. Create test LUN (1GB). 3. Assign (map/mask) test LUN to destination storage host group. 4. Remove the test LUN.

3.1.4. Execute Phase

The execute phase focuses on the actual LUN migration (see Figure 7/Table 15 for FLI offline and Figure 8/Table 16 for FLI online) execution tasks. The host event logs are reviewed in order to find and correct any problems and reduce risk. The hosts are rebooted to make sure that there are no underlying issues with the hosts before major reconfiguration occurs. After the source LUNs are visible on the destination storage, migration jobs can be created and executed. After migrations are complete (FLI offline) or the FLI LUN relationship is established (FLI online), the host is zoned to the destination storage; new LUNs are mapped; and host remediation can begin for drivers, multipath software, and any other updates that have been identified in the analyze phase.

3.1.4.2 Offline Migration

Figure 7) FLI offline execute workflow.

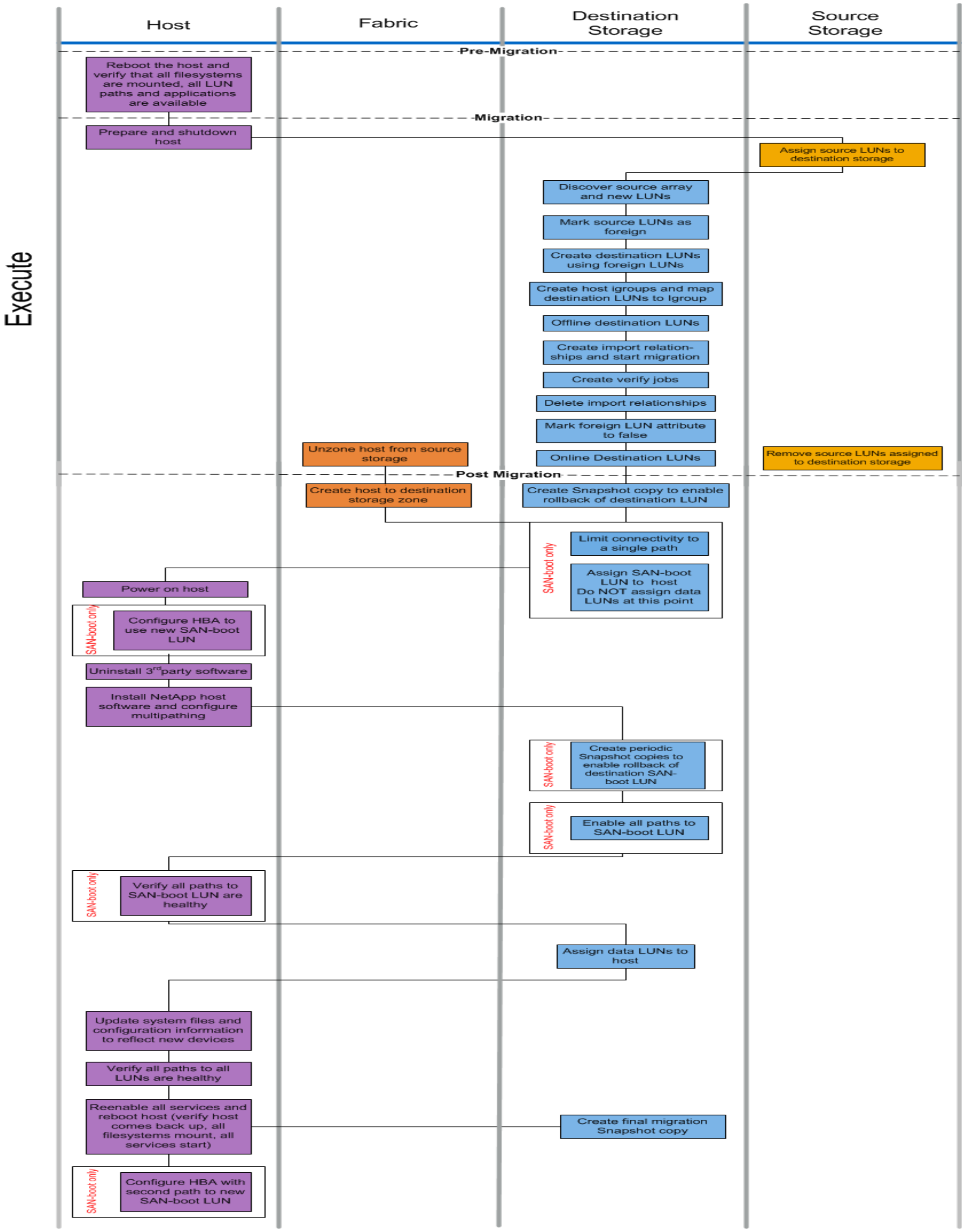


Table 15) Execute offline migration tasks

Component	Tasks
Host	1. Reboot the host and verify that all file systems mount, all LUN paths are available, and services start. 2. Prepare and shut down the host. 3. After the migration completes, power on host. 4. Configure the HBA to use new SAN boot LUN (SAN boot only). 5. Uninstall third-party MPIO. 6. Install NetApp host software and configure multipathing. 7. Verify all paths to SAN boot LUN are healthy (SAN boot only). 8. Update system files and configuration to reflect new devices. 9. Verify all paths to all LUNs are healthy. 10. Reenable all services and reboot host (verify host comes back up, all file systems mount, all services start). 11. Configure the HBA with the second path to new SAN boot LUN (SAN boot only).
Fabric	1. Unzone the host from the source storage. 2. Create host to destination storage zone.
Destination storage	1. Discover source array and new LUNs. 2. Mark source LUNs as foreign. 3. Create destination LUNs using foreign LUNs. 4. Create host initiator igroups and map destination LUNs to igroup. 5. Offline destination LUNs. 6. Create import relationships and start import jobs. 7. Create verify jobs (optional). 8. Delete import relationships. 9. Mark foreign LUN attribute to false. 10. Online destination LUNs. 11. Create a Snapshot® copy to enable rollback of destination LUN. 12. Limit connectivity to a single path (SAN boot only). 13. Assign SAN boot LUN to host; do not assign data LUNs at this point (SAN boot only). 14. Verify all host ports are logged in. 15. Create periodic Snapshot copies to enable rollback of destination SAN boot LUN (SAN boot only). 16. Enable all paths to SAN boot LUN (SAN boot only). 17. Assign data LUNs to host. 18. Create a final migration Snapshot copy.
Source storage	1. Assign source LUNs to destination storage. 2. Remove the source LUNs assigned to destination storage.

3.1.4.2 Online Migration

Figure 8) FLI online execute workflow.

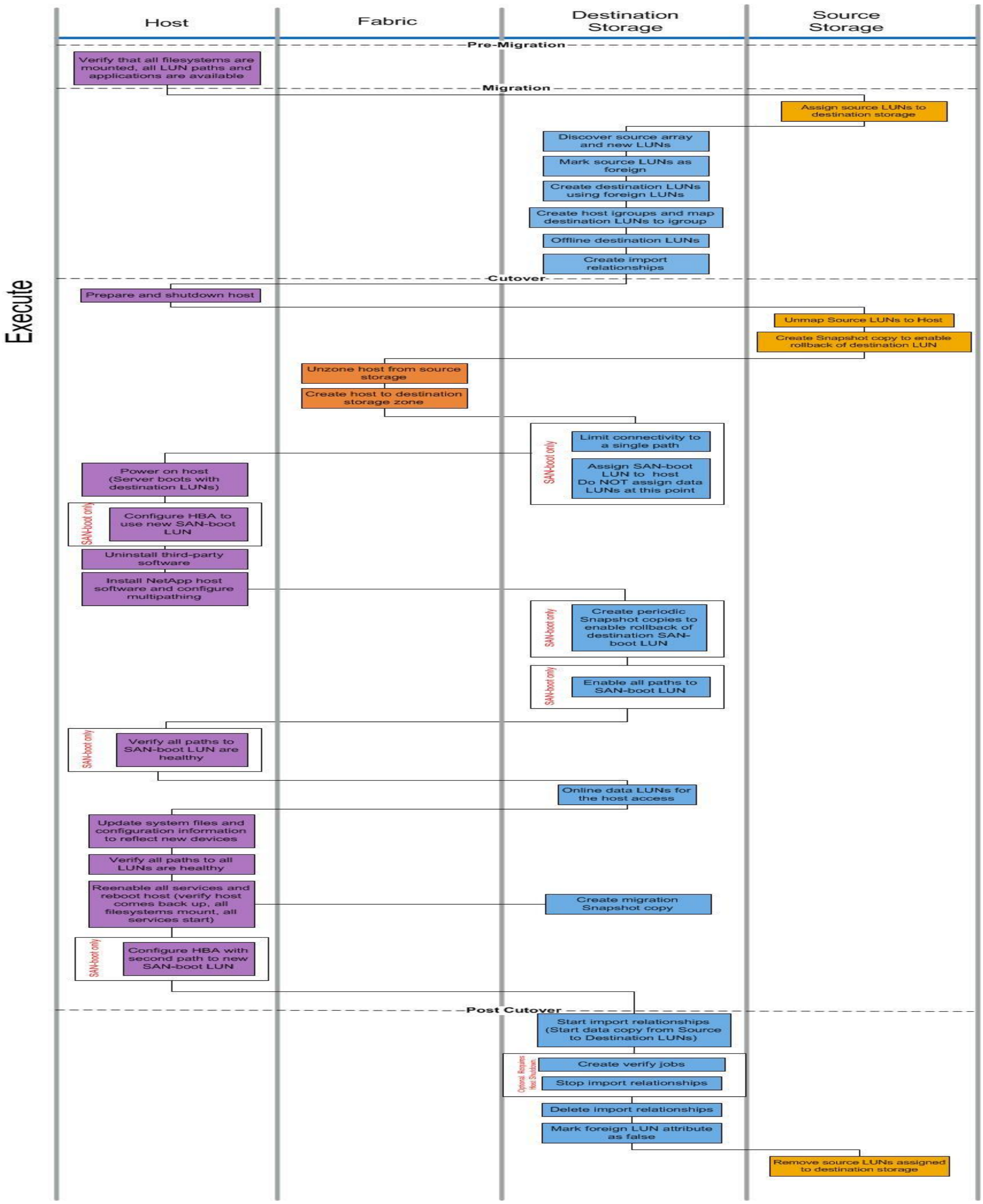


Table 16) Execute online migration tasks

Component	Tasks
Host	1. Verify that all file systems are mounted and all LUN paths and applications are available. 2. Optional: If the LUNs being imported are for ESX, review and follow the instructions in Appendix A: ESX CAW/ATS Remediation. 3. Prepare and shut down the hosts. 4. Power on the hosts with destination LUNs. 5. Configure the HBA to use new SAN boot LUN (SAN boot only). 6. Uninstall third-party MPIO. 7. Install NetApp host software and configure multipathing. 8. Verify all paths to SAN boot LUN are healthy (SAN boot only). 9. Update system files and configuration to reflect new devices. 10. Verify all paths to all LUNs are healthy. 11. Reenable all services and reboot host (verify host comes back up, all file systems mount, all services start). 12. Configure the HBA with the second path to new SAN boot LUN (SAN boot only).
Fabric	1. Unzone the host from the source storage. 2. Create host to destination storage zone.
Destination storage	1. Discover source array and new LUNs. 2. Mark source LUNs as foreign. 3. Create destination LUNs using foreign LUNs. 4. Create host initiator igroups and map destination LUNs to igroup. 5. Offline the destination LUNs. 6. Remove hosts from source array LUN masking (igroups). 7. Create import relationships and start import jobs. 8. Perform host step 4 earlier (remap hosts to new LUN locations). 9. Limit connectivity to a single path (SAN boot only). 10. Assign SAN boot LUN to host; do not assign data LUNs at this point (SAN boot only). 11. Create periodic Snapshot copies to enable rollback of destination SAN boot LUN (SAN boot only). 12. Enable all paths to SAN boot LUN (SAN boot only). 13. Online destination LUNs. 14. Create a Snapshot copy to enable rollback of destination LUN. 15. Start import relationships (start data copy from source to destination LUNs). 16. Create verify jobs and stop import relationships (optional). 17. Delete import relationships. 18. Mark foreign LUN attribute to false.

Component	Tasks
Source storage	1. Assign source LUNs to destination storage. 2. Unmap source LUNs to host. 3. Create Snapshot copy to enable rollback of destination LUN. 4. Remove the source LUNs assigned to destination storage.

3.1.5. Verify Phase

The verify phase focuses on the post-migration cleanup process and confirming the accuracy of the execution of the migration plan (see Table 17 and Figure 9). Initiator records on the source storage and zone between source and destination zone are removed.

Figure 9) Verification and cleanup flowchart.

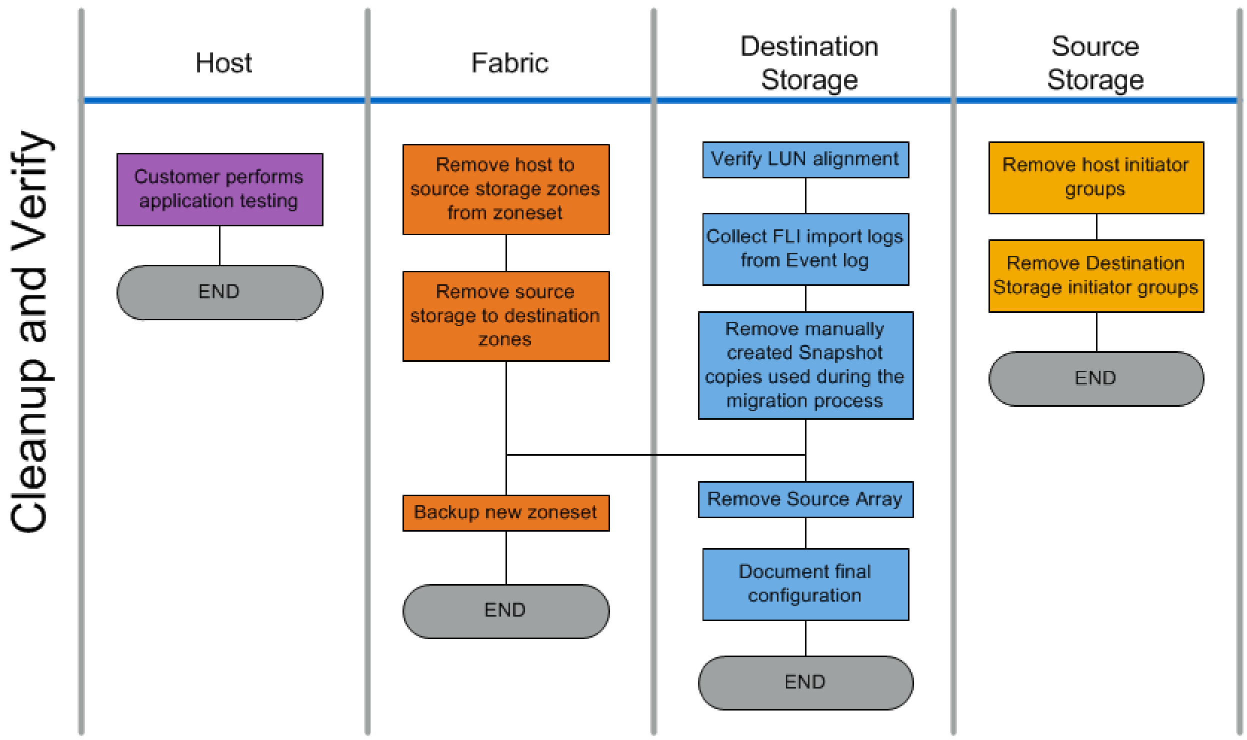


Table 17) Verification, cleanup, and post-migration tasks.

Component	Tasks
Host	1. Customer performs application testing.
Fabric	1. Remove host to source storage zones from zoneset. 2. Remove source storage to destination storage zones. 3. Back up new zoneset.

Component	Tasks
Destination storage	1. Verify LUN alignment. 2. Collect FLI import logs from event log. 3. Remove manually created Snapshot copies used during the migration process. 4. Remove source array. 5. Perform storage failover testing as necessary for production environments. 6. Document final configuration.
Source storage	1. Remove host initiator groups. 2. Remove destination storage initiator groups.

3.2 Supported Operating Systems

The list of supported operating systems changes as engineering qualifies new configurations. Refer to the NetApp Interoperability Matrix for to verify support for specific configurations.

- All NetApp supported configurations (per the IMT) are supported as destination MPIO (for example, Windows 2012 supported destination MPIO configurations include MSDSM and Data ONTAP DSM).
- The data migration program will provide support for the configurations in the NetApp Interoperability Matrix.
- Additional MPIO stacks will be supported in the future.
- Additional MPIO configurations might work, but the configurations might not have been tested.
- Customer environments vary greatly; the configurations in the NetApp Interoperability Matrix should be used as a guideline.
- Boot from SAN is supported in all configurations unless specifically noted.
- If you are unable to find your host OS listed, it may still be possible to get support for it using PVR. In order to investigate the feasibility of that option, contact your NetApp account team.

Data Migration Best Practice
NetApp recommends that all configurations be tested in a customer test environment before migration of production data.

4 Discover and Analyze Phases

4.1 Discover Phase

The discover phase collects specifics of the customer environment to provide information necessary for successful planning and execution of the migration.

4.1.1 Gather Information Using nSANity

nSANity Diagnostic and Configuration Data Collector (nSANity) is used primarily to collect pre-migration configuration data for SAN environment being migrated. nSANity runs a series of predefined remote commands against a variety of possible components gathering diagnostics and configuration data. The collected data is stored as a gzip XML file and may be viewed and/or parsed using NetApp Data Center Planner (NDCP).

For more information regarding the list of supported components, refer to the readme file included as part of the nSANity software distribution.

The syntax used for collection of Windows, Linux, ESX hosts, Cisco and Brocade switches, and NetApp storage is as follows:

- **Windows Syntax**

```
nsanity windows://[[domain|host\]username[:password | *]@]windows_server
```

- **Linux Syntax**

```
nsanity linux://username:password@linux_server_ip_address
```

- **ESX Syntax**

```
nsanity vmware://username:password@vmware_server_ip_address
```

- **Cisco Syntax**

```
nsanity cisco://username:password@cisco_switch_ip_address
```

- **Brocade Syntax**

```
nsanity brocade://username:password@cisco_switch_ip_address
```

- **NetApp Syntax**

```
nsanity ontap://username:password@NetappController_switch_ip_address
```

Windows Host Examples

- Using plain text password:

```
nsanity windows://netapp\administrator:migrate@10.61.187.31
```

- Prompting for password:

```
 nsanity windows://netapp\administrator:*@10.61.187.31
```

Support Note

- nSANity remotely performs data collection from the components.
- Mac OS X and Linux binaries cannot collect Windows component data.
- nSANity can be run locally on a Windows host using loopback address 127.0.0.1.
- nSANity should be run against at least one switch in each fabric and all hosts included in the migration scope.

4.1.2 NetApp Data Center Planner (NDCP)

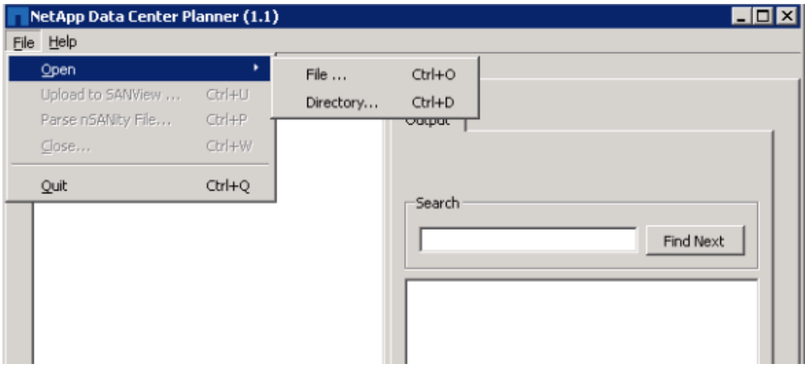
NetApp Data Center Planner (NDCP) is an application suite composed of utilities that assist in data migration. The application GUI consists of the Viewer and Parser tabs. The Viewer tab is used to view details of nSANity files. The left pane provides a tree view of the top-level nodes corresponding to the loaded file, and the right pane shows the details of the node selected in the left pane. The Parser tab is used to parse nSANity or SPCollect files and present the parsed content in a tabular format. The parsed content can be exported to formats such as csv, xls, yaml, and json.

4.1.2.1 Open nSANity Files in the NDCP Viewer Tab

To open nSANity files in the NDCP Viewer tab, complete the following steps:

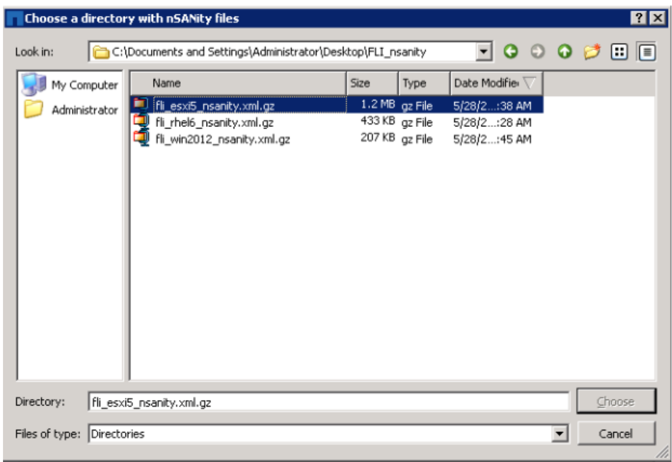
1. In the Viewer tab, select File > Open and select the required nSANity file.

Figure 10) NetApp Data Center Planner: open file.



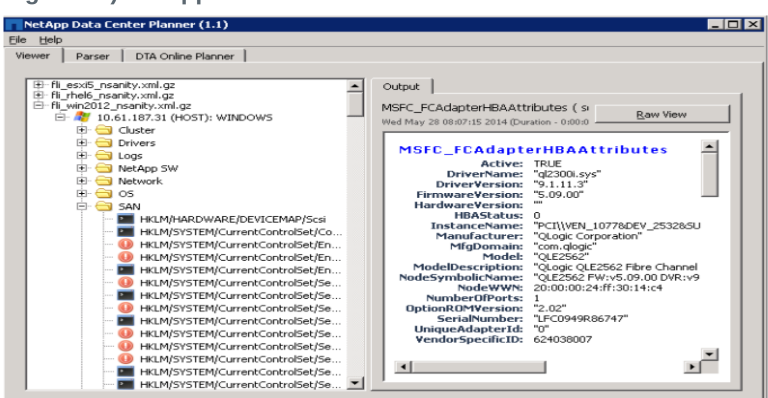
2. Select the gzip XML file or directory to open.

Figure 11) NetApp Data Center Planner: open file (continued).



3. From the left pane, expand the tree view of a loaded file and select an item. The details of this item are displayed in the right pane.

Figure 12) NetApp Data Center Planner: Viewer tab.

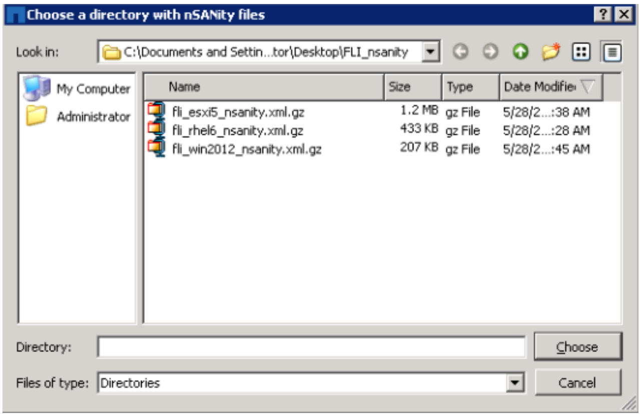


4.1.2.2 Open nSANity Files in the NDCP Parser Tab

To open nSANity and SPCollect files in the NDCP Parser tab, complete the following steps:

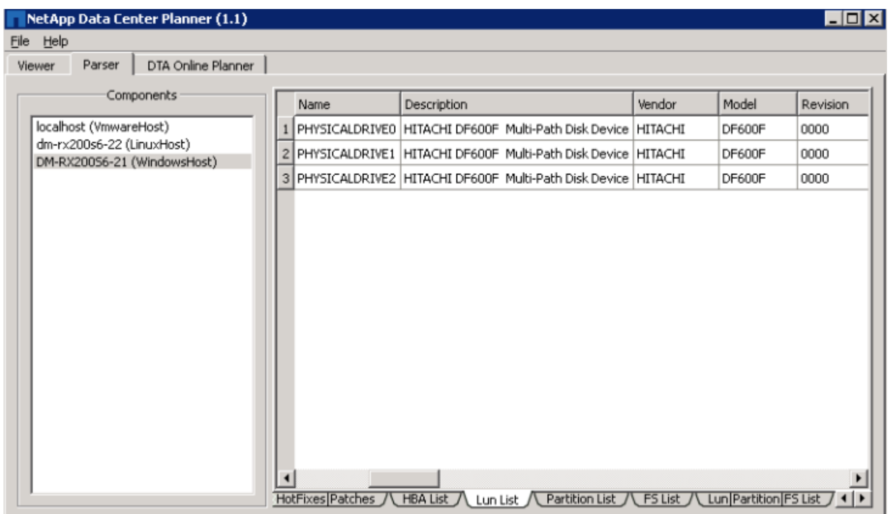
1. In the Parser tab, click File > Open. Select File or Directory. Select nSANity or spcollect and click Next.
2. Select the file or directory to open.

Figure 13) NetApp Data Center Planner: open nSanity data collection.



3. Each tab in the right pane represents different elements of the components selected in the left pane. This information will be used to complete your Site Survey and Planning worksheet associated with the data migration project.

Figure 14) NetApp Data Center Planner: Parser tab.



4.1.2.3 Host Information

Figure 15 and Table 18 provide an overview of the Hosts tab.

Figure 15) Hosts Tab

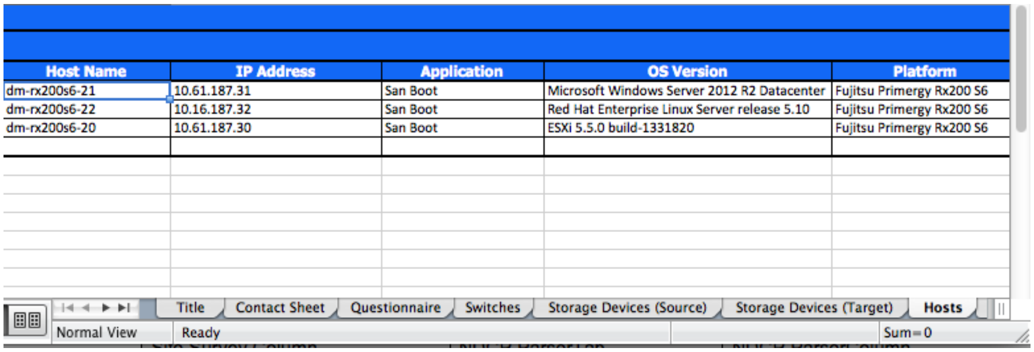


Table 18) Hosts tab input from NDCP parser output

Hosts Tab		
Site Survey Column	**NDCP Parser Tab**	**NDCP Parser Column**
Hostname	Host	hostname
IP Address	Host	collection target
OS Version	Host	os_major_rev
Platform	Host	cpu_type
Architecture	Host	cpu_desc
Service Pack		os_minor_rev
Cluster	Host	is_clustered cluster_name cluster_members
Volume Manager	FS List	parent_os_dev
File System	FS List	type
MPIO	Host	mpio/dsm
Adapter	HBA List	manuf model
Driver	HBA List	driver
Firmware	HBA List	fw

Note: Enter the information for each of the hosts in the migration in the Hosts tab.

4.1.2.4 Switch Information

Figure 16 and Table 19 provide an overview of the Switches tab.

Figure 16) Switches tab from NDCP parser

Switches						
Current						
Host name	IP Address	Vendor	Model	Fabric Name	VSAN/Domain	Firmware
DM-Cisco9506-1	10.61.187.6	Cisco	9506	Production Fabric A	10	3.3(5a)
DM-Cisco9506-2	10.61.187.7	Cisco	9506	Production Fabric B	10	3.3(5a)

Title | Contact Sheet | Questionnaire | Switches | Storage Devices (Source) | Storage Devices (Target) | Hosts

Normal View | Ready | Sum=0

Table 19) Switches tab input from NDCP viewer output

Switch Tab	
Site Survey Column	**NDCP Viewer Element**
Hostname	show switchname
Vendor	show hardware
Firmware	show module

Support Note

- Switch details can be gathered by running nSANity against a switch. The nSANity file can then be imported into NDCP Viewer to obtain the required switch information.
- A minimum of a single primary path is required for each controller owning a LUN that will be included in the migration. Additional paths through other controllers provide a degree of resiliency in the event of a fabric or storage controller outage.

4.1.2.5 HBA and Zone Information

Figure 17 and Table 20 provide an overview of the HBA and Zone Information tab.

Figure 17) HBA and zone information from NDCP parser

Fabric Details						
Host Name	Description	WWPN	Fabric Name	VSAN/Domain	Port Number	Pre-migration Zone Membership
dm-rx200s6-21	HBA0	21:00:00:24:ff:30:14:c5	Production Fabric A	10	fc2/3	rx21_AMS2100
dm-rx200s6-21	HBA1	21:00:00:24:ff:30:14:c4	Production Fabric B	10	fc2/3	rx21_AMS2100
dm-rx200s6-22	HBA0	21:00:00:24:ff:30:04:85	Production Fabric A	10	fc2/7	rx22_AMS2100
dm-rx200s6-22	HBA1	21:00:00:24:ff:30:04:84	Production Fabric B	10	fc2/7	rx22_AMS2100
dm-rx200s6-20	HBA0	21:00:00:24:ff:30:03:ea	Production Fabric A	10	fc3/20	rx20_AMS2100
dm-rx200s6-20	HBA1	21:00:00:24:ff:30:03:eb	Production Fabric B	10	fc3/20	rx20_AMS2100

Storage Devices (Source) | Storage Devices (Target) | Hosts | HBA and Zone Information | Source LUNs | Storage Groups | LUN Details

Normal View | Ready | Sum=0

Table 20) HBA and zone information tab input from NDCP parser

HBA and Zone Information		
Site Survey Column	**NDCP Parser Tab**	**NDCP Parser Column**
Hostname	HBA List	hostname
WWPN	HBA List	Wwpn
HBA Port Number in Fabric	NDCP Viewer element show flogi database	Cross-referenced by WWPN
Fabric Name	NDCP Viewer element show flogi database	Cross-referenced by WWPN
Pre-migration Zone Membership	NDCP Viewer element show zoneset active	Cross-referenced by WWPN
Post-migration Zone Membership	Host to Destination Zone Name	

Support Note
Pre-migration zones must be identified so they may be replaced post-migration.

4.1.2.6 Source LUN Information

Figure 18 provides an overview of the Source LUNs tab.

Figure 18) Source LUNs from NDCP parser

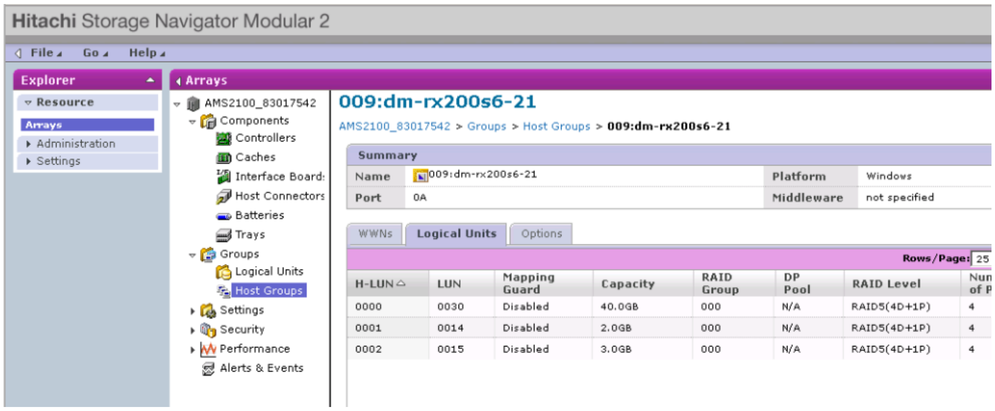
		Masked LUNs		Source Luns		All LU
Storage Group Name	**Host LUN ID**	**Array LUN ID**	**Thick/Thin**	**UID**		**LUN Name**
dm-rx200s6-21	0	30	Thick	60060e801046b96004f2bf460000001e		LUN30
dm-rx200s6-21	1	14	Thick	60060e801046b96004f2bf460000000e		LUN14
dm-rx200s6-21	2	15	Thick	60060e801046b96004f2bf460000000f		LUN15
dm-rx200s6-22	0	16	Thick	60060e801046b96004f2bf4600000010		LUN16
dm-rx200s6-22	1	17	Thick	60060e801046b96004f2bf4600000011		LUN17
dm-rx200s6-22	2	18	Thick	60060e801046b96004f2bf4600000012		LUN18
dm-rx200s6-22	3	19	Thick	60060e801046b96004f2bf4600000013		LUN19
dm-rx200s6-20	0	20	Thick	60060e801046b96004f2bf4600000014		LUN20
dm-rx200s6-20	1	21	Thick	60060e801046b96004f2bf4600000015		LUN21
dm-rx200s6-20	2	22	Thick	60060e801046b96004f2bf4600000016		LUN22
dm-rx200s6-20	3	23	Thick	60060e801046b96004f2bf4600000017		LUN23
dm-rx200s6-20	4	24	Thick	60060e801046b96004f2bf4600000018		LUN24
dm-rx200s6-20	5	25	Thick	60060e801046b96004f2bf4600000019		LUN25

Storage Devices (Source) | Storage Devices (Target) | Hosts | HBA and Zone Information | Source LUNs | Storage Groups | LUN Details

Normal View | Ready | Sum=0

Source LUN and storage group information is obtained from source storage. Log in to source storage and find storage group, host LUN ID, and array LUN ID.

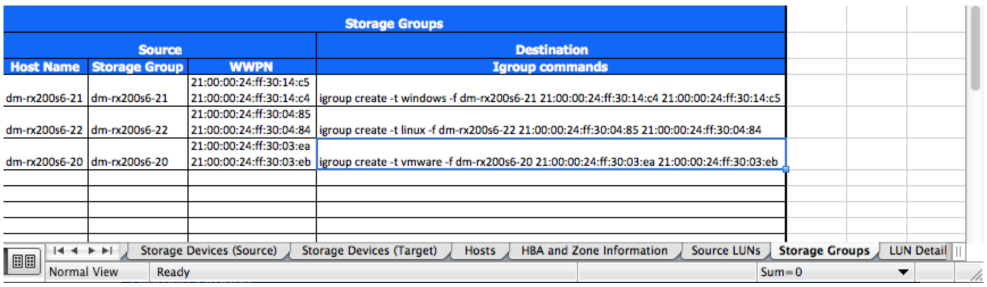
Figure 19) HDS Storage Navigator: display host groups



4.1.2.7 Storage Group Information

Figure 20 provides an overview of the Storage Groups tab.

Figure 20) Storage groups information from NDCP parser



Storage Groups			
Source			Destination
Host Name	Storage Group	WWPN	Igroup commands
dm-rx200s6-21	dm-rx200s6-21	21:00:00:24:ff:30:14:c5 21:00:00:24:ff:30:14:c4	igroup create -t windows -f dm-rx200s6-21 21:00:00:24:ff:30:14:c4 21:00:00:24:ff:30:14:c5
dm-rx200s6-22	dm-rx200s6-22	21:00:00:24:ff:30:04:85 21:00:00:24:ff:30:04:84	igroup create -t linux -f dm-rx200s6-22 21:00:00:24:ff:30:04:85 21:00:00:24:ff:30:04:84
dm-rx200s6-20	dm-rx200s6-20	21:00:00:24:ff:30:03:ea 21:00:00:24:ff:30:03:eb	igroup create -t vmware -f dm-rx200s6-20 21:00:00:24:ff:30:03:ea 21:00:00:24:ff:30:03:eb

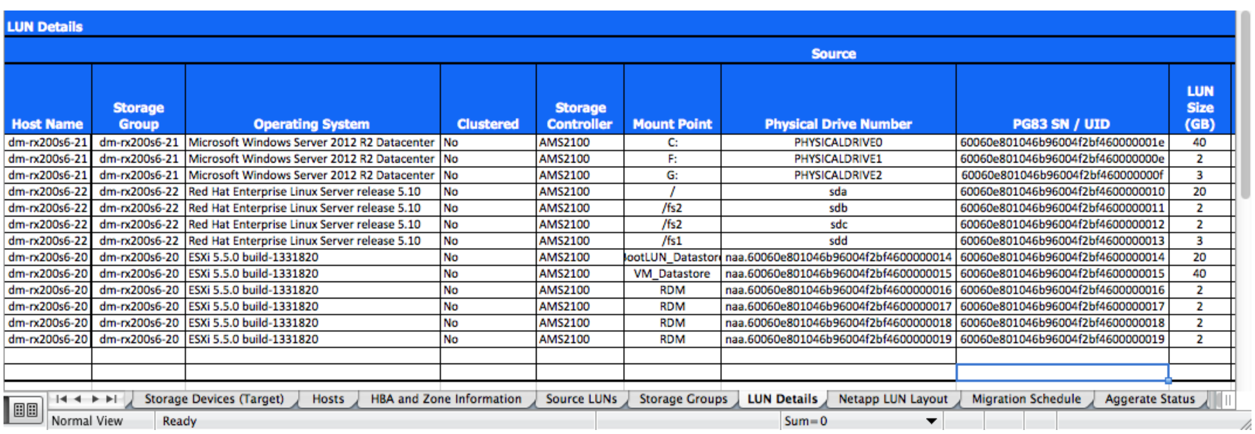
Storage Devices (Source) | Storage Devices (Target) | Hosts | HBA and Zone Information | Source LUNs | Storage Groups | LUN Detail

Normal View | Ready | Sum=0

4.1.2.8 LUN Details Information

Figure 21 and Table 21 provide an overview of the LUN Details tab.

Figure 21) LUN details from NDCP parser



LUN Details								
Source								
Host Name	Storage Group	Operating System	Clustered	Storage Controller	Mount Point	Physical Drive Number	PG83 SN / UID	LUN Size (GB)
dm-rx200s6-21	dm-rx200s6-21	Microsoft Windows Server 2012 R2 Datacenter	No	AMS2100	C:	PHYSICALDRIVE0	60060e801046b96004f2bf460000001e	40
dm-rx200s6-21	dm-rx200s6-21	Microsoft Windows Server 2012 R2 Datacenter	No	AMS2100	F:	PHYSICALDRIVE1	60060e801046b96004f2bf460000000e	2
dm-rx200s6-21	dm-rx200s6-21	Microsoft Windows Server 2012 R2 Datacenter	No	AMS2100	G:	PHYSICALDRIVE2	60060e801046b96004f2bf460000000f	3
dm-rx200s6-22	dm-rx200s6-22	Red Hat Enterprise Linux Server release 5.10	No	AMS2100	/	sda	60060e801046b96004f2bf4600000010	20
dm-rx200s6-22	dm-rx200s6-22	Red Hat Enterprise Linux Server release 5.10	No	AMS2100	/fs2	sdb	60060e801046b96004f2bf4600000011	2
dm-rx200s6-22	dm-rx200s6-22	Red Hat Enterprise Linux Server release 5.10	No	AMS2100	/fs2	sdc	60060e801046b96004f2bf4600000012	2
dm-rx200s6-22	dm-rx200s6-22	Red Hat Enterprise Linux Server release 5.10	No	AMS2100	/fs1	sdd	60060e801046b96004f2bf4600000013	3
dm-rx200s6-20	dm-rx200s6-20	ESXi 5.5.0 build-1331820	No	AMS2100	ootLUN_Datastor	naa.60060e801046b96004f2bf4600000014	60060e801046b96004f2bf4600000014	20
dm-rx200s6-20	dm-rx200s6-20	ESXi 5.5.0 build-1331820	No	AMS2100	VM_Datastore	naa.60060e801046b96004f2bf4600000015	60060e801046b96004f2bf4600000015	40
dm-rx200s6-20	dm-rx200s6-20	ESXi 5.5.0 build-1331820	No	AMS2100	RDM	naa.60060e801046b96004f2bf4600000016	60060e801046b96004f2bf4600000016	2
dm-rx200s6-20	dm-rx200s6-20	ESXi 5.5.0 build-1331820	No	AMS2100	RDM	naa.60060e801046b96004f2bf4600000017	60060e801046b96004f2bf4600000017	2
dm-rx200s6-20	dm-rx200s6-20	ESXi 5.5.0 build-1331820	No	AMS2100	RDM	naa.60060e801046b96004f2bf4600000018	60060e801046b96004f2bf4600000018	2
dm-rx200s6-20	dm-rx200s6-20	ESXi 5.5.0 build-1331820	No	AMS2100	RDM	naa.60060e801046b96004f2bf4600000019	60060e801046b96004f2bf4600000019	2

Storage Devices (Target) | Hosts | HBA and Zone Information | Source LUNs | Storage Groups | LUN Details | Netapp LUN Layout | Migration Schedule | Aggerate Status

Normal View | Ready | Sum=0

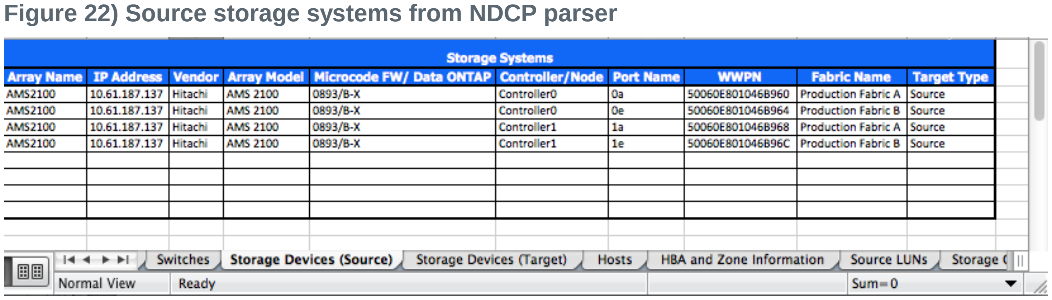
Table 21) LUN details tab input from NDCP parser output

LUN Details		
Site Survey Column	**NDCP Parser Tab**	**NDCP Parser Column**
Host Name	Hosts	hostname
Storage Group	Source Storage	Storage Group Name
Operating System	Hosts	os_major_rev
Clustered	Hosts	is_clustered
Storage Controller	SP Collect output – Storage-Controller List	Controller Name
Mount Point	FS List	mount_point
Physical Drive Number	LUN List	os_dev
Port	LUN List	port
Bus	LUN List	bus
Target	LUN List	target
LUN	LUN List	lun_id
PG80 SN	LUN List	pg80 sn
PG83 SN/UID	LUN List	pg83 sn
LUN Size (GB)	LUN List	size
Starting Offset	Partition List	offset
LUN Type	LUN List	alignment_lun_type
Alignment Information	LUN List	alignment_info
Custom Prefix	LUN List	commands (-P option value).

4.1.2.9 Storage System Information

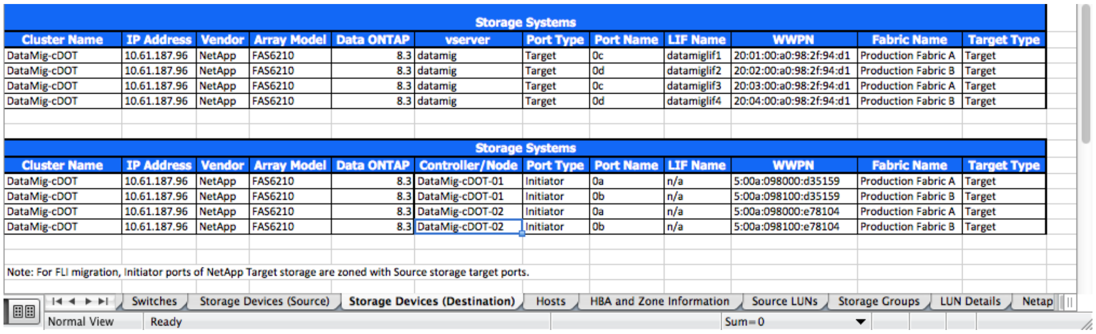
Figures 22 and 23 and Table 22 provide an overview of the Storage Devices tab.

Figure 22) Source storage systems from NDCP parser



Storage Systems									
Array Name	IP Address	Vendor	Array Model	Microcode FW/ Data ONTAP	Controller/Node	Port Name	WWPN	Fabric Name	Target Type
AMS2100	10.61.187.137	Hitachi	AMS 2100	0893/B-X	Controller0	0a	50060E801046B960	Production Fabric A	Source
AMS2100	10.61.187.137	Hitachi	AMS 2100	0893/B-X	Controller0	0e	50060E801046B964	Production Fabric B	Source
AMS2100	10.61.187.137	Hitachi	AMS 2100	0893/B-X	Controller1	1a	50060E801046B968	Production Fabric A	Source
AMS2100	10.61.187.137	Hitachi	AMS 2100	0893/B-X	Controller1	1e	50060E801046B96C	Production Fabric B	Source

Figure 23) Destination storage systems from NDCP parser



Storage Systems											
Cluster Name	IP Address	Vendor	Array Model	Data ONTAP	vserver	Port Type	Port Name	LIF Name	WWPN	Fabric Name	Target Type
DataMig-cDOT	10.61.187.96	NetApp	FAS6210	8.3	datamig	Target	0c	datamiglif1	20:01:00:a0:98:2f:94:d1	Production Fabric A	Target
DataMig-cDOT	10.61.187.96	NetApp	FAS6210	8.3	datamig	Target	0d	datamiglif2	20:02:00:a0:98:2f:94:d1	Production Fabric B	Target
DataMig-cDOT	10.61.187.96	NetApp	FAS6210	8.3	datamig	Target	0c	datamiglif3	20:03:00:a0:98:2f:94:d1	Production Fabric A	Target
DataMig-cDOT	10.61.187.96	NetApp	FAS6210	8.3	datamig	Target	0d	datamiglif4	20:04:00:a0:98:2f:94:d1	Production Fabric B	Target

Storage Systems											
Cluster Name	IP Address	Vendor	Array Model	Data ONTAP	Controller/Node	Port Type	Port Name	LIF Name	WWPN	Fabric Name	Target Type
DataMig-cDOT	10.61.187.96	NetApp	FAS6210	8.3	DataMig-cDOT-01	Initiator	0a	n/a	5:00a:098000:d35159	Production Fabric A	Target
DataMig-cDOT	10.61.187.96	NetApp	FAS6210	8.3	DataMig-cDOT-01	Initiator	0b	n/a	5:00a:098100:d35159	Production Fabric B	Target
DataMig-cDOT	10.61.187.96	NetApp	FAS6210	8.3	DataMig-cDOT-02	Initiator	0a	n/a	5:00a:098000:e78104	Production Fabric A	Target
DataMig-cDOT	10.61.187.96	NetApp	FAS6210	8.3	DataMig-cDOT-02	Initiator	0b	n/a	5:00a:098100:e78104	Production Fabric B	Target

Note: For FLI migration, Initiator ports of NetApp Target storage are zoned with Source storage target ports.

Table 22) Storage devices tab from NDCP parser output

Storage System		
Site Survey Column	**NDCP Parser Tab**	**NDCP Parser Column**
Hostname	Source Storage	Array Name
IP Address	Source Storage	
Vendor	Source Storage	system_type
Array Model	Source Storage	Controller Model
Microcode FW/Data ONTAP	Source Storage	Controller HW
Controller/Node	Source Storage	Controller HW
	Source Storage	Base WWN
Port Name	See Figure 18	Cross-referenced by 4th octate of WWPN
WWPN	NDCP Viewer element show flogi database	Cross-referenced by Base WWN
Fabric Name	NDCP Viewer element show flogi database	cross-referenced by Base WWPN
Target Type	Array may be a source or destination during migration	

Support Note
NetApp controller information can be gathered using nSANity and viewed using NDCP Viewer. Create storage virtual machines (SVMs, formerly known as Vservers) and FC logical interfaces (LIFs) if not already created.

4.2 Analyze Phase

The analyze phase focuses on items that must be addressed before proceeding with the migration activities. The host configuration information must be compared to supported configurations documented in the [NetApp Interoperability Matrix (IMT).]

The [NetApp Interoperability Matrix (IMT)]is a web-based utility that enables searching for information about configurations for NetApp products that work with third-party products and components qualified by NetApp. The IMT contains both supported and certified NetApp configurations. Supported configurations are those qualified by NetApp. Certified configurations are those qualified by a third-party company to work with NetApp components. You can download the Interoperability Matrix Tool User's Guide from http://support.netapp.com/matrix/help-cms/pdf/User%20Guide.pdf.

IMT Best Practice

- Enter the NetApp IMT recommendations for required software and upgrades into the Switches and Hosts section of your Site Survey and Planning worksheet.
- Start by entering static information, such as Data ONTAP OS, protocol, and CF mode, into the IMT. Then, using the site survey as a filter guide, enter host OS, volume manager, and HBA information.
- Do not be so specific as to have no results returned; it is better to view multiple returned results and choose the best fit.
- Host HBAs are sometimes reported on the OEM part number and will need to be cross-referenced before they are entered into the IMT.
- Check each host against the IMT for supportability.

4.3 Create the Gap Analysis Report

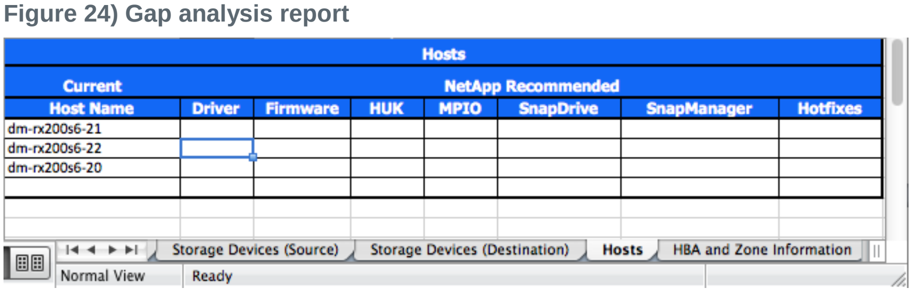
The gap analysis is a report of the customer’s current and NetApp recommended environment. It presents all recommended upgrades to the customer’s environment that will need to take place post-migration. PVRs might need to be submitted if the customer’s environment is not able to support the recommended upgrades.

The target configuration (post-migration) includes details for each host (OS configuration, MPIO, HBA details, Host Utility Kit version, and so on). Information about additional NetApp required products, such as SnapDrive and SnapManager, is also available.

The changes required are typically not made until the actual migration event, because of the usual need to schedule maintenance windows. Typically, any changes made to the MPIO configuration before migration will affect the support of the current storage as well.

The completed NetApp Recommended section in the Hosts section of your Site Survey and Planning worksheet will serve as the gap analysis report (Figure 24). The gap analysis must be completed for every host included in the migration project. The completed gap analysis report must be reviewed with the customer.

Figure 24) Gap analysis report



Hosts							
Current	NetApp Recommended						
Host Name	Driver	Firmware	HUK	MPIO	SnapDrive	SnapManager	Hotfixes
dm-rx200s6-21							
dm-rx200s6-22							
dm-rx200s6-20							

5 Plan and Prepare Phase

The plan and prepare phase focuses on the tasks required to create detailed migration plans and prepare the customer environment for the actual migration. One or more test migrations is/are performed during this phase to verify the installation and setup of the FLI.

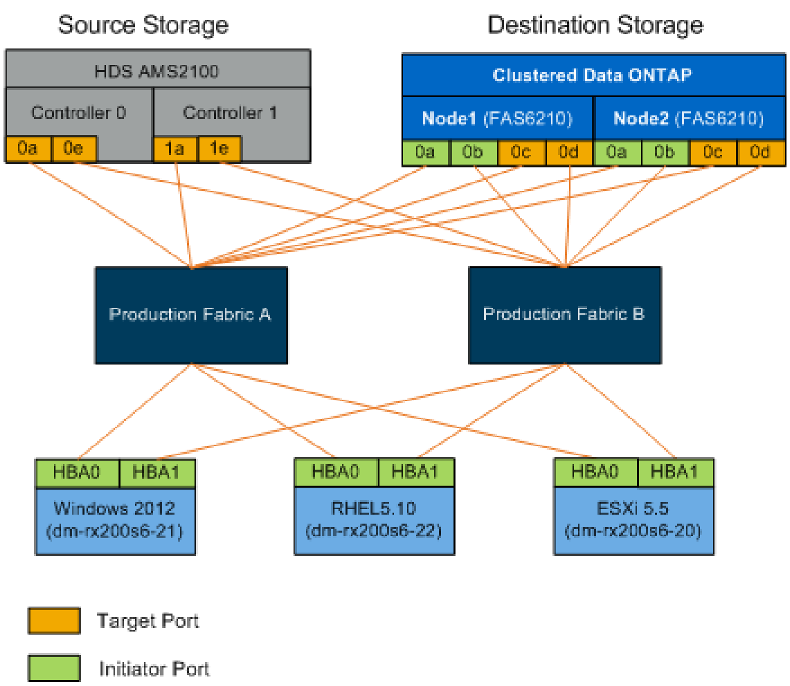
Support Note

Create a mapping of source and destination LUNs by entering the storage mapping information for each storage array in the LUN Details section of your Site Survey and Planning worksheet.

5.1 Configure Clustered Data ONTAP Storage for FLI Migration

Wire the source storage into the fabric based on your planning information and recommended best practices (Figure 25).

Figure 25) Fabric connectivity of source storage and destination storage in production fabric



FLI Wiring Best Practice

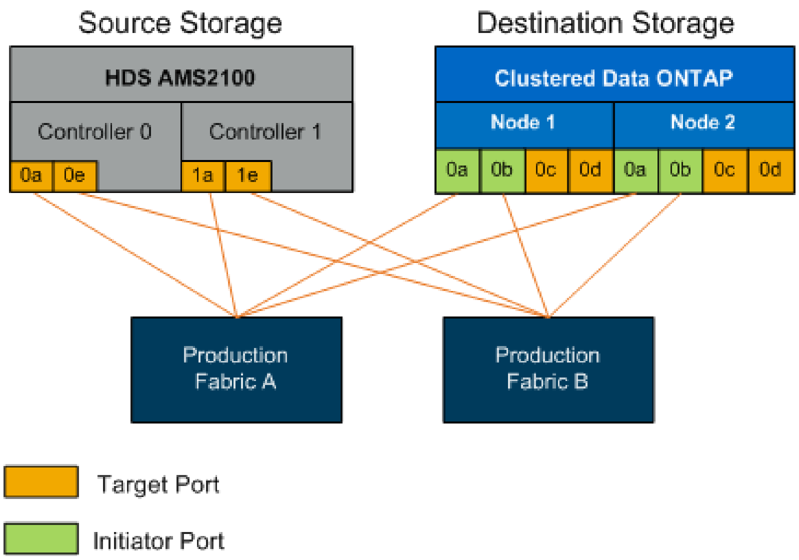
- Use dual fabrics for redundancy.
- Use at least two initiators and two target ports from each destination storage for FLI migration.
- Do not zone destination storage initiator ports with the host. Initiator ports of clustered Data ONTAP are used to zone with target ports of source storage.

5.2 Configure Switch Zones

To create required zones on the SAN switches for connecting the source storage to the destination storage, complete the following steps:

1. Back up the existing zonesets on each switch in the production and migration fabric.
2. Zone the source storage and destination storage as shown in Figure 26.

Figure 26) Source and destination storage zoning



Production Fabric A

Table 23) Production zone, production fabric A

Zone	WWPN	Zone Members
ZONE_AMS2100_cDOT_Initiator_fabA	50:06:0e:80:10:46:b9:60 50:06:0e:80:10:46:b9:68 50:0a:09:80:00:d3:51:59 50:0a:09:80:00:e7:81:04	AMS2100 Ctrl 0 Port 0a AMS2100 Ctrl 1 Port 1a Clustered Data ONTAP Node 1 Port 0a Clustered Data ONTAP Node 2 Port 0a

Production Fabric B

Table 24) Production zone, production fabric B

Zone	WWPN	Zone Members
ZONE_AMS2100_cDOT_Initiator_fabB	50:06:0e:80:10:46:b9:64 50:06:0e:80:10:46:b9:6c 50:0a:09:81:00:d3:51:59 50:0a:09:81:00:e7:81:04	AMS2100 Ctrl 0 Port 0e AMS2100 Ctrl 1 Port 1e Clustered Data ONTAP Node 1 Port 0b Clustered Data ONTAP Node 2 Port 0b

1. Create the zone and add it to the zoneset in production fabric A.
2. Activate the zoneset in fabric A.
3. Create the zone and add it to the zoneset in production fabric B.
4. Activate the zoneset in production fabric B.

5.3 Configure Source Array

Consult the array documentation for the source array in order to add a host entry for the initiator ports (LUN masking, igroup in NetApp parlance). This information can be retrieved from the Storage Groups section of your Site Survey and Planning worksheet.

5.4 Test Migration

At this point we recommend that you perform one or more test migrations in order to verify that your arrays, switches, and hosts are properly configured and also in order to get several samples that can be extrapolated from to determine migration durations and levels of effort. For an example test migration, review Appendix F: Test Migration Example Using Hitachi AMS2100.

6 Foreign LUN Import Offline Workflow

This is the first of four FLI workflow-specific examples. It covers the original version of FLI, FLI offline, which was first available in clustered Data ONTAP 8.3. This workflow uses an HDS AMS2100 array as the source array. There will be similar follow-on sections illustrating the other FLI workflow types. This section is broken down into the following subsections:

- FLI Offline Example: Preparation/Cutover
- FLI Offline Example: Import
- FLI Offline Example: Verify (Optional)
- FLI Offline Post-migration Tasks

6.1 FLI Offline Example: Preparation/Cutover

6.1.1 Pre-migration

During pre-migration, hosts are rebooted for validation, and source LUN paths are verified. After the host reboots, it is shut down in preparation for the migration.

When migration and remediation are complete, hosts can be brought up connected to the new destination storage, and the applications can be verified by end users.

6.1.1.1 Validate Host Reboot

Migration hosts are rebooted prior to making any changes to their configuration. Before proceeding with migration, verify that the system is in a known good state. To verify that the server configuration is persistent and pristine across reboots, complete the following steps:

1. Shut down all your open applications.
2. Reboot the host.
3. Review the logs for errors.

6.1.2 Verify Host LUN Path and Multipath Configuration

Prior to any migrations, you will need to verify that multipathing is correctly configured and working properly. All available paths to LUNs should be active. Check Appendix D: SAN Host Multipath Verification for examples of how to verify multipathing on ESXi, Linux, and Windows.

6.1.3 Prepare Hosts for the Migration

The execution phase includes the preparation of migration hosts. In many instances it may be possible to have performed this remediation prior to this step. If not, then this is where you would perform any host remediation such as installing host attach kits or DSMs. From the analysis phase, you will have a gap list of items that need to be performed on each host in order for that host to be in a supported configuration using NetApp clustered Data ONTAP. Depending on the type of migration being performed, either the host would be remediated and then rebooted (online FLI/7-Mode to clustered Data ONTAP FLI), or it would be remediated and then shut down pending the completion of the migration process (offline FLI).

6.1.4 Present Source LUNs to Clustered Data ONTAP Storage

1. Log in to the source array.
2. Add the NetApp initiators to the host group created during the plan phase.
3. Select the host LUNs that need to be migrated from available logical LUNs. Use LUN names for each host mentioned in the source LUNs section of your Site Survey and Planning worksheet.

6.1.5 Verify Source LUNs on Destination Storage

1. Verify the source LUNs and mapping from source storage to destination storage.
2. Log in to the clustered Data ONTAP storage through SSH using admin user.
3. FLI commands are available in Advanced privilege mode. Change the mode to Advanced.

```
DataMig-cmode::> set -privilege advanced

Warning: These advanced commands are potentially dangerous; use them only when directed to do so by
NetApp personnel.
Do you want to continue? {y|n}: y

DataMig-cmode::*>
```

4. Discover the source array on clustered Data ONTAP. Wait for a few minutes and retry to detect the source array.

```
DataMig-cmode::*> storage array show
Prefix                         Name    Vendor            Model Options
-------- ---------------------------- -------- ---------------- ----------
HIT-1                HITACHI_DF600F_1  HITACHI            DF600F
```


Support Note

When the storage array is discovered for the first time, clustered Data ONTAP might not show the array by discovering automatically. Use the following instructions to reset the switch port where clustered Data ONTAP initiator ports are connected.

5. Verify the source array is discovered through all the initiator ports.

```
DataMig-cmode::*> storage array config show -array-name HITACHI_DF600F_1
             LUN   LUN
Node         Group Count     Array Name       Array Target Port     Initiator
------------ ----- ----- ---------------------------- ----------------------
DataMig-cmode-01 0     1     HITACHI_DF600F_1      50060e801046b960        0a
                                                   50060e801046b964        0b
                                                   50060e801046b968        0a
                                                   50060e801046b96c        0b
DataMig-cmode-02 0     1     HITACHI_DF600F_1      50060e801046b960        0a
                                                   50060e801046b964        0b
                                                   50060e801046b968        0a
                                                   50060e801046b96c        0b
```

6. List the source LUNs mapped from Hitachi storage. Verify the disk properties and paths. You should see the number of paths expected based on your cabling (at least two paths for each source controller). You should also check the event log after masking the array LUNs.

```
DataMig-cmode::*> storage disk show -array-name HITACHI_DF600F_1 -fields disk, serial-number, container-type, owner, path-lun-in-use-count, import-in-progress, is-foreign
disk     owner is-foreign container-type import-in-progress path-lun-in-use-count serial-number
-------- ----- ---------- -------------- ------------------ --------------------- -------------
HIT-1.2  -     false      unassigned     false        0,0,0,0,0,0,0,0       83017542001E
HIT-1.3  -     false      unassigned     false        0,0,0,0,0,0,0,0       83017542000E
HIT-1.14 -     false      unassigned     false        0,0,0,0,0,0,0,0       830175420019
3 entries were displayed.

DataMig-cmode::*>
```

6.1.6 Configure Migration Job

1. For FLI migration, the source LUN needs to be marked as foreign. Mark the source LUNs as foreign using the serial number.

```
DataMig-cmode::*> storage disk modify { -serial-number 83017542001E } -is-foreign true
DataMig-cmode::*> storage disk modify { -serial-number 83017542000E } -is-foreign true
DataMig-cmode::*> storage disk modify { -serial-number 83017542000F } -is-foreign true
```

2. Verify the source LUN is marked as foreign.

```
DataMig-cmode::*> storage disk show -array-name HITACHI_DF600F_1 -fields disk, serial-number, container-type, owner,import-in-progress, is-foreign
disk     owner is-foreign container-type import-in-progress serial-number
-------- ----- ---------- -------------- ------------------ -------------
HIT-1.2  -     true       foreign        false              83017542001E
HIT-1.3  -     true       foreign        false              83017542000E
HIT-1.4  -     true       foreign        false              83017542000F
3 entries were displayed.
```

3. Create destination volumes.

```
DataMig-cmode::*> vol create -vserver datamig winvol aggr1 -size 100g
[Job 5606] Job succeeded: Successful
```

4. Disable default Snapshot policy on each volume. If default Snapshot copies exist prior to FLI migration, the volume needs additional space to store changed data.

```
DataMig-cmode::> volume modify -vserver datamig -volume winvol -snapshot-policy none
```

```
Warning: You are changing the Snapshot policy on volume winvol to none.  Any Snapshot copies on this
volume from the previous policy will not be deleted by
         this new Snapshot policy.
Do you want to continue? {y|n}: y
Volume modify successful on volume winvol of Vserver datamig.
```

5. Set fraction_reserve option for each volume to 0 and set the Snapshot policy to none.

```
DataMig-cmode::> vol modify -vserver datamig -volume * -fractional-reserve 0 –snapshot-policy none
Volume modify successful on volume winvol of Vserver datamig.
```

6. Check your volume settings.

```
DataMig-cmode::> vol show -vserver datamig -volume * -fields fractional-reserve,snapshot-policy
vserver        volume  snapshot-policy       fractional-reserve
------         --------       ---------------       ------------------
datamig         datamig_root  none    0%
datamig        winvol         none    0%
Volume modify successful on volume winvol of Vserver datamig.
```

7. Delete any existing Snapshot copies.

```
DataMig-cmode::> set advanced; snap delete –vserver datamig –vol winvol –snapshot * -force true
1 entry was acted on.
```

Support Note

FLI migration modifies every block of the target LUN. If default or other Snapshot copies exist on a volume prior to FLI migration, the volume gets filled up. Changing the policy and removing any existing Snapshot copies before FLI migration are required. Snapshot policy can be set again post-migration.

Support Note

The LUN create command detects the size and alignment based on partition offset and creates the LUN accordingly with foreign-disk option. For a review of I/O misalignment, review NetApp KB 3011193, What is an unaligned I/O? Also note that some I/O will always appear be partial writes and will therefore look misaligned. Examples of this would be database logs.

8. Create destination LUNs using foreign LUN.

```
DataMig-cmode::*> lun create -vserver datamig -path /vol/winvol/bootlun -ostype windows_2008 -foreign-
disk 83017542001E

Created a LUN of size 40g (42949672960)

Created a LUN of size 20g (21474836480)
DataMig-cmode::*> lun create -vserver datamig -path /vol/linuxvol/lvmlun1 -ostype linux -foreign-disk
830175420011

Created a LUN of size 2g (2147483648)
DataMig-cmode::*> lun create -vserver datamig -path /vol/esxvol/bootlun -ostype vmware -foreign-disk
830175420014

Created a LUN of size 20g (21474836480)
```

9. List the destination LUNs and verify the size of LUN with source LUN.

```
DataMig-cmode::*> lun show -vserver datamig
Vserver   Path                            State   Mapped   Type        Size
--------- ------------------------------- ------- -------- -------- --------
datamig   /vol/esxvol/bootlun             online  unmapped vmware       20GB
datamig   /vol/esxvol/linuxrdmvlun        online  unmapped linux         2GB
datamig   /vol/esxvol/solrdmplun          online  unmapped solaris       2GB
datamig   /vol/winvol/gdrive              online  unmapped windows_2008  3GB
```

```
4 entries were displayed.

DataMig-cmode::*>
```

Support Note

For FLI offline migration, the LUN must be mapped to the igroup and then be offlined before creating the LUN import relationship.

10. Create host igroup of protocol FCP and add initiators. Find initiator WWPNs from storage groups section of your Site Survey and Planning worksheet.

```
DataMig-cmode::*> lun igroup create -ostype windows -protocol fcp -vserver datamig -igroup dm-rx200s6-21
-initiator 21:00:00:24:ff:30:14:c4,21:00:00:24:ff:30:14:c5

DataMig-cmode::*> lun igroup create -ostype linux -protocol fcp -vserver datamig  -igroup dm-rx200s6-22
-initiator 21:00:00:24:ff:30:04:85,21:00:00:24:ff:30:04:84

DataMig-cmode::*> lun igroup create -ostype vmware -protocol fcp -vserver datamig -igroup dm-rx200s6-20
-initiator 21:00:00:24:ff:30:03:ea,21:00:00:24:ff:30:03:eb
```

Support Note

Use the same LUN ID as source. Refer to source LUNs section of your Site Survey and Planning worksheet.

11. Map the destination LUNs to igroup.

```
DataMig-cmode::*> lun map -vserver datamig -path /vol/winvol/bootlun -igroup dm-rx200s6-21 -lun-id 0
DataMig-cmode::*> lun map -vserver datamig -path /vol/linuxvol/bootlun -igroup dm-rx200s6-22 -lun-id 0
DataMig-cmode::*> lun map -vserver datamig -path /vol/esxvol/bootlun -igroup dm-rx200s6-20 -lun-id 0
```

12. Offline the destination LUNs.

```
DataMig-cmode::*> lun offline -vserver datamig -path /vol/esxvol/bootlun
DataMig-cmode::*> lun offline -vserver datamig -path /vol/esxvol/linuxrdmvlun
DataMig-cmode::*> lun offline -vserver datamig -path /vol/esxvol/solrdmplun
```

13. Create import relationship with destination LUN and source LUN.

```
DataMig-cmode::*> lun import create -vserver datamig -path /vol/winvol/bootlun -foreign-disk
83017542001E
DataMig-cmode::*> lun import create -vserver datamig -path /vol/linuxvol/ext3lun -foreign-disk
830175420013
DataMig-cmode::*> lun import create -vserver datamig -path /vol/esxvol/linuxrdmvlun -foreign-disk
830175420018
DataMig-cmode::*> lun import create -vserver datamig -path /vol/esxvol/solrdmplun -foreign-disk
830175420019
```

14. Verify the import job creation.

```
DataMig-cmode::*> lun import show -vserver datamig
vserver foreign-disk   path                operation admin operational percent
                                          in progress state state       complete
-------------------------------------------------------------------------------
datamig 83017542000E   /vol/winvol/fdrive  import    stopped
                                                           stopped           0
datamig 83017542000F   /vol/winvol/gdrive  import    stopped
                                                           stopped           0
```

```
datamig 830175420010    /vol/linuxvol/bootlun
                                           import    stopped
                                                           stopped            0
3 entries were displayed.
```

6.2 FLI Offline Example: Import

1. Start the migration (import).

```
DataMig-cmode::*> lun import start -vserver datamig -path /vol/winvol/bootlun

DataMig-cmode::*> lun import start -vserver datamig -path /vol/winvol/fdrive

DataMig-cmode::*> lun import start -vserver datamig -path /vol/winvol/gdrive
```

2. Monitor the import progress. You can compare the progress you are seeing here with the migration performance estimates that you developed after performing your test migrations.

```
DataMig-cmode::*> lun import show -vserver datamig -fields vserver, foreign-disk, path, admin-state,
operational-state, percent-complete, imported-blocks, total-blocks, , estimated-remaining-duration
vserver foreign-disk path               admin-state operational-state percent-complete imported-blocks
total-blocks estimated-remaining-duration
------- ------------ ------------------ ----------- ----------------- ---------------- --------------- -
----------- ----------------------------
datamig 83017542000E /vol/winvol/fdrive started     completed         100              4194304
4194304      -
datamig 83017542000F /vol/winvol/gdrive started     completed         100              6291456
6291456      -
datamig 830175420010 /vol/linuxvol/bootlun
                                        started     in_progress       83               35107077
41943040     00:00:48
3 entries were displayed.
```

3. Check the import job is completed successfully.

```
DataMig-cmode::*> lun import show -vserver datamig -fields vserver, foreign-disk, path, admin-state,
operational-state, percent-complete, imported-blocks, total-blocks, , estimated-remaining-duration
vserver foreign-disk path               admin-state operational-state percent-complete imported-blocks
total-blocks estimated-remaining-duration
------- ------------ ------------------ ----------- ----------------- ---------------- --------------- -
----------- ----------------------------
datamig 83017542000E /vol/winvol/fdrive started     completed         100              4194304
4194304      -
datamig 83017542000F /vol/winvol/gdrive started     completed         100              6291456
6291456      -
datamig 830175420010 /vol/linuxvol/bootlun
                                        started     completed         100
3 entries were displayed.
```

6.3 FLI Offline Example: Verify (Optional)

Support Note

A verify job is optional but is recommended. It is a block-by-block comparison of the source and destination LUNs. Verify jobs take almost the same or slightly more time than migration time.

1. Start the verify job to compare source and destination LUN. Monitor the verify progress.

```
DataMig-cmode::*> lun import verify start -vserver datamig -path /vol/winvol/bootlun

DataMig-cmode::*> lun import verify start -vserver datamig -path /vol/winvol/fdrive

DataMig-cmode::*> lun import verify start -vserver datamig -path /vol/winvol/gdrive
```

2. Monitor the verify job status.

```
DataMig-cmode::*> lun import show -vserver datamig -fields vserver, foreign-disk, path, admin-state,
operational-state, percent-complete, imported-blocks, total-blocks, , estimated-remaining-duration
vserver foreign-disk path               admin-state operational-state percent-complete imported-blocks
total-blocks estimated-remaining-duration
------- ------------ ------------------ ----------- ----------------- ---------------- --------------- -
----------- ----------------------------
datamig 83017542000E /vol/winvol/fdrive started     in_progress       57               -
4194304      00:01:19
datamig 83017542000F /vol/winvol/gdrive started     in_progress       40               -
6291456      00:02:44
datamig 830175420010 /vol/linuxvol/bootlun
                                        started     in_progress       8                -
41943040     00:20:29
3 entries were displayed.
```

3. Confirm that verify jobs are completed.

```
DataMig-cmode::*> lun import show -vserver datamig -fields vserver, foreign-disk, path, admin-state,
operational-state, percent-complete, imported-blocks, total-blocks, , estimated-remaining-duration
vserver foreign-disk path               admin-state operational-state percent-complete imported-blocks
total-blocks estimated-remaining-duration
------- ------------ ------------------ ----------- ----------------- ---------------- --------------- -
----------- ----------------------------
datamig 83017542000E /vol/winvol/fdrive started     completed         100              -
4194304      -
datamig 83017542000F /vol/winvol/gdrive started     completed         100              -
6291456      -
datamig 830175420010 /vol/linuxvol/bootlun
                                        started     completed         100              -
41943040     -
3 entries were displayed.
```

4. Stop the verify job after verify is completed.

```
DataMig-cmode::*> lun import verify stop -vserver datamig -path /vol/esxvol/winrdmplun
```

5. Delete the import relationship to remove the migration job.

```
DataMig-cmode::*> lun import delete -vserver datamig -path /vol/winvol/bootlun

DataMig-cmode::*> lun import delete -vserver datamig -path /vol/winvol/fdrive

DataMig-cmode::*> lun import delete -vserver datamig -path /vol/winvol/gdrive
```

6. Verify import jobs are deleted.

```
DataMig-cmode::*> lun import show -vserver datamig
There are no entries matching your query.
```

7. Mark the foreign LUN attribute to false.

```
DataMig-cmode::*> storage disk modify { -serial-number 83017542001E } -is-foreign false

DataMig-cmode::*> storage disk modify { -serial-number 83017542000E } -is-foreign false

DataMig-cmode::*> storage disk modify { -serial-number 83017542000F } -is-foreign false
```

8. Verify the foreign LUNs are marked as false after import.

```
DataMig-cmode::*> storage disk show -array-name HITACHI_DF600F_1 -fields disk, serial-number, container-
type, owner,import-in-progress, is-foreign
disk     owner is-foreign container-type import-in-progress serial-number
-------- ----- ---------- -------------- ------------------ -------------
HIT-1.2  -     false      unassigned     false              83017542001E
HIT-1.3  -     false      unassigned     false              83017542000E
HIT-1.4  -     false      unassigned     false              83017542000F
3 entries were displayed.
```

9. Online the destination LUNs.

```
DataMig-cmode::*> lun online -vserver datamig -path /vol/winvol/bootlun
```



```
DataMig-cmode::*> lun online -vserver datamig -path /vol/winvol/fdrive

DataMig-cmode::*> lun online -vserver datamig -path /vol/winvol/gdrive
```

10. Verify the LUNs are online.

```
DataMig-cmode::*> lun show -vserver datamig
Vserver   Path                             State   Mapped   Type        Size
--------- -------------------------------- ------- -------- -------- --------
datamig   /vol/esxvol/bootlun              online  mapped   vmware      20GB
datamig   /vol/esxvol/linuxrdmvlun         online  mapped   linux        2GB
datamig   /vol/esxvol/solrdmplun           online  mapped   solaris      2GB
3 entries were displayed.
```

Support Note

Import logs are stored in cluster event log file.

```
DataMig-cmode::*> event log  show -event fli*
7/7/2014 18:37:21   DataMig-cmode-01 INFORMATIONAL fli.lun.verify.complete: Import verify of foreign
LUN 83017542001E of size 42949672960 bytes from array model DF600F belonging to vendor HITACHI  with
NetApp LUN QvChd+EUXoiS is successfully completed.
7/7/2014 18:37:15   DataMig-cmode-01 INFORMATIONAL fli.lun.verify.complete: Import verify of foreign
LUN 830175420015 of size 42949672960 bytes from array model DF600F belonging to vendor HITACHI  with
NetApp LUN QvChd+EUXoiX is successfully completed.
7/7/2014 18:02:21   DataMig-cmode-01 INFORMATIONAL fli.lun.import.complete: Import of foreign LUN
83017542000F of size 3221225472 bytes from array model DF600F belonging to vendor HITACHI  is
successfully completed. Destination NetApp LUN is QvChd+EUXoiU.
```

6.4 FLI Offline Post-migration Tasks

Any outstanding server remediation not performed earlier is performed during post-migration. The third-party software is removed, NetApp software is installed and configured, and then the host is brought up accessing the LUNs on NetApp. See Appendix B: Host Remediation for examples of post-migration remediation for specific host types.

Review logs for errors, check pathing, and perform any application testing to verify that your migration completed cleanly and successfully.

7 Foreign LUN Import Online Workflow

This section of the technical report provides an example FLI online migration. The source array in this example is an EMC VNX5500. The example provided should give a thorough walkthrough of the FLI online process and is designed to work with the common information and processes discussed in earlier portions of this report. This section is broken down into the following subsections:

1. FLI Online Example: Preparation
2. FLI Online Example: Disruptive Cutover
3. FLI Online Example: Import
4. FLI Online Example: Verify (Optional)
5. FLI Online Example: Cleanup

Optionally, you may want to reboot hosts prior to starting this workflow in order to verify that the host is in a known good state. This would also be a good time to take a Snapshot copy in order to facilitate a revert if needed later. To verify that the server configuration is persistent and pristine across reboots, complete the following steps:

1. Shut down all your open applications.
2. Reboot the host.

3. Review the logs for errors.

7.1 Host OSs That Support the FLI Online Workflow

The FLI online workflow can be used for LUNs connected to hosts running one of the following list of operating systems:

1. Microsoft (all versions of the servers listed are supported):
   a. Windows Server 2008 (includes Windows Server failover clusters)
   b. Microsoft Hyper-V server 2008
   c. Windows Server 2012 (includes Windows Server 2012 cluster)
   d. Microsoft Hyper-V Server 2012
2. VMware:
   a. All ESXi 5.x releases
3. Linux:
   a. Red Hat Enterprise Linux (RHEL) 5.x/6.x

Consider using the FLI offline workflow for host operating systems not on the preceding list.

7.2 Do Not use FLI Online Workflow with Metrocluster as a Destination.

If the NetApp controller destination is a Metrocluster (MCC) do NOT use the online workflow. The problem is that if a site failover occurred during an active online import, write pass-throughs to the source array could fail which would lead to a verification failure and potential data loss. If the destination is MCC, use FLI Offline regardless of the host OS.

7.3 Verify Host LUN Path and Multipath Configuration

Prior to any migrations you will need to verify that multipathing is correctly configured and working properly. All available paths to LUNs should be active. Check Appendix D: SAN Host Multipath Verification for examples of how to verify multipathing on ESXi, Linux, and Windows.

7.4 Prepare Hosts for the Migration

The execution phase includes the preparation of migration hosts. In many instances it may be possible to have performed this remediation prior to this step. If not, then this is where you would perform any host remediation such as installing host attach kits or DSMs. From the analysis phase, you will have a gap list of items that need to be performed on each host in order for that host to be in a supported configuration using NetApp clustered Data ONTAP. Depending on the type of migration being performed, either the host would be remediated and then rebooted, or simply remediated.

7.5 FLI Online Example: Preparation

1. In clustered Data ONTAP, change to advanced privilege level.

```
cluster::> set adv


Warning: These advanced commands are potentially dangerous; use them only when directed to do so by
NetApp personnel.

Do you want to continue? {y|n}: y
```

2. Verify that the source array can be seen on the destination controller.


```
cluster::*> storage array show
Prefix                         Name   Vendor            Model Options
-------- ---------------------------- -------- ---------------- ----------
DGC-1                      DGC_LUNZ_1      DGC             LUNZ
1 entries were displayed.
```

3. Display source LUN details.

```
cluster::*> storage array config show -array-name DGC_LUNZ_1 -instance


           Controller Name: ontaptme-fc-cluster-01
                 LUN Group: 0
        Array Target Ports: 500601643ea067da
          Initiator: 0c
                Array Name: DGC_LUNZ_1
   Target Side Switch Port: stme-5010-3:2-1
Initiator Side Switch Port: stme-5010-3:2-3
      Number of array LUNs: 1


           Controller Name: ontaptme-fc-cluster-01
                 LUN Group: 0
        Array Target Ports: 500601653ea067da
                 Initiator: 0d
                Array Name: DGC_LUNZ_1
   Target Side Switch Port: stme-5010-4:2-1
Initiator Side Switch Port: stme-5010-4:2-3
      Number of array LUNs: 1
~~~~~~~~~~~ output truncated for readability ~~~~~~~~~~~~~~~~~
8 entries were displayed.
```

4**.** Verify the source array is discovered through all the initiator ports.

```
cluster::*> storage array config show -array-name DGC_LUNZ_1
             LUN   LUN
Node         Group Count                   Array Name       Array Target Port Initiator
------------ ----- ----- ---------------------------- ----------------------- ---------
ontaptme-fc-cluster-01
                 0     1                   DGC_LUNZ_1        500601643ea067da        0c
                                                             500601653ea067da        0d
                                                             5006016c3ea067da        0c
                                                             5006016d3ea067da        0d
ontaptme-fc-cluster-02
                 0     1                   DGC_LUNZ_1        500601643ea067da        0c
                                                             500601653ea067da        0d
                                                             5006016c3ea067da        0c
                                                             5006016d3ea067da        0d
```



```
8 entries were displayed.
```

Support Note

The word wrapping in the following output has no significance.

5. List the LUNs mapped from the source storage. Verify the disk properties and paths.

```
cluster::*> storage disk show -array-name DGC_LUNZ_1 -instance
                  Disk: DGC-1.9
        Container Type: unassigned
       Owner/Home: -  / -
             DR Home: -
    Stack ID/Shelf/Bay: -  / -  / -
                   LUN: 0
                 Array: DGC_LUNZ_1
                Vendor: DGC
                 Model: VRAID
         Serial Number: 600601603F103100662E70861000E511
                   UID:
60060160:3F103100:662E7086:1000E511:00000000:00000000:00000000:00000000:00000000:00000000
                   BPS: 512
         Physical Size: -
              Position: present
Checksum Compatibility: block
             Aggregate: -
                  Plex: -
Paths:
                                     LUN  Initiator Side        Target Side
Link
Controller         Initiator     ID  Switch Port          Switch Port          Acc Use  Target Port
TPGN    Speed      I/O KB/s          IOPS
------------------ ---------  -----  -------------------- -------------------- --- ---  --------------
---------  ------  -------  ------------  ------------
ontaptme-fc-cluster-02
                   0c             0  stme-5010-3:2-4      stme-5010-3:2-2      AO  INU
5006016c3ea067da              2   4 Gb/S              0             0
ontaptme-fc-cluster-02
                   0d             0  stme-5010-4:2-4      stme-5010-4:2-2      AO  INU
5006016d3ea067da              2   4 Gb/S              0             0
ontaptme-fc-cluster-02
                   0d             0  stme-5010-4:2-4      stme-5010-4:2-1      ANO RDY
500601653ea067da              1   4 Gb/S              0             0


Errors:
```

```
-
```

6. View the source LUN.

```
cluster::*> storage disk show -array-name DGC_LUNZ_1
                     Usable           Disk    Container   Container
Disk                   Size Shelf Bay Type    Type        Name      Owner
---------------- ---------- ----- --- ------- ----------- --------- --------
DGC-1.9                   -     -   - LUN     unassigned  -         -
```

7. Mark the source LUN as foreign.

```
cluster::*> storage disk modify -is-foreign true -disk DGC-1.9
```

8. Verify the source LUN is marked as foreign.

```
cluster::*> storage disk show -array-name DGC_LUNZ_1
                     Usable           Disk    Container   Container
Disk                   Size Shelf Bay Type    Type        Name      Owner
---------------- ---------- ----- --- ------- ----------- --------- --------
DGC-1.9                   -     -   - LUN     foreign     -         -
```

9. Serial numbers are used in FLI LUN import commands. List all foreign LUNs and their serial numbers.

```
cluster::*> storage disk show -container-type foreign -fields serial-number
disk    serial-number
------- --------------------------------
DGC-1.9 600601603F103100662E70861000E511
```

10. Create a destination volume.

```
cluster::*> vol create -vserver fli -volume fli_vol -aggregate aggr1 -size 2t
[Job 13888] Job succeeded: Successful
```

11. Verify volume.

```
cluster::*> vol show -vserver fli
Vserver   Volume       Aggregate    State      Type       Size  Available Used%
--------- ------------ ------------ ---------- ---- ---------- ---------- -----
fli       fli_root     aggr1        online     RW          1GB    972.6MB    5%
fli       fli_vol      aggr1        online     RW          2TB     1.90TB    5%
2 entries were displayed.
```

12. Set fraction_reserve option for each volume to 0 and set the Snapshot policy to none.

```
DataMig-cmode::> vol modify -vserver datamig -volume * -fractional-reserve 0 –snapshot-policy none
Volume modify successful on volume winvol of Vserver datamig.
```

13. Check your volume settings.

```
DataMig-cmode::> vol show -vserver datamig -volume * -fields fractional-reserve,snapshot-policy
vserver        volume  snapshot-policy       fractional-reserve
------         --------       ---------------       ------------------
datamig        datamig_root   none    0%
datamig        winvol         none    0%
Volume modify successful on volume winvol of Vserver datamig.
```

14. Delete any existing Snapshot copies.


```
DataMig-cmode::> set advanced; snap delete -vserver datamig -vol winvol -snapshot * -force true
1 entry was acted on.
```

Support Note

FLI migration modifies every block of the target LUNs. If default or other Snapshot copies exist on a volume prior to FLI migration, the volume gets filled up. Changing the policy and removing any existing Snapshot copies before FLI migration is required. Snapshot policy can be set again post-migration.

Support Note

The LUN create command detects the size and alignment based on partition offset and creates the LUN accordingly with foreign-disk option. For a review of I/O misalignment, review [NetApp KB 3011193, What is an unaligned I/O?](#) Also note that some I/O will always appear be partial writes and will therefore look misaligned. Examples of this would be database logs.

15. Create the target LUN. The LUN create command detects the size and alignment based on partition offset and creates the LUN accordingly with the foreign-disk argument.

```
cluster::*> lun create -vserver fli -path /vol/fli_vol/OnlineFLI_LUN -ostype windows_2008 -foreign-disk 600601603F103100662E70861000E511


Created a LUN of size 1t (1099511627776)
```

16. Verify new LUN.

```
cluster::*> lun show -vserver fli
Vserver   Path                            State   Mapped   Type        Size
--------- ------------------------------- ------- -------- -------- --------
fli       /vol/fli_vol/OnlineFLI_LUN      online  unmapped windows_2008  1TB
```

17. Create an igroup of protocol FCP with host initiators.

```
cluster::*> igroup create -vserver fli -igroup FLI -protocol fcp -ostype windows -initiator 10:00:00:00:c9:e6:e2:79
```

18. Verify that the host logs in on all paths to the new igroup.

```
cluster::*> igroup show –vserver fli –igroup FLI
          Vserver name: fli
           Igroup name: FLI
              Protocol: fcp
               OS Type: Windows
Portset Binding Igroup: -
          Igroup UUID: 5c664f48-0017-11e5-877f-00a0981cc318
                 ALUA: true
           Initiators: 10:00:00:00:c9:e6:e2:77 (logged in)
10:00:00:00:c9:e6:e2:79 (logged in)
```

19. Offline the destination LUN.

```
cluster::*> lun offline -vserver fli -path /vol/fli_vol/OnlineFLI_LUN
```



```
Warning: This command will take LUN "/vol/fli_vol/OnlineFLI_LUN" in Vserver "fli" offline.
Do you want to continue? {y|n}: y
```

20. Map the destination LUN to the igroup.

```
cluster::*> lun map -vserver fli -path /vol/fli_vol/OnlineFLI_LUN -igroup FLI
```

21. Create import relationship between new LUN and foreign LUN.

```
cluster::*> lun import create -vserver fli -path /vol/fli_vol/OnlineFLI_LUN -foreign-disk
600601603F103100662E70861000E511
```

Support Note

If the LUN you are trying to create a relationship with is being used by a host-based cluster you may need to create the LUN relationship after disabling host access to the original LUN and prior to trying to re-point your host to the new NetApp hosted LUN. This is necessary because many clustering solutions use persistent LUN reservations that will block your ability to form the LUN relationship between the source and NetApp-hosted LUN.

Once the hosts LUN access is disabled it may take some time before the persistent reservation is cleared before you can establish the LUN relationship. You can reduce this window by reviwing your source storage vendor documentation for releasing persistent reservations.

7.6 FLI Online Example: Disruptive Cutover

For host remediation walkthrough of Windows, Linux, and ESXi, see follow-on sections of this report as well as host OS and host attach kit documentation.

1. On the foreign array, display the storage group to which the source LUN is mapped. **(**Review vendor documentation for the appropriate commands.)
2. If the LUNs being imported are for ESX, review and follow the instructions in Appendix A: ESX CAW/ATS Remediation.
3. <The disruption window begins here> Unmap source LUN from hosts.

Support Note

The disruption begins immediately after the “unmap” command is executed. Generally, the disruption window can be measured in minutes. It is literally the length of time it takes to repoint the host at the new NetApp target and scan for LUNs.

Make sure that this is the only LUN mapped to this igroup, because removing the host (initiator) from the igroup affects other LUNs mapped to the igroup. (Review vendor documentation for the appropriate commands.)

4. Verify that the host initiators are no longer present.
5. On the clustered Data ONTAP cluster, online the destination LUN and verify that it’s mapped.

```
cluster::*> lun online -vserver fli -path /vol/fli_vol/OnlineFLI_LUN
```

6. Verify that the LUN is online.

```
cluster::*> lun show -vserver fli
Vserver   Path                           State   Mapped   Type         Size
--------- ------------------------------ ------- -------- -------- --------
fli       /vol/fli_vol/OnlineFLI_LUN     online  mapped   windows_2008   1TB
```


7. Rescan disks on the host; find the LUN on the clustered Data ONTAP target and verify that the DSM has claimed the LUNs. <The disruption window ends here>
8. Verify that you can see all expected paths. Check your event logs to verify no errors exist.

Support Note
At this point the disruptive part of this migration is complete, unless there are host remediation tasks (identified during your analysis and planning phases) outstanding that are disruptive. LUNs are online and mapped, and hosts are now mounting the new clustered Data ONTAP hosted LUN. Reads are passed through the clustered Data ONTAP array to the source LUN, and writes are written to both the new clustered Data ONTAP hosted LUN and also the original source LUN. Both source and destination LUNs will maintain sync until the migration is complete and the LUN relationship has been broken.

7.7 FLI Online Example: Import

1. Start the migration (import).

```
cluster::*> lun import start -vserver fli_72C -path /vol/flivol/72Clun1
```

2. Display FLI status.

```
cluster::*> lun import show -vserver fli_72C -path /vol/flivol/72Clun1
```

7.8 FLI Online Example: Verify (Optional)

Support Note
This process is disruptive.

Start the verify job to compare source and destination LUNs. Monitor the verify progress. The LUNs being verified need to be offline for the duration of the verification session. The verification session can potentially be lengthy because it is a block-by-block comparison between source and destination LUNs. Verification is not required, but we encourage you to verify a subset of the LUNs imported/migrated to feel comfortable about the import process. These verifications would be in addition to those performed during the test/pilot migrations.

Support Note
The LUN import verify must be explicitly stopped before bringing the LUN back online. Otherwise, the LUN online fails. See the following CLI output.

1. Offline the LUNs to be verified. <The disruption window begins here>

```
cluster::*> lun offline -vserver fli_72C -path /vol/flivol/72Clun1
Warning: This command will take LUN "/vol/flivol/72Clun1" in Vserver "fli_72C" offline.
Do you want to continue? {y|n}: y
```

2. Start LUN verify.

```
lun import verify start -vserver fli_72C -path /vol/flivol/72Clun1
```

3. Display LUN verify status.

```
ontaptme-fc-cluster::*> lun import show -vserver fli_72C -path /vol/flivol/72Clun1
vserver foreign-disk   path                operation admin operational percent
                                          in progress state state       complete
-------------------------------------------------------------------------------
fli_72C D0i1E+G8Wg6m   /vol/flivol/72Clun1 verify    started
                                                                                9
```

4. Stop LUN verification. This step needs to performed manually even if the status shows that verify is complete.

```
lun import verify stop -vserver fli_72C -path /vol/flivol/72Clun1
```

5. Online the LUN upon completion of verification. <The disruption window ends here>

```
lun online -vserver fli_72C -path /vol/flivol/72Clun1
```

7.9 FLI Online Example: Cleanup

When ready, the LUN import relationship can be safely removed because the host is now accessing the new NetApp array for all I/O to the new clustered Data ONTAP LUN, and the source LUN is no longer in use.

6. Delete the LUN import relationship.

```
lun import delete -vserver fli_72C -path /vol/flivol/72Clun1
```

7.10 FLI Online Post-migration Tasks

Any server remediation not performed pre-migration, is performed during post-migration. Any third-party software is removed. NetApp software is installed and configured. See Appendix B: Host Remediation for examples of post-migration remediation for specific host types.

Review logs for errors, check pathing, and perform any application testing to verify that your migration completed cleanly and successfully.

8 Foreign LUN Import 7-Mode to Clustered Data ONTAP Transition Workflow

This section of the technical report provides an example FLI 7-Mode to clustered Data ONTAP transition. This FLI transition is recommended when either the source LUN is hosted on a 32-bit aggregate and/or the LUN is misaligned. The FLI 7-Mode to clustered Data ONTAP transition is able to combine transitioning the LUN from 7-Mode to clustered Data ONTAP along with correcting LUN alignment and transitioning the LUN from a 32-bit to 64-bit aggregate. Other methods of transitioning LUN, including 7-Mode Transition Tool (7MTT), may require remediating LUN alignment and/or converting 32-bit to 64-bit aggregates prior to transitioning to clustered Data ONTAP.

The FLI 7-Mode to clustered Data ONTAP transition workflow can be run as either an online or offline workflow. These workflows are functionally identical to the two corresponding FLI offline and online migration workflows discussed in sections 6 and 7, with the exception that the source array is a NetApp 7-Mode storage array. Both workflows share the same rules and procedures as their migration equivalents. This includes the FLI online workflow host operating support list.

The example provided should give a thorough walkthrough of the FLI 7-Mode to clustered Data ONTAP process and is designed to work with the common information and processes discussed in earlier portions of this report. This section is broken down into the following subsections:

- FLI 7-Mode to Clustered Data ONTAP Example: Preparation
- FLI 7-Mode to Clustered Data ONTAP Example: Disruptive Cutover
- FLI 7-Mode to Clustered Data ONTAP Example: Import

- FLI 7-Mode to Clustered Data ONTAP Example: Verify (Optional)
- FLI 7-Mode to Clustered Data ONTAP Example: Cleanup

Optionally, you may want to reboot hosts prior to starting this workflow in order to verify that the host is in a known good state. This would also be a good time to take a Snapshot copy in order to facilitate a revert if needed later. To verify that the server configuration is persistent and pristine across reboots, complete the following steps:

1. Shut down all your open applications.
2. Review the logs for errors.
3. Verify that the host sees all of its paths.
4. Reboot the host.

8.1 FLI 7-Mode to Clustered Data ONTAP Example: Preparation

8.1.1 Verify Host LUN Path and Multipath Configuration

Prior to any migrations, you will need to verify that multipathing is correctly configured and working properly. All available paths to LUNs should be active. Check Appendix D: SAN Host Multipath Verification for examples of how to verify multipathing on ESXi, Linux, and Windows.

8.1.2 Prepare Hosts for the Transition

The execution phase includes the preparation of migration hosts. In many instances it may be possible to have performed this remediation prior to this step. If not, then this is where you would perform any host remediation such as installing host attach kits or DSMs. From the analysis phase, you will have a gap list of items that need to be performed on each host in order for that host to be in a supported configuration using NetApp clustered Data ONTAP. Depending on the type of migration being performed, either the host would be remediated and then rebooted (FLI 7-Mode to clustered Data ONTAP online) or hosts would be rebooted, remediated, and then shut down (FLI 7-Mode to clustered Data ONTAP offline).

8.1.3 Prepare Source and Destination Arrays for Migration

1. In clustered Data ONTAP, change to advanced privilege level.

```
cluster::> set adv

Warning: These advanced commands are potentially dangerous; use them only when directed to do so by
NetApp personnel.
Do you want to continue? {y|n}: y

cluster::*>
```

2. Verify that the source array can be seen on the destination controller.

```
cluster::*> storage array show
Prefix                         Name    Vendor            Model Options
-------- ---------------------------- -------- ---------------- ----------
NET-1                    NETAPP_LUN_1    NETAPP              LUN

cluster::*> storage array config show -array-name NETAPP_LUN_1
             LUN    LUN
Node         Group Count                  Array Name       Array Target Port Initiator
------------ ----- ----- ---------------------------- ----------------------- ---------
ontaptme-fc-cluster-01
                 1     2                NETAPP_LUN_1        500a0981880b813d        0d
                                                            500a0981980b813d        0d
ontaptme-fc-cluster-02
                 1     2                NETAPP_LUN_1        500a0981880b813d        0d
                                                            500a0981980b813d        0d
4 entries were displayed.

Warning: Configuration errors were detected.  Use 'storage errors show' for detailed information.
```


3. View details on any storage errors listed. Some errors might require action before proceeding. However, the errors shown in the following example, “This device is a Data ONTAP(R) LUN.” can be safely ignored.

Support Note

The error message “This device is a Data ONTAP(R) LUN.” Is caused because FLI relies on FlexArray technology which doesn’t support virtualizing Data ONTAP or clustered Data ONTAP targets. FLI is able to import the LUNs, however, FlexArray doesn’t support virtualizing them.

```
cluster::*> storage errors show
Disk: NET-1.1
UID: 60A98000:44306931:452B4738:5767366B:00000000:00000000:00000000:00000000:00000000:00000000
--------------------
NET-1.1 (60a9800044306931452b47385767366b): This device is a Data ONTAP(R) LUN.

Disk: NET-1.2
UID: 60A98000:44306931:452B4738:5767366D:00000000:00000000:00000000:00000000:00000000:00000000
--------------------
NET-1.2 (60a9800044306931452b47385767366d): This device is a Data ONTAP(R) LUN.

2 entries were displayed.
```

4. Display source LUN details.

```
cluster::*> storage array config show -array-name NETAPP_LUN_1 -instance

           Controller Name: ontaptme-fc-cluster-01
                 LUN Group: 1
        Array Target Ports: 500a0981880b813d
                 Initiator: 0d
                Array Name: NETAPP_LUN_1
   Target Side Switch Port: stme-5010-4:2-6
Initiator Side Switch Port: stme-5010-4:2-3
      Number of array LUNs: 2

           Controller Name: ontaptme-fc-cluster-01
                 LUN Group: 1
        Array Target Ports: 500a0981980b813d
                 Initiator: 0d
                Array Name: NETAPP_LUN_1
   Target Side Switch Port: stme-5010-4:2-5
Initiator Side Switch Port: stme-5010-4:2-3
      Number of array LUNs: 2

~~~~~~ Output truncated ~~~~~~~
4 entries were displayed.

Warning: Configuration errors were detected.  Use 'storage errors show' for detailed information.
```

5. Verify the source array is discovered through all the initiator ports.

```
cluster::*> storage array config show -array-name NETAPP_LUN_1
             LUN   LUN
Node         Group Count                   Array Name       Array Target Port Initiator
------------ ----- ----- ---------------------------- ----------------------- ---------
ontaptme-fc-cluster-01
                 1     2                 NETAPP_LUN_1        500a0981880b813d        0d
                                                             500a0981980b813d        0d
ontaptme-fc-cluster-02
                 1     2                 NETAPP_LUN_1        500a0981880b813d        0d
                                                             500a0981980b813d        0d
4 entries were displayed.

Warning: Configuration errors were detected.  Use 'storage errors show' for detailed information.
```


6. List the LUNs mapped from the 7-Mode storage. Verify the disk properties and paths.

```
cluster::*> storage disk show -array-name NETAPP_LUN_1 -instance
                    Disk: NET-1.1
          Container Type: unassigned
              Owner/Home: -  / -
                 DR Home: -
    Stack ID/Shelf/Bay: -  / -  / -
                     LUN: 0
                   Array: NETAPP_LUN_1
                  Vendor: NETAPP
                   Model: LUN
           Serial Number: D0i1E+G8Wg6k
                     UID:
60A98000:44306931:452B4738:5767366B:00000000:00000000:00000000:00000000:00000000:00000000
                     BPS: 512
           Physical Size: -
                Position: present
Checksum Compatibility: block
               Aggregate: -
                    Plex: -
Paths:
                                LUN  Initiator Side        Target Side
Link
Controller         Initiator     ID  Switch Port           Switch Port           Acc Use  Target Port
TPGN    Speed      I/O KB/s          IOPS
------------------ ---------  -----  --------------------  --------------------  --- ---  --------------
---------  ------  -------  ------------  ------------
ontaptme-fc-cluster-02
                   0d             0  stme-5010-4:2-4       stme-5010-4:2-6       ANO RDY
500a0981880b813d            1    4 Gb/S              0             0
ontaptme-fc-cluster-02
                   0d             0  stme-5010-4:2-4       stme-5010-4:2-5       AO  INU
500a0981980b813d            0    4 Gb/S              0             0
ontaptme-fc-cluster-01
                   0d             0  stme-5010-4:2-3       stme-5010-4:2-6       ANO RDY
500a0981880b813d            1    4 Gb/S              0             0
ontaptme-fc-cluster-01
                   0d             0  stme-5010-4:2-3       stme-5010-4:2-5       AO  INU
500a0981980b813d            0    4 Gb/S              0             0

Errors:
NET-1.1 (60a9800044306931452b47385767366b): This device is a Data ONTAP(R) LUN.
~~~~~~ Output truncated ~~~~~~~
2 entries were displayed.
```

7. Verify the source LUN is marked as foreign.

```
cluster::*> storage disk show -array-name NETAPP_LUN_1
                     Usable           Disk    Container   Container
Disk                   Size Shelf Bay Type    Type        Name      Owner
---------------- ---------- ----- --- ------- ----------- --------- --------
NET-1.1                   -     -   - LUN     unassigned  -         -
NET-1.2                   -     -   - LUN     foreign     -         -
2 entries were displayed.
```

8. Serial numbers are used in FLI LUN import commands. List all foreign LUNs and their serial numbers.

```
cluster::*> storage disk show -container-type foreign -fields serial-number
disk    serial-number
------- --------------------------------
NET-1.2 D0i1E+G8Wg6m
```

9. Create the target LUN. The LUN create command detects the size and alignment based on partition offset and creates the LUN accordingly with the foreign-disk argument

```
cluster::*> vol create -vserver fli_72C -volume flivol -aggregate aggr1 -size 10G
[Job 12523] Job succeeded: Successful
```

10. Verify volume.


```
cluster::*> vol show -vserver fli_72C
Vserver   Volume       Aggregate    State      Type       Size  Available Used%
--------- ------------ ------------ ---------- ---- ---------- ---------- -----
fli_72C   flivol       aggr1        online     RW         10GB     9.50GB    5%
fli_72C   rootvol      aggr1        online     RW          1GB    972.6MB    5%
2 entries were displayed.
```

11. Create the target LUN.

```
cluster::*> lun create -vserver fli_72C -path /vol/flivol/72Clun1 -ostype windows_2008 -foreign-disk
D0i1E+G8Wg6m

Created a LUN of size 3g (3224309760)
```

12. Verify new LUN.

```
cluster::*> lun show -vserver fli_72C
Vserver   Path                            State   Mapped   Type        Size
--------- ------------------------------- ------- -------- -------- --------
fli_72C   /vol/flivol/72Clun1             online  unmapped windows_2008
                                                                     3.00GB
```

13. Create an igroup of protocol FCP with host initiators.

```
cluster::*> lun igroup create -vserver fli_72C -igroup 72C_g1 -protocol fcp -ostype windows –initiator
10:00:00:00:c9:e6:e2:79

cluster::*> lun igroup show -vserver fli_72C -igroup 72C_g1
          Vserver Name: fli_72C
           Igroup Name: 72C_g1
              Protocol: fcp
               OS Type: windows
Portset Binding Igroup: -
           Igroup UUID: 7bc184b1-dcac-11e4-9a88-00a0981cc318
                  ALUA: true
            Initiators: 10:00:00:00:c9:e6:e2:79 (logged in)
```

14. Map the test LUN to the test igroup.

```
cluster::*> lun map -vserver fli_72C -path /vol/flivol/72Clun1 -igroup 72C_g1

cluster::*> lun mapping show -vserver fli_72C
Vserver    Path                                      Igroup   LUN ID  Protocol
---------- ----------------------------------------  -------  ------  --------
fli_72C    /vol/flivol/72Clun1                       72C_g1        0  fcp
```

15. Offline the test LUN.

```
cluster::*> lun offline -vserver fli_72C -path /vol/flivol/72Clun1

Warning: This command will take LUN "/vol/flivol/72Clun1" in Vserver "fli_72C" offline.
Do you want to continue? {y|n}: y

cluster::*> lun show -vserver fli_72C
Vserver   Path                            State   Mapped   Type        Size
--------- ------------------------------- ------- -------- -------- --------
fli_72C   /vol/flivol/72Clun1             offline mapped   windows_2008
                                                                     3.00GB
```

16. Create import relationship between new LUN and foreign LUN.

```
cluster::*> lun import create -vserver fli_72C -path /vol/flivol/72Clun1 -foreign-disk D0i1E+G8Wg6m

cluster::*> lun import show -vserver fli_72C -path /vol/flivol/72Clun1
vserver foreign-disk   path                operation admin operational percent
                                          in progress state state       complete
-------------------------------------------------------------------------------
fli_72C D0i1E+G8Wg6m   /vol/flivol/72Clun1 import    stopped
                                                           stopped            0
```


8.2 FLI 7-Mode to Clustered Data ONTAP Example: Disruptive Cutover

For host remediation walkthrough of Windows, Linux, and ESXi, see follow-on sections of this report as well as host OS and host attach kit documentation.

1. On the 7-Mode system, display the igroup to which the source LUN is mapped.

```
stme-7ma> igroup show
    FLI_on_fcp (FCP) (ostype: windows):
        10:00:00:00:c9:e6:e2:79 (logged in on: 0c, vtic)
        50:0a:09:81:00:96:43:70 (logged in on: 0c, vtic)
        50:0a:09:81:00:96:3c:f0 (logged in on: 0c, vtic)
```

Support Note

The disruption begins immediately after the “unmap” command is executed. Generally, the disruption window can be measured in minutes. It is literally the length of time it takes to repoint the host at the new NetApp target and scan for LUNs.

2. If the LUNs being imported are for ESX, review and follow the instructions in Appendix A: ESX CAW/ATS Remediation.
3. Unmap LUN from hosts. <The disruption window begins here>

```
stme-7ma> igroup remove -f FLI_on_fcp 10:00:00:00:c9:e6:e2:79
```

4. Verify that the host initiators are no longer present.

```
stme-7ma> igroup show
    FLI_on_fcp (FCP) (ostype: windows):
        50:0a:09:81:00:96:43:70 (logged in on: 0c, vtic)
        50:0a:09:81:00:96:3c:f0 (logged in on: 0c, vtic)
```

5. On the clustered Data ONTAP cluster, online the destination LUN and verify that it’s mapped.

```
cluster::*> lun online -vserver fli_72C -path /vol/flivol/72Clun1

cluster::*> lun show -path /vol/flivol/72Clun1
Vserver   Path                            State   Mapped   Type        Size
--------- ------------------------------- ------- -------- -------- --------
fli_72C   /vol/flivol/72Clun1             online  mapped   windows_2008
                                                                     3.00GB
```

6. Rescan disks on the host; find the LUN on the clustered Data ONTAP target. <The disruption window ends here>

Support Note

At this point the disruptive part of this migration is complete. LUNs are online and mapped, and hosts are now mounting the new clustered Data ONTAP hosted LUN. Reads are passed through the clustered Data ONTAP array to the source LUN, and writes are written to both the new clustered Data ONTAP hosted LUN and also the original source LUN. Both source and destination LUNs will maintain sync until the migration is complete and the LUN relationship has been broken.

8.3 FLI 7-Mode to Clustered Data ONTAP Example: Import

1. Start the migration (import).

```
cluster::*> lun import start -vserver fli_72C -path /vol/flivol/72Clun1
```


2. Display FLI status.

```
cluster::*> lun import show -vserver fli_72C -path /vol/flivol/72Clun1
vserver foreign-disk   path                operation admin operational percent
                                         in progress state state       complete
-------------------------------------------------------------------------------
fli_72C D0i1E+G8Wg6m   /vol/flivol/72Clun1 import    started
                                                           completed        100
```

Support Note

If you want to make sure the source LUN remains consistent after the migration completes, you will need to:
1. After the import show indicates it is completed, shut down the host.
2. Delete the LUN relationship: `lun import delete -vserver fli_72C -path /vol/flivol/72Clun1`.

Remember that after the LUN relationship is broken, the LUNs will quickly lose sync because changes are made to the new LUN only. Therefore, while it may be beneficial to maintain a consistent state in the event you want to restore the original state, the new LUN will likely have changes not reflected in the source LUN.

Support Note

After the import is stopped, you can destroy the import relationship unless you intend to verify the import.

8.4 FLI 7-Mode to Clustered Data ONTAP Example: Verify (Optional)

Start the verify job to compare source and destination LUNs. Monitor the verify progress. The LUNs being verified need to be offline for the duration of the verification session. The verification session can potentially be lengthy because it is a block-for-block comparison between source and destination LUNs. It should take approximately the same amount of time as the migration. Verification is not required, but we encourage you to verify a subset of the LUNs imported/migrated to feel comfortable about the import process.

Support Note

The LUN import verify must be explicitly stopped before bringing the LUN back online. Otherwise, the LUN online fails. This behavior will be changed in an upcoming release of clustered Data ONTAP.

1. Offline the LUNs to be verified.

```
cluster::*> lun offline -vserver fli_72C -path /vol/flivol/72Clun1

Warning: This command will take LUN "/vol/flivol/72Clun1" in Vserver "fli_72C" offline.

Do you want to continue? {y|n}: y
```

2. Start LUN verify.

```
lun import verify start -vserver fli_72C -path /vol/flivol/72Clun1
```

3. Display LUN verify status.

```
ontaptme-fc-cluster::*> lun import show -vserver fli_72C -path /vol/flivol/72Clun1
```



```
vserver foreign-disk   path                 operation admin operational percent
                                          in progress state state       complete
-------------------------------------------------------------------------------
fli_72C D0i1E+G8Wg6m   /vol/flivol/72Clun1 verify    started
                                                                             9
```

Support Note

The LUN import verify must be explicitly stopped before bringing the LUN back online. Otherwise, the LUN online fails. See the following CLI output.

4. Stop LUN verification. This step needs to performed manually even if the status shows that verify is complete.

```
lun import verify stop -vserver fli_72C -path /vol/flivol/72Clun1
```

5. Online the LUN upon completion of verification.

```
lun online -vserver fli_72C -path /vol/flivol/72Clun1
```

8.5 FLI 7-Mode to Clustered Data ONTAP Example: Cleanup

When ready, the LUN import relationship can be safely removed because the host is now accessing the new NetApp array for all I/O to the new clustered Data ONTAP LUN, and the source 7-Mode LUN is no longer in use.

Delete the LUN import relationship.

```
lun import delete -vserver fli_72C -path /vol/flivol/72Clun1
```

8.6 FLI 7-Mode to Clustered Data ONTAP Post-migration Tasks

All server remediation is performed during post-migration. The third-party software is removed, NetApp software is installed and configured, and then the host is brought up accessing the LUNs on NetApp. See Appendix B: Host Remediation for examples of post-migration remediation for specific host types.

Review logs for errors, check pathing, and perform any application testing to verify that your migration completed cleanly and successfully.

9 Foreign LUN Import Using Workflow Automation (WFA)

Workflow automation can be used in conjunction with FLI to automate FLI pre, post, migration, transition, and status checks. In order to use WFA in conjunction with FLI, you will need to download and install WFA on a suitable server in your environment, if one doesn't already exist. After WFA is installed, you will need to download the workflows specified later. The two FLI automation packs available for download as of this writing are FLI offline and FLI online. The automation packs automate FLI; however, they follow the same supportability rules as the FLI offline and FLI online workflows. This includes the list of host operating systems that support FLI online.

WFA automation packs can be downloaded from the WFA automation store. For more information about the specific actions performed and other detailed workflow information, review the help file embedded with each pack.

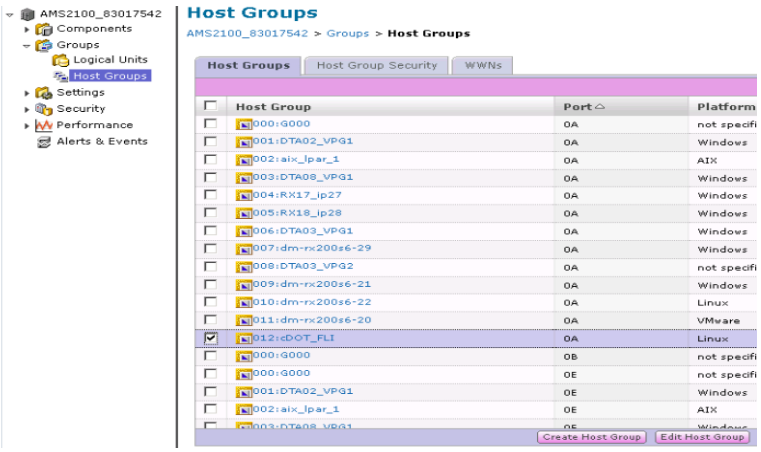
10 Post-migration/Transition Tasks

All of the Post-migration tasks listed use an HDS AMS2100 array in the examples. Your tasks may be different if you are using a different array or a different version of the array GUI.

10.1 Remove Source LUNs from Clustered Data ONTAP Storage

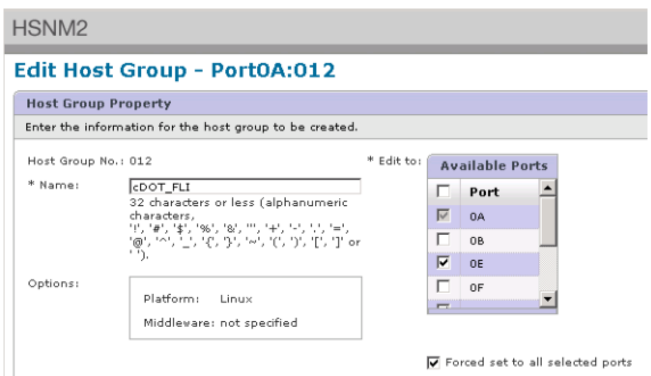
1. Log in to Hitachi Storage Navigator Modular.
2. Select the clustered Data ONTAP host group created during the plan phase and select Edit Host Group.

Figure 27) HDS Storage Navigator: display host groups



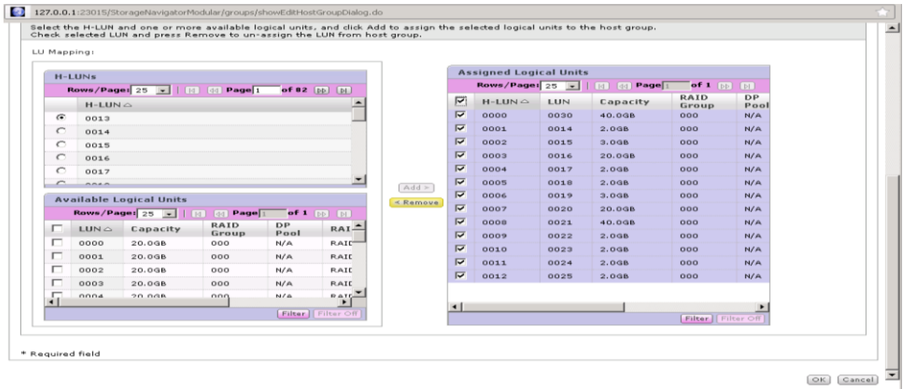
3. Select the Ports and select Forced set to all selected ports.

Figure 28) HDS Storage Navigator: display host groups



4. Select the host LUNs that are migrated from Assigned Logical LUNs. Use LUN Names for each host mentioned in Source LUNs worksheet of Site Survey and Planning worksheet. Here, select LUNs of Windows 2012, RHEL 5.10, and ESXi 5.5 hosts and select Remove.

Figure 29) HDS Storage Navigator: assign LUNs to host groups

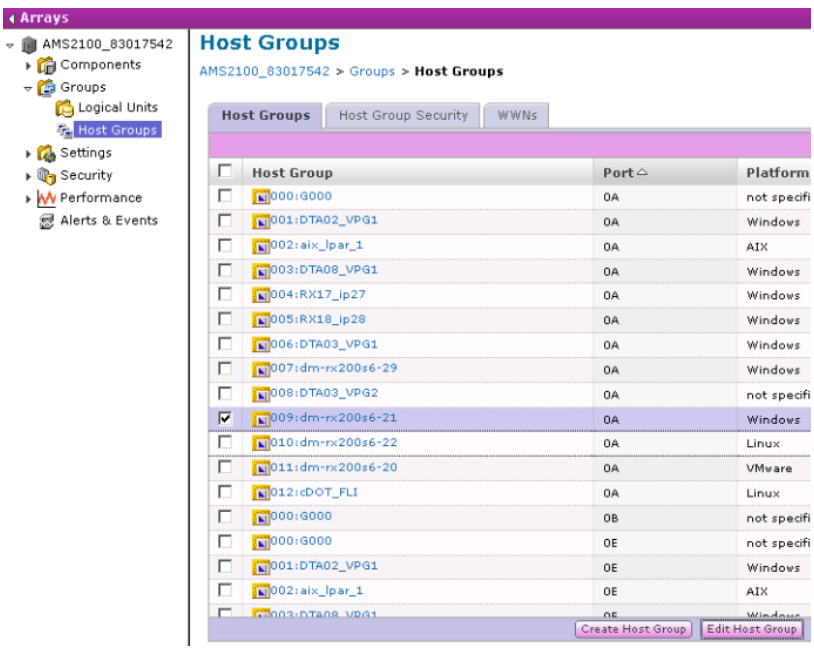


10.2 Remove Source LUNs from Host

To remove source LUNs from the host, complete the following steps:

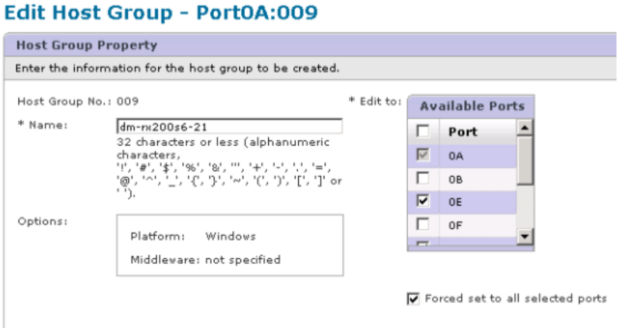
1. Log in to Hitachi Storage Navigator Modular.
2. Select the host that is migrated and select Edit Host Group.

Figure 30) HDS Storage Navigator: assign LUNs to host groups



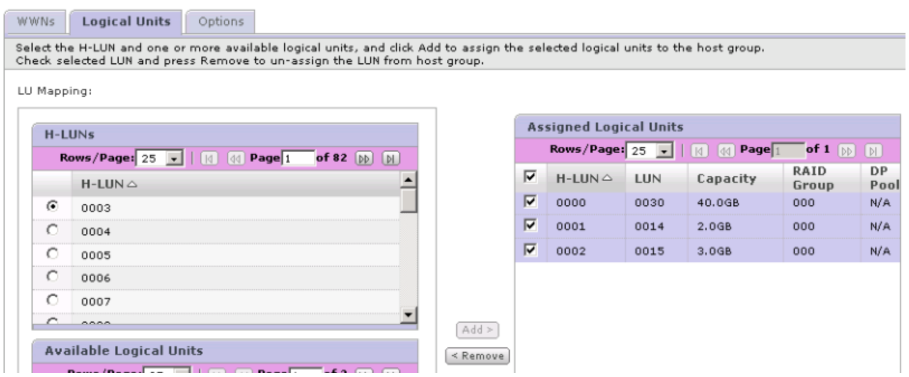
3. Select the Ports and select Forced set to all selected ports.

Figure 31) HDS Storage Navigator: edit host groups



4. Select the host LUNs that are migrated from Assigned Logical LUNs. Use LUN Names for each host mentioned in Source LUNs worksheet of [Site Survey and Planning worksheet](#). Here, select LUNs of Windows 2012 host and select Remove.

Figure 32) HDS Storage Navigator: LUN mappings



5. Repeat the steps for Linux and VMware ESX hosts.

10.3 Remove Source Storage and Host Zone from Zoneset

To remove source storage and host zone, complete the following steps:

Zone Name: rx21_AMS2100

Brocade Fabric Example

1. Remove the zone from the zoneset in fabric A.

```
cfgDelete "PROD_LEFT", "rx21_AMS2100"
cfgDelete "PROD_LEFT", "rx22_AMS2100"
cfgDelete "PROD_LEFT", "rx20_AMS2100"
```

2. Activate the zoneset in fabric A.

```
cfgEnable "PROD_LEFT"
cfgSave
```

3. Remove the zone from the zoneset in fabric B.

```
cfgDelete "PROD_RIGHT", "rx21_AMS2100"
cfgDelete "PROD_RIGHT", "rx22_AMS2100"
cfgDelete "PROD_RIGHT", "rx20_AMS2100"
```

4. Activate the zoneset in fabric B.


```
cfgEnable "PROD_RIGHT"
cfgSave
```

Cisco Fabric Example

1. Remove the zone from the zoneset in fabric A.

```
conf t
zoneset name PROD_LEFT vsan 10
no member rx21_AMS2100
no member rx22_AMS2100
no member rx20_AMS2100
exit
```

2. Activate the zoneset in fabric A.

```
zoneset activate name PROD_LEFT vsan 10
end
copy running-config startup-config
```

3. Remove the zone from the zoneset in fabric B.

```
conf t
zoneset name PROD_RIGHT vsan 10
no member rx21_AMS2100
no member rx22_AMS2100
no member rx20_AMS2100
exit
```

4. Activate the zoneset in fabric B.

```
zoneset activate name PROD_RIGHT vsan 10
end
copy running-config startup-config
```

10.4 Create a Post-migration Snapshot Copy

```
DataMig-cmode::> snap create -vserver datamig -volume winvol -snapshot post-migration

DataMig-cmode::> snap create -vserver datamig -volume linuxvol -snapshot post-migration

DataMig-cmode::> snap create -vserver datamig -volume esxvol -snapshot post-migration
```

10.5 Clean Up and Verify Phase

In cleanup phase, FLI migration logs are collected, source storage configuration is removed from NetApp storage, and NetApp storage host group is removed from source storage. Also, source to destination zones are deleted. Verification is the point where the accuracy of the migration plan execution is determined.

Review logs for errors, check pathing, and perform any application testing to verify that your migration completed cleanly and successfully.

10.6 Collect Migration Report from Destination Storage

Support Note
Import logs are stored in cluster event log file.

```
DataMig-cmode::*> rows 0; event log show -nodes * -event fli*
7/7/2014 18:37:21   DataMig-cmode-01 INFORMATIONAL fli.lun.verify.complete: Import verify of foreign LUN
83017542001E of size 42949672960 bytes from array model DF600F belonging to vendor HITACHI  with NetApp
LUN QvChd+EUXoiS is successfully completed.
~~~~~~ Output truncated ~~~~~~~
```

Support Note

The necessary job verification steps to compare the source and destination LUNs are covered in the execute migration job phase. Importing and LUN verification steps are covered together there in the execute migration job itself because these are linked to the import job and foreign LUN.

10.7 Unzone Source and Destination Array

To unzone source and destination array, complete the following steps:

Support Note

Perform this procedure when all migrations/transitions/verifications are completed.

Remove the source storage to destination zone from both fabrics.

Brocade Fabric Example

1. Remove the zone from the zoneset in fabric A.

```
cfgDelete "PROD_LEFT", "ZONE_AMS2100_cDOT_Initiator_fabA"
zoneDelete "ZONE_AMS2100_cDOT_Initiator_fabA"
```

2. Activate the zonesets in fabric A.

```
cfgEnable "PROD_LEFT"
cfgSave
```

3. Remove the zone from the zoneset in fabric B.

```
cfgDelete "PROD_RIGHT", "ZONE_AMS2100_cDOT_Initiator_fabB"
zoneDelete "ZONE_AMS2100_cDOT_Initiator_fabA"
```

4. Activate the zonesets in fabric B.

```
cfgEnable "PROD_RIGHT"
cfgSave
```

Cisco Fabric Example

1. Remove the zone from the zoneset in fabric A.

```
conf t
zoneset name PROD_LEFT vsan 10
no member ZONE_AMS2100_cDOT_Initiator_fabA
no zone name ZONE_AMS2100_cDOT_Initiator_fabA vsan 10
exit
```

2. Activate the zonesets in fabric A.

```
zoneset activate name PROD_LEFT vsan 10
end
copy running-config startup-config
```

3. Remove the zone from the zoneset in fabric B.

```
conf t
zoneset name PROD_RIGHT vsan 10
no member ZONE_AMS2100_cDOT_Initiator_fabB
no zone name ZONE_AMS2100_cDOT_Initiator_fabB vsan 10
exit
```

4. Activate the zonesets in fabric B.

```
zoneset activate name PROD_RIGHT vsan 10
end
Copy running-config startup-config
```

10.8 Remove Source Array from Destination Array

To remove the source array from clustered Data ONTAP, complete the following steps:

1. Display all visible source arrays.

```
DataMig-cmode::> storage array show
Prefix                         Name    Vendor            Model Options
-------- ---------------------------- -------- ---------------- ----------
HIT-1                HITACHI_DF600F_1  HITACHI           DF600F
```

2. Remove the source storage array.

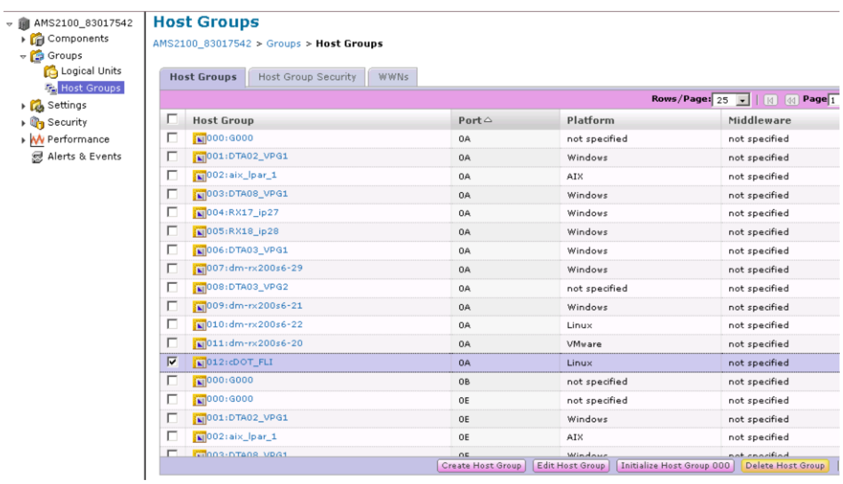
```
DataMig-cmode::> storage array remove -name HITACHI_DF600F_1
```

10.9 Remove Destination Array Configuration from Source Array

To remove a destination array configuration, complete the following steps:

1. Log in to Hitachi Storage Navigator Modular as system.
2. Select AMS 2100 array and click Show and Configure Array.
3. Log in using root.
4. Expand Groups and select Host Groups.
5. Select cDOT_FLI host group and click Delete Host Group.

Figure 33) HDS Storage Navigator: view host groups



6. Confirm to delete the host group.

Figure 34) HDS Storage Navigator: delete host group confirmation

10.10 Document Customer Environment

To document the customer environment, complete the following steps:

1. Issue an AutoSupport™ command to document the final configuration.

```
B9CModeCluster::*> autosupport invoke -node DataMig-cmode-01 -type all –message "migration-final"
```

2. Fully document the newly migrated environment.

11 Requirements

It is important to verify that the host OS, HBA, switch, and clustered Data ONTAP array to which you are ultimately transitioning are a supported configuration. If you are using the FLI 7-Mode to clustered Data ONTAP transition workflow, you don't need to verify your source (7-Mode controller) in the FlexArray IMT. It won't be listed but is supported expressly for this transition workflow. You do still need to verify all hosts are in a supported configuration.

There are no FLI-specific platform requirements. There are also no minimum versions of 7-Mode Data ONTAP, although the version would have to support Fibre Channel protocol (FCP). The minimum destination protocol supported by FLI 7-Mode to clustered Data ONTAP is clustered Data ONTAP 8.3.1.

The maximum size LUN that FLI can import is 16TB. This is a limitation based on the current maximum size drives currently supported by clustered Data ONTAP. If you attempt to mount a larger foreign LUN, the LUN will be marked as broken, and you will not be able to write a label to it.

12 Architecture

Architecturally the three migrations and the transition workflow are fairly similar. All four rely on NetApp's FlexArray technology to allow your clustered Data ONTAP controller to act as an initiator in front of a source array and to use that position to copy LUNs block for block from the source to a LUN on the destination clustered Data ONTAP array. The differences between the workflows have to do with when cutovers occur, length of the disruption window, and if you are using automation or if the source array is a NetApp array running Data ONTAP 7-Mode.

13 Interoperability

It is important to verify that the source array, host OS, HBA, switch, and clustered Data ONTAP array are all on the FLI IMT and that your final configuration (host OS, HBA, switch, and clustered Data ONTAP array) is also on the IMT.

FLI is not currently supported on NetApp All Flash FAS (AFF) systems. However, it can be supported with an approved PVR. See your NetApp account team for assistance with getting a PVR submitted.

13.1 Importing Non-FC LUNs

Because FLI leverages FlexArray technology to mount “foreign” LUNs, it can only connect to source arrays using FCP. On the face of it, that suggests that only FC LUNs are supported by FLI. However, there is a workaround that allows you to import iSCSI LUNs. Because you will be importing the iSCSI LUNs as FC LUNs, unlike other FLI online 7-Mode to clustered Data ONTAP workflows, the disruption window would span this entire workflow:

1. On the source array, you will need to unmap the desired iSCSI LUN from its iSCSI igroup.
2. On the source array, map the LUN to a FC igroup, making sure that the destination array WWPNs have been added to the igroup.
3. Import the LUN.
4. After the LUN has been imported, you can create a new iSCSI igroup and add the hosts to the igroup.
5. On the hosts, rescan for LUNs.

Refer to the Interoperability Matrix Tool (IMT) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

13.2 Using FLI to Import LUNs into All Flash FAS (AFF)

As of ONTAP 8.3.2, AFF can support FLI with an approved PVR. Contact your NetApp account team to get the PVR submitted for approval. On approval, the submitter (usually a NetApp System Engineer) will receive an approval letter with instruction for enabling FLI functionality.

For versions of ONTAP previous to 8.3.2, AFF doesn’t currently support FlexArray due to some of the write optimizations that have been made. Unless or until this changes, you will need to stage FLI imports to a non-AFF HA pair on the same cluster with the AFF. After the migration has been completed, you can then use non-disruptive operations (NDO) such as vol or LUN move to move the migrated LUNs to AFF. If your AFF cluster doesn’t have any non-AFF nodes, talk to your account team about the possibility of borrowing swing gear to facilitate this.

13.3 Potential ZFS Alignment Problems When Using FLI to Import ZPool LUNs

Caution: Among the features of Foreign LUN Import is automatic alignment detection and adjustment. In this context, the term “alignment” refers to a partition on a LUN device. Optimum performance requires that IO be aligned to 4K blocks. If a partition is placed as an offsite that is not a multiple of 4K performance will suffer.

There is a second aspect of alignment that cannot be corrected by adjusting a partition offset – the filesystem block size. For example, a ZFS filesystem generally defaults to using an internal block size of 512 bytes. Customers using AIX have occasionally created jfs2 filesystems with 512 or 1024 byte block size. Although the filesystem might be aligned to a 4K boundary, the files created within that filesystem will not and performance will suffer.

FLI should not be used in these circumstances. Although the data would be accessible after migration, the result would be filesystems with serious performance limitations. As a general principle, any filesystem supporting a random overwrite workload on Data ONTAP should use a 4K block size. This is primarily applicable to workloads such as database datafiles and VDI deployments. The block size can be identified using the relevant host operating system commands. For example, on AIX this can be viewed with lsfs -q. With linux, xfs_info and tune2fs can be used for xfs and ext3/ext4, respectively. With zfs, the command is zdb -C. The parameter the controls the block size is ashift and generally defaults to a value of 9, which means 2^9, or 512 bytes. For optimum performance, the ashift value must be 12 (2^12=4K). This value is set at the time the zpool is created and cannot be changed, which means data zpools with ashift other than 12 should be migrated by copying data to a newly created zpool.

Oracle ASM does not have a fundamental block size. The only requirement is the partition on which the ASM disk is built must be properly aligned.

14 Performance

14.1 Performance Enhancements in Clustered Data ONTAP 8.3.1

There have been some enhancements to FLI to better manage performance and stop workload starvation from occurring. FLI enhancements in clustered Data ONTAP 8.3.1 include a new throttle command and a couple of lun import show enhancements showing throughput and QoS policy groups:

- ***lun import throttle,*** which is used to limit the maximum speed at which an import can run. The command syntax for the lun import throttle command is:

```
cluster::*> lun import throttle -vserver fli_72C -path /vol/flivol/72Clun1 -max-throughput-limit

{<integer>[KB|MB|GB|TB|PB]}  Maximum Throughput Limit (per sec)
```

Use the “instance” switch with “lun import show” to display extended LUN import information, including throttle and QoS information.

```
cluster::*> lun import show -instance

                                        Vserver Name: fli_72C
                                                   LUN Path: /vol/flivol/72Clun1
                  Foreign Disk Serial Number: D0i1E+G8Wg6m
                                Import Home Node: ontaptme-fc-cluster-01
                             Import Current Node: ontaptme-fc-cluster-01
                           Operation In Progress: import
                                             Admin State: stopped
                                   Operational State: stopped
                                   Percent Complete: 0
                                       Blocks Imported: -
                                     Blocks Compared: -
                                              Total Blocks: 6297480
           Estimated Remaining Duration: -
                                        Failure Reason: -
Maximum Throughput Limit(per sec): -
             Current Throughput (per sec): -
                                   QoS Policy Group: -
```

The values for the “current throughput” show the current rate of throughput of import or verify operations. Users should check this before setting a throttle value. It is empty when not running. The QoS policy group” shows the QoS group if the LUN import throttle was used.

14.2 Determining FLI Performance

For best performance, use no more than 16 concurrent FLI migrations per node. During QA around FLI, online speeds of up to 1.5TB/hr were observed between source and destination arrays. However, this by no means guarantees or even suggests that you will see similar performance. The number of variables that affect how quickly a given migration will complete include, but are not limited to:

- How many concurrent migrations are running between a given source and destination
- Source array capabilities
- Source array load
- Destination array capabilities

- Destination array load
- How much I/O is being generated to the LUN during migration
- The type, bandwidth, and fan-ins/fan-outs on front-end fabrics

Given the number of variables that affect migration performance, it is recommended that a number of test migrations be performed. Generally, the larger the test sample, the better the characterization will be. Therefore, we recommend that a number of different sized test migrations be performed in order to get an accurate sampling of throughput performance. Performance data from those tests can then be used to extrapolate timing and durations of the planned production migrations.

14.3 Benchmarks for Estimating Migration Durations

For planning purposes we have used the following assumptions when determining level of effort and import durations. As noted earlier, to get an accurate estimate of your actual performance, you should run a number of test migrations of different sizes in order to get accurate performance numbers for your specific environments. The following benchmarks are strictly for planning purposes and are unlikely to be particularly accurate for specific environments.

Assumptions:

5 hours per host migration based on a host with 8 LUNs with a total of 2TB of data. This gives us a planning number of approximately 400GB/hour.

15 Best Practices

NetApp strongly recommends a professional services or partner professional services engagement to scope and plan the migration as well as to train customer personnel on how to perform data migrations using FLI 7-Mode to clustered Data ONTAP.

- Perform one or more test migrations at least a week prior to your migration project in order to verify configuration, connectivity, and throughput; uncover any other issues; and validate your methodology.
- For maximum throughput, don’t run more than 16 migrations concurrently per node.
- Verification is not required, but we encourage you to verify a subset of the LUNs imported/migrated to validate the import process.
- Use the throughput observed in your test migrations to plan production migration durations.
- For best performance, migrate LUNs during nonpeak demand periods.

Appendix A: ESX CAW/ATS Remediation

Online FLI doesn’t support VMware Atomic Test and Set (ATS)/SCSI Compare and Write (CAW). This is important if you are using VMFS5 and your source array supports CAW. This is because FLI online LUN relationships don’t support ATS/CAW commands, and the VMFS5 file system would fail mounting on the destination ESXi 5.x host. All this happens because VMware maintains an ATS bit on the VMFS5 header, which enforces CAW/ATS and will not allow it to work on a host or array without ATS. That ATS bit is carried in the VMFS header, which is part of the first LUN listed in the “Partitions spanned (on "lvm").” This is the only LUN (if there are multiple extents listed) that needs to be remediated.

If the LUN is shared by more than one host, then updating it on one of the hosts is sufficient because it will reflect on all other hosts automatically after a rescan. Disabling ATS/CAW will fail if any VM or ESXi active I/O from any of the sharing hosts is running on the LUN. We recommend shutting down the VMs and other host machines sharing the LUN while making the necessary ATS/CAW changes. This action can be performed at the beginning of disruptive parts of the host repoint/cutover listed in the , “Disruptive Cutover.” section of the appropriate FLI workflow.

If the LUN is shared by more than one host, all hosts will need to be offline while the ATS bit is enabled or disabled. After enabling or disabling ATS, you will need to refresh LUNs, and after you have completed any remapping, you can then bring the hosts back up and verify that you are able to access the LUNs.

If you are running a previous version of VMFS or upgraded from a previous version, then you shouldn't have to perform any remediation. If you do need to either enable or disable ATS/CAW, you can use the commands listed below. However, neither will work if the VM is active and there is any I/O running to the VMFS5 datastore. We recommend shutting down the host machine, making the necessary ATS/CAW changes, and performing the rest of the disruptive parts of the host repoint/cutover listed in the , "Disruptive Cutover." section of the appropriate FLI workflow.

You can check ATS/CAW status by running the following command:

```
~ # vmkfstools -Ph -v 1 /vmfs/volumes/fli-orig-3
VMFS-5.58 file system spanning 1 partitions.
File system label (if any): fli-orig-3
Mode: public ATS-only
Capacity 99.8 GB, 58.8 GB available, file block size 1 MB, max file size 62.9 TB
Volume Creation Time: Wed Jun 10 13:56:05 2015
Files (max/free): 130000/129979
Ptr Blocks (max/free): 64512/64456
Sub Blocks (max/free): 32000/31995
Secondary Ptr Blocks (max/free): 256/256
File Blocks (overcommit/used/overcommit %): 0/41931/0
Ptr Blocks  (overcommit/used/overcommit %): 0/56/0
Sub Blocks  (overcommit/used/overcommit %): 0/5/0
Volume Metadata size: 804159488
UUID: 557841f5-145136df-8de6-0025b501a002
Partitions spanned (on "lvm"):
naa.60080e50001f83d4000003075576b218:1
Is Native Snapshot Capable: YES
OBJLIB-LIB: ObjLib cleanup done.
~ # vmkfstools -Ph -v 1 /vmfs/volumes/fli-orig-3
~ # vmkfstools --help
```

If the mode had listed the word "public" only, no remediation would be necessary. In the case above "public ATS-only" means that ATS is enabled and needs to be disabled until the import is completed, at which time it can be reenabled.

To disable ATS/CAW on a LUN, use the following command:

```
 # vmkfstools --configATSOnly 0 /vmfs/devices/disks/naa.xxxxxxxxxxxxxxx
```

To reenable ATS/CAW, after the migration is complete, use:

```
# vmkfstools --configATSOnly 1 /vmfs/devices/disks/naa.xxxxxxxxxxxxxxx
```

Appendix B: Host Remediation

Depending on the type of migration, host remediation may take place inline to the migration (FLI online, and 7-Mode to clustered Data ONTAP) or might occur after the migration is complete (FLI offline). Use the 7-Mode Transition Tool 2.0 SAN Host Transition and Remediation Supplemental Guide for remediation steps for different host OSs. Consult your gap analysis, put together during the planning and analysis phases, and appropriate NetApp and vendor documentation for steps specific to your migration.

Support Note

FLI uses the same remediation procedures that would be used with the 7MTT. Therefore it makes sense to leverage the same remediation document rather then document those procedures multiple times in different places.

Support Note

One exception to the recommendation that you use the 7-Mode Transition Tool 2.0 SAN Host Transition and Remediation Supplemental Guide to research and perform host migrations is CAW remediation, which is discussed in Appendix A of this document.

Appendix C: Clearing SCSI-3 Persistent Reservations

If you have a Windows cluster, you need to remove SCSI-3 reservations for the quorum disk even if you have offlined all clustered hosts. You know you need to do this if you see an error message similar to this when you attempt to label the source LUN as a foreign disk:

```
Error: command failed: The specified foreign disk has SCSI persistent      reservations. Disk serial
number: "6006016021402700787BAC217B44E411".  Clear the reservation using the "storage disk remove-
reservation" command   before creating the import relationship.
```

This can be done on the NetApp controller using the “storage disk remove-reservation command:

```
storage disk remove-reservation –disk disk_name.
```

Here is a snippet showing this error and the remediation for it:

```
cluster-4b::*> lun offline -vserver fli_cluster -path /vol/fli_volume/cluster_CVS
cluster-4b::*> lun import create -vserver fli_cluster -path /vol/fli_volume/cluster_CVS -foreign-disk
6006016021402700787BAC217B44E411
Error: command failed: The specified foreign disk is not marked as foreign. Disk serial number:
"6006016021402700787BAC217B44E411".

cluster-4b::*> sto disk show -disk DGC-1.6 -fields serial-number,is-foreign
(storage disk show)
disk is-foreign serial-number
------- ---------- --------------------------------
DGC-1.6 true 6006016021402700787BAC217B44E411

cluster-4b::*> lun import create -vserver fli_cluster -path /vol/fli_volume/cluster_CVS -foreign-disk
6006016021402700787BAC217B44E411

Error: command failed: The specified foreign disk has SCSI persistent reservations. Disk serial number:
"6006016021402700787BAC217B44E411". Clear the reservation using the "storage disk remove-reservation"
command before creating the import relationship.

cluster-4b::*> storage disk remove-reservation -disk DGC-1.6
cluster-4b::*> lun import create -vserver fli_cluster -path /vol/fli_volume/cluster_CVS -foreign-disk
6006016021402700787BAC217B44E411
cluster-4b::*> lun online -vserver fli_cluster -path /vol/fli_volume/cluster_CVS
cluster-4b::*> lun import show

vserver foreign-disk path operation admin operational percent in progress state state complete
-------------------------------------------------------------------------------
fli_cluster 6006016021402700787BAC217B44E411 /vol/fli_volume/cluster_CVS import stopped stopped 0

cluster-4b::*> lun import start -vserver fli_cluster -path /vol/fli_volume/cluster_CVS
cluster-4b::*> lun import show

vserver foreign-disk path operation admin operational percent in progress state state complete
-------------------------------------------------------------------------------
```



```
fli_cluster 60060160214027007 87BAC217B44E411 /vol/fli_volume/cluster_CVS import started in_progress 7
```

Appendix D: SAN Host Multipath Verification

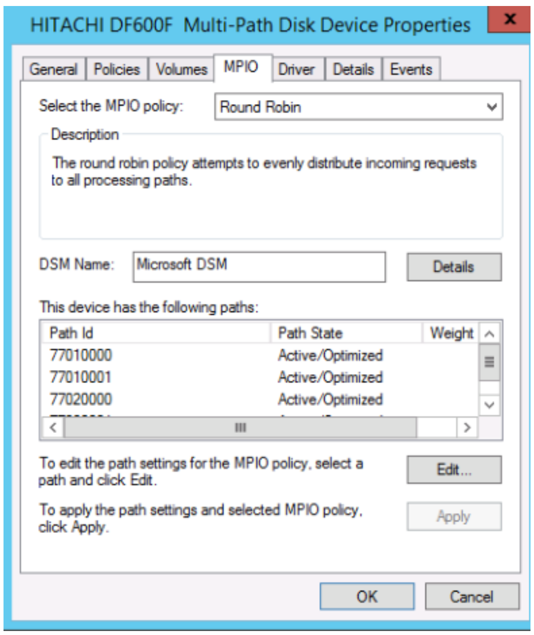
To verify that the server multipath is configured and functioning correctly, complete the following steps:

Windows Host

To verify that multipath is configured and functioning correctly on a Windows host, complete the following steps:

1. Open Disk Management. To open Disk Management, on the Windows desktop, click Start. In the Start Search field, type diskmgmt.msc. In the Programs list, click diskmgmt.
2. Right-click each disk for which you want to verify the multiple paths and then click Properties.
3. On the MPIO tab, in the Select the MPIO policy list, click all the paths that are Active.

Figure 35) Windows MPIO properties



To verify multipathing using the command line, complete the following steps:

1. Open Windows command prompt.
2. Run mpclaim.exe –v c:\multipathconfig.txt to capture multipath configuration.

Linux Host

1. To verify that DM-MP multipath is configured and functioning correctly on a Linux host, run the following commands:

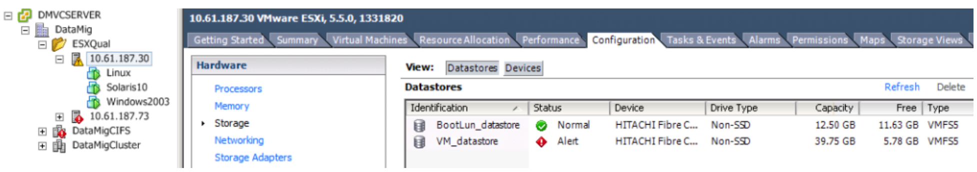
```
[root@dm-rx200s6-22 ~]# multipath -ll
mpath2 (360060e801046b96004f2bf4600000012) dm-6 HITACHI,DF600F
[size=2.0G][features=0][hwhandler=0][rw]
\_ round-robin 0 [prio=1][active]
 \_ 0:0:1:2 sdg 8:96  [active][ready]
 \_ 1:0:1:2 sdo 8:224 [active][ready]
\_ round-robin 0 [prio=0][enabled]
 \_ 0:0:0:2 sdc 8:32  [active][ready]
 \_ 1:0:0:2 sdk 8:160 [active][ready]
mpath1 (360060e801046b96004f2bf4600000011) dm-5 HITACHI,DF600F
```

```
[size=2.0G][features=0][hwhandler=0][rw]
\_ round-robin 0 [prio=1][active]
 \_ 0:0:0:1 sdb 8:16  [active][ready]
 \_ 1:0:0:1 sdj 8:144 [active][ready]
\_ round-robin 0 [prio=0][enabled]
 \_ 0:0:1:1 sdf 8:80  [active][ready]
 \_ 1:0:1:1 sdn 8:208 [active][ready]
mpath0 (360060e801046b96004f2bf4600000010) dm-0 HITACHI,DF600F
[size=20G][features=0][hwhandler=0][rw]
\_ round-robin 0 [prio=1][active]
 \_ 0:0:1:0 sde 8:64  [active][ready]
 \_ 1:0:1:0 sdm 8:192 [active][ready]
\_ round-robin 0 [prio=0][enabled]
 \_ 0:0:0:0 sda 8:0   [active][ready]
 \_ 1:0:0:0 sdi 8:128 [active][ready]
mpath3 (360060e801046b96004f2bf4600000013) dm-7 HITACHI,DF600F
[size=3.0G][features=0][hwhandler=0][rw]
\_ round-robin 0 [prio=1][active]
 \_ 0:0:0:3 sdd 8:48  [active][ready]
 \_ 1:0:0:3 sdl 8:176 [active][ready]
\_ round-robin 0 [prio=0][enabled]
 \_ 0:0:1:3 sdh 8:112 [active][ready]
 \_ 1:0:1:3 sdp 8:240 [active][ready]
[root@dm-rx200s6-22 ~]#
```

ESXi Host

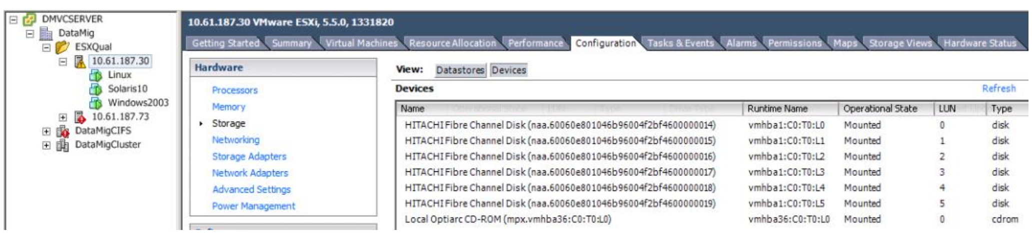
1. Determine ESXi and virtual machine using VMware vSphere Client.

Figure 36) vSphere storage datastores



2. Determine SAN LUNs to be migrated using vSphere Client.

Figure 37) vSphere storage devices



3. Determine VMFS and RDM (vfat) volumes to be migrated.

```
~ # esxcli storage filesystem list
Mount Point                                        Volume Name        UUID
Mounted  Type            Size         Free
-------------------------------------------------  -----------------  ----------------------------------
-  -------  ------  -----------  -----------
/vmfs/volumes/538400f6-3486df59-52e5-00262d04d700  BootLun_datastore  538400f6-3486df59-52e5-
00262d04d700     true  VMFS-5  13421772800  12486443008
/vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700  VM_datastore       53843dea-5449e4f7-88e0-
00262d04d700     true  VMFS-5  42681237504   6208618496
/vmfs/volumes/538400f6-781de9f7-c321-00262d04d700                     538400f6-781de9f7-c321-
00262d04d700     true  vfat     4293591040   4269670400
/vmfs/volumes/c49aad7f-afbab687-b54e-065116d72e55                     c49aad7f-afbab687-b54e-
065116d72e55     true  vfat      261853184     77844480
```



```
/vmfs/volumes/270b9371-8fbedc2b-1f3b-47293e2ce0da                     270b9371-8fbedc2b-1f3b-
47293e2ce0da     true  vfat      261853184    261844992
/vmfs/volumes/538400ef-647023fa-edef-00262d04d700                     538400ef-647023fa-edef-
00262d04d700     true  vfat      299712512     99147776
~ #
```

Support Note

In case of VMFS with extends (spanned VMFS), all LUNs that are part of the span should be migrated. To show all the extends in the GUI, go to Configuration > Hardware > Storage and click datastore to select the Properties link.
Note: Post-migration, while adding them back to storage, you will see multiple LUN entries with the same VMFS label. In this scenario you should ask the customer to select only the entry marked as head.

4. Determine the LUN and size to be migrated.

```
~ # esxcfg-scsidevs -c
Device UID                            Device Type      Console Device
Size      Multipath PluginDisplay Name
mpx.vmhba36:C0:T0:L0                  CD-ROM           /vmfs/devices/cdrom/mpx.vmhba36:C0:T0:L0
0MB       NMP     Local Optiarc CD-ROM (mpx.vmhba36:C0:T0:L0)
naa.60060e801046b96004f2bf4600000014  Direct-Access
/vmfs/devices/disks/naa.60060e801046b96004f2bf4600000014  20480MB   NMP     HITACHI Fibre Channel Disk
(naa.60060e801046b96004f2bf4600000014)
naa.60060e801046b96004f2bf4600000015  Direct-Access
/vmfs/devices/disks/naa.60060e801046b96004f2bf4600000015  40960MB   NMP     HITACHI Fibre Channel Disk
(naa.60060e801046b96004f2bf4600000015)
~~~~~~ Output truncated ~~~~~~~
~ #
```

5. Identify raw device mapping (RDM) LUNs to be migrated.
6. Find RDM devices.

```
~ # find /vmfs/volumes -name **-rdm**
/vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Windows2003/Windows2003_1-rdmp.vmdk
/vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Windows2003/Windows2003_2-rdm.vmdk
/vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Linux/Linux_1-rdm.vmdk
/vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Solaris10/Solaris10_1-rdmp.vmdk
```

7. Remove -rdmp and -rdm from preceding output and run the vmkfstools command to find vml mapping and RDM type.

Support Note

Passthrough is RDM with physical (RDMP), and nonpassthrough is RDM with virtual (RDMV).

VMs with virtual RDMs and VM Snapshot copies will break after migration due to VM Snapshot delta vmdk pointing to an RDM that has a stale naa ID. So before migration, ask the customer to remove all Snapshot copies in such VMs. Right-click VM and click the Snapshot --> Snapshot Manager Delete All button.

Refer to NetApp KB 3013935 for details about hardware-accelerated locking for VMware on NetApp storage.

```
~ # vmkfstools -q /vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Windows2003/Windows2003_1.vmdk
Disk /vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Windows2003/Windows2003_1.vmdk is a Passthrough
Raw Device Mapping
Maps to: vml.020002000060060e801046b96004f2bf460000001644463630304 6
~ # vmkfstools -q /vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Windows2003/Windows2003_2.vmdk
Disk /vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Windows2003/Windows2003_2.vmdk is a Non-
passthrough Raw Device Mapping
Maps to: vml.020003000060060e801046b96004f2bf4600000017444636303046
~ # vmkfstools -q /vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Linux/Linux_1.vmdk
```

```
Disk /vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Linux/Linux_1.vmdk is a Non-passthrough Raw
Device Mapping
Maps to: vml.020005000060060e801046b96004f2bf4600000019444636303046
~ # vmkfstools -q /vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Solaris10/Solaris10_1.vmdk
Disk /vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Solaris10/Solaris10_1.vmdk is a Passthrough Raw
Device Mapping
Maps to: vml.020004000060060e801046b96004f2bf4600000018444636303046
~ #
```

8. Identify LUN naa to RDM device mapping.

```
~ # esxcfg-scsidevs -u | grep vml.020002000060060e801046b96004f2bf4600000016444636303046
naa.60060e801046b96004f2bf4600000016
vml.020002000060060e801046b96004f2bf4600000016444636303046
~ # esxcfg-scsidevs -u | grep vml.020003000060060e801046b96004f2bf4600000017444636303046
naa.60060e801046b96004f2bf4600000017
vml.020003000060060e801046b96004f2bf4600000017444636303046
~ # esxcfg-scsidevs -u | grep vml.020005000060060e801046b96004f2bf4600000019444636303046
naa.60060e801046b96004f2bf4600000019
vml.020005000060060e801046b96004f2bf4600000019444636303046
~ # esxcfg-scsidevs -u | grep vml.020004000060060e801046b96004f2bf4600000018444636303046
naa.60060e801046b96004f2bf4600000018
vml.020004000060060e801046b96004f2bf4600000018444636303046
~ #
```

9. Determine virtual machine configuration. Record UUID of the datastore.

```
~ # esxcli storage filesystem list | grep VMFS
/vmfs/volumes/538400f6-3486df59-52e5-00262d04d700  BootLun_datastore  538400f6-3486df59-52e5-
00262d04d700     true  VMFS-5  13421772800  12486443008
/vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700  VM_datastore       53843dea-5449e4f7-88e0-
00262d04d700     true  VMFS-5  42681237504   6208618496
~ #
```

10. Make a copy of /etc/vmware/hostd/vmInventory.xml and note the contents of file and vmx config path.

```
~ # cp /etc/vmware/hostd/vmInventory.xml /etc/vmware/hostd/vmInventory.xml.bef_mig
~ # cat /etc/vmware/hostd/vmInventory.xml
<ConfigRoot>
  <ConfigEntry id="0001">
    <objID>2</objID>
    <vmxCfgPath>/vmfs/volumes/53843dea-5449e4f7-88e0-
00262d04d700/Windows2003/Windows2003.vmx</vmxCfgPath>
  </ConfigEntry>
  <ConfigEntry id="0004">
    <objID>5</objID>
    <vmxCfgPath>/vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Linux/Linux.vmx</vmxCfgPath>
  </ConfigEntry>
  <ConfigEntry id="0005">
    <objID>6</objID>
    <vmxCfgPath>/vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Solaris10/Solaris10.vmx</vmxCfgPath>
  </ConfigEntry>
</ConfigRoot>
~ #
```

11. Identify the virtual machine hard disks. This information is required post-migration to add the removed RDM devices in order.

```
~ # grep fileName /vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Windows2003/Windows2003.vmx
scsi0:0.fileName = "Windows2003.vmdk"
scsi0:1.fileName = "Windows2003_1.vmdk"
scsi0:2.fileName = "Windows2003_2.vmdk"
~ # grep fileName /vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Linux/Linux.vmx
scsi0:0.fileName = "Linux.vmdk"
scsi0:1.fileName = "Linux_1.vmdk"
~ # grep fileName /vmfs/volumes/53843dea-5449e4f7-88e0-00262d04d700/Solaris10/Solaris10.vmx
scsi0:0.fileName = "Solaris10.vmdk"
scsi0:1.fileName = "Solaris10_1.vmdk"
~ #
```

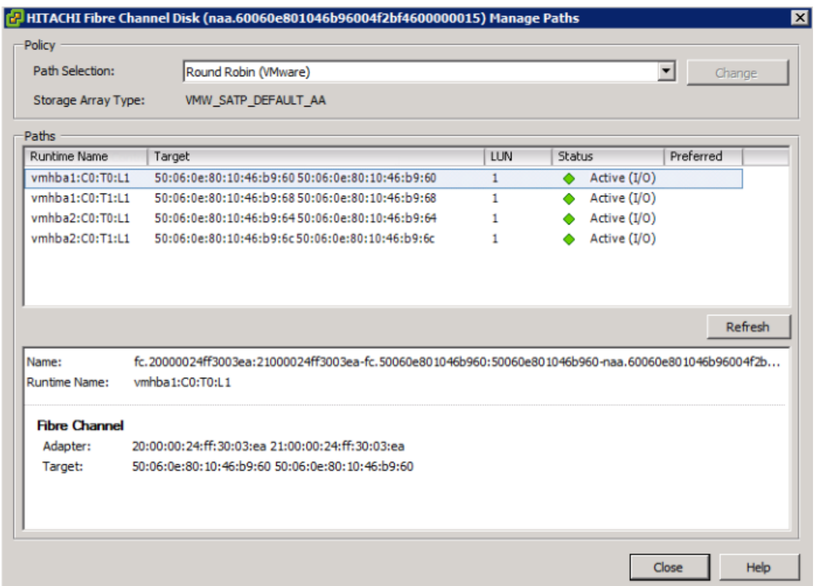
12. Determine RDM device, virtual machine mapping, and compatibility mode.

13. Using the preceding information, note down the RDM mapping to device, virtual machine, compatibility mode, and order. You need this information while adding RDM devices to the VM later.

```
Virtual Machine -> Hardware -> NAA -> Compatibility mode
Windows2003 VM -> scsi0:1.fileName = "Windows2003_1.vmdk" -> naa.60060e801046b96004f2bf4600000016
-> RDM Physical
Windows2003 VM -> scsi0:2.fileName = "Windows2003_2.vmdk" -> naa.60060e801046b96004f2bf4600000017
-> RDM Virtual
Linux VM       -> scsi0:1.fileName = "Linux_1.vmdk" -> naa.60060e801046b96004f2bf4600000019 -> RDM
Virtual
Solaris10 VM   -> scsi0:1.fileName = "Solaris10_1.vmdk" -> naa.60060e801046b96004f2bf4600000018 -> RDM
Physical
```

14. Determine multipath configuration.
15. To obtain multipath settings for your storage in the vSphere Client:
    a. Select an ESX or ESXi host in the vSphere Client and click the Configuration tab.
    b. Click Storage.
    c. Select a datastore or mapped LUN.
    d. Click Properties.
    e. In the Properties dialog box, select the desired extent, if necessary.
    f. Click Extent Device > Manage Paths and obtain the paths in the Manage Path dialog box.

Figure 38) vSphere storage devices paths



    g. To obtain LUN multipathing information from the ESXi host command line:
        1. Log in to the ESXi host console.
        2. Run esxcli storage nmp device list to get multipath information.

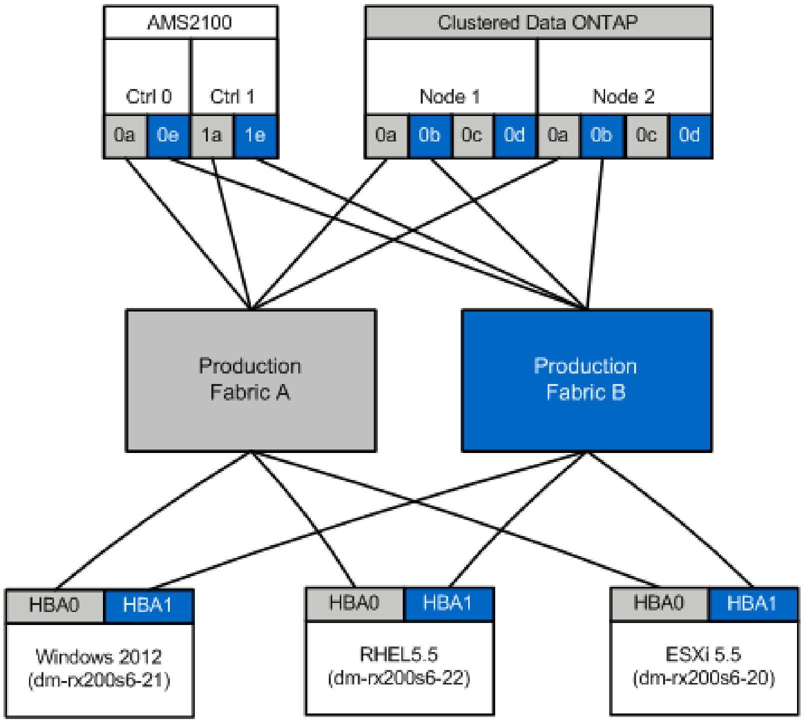
```
~ # esxcli storage nmp device list
naa.60060e801046b96004f2bf4600000014
   Device Display Name: HITACHI Fibre Channel Disk (naa.60060e801046b96004f2bf4600000014)
   Storage Array Type: VMW_SATP_DEFAULT_AA
   Storage Array Type Device Config: SATP VMW_SATP_DEFAULT_AA does not support device configuration.
   Path Selection Policy: VMW_PSP_RR
   Path Selection Policy Device Config: {policy=rr,iops=1000,bytes=10485760,useANO=0; lastPathIndex=3:
NumIOsPending=0,numBytesPending=0}
   Path Selection Policy Device Custom Config:
   Working Paths: vmhba2:C0:T1:L0, vmhba2:C0:T0:L0, vmhba1:C0:T1:L0, vmhba1:C0:T0:L0
```



```
   Is Local SAS Device: false
   Is Boot USB Device: false

naa.60060e801046b96004f2bf4600000015
   Device Display Name: HITACHI Fibre Channel Disk (naa.60060e801046b96004f2bf4600000015)
   Storage Array Type: VMW_SATP_DEFAULT_AA
   Storage Array Type Device Config: SATP VMW_SATP_DEFAULT_AA does not support device configuration.
   Path Selection Policy: VMW_PSP_RR
   Path Selection Policy Device Config: {policy=rr,iops=1000,bytes=10485760,useANO=0; lastPathIndex=0:
NumIOsPending=0,numBytesPending=0}
   Path Selection Policy Device Custom Config:
   Working Paths: vmhba2:C0:T1:L1, vmhba2:C0:T0:L1, vmhba1:C0:T1:L1, vmhba1:C0:T0:L1
   Is Local SAS Device: false
   Is Boot USB Device: false

naa.60060e801046b96004f2bf4600000016
   Device Display Name: HITACHI Fibre Channel Disk (naa.60060e801046b96004f2bf4600000016)
   Storage Array Type: VMW_SATP_DEFAULT_AA
   Storage Array Type Device Config: SATP VMW_SATP_DEFAULT_AA does not support device configuration.
   Path Selection Policy: VMW_PSP_RR
   Path Selection Policy Device Config: {policy=rr,iops=1000,bytes=10485760,useANO=0; lastPathIndex=1:
NumIOsPending=0,numBytesPending=0}
   Path Selection Policy Device Custom Config:
   Working Paths: vmhba2:C0:T1:L2, vmhba2:C0:T0:L2, vmhba1:C0:T1:L2, vmhba1:C0:T0:L2
   Is Local SAS Device: false
   Is Boot USB Device: false

naa.60060e801046b96004f2bf4600000017
   Device Display Name: HITACHI Fibre Channel Disk (naa.60060e801046b96004f2bf4600000017)
   Storage Array Type: VMW_SATP_DEFAULT_AA
   Storage Array Type Device Config: SATP VMW_SATP_DEFAULT_AA does not support device configuration.
   Path Selection Policy: VMW_PSP_RR
   Path Selection Policy Device Config: {policy=rr,iops=1000,bytes=10485760,useANO=0; lastPathIndex=1:
NumIOsPending=0,numBytesPending=0}
   Path Selection Policy Device Custom Config:
   Working Paths: vmhba2:C0:T1:L3, vmhba2:C0:T0:L3, vmhba1:C0:T1:L3, vmhba1:C0:T0:L3
   Is Local SAS Device: false
   Is Boot USB Device: false

naa.60060e801046b96004f2bf4600000018
   Device Display Name: HITACHI Fibre Channel Disk (naa.60060e801046b96004f2bf4600000018)
   Storage Array Type: VMW_SATP_DEFAULT_AA
   Storage Array Type Device Config: SATP VMW_SATP_DEFAULT_AA does not support device configuration.
   Path Selection Policy: VMW_PSP_RR
   Path Selection Policy Device Config: {policy=rr,iops=1000,bytes=10485760,useANO=0; lastPathIndex=1:
NumIOsPending=0,numBytesPending=0}
   Path Selection Policy Device Custom Config:
   Working Paths: vmhba2:C0:T1:L4, vmhba2:C0:T0:L4, vmhba1:C0:T1:L4, vmhba1:C0:T0:L4
   Is Local SAS Device: false
   Is Boot USB Device: false

naa.60060e801046b96004f2bf4600000019
   Device Display Name: HITACHI Fibre Channel Disk (naa.60060e801046b96004f2bf4600000019)
   Storage Array Type: VMW_SATP_DEFAULT_AA
   Storage Array Type Device Config: SATP VMW_SATP_DEFAULT_AA does not support device configuration.
   Path Selection Policy: VMW_PSP_RR
   Path Selection Policy Device Config: {policy=rr,iops=1000,bytes=10485760,useANO=0; lastPathIndex=1:
NumIOsPending=0,numBytesPending=0}
   Path Selection Policy Device Custom Config:
   Working Paths: vmhba2:C0:T1:L5, vmhba2:C0:T0:L5, vmhba1:C0:T1:L5, vmhba1:C0:T0:L5
   Is Local SAS Device: false
   Is Boot USB Device: false
```

Appendix E: Create the Host to Destination Zones

Figure 39) Host and destination storage zoning



Production Fabric A

Table 25) Production zones in production fabric A

Zone	WWPN	Zone Members
Zone: rx21_flicDOT	21:00:00:24:ff:30:14:c5 20:01:00:a0:98:2f:94:d1 20:03:00:a0:98:2f:94:d1	RX21 HBA 0 flicDOT lif1 flicDOT lif3
Zone: rx22_flicDOT	21:00:00:24:ff:30:04:85 20:01:00:a0:98:2f:94:d1 20:03:00:a0:98:2f:94:d1	RX22 HBA 0 flicDOT lif1 flicDOT lif3
Zone: rx20_flicDOT	21:00:00:24:ff:30:03:ea 20:01:00:a0:98:2f:94:d1 20:03:00:a0:98:2f:94:d1	RX20 HBA 0 flicDOT lif1 flicDOT lif3

Production Fabric B

Table 26) Production zones in production fabric B

Zone	WWPN	Zone Members
Zone: rx21_flicDOT	21:00:00:24:ff:30:14:c4 20:02:00:a0:98:2f:94:d1 20:04:00:a0:98:2f:94:d1	RX21 HBA 1 flicDOT lif2 flicDOT lif4
Zone: rx22_flicDOT	21:00:00:24:ff:30:04:84 20:02:00:a0:98:2f:94:d1 20:04:00:a0:98:2f:94:d1	RX22 HBA 1 flicDOT lif2 flicDOT lif4
Zone: rx20_flicDOT	21:00:00:24:ff:30:03:eb 20:02:00:a0:98:2f:94:d1 20:04:00:a0:98:2f:94:d1	RX20 HBA 1 flicDOT lif2 flicDOT lif4

Brocade Fabric Example

Production Fabric A

1. Create the zone in production fabric A.

```
zoneCreate "rx21_flicDOT", "21:00:00:24:ff:30:14:c5"
zoneAdd "rx21_flicDOT", "20:01:00:a0:98:2f:94:d1"
zoneAdd "rx21_flicDOT", "20:03:00:a0:98:2f:94:d1"
zoneCreate "rx22_flicDOT", "21:00:00:24:ff:30:04:85"
zoneAdd "rx22_flicDOT", "20:01:00:a0:98:2f:94:d1"
zoneAdd "rx22_flicDOT", "20:03:00:a0:98:2f:94:d1"
zoneCreate "rx20_flicDOT", "21:00:00:24:ff:30:03:ea"
zoneAdd "rx20_flicDOT", "20:01:00:a0:98:2f:94:d1"
zoneAdd "rx20_flicDOT", "20:03:00:a0:98:2f:94:d1"
```

2. Activate the zone in production fabric A.

```
cfgAdd "PROD_LEFT", "rx21_flicDOT"
cfgAdd "PROD_LEFT", "rx22_flicDOT"
cfgAdd "PROD_LEFT", "rx20_flicDOT"
cfgEnable "PROD_LEFT"
cfgSave
```

Production Fabric B

1. Create the zone in production fabric B.

```
zoneCreate "rx21_flicDOT", "21:00:00:24:ff:30:14:c4"
zoneAdd "rx21_flicDOT", "20:02:00:a0:98:2f:94:d1"
zoneAdd "rx21_flicDOT", "20:04:00:a0:98:2f:94:d1"
zoneCreate "rx22_flicDOT", "21:00:00:24:ff:30:04:84"
zoneAdd "rx22_flicDOT", "20:02:00:a0:98:2f:94:d1"
zoneAdd "rx22_flicDOT", "20:04:00:a0:98:2f:94:d1"
zoneCreate "rx20_flicDOT", "21:00:00:24:ff:30:03:eb"
zoneAdd "rx20_flicDOT", "20:02:00:a0:98:2f:94:d1"
zoneAdd "rx20_flicDOT", "20:04:00:a0:98:2f:94:d1"
```

2. Activate the zone in production fabric B.

```
cfgAdd "PROD_RIGHT", "rx21_flicDOT"
cfgAdd "PROD_RIGHT", "rx22_flicDOT"
cfgAdd "PROD_RIGHT", "rx20_flicDOT"
cfgEnable "PROD_RIGHT"
```

```
cfgSave
```

Cisco Fabric Example

Production Fabric A

1. Create the zone in production fabric A.

```
conf t
zone name rx21_flicDOT vsan 10
member pwwn 21:00:00:24:ff:30:14:c5
member pwwn 20:01:00:a0:98:2f:94:d1
member pwwn 20:03:00:a0:98:2f:94:d1
zone name rx22_flicDOT vsan 10
member pwwn 21:00:00:24:ff:30:04:85
member pwwn 20:01:00:a0:98:2f:94:d1
member pwwn 20:03:00:a0:98:2f:94:d1
zone name rx20_flicDOT vsan 10
member pwwn 21:00:00:24:ff:30:03:ea
member pwwn 20:01:00:a0:98:2f:94:d1
member pwwn 20:03:00:a0:98:2f:94:d1
exit
end
```

2. Activate the zone in production fabric A.

```
conf t
zoneset name PROD_LEFT vsan 10
member rx21_flicDOT
member rx22_flicDOT
member rx20_flicDOT
exit
zoneset activate name PROD_LEFT vsan 10
end
copy running-config startup-config
```

Production Fabric B

1. Create the zone in production fabric B.

```
conf t
zone name rx21_flicDOT vsan 10
member pwwn 21:00:00:24:ff:30:14:c4
member pwwn 20:02:00:a0:98:2f:94:d1
member pwwn 20:04:00:a0:98:2f:94:d1
zone name rx22_flicDOT vsan 10
member pwwn 21:00:00:24:ff:30:04:84
member pwwn 20:02:00:a0:98:2f:94:d1
member pwwn 20:04:00:a0:98:2f:94:d1
zone name rx20_flicDOT vsan 10
member pwwn 21:00:00:24:ff:30:03:eb
member pwwn 20:02:00:a0:98:2f:94:d1
member pwwn 20:04:00:a0:98:2f:94:d1
exit
end
```

2. Activate the zone in production fabric B.

```
conf t
zoneset name PROD_RIGHT vsan 10
member rx21_flicDOT
member rx22_flicDOT
member rx20_flicDOT
exit
zoneset activate name PROD_RIGHT vsan 10
end
copy running-config startup-config
```

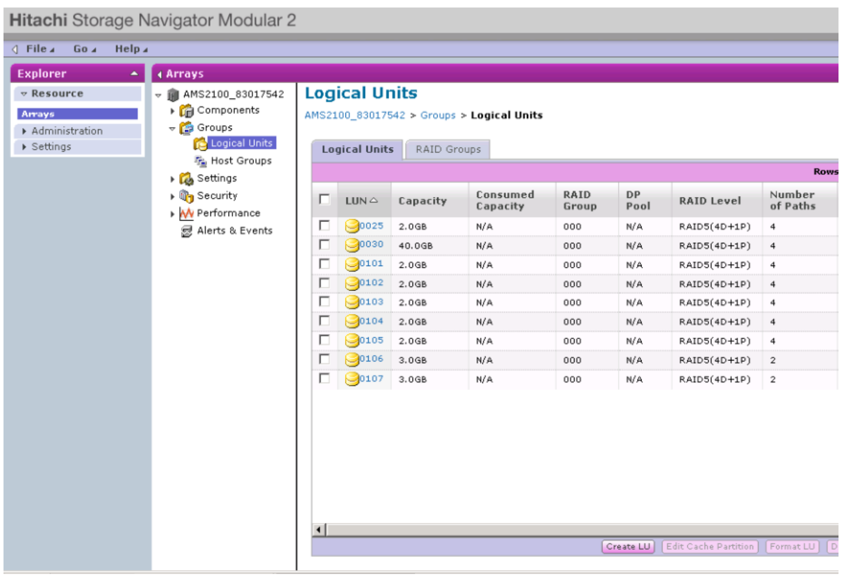
Appendix F: Test Migration Example Using Hitachi AMS2100

The following is an example test migration using a Hitachi AMS2100 as the foreign array. Depending on the arrays involved, host OSs, and other variables, your steps may be different. However, the following example should still be a good guide to general steps required to perform test migrations. As noted earlier, it is important to perform several test migrations in order to test connectivity and your processes. NetApp recommends performing these test migrations as early as possible in order to find and have as much time as possible to resolve any issues brought to light by the tests.

To perform a test migration, complete the following steps:

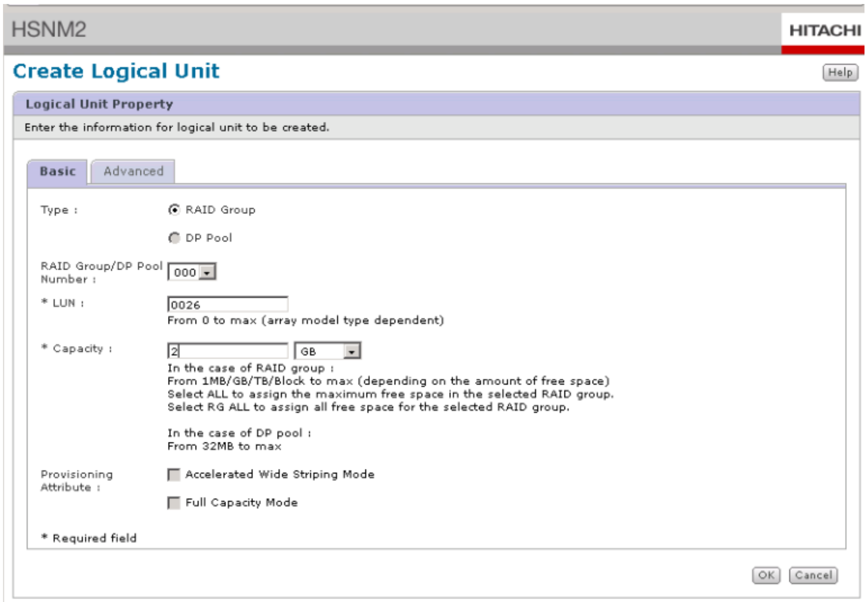
1. Create a 2GB test LUN on the source array.
2. Log in to Hitachi Storage Navigator Modular as system.
3. Select AMS 2100 array and click Show and Configure Array.
4. Log in using root.
5. Expand Groups and select Logical Units.

Figure 40) HDS Storage Navigator: display LUNs



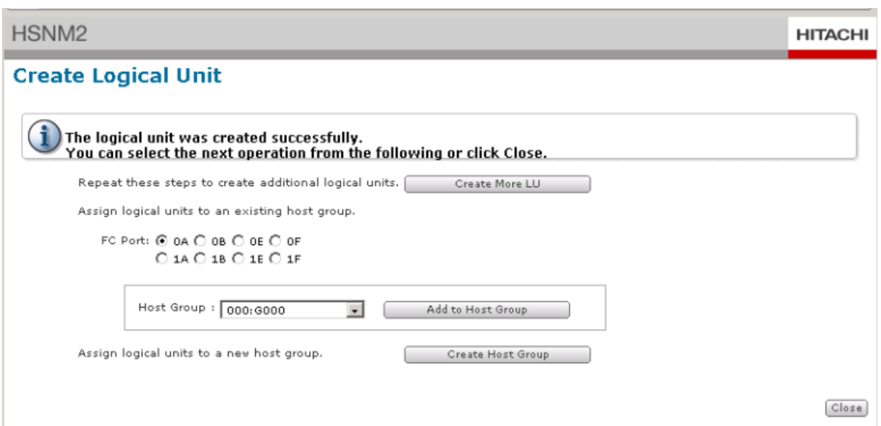
6. Select Create LU to create the test LUN. Create a test LUN of 2GB and click OK.

Figure 41) HDS Storage Navigator: create LUNs



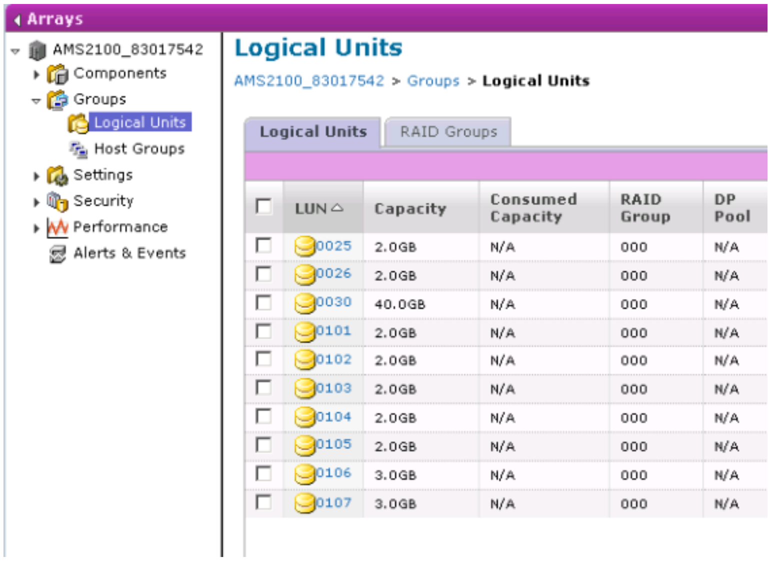
7. Skip the LUN assignment here and proceed by clicking Close.

Figure 42) HDS Storage Navigator: create LUN (continued)



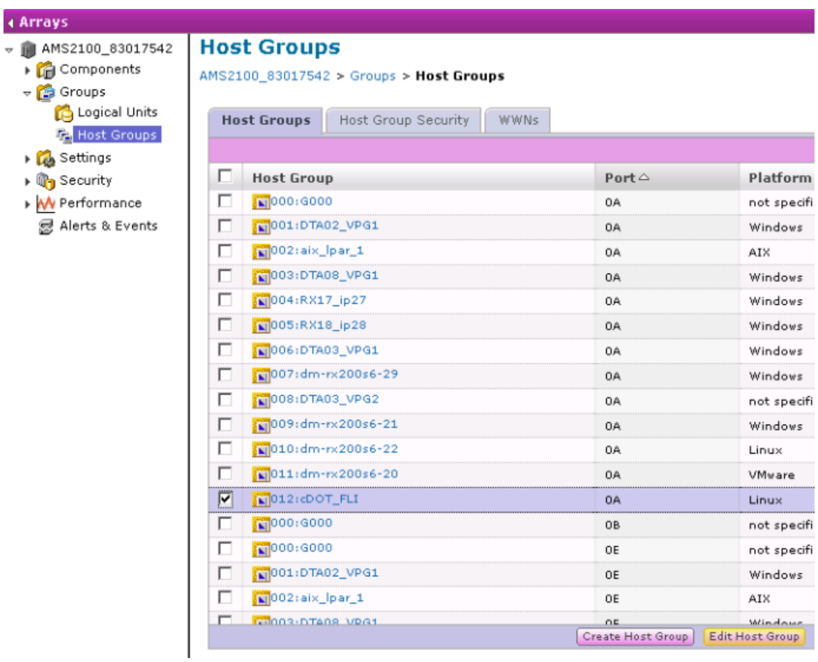
8. Verify LUN 0026 is created.

Figure 43) HDS Storage Navigator: display LUNs



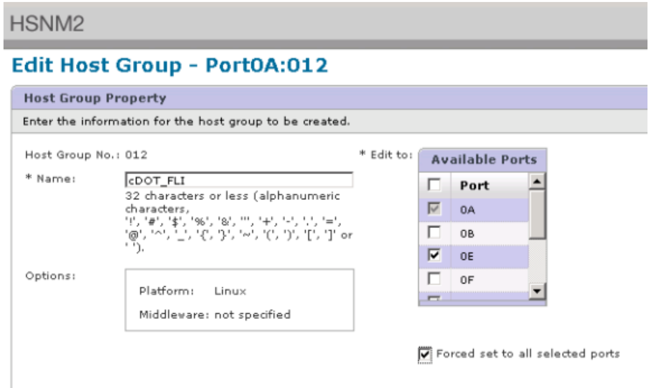
9. Expand Groups and select Logical Units.
10. Select Host Groups to map the test LUN to the cDOT_FLI host group.
11. Select host group cDOT_FLI created in the previous step and click Edit Host Group.

Figure 44) HDS Storage Navigator: display host groups



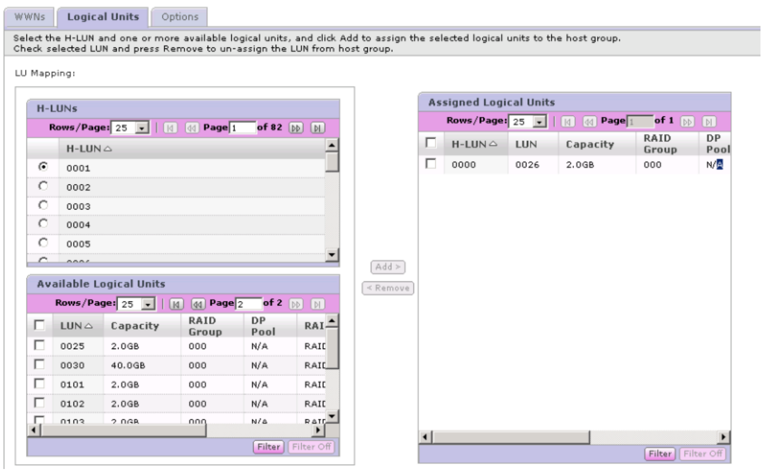
12. Choose the ports for the host group. In this example we choose 0a, 0e, 1a, 1e. Select the Forced Set to All Selected Ports option.

Figure 45) HDS Storage Navigator: edit host group



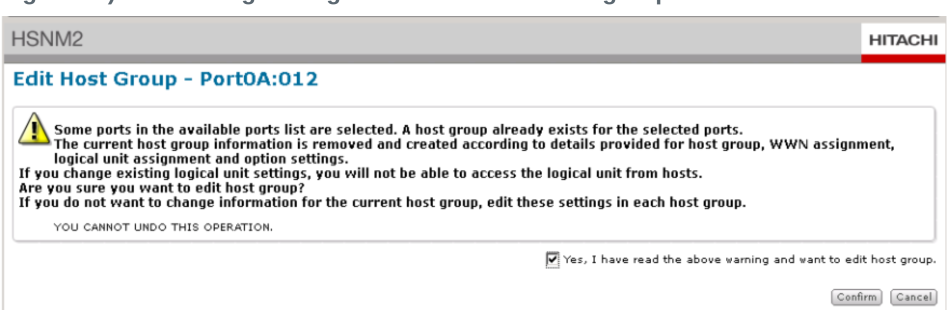
13. Click Logical Units and add the test LUN LUN0026. Click OK to map the LUN.

Figure 46) HDS Storage Navigator: edit host group



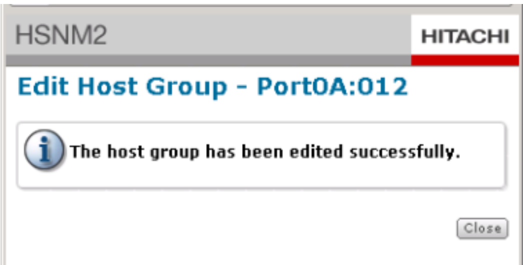
14. Select Yes, I Have Read the Above Warning and Want to Edit Host Group and click Confirm.

Figure 47) HDS Storage Navigator: confirm edit host group



15. Verify host group creation and click Close.

Figure 48) HDS Storage Navigator: edit host group successful



16. Verify the test LUN and mapping from the source storage to destination storage and perform FLI import.
17. Log in to the clustered Data ONTAP storage through SSH using admin user.
18. FLI commands are available in the Advanced privilege mode. Change the mode to Advanced.

```
DataMig-cmode::> set -privilege advanced

Warning: These advanced commands are potentially dangerous; use them only when directed to do so by
NetApp personnel.
Do you want to continue? {y|n}: y

DataMig-cmode::*>
```

19. Discover the source array on clustered Data ONTAP. Wait for a few minutes and retry to detect the source array.

```
DataMig-cmode::*> storage array show
Prefix                         Name    Vendor            Model Options
-------- ---------------------------- -------- ---------------- ----------
HIT-1                HITACHI_DF600F_1   HITACHI           DF600F
```

Support Note

When the storage array is discovered for the first time, clustered Data ONTAP might not show the array by discovering automatically. Use the following instructions to reset the switch port where clustered Data ONTAP initiator ports are connected.

For example:

The DataMig-cmode cluster initiator ports 0a and 0b of clustered Data ONTAP are connected to Cisco ports 4/9 and 4/11. To reset port 4/9 on the Cisco switch:

```
conf t
interface fc4/9
shutdown
no shutdown
exit
exit
```

Resetting one port is usually enough. Check the array list and LUN paths after resetting one port.

20. Verify the source array is discovered through all the initiator ports.

```
DataMig-cmode::*> storage array config show -array-name HITACHI_DF600F_1
             LUN   LUN
Node         Group Count     Array Name       Array Target Port     Initiator
------------ ----- ----- ---------------------------- -----------------------
DataMig-cmode-01 0      1     HITACHI_DF600F_1      50060e801046b960        0a
                                                    50060e801046b964        0b
                                                    50060e801046b968        0a
                                                    50060e801046b96c        0b
DataMig-cmode-02 0      1     HITACHI_DF600F_1      50060e801046b960        0a
                                                    50060e801046b964        0b
```

```
                                                  50060e801046b968        0a
                                                  50060e801046b96c        0b
```

21. List the test LUN mapped from Hitachi storage. Verify the disk properties and paths.

```
DataMig-cmode::*> storage disk show -array-name HITACHI_DF600F_1 -instance
                  Disk: HIT-1.1
        Container Type: unassigned
            Owner/Home: -  / -
               DR Home: -
    Stack ID/Shelf/Bay: -  / -  / -
                   LUN: 0
                 Array: HITACHI_DF600F_1
                Vendor: HITACHI
                 Model: DF600F
         Serial Number: 83017542001A
                   UID:
48495441:43484920:38333031:37353432:30303236:00000000:00000000:00000000:00000000:00000000
                   BPS: 512
         Physical Size: -
              Position: present
Checksum Compatibility: block
             Aggregate: -
                  Plex: -
Paths:
                                LUN  Initiator Side        Target Side
Link
Controller         Initiator     ID  Switch Port           Switch Port           Acc Use  Target Port
TPGN    Speed      I/O KB/s          IOPS
------------------ ---------  -----  --------------------  --------------------  --- ---  --------------
---------  ------  -------  ------------  ------------
DataMig-cmode-01   0a             0  DM-Cisco9506-1:4-9    DM-Cisco9506-1:2-24   AO  INU
50060e801046b968            2   2 Gb/S             0             0
DataMig-cmode-01   0b             0  DM-Cisco9506-2:4-9    DM-Cisco9506-2:2-24   AO  INU
50060e801046b96c            2   2 Gb/S             0             0
DataMig-cmode-01   0b             0  DM-Cisco9506-2:4-9    DM-Cisco9506-2:1-14   AO  INU
50060e801046b964            1   2 Gb/S             0             0
DataMig-cmode-01   0a             0  DM-Cisco9506-1:4-9    DM-Cisco9506-1:1-14   AO  INU
50060e801046b960            1   2 Gb/S             0             0
DataMig-cmode-02   0a             0  DM-Cisco9506-1:4-11   DM-Cisco9506-1:2-24   AO  INU
50060e801046b968            2   2 Gb/S             0             0
DataMig-cmode-02   0b             0  DM-Cisco9506-2:4-11   DM-Cisco9506-2:2-24   AO  INU
50060e801046b96c            2   2 Gb/S             0             0
DataMig-cmode-02   0b             0  DM-Cisco9506-2:4-11   DM-Cisco9506-2:1-14   AO  INU
50060e801046b964            1   2 Gb/S             0             0
DataMig-cmode-02   0a             0  DM-Cisco9506-1:4-11   DM-Cisco9506-1:1-14   AO  INU
50060e801046b960            1   2 Gb/S             0             0

Errors:
-

DataMig-cmode::*>
```

22. For FLI migration, the source LUN needs to be marked as foreign. Mark the source LUN as foreign using the serial number.

```
DataMig-cmode::*> storage disk modify { -serial-number 83017542001A } -is-foreign true
```

23. Verify the source LUN is marked as foreign.

```
DataMig-cmode::*> storage disk show -array-name HITACHI_DF600F_1
                    Usable           Disk    Container   Container
Disk                  Size Shelf Bay Type    Type        Name      Owner
---------------- ---------- ----- --- ------- ----------- --------- --------
HIT-1.1                   -     -   - LUN     foreign     -         -
```

24. Serial numbers are used in FLI LUN import commands. List all foreign arrays and their serial numbers.

```
DataMig-cmode::*> storage disk show -container-type foreign -fields serial-number
disk    serial-number
------- -------------
```



```
HIT-1.1 83017542001A
```

> **Support Note**
>
> The LUN create command detects the size and alignment based on partition offset and creates the LUN accordingly with the foreign-disk argument.

25. Create a destination volume and test LUN using a foreign LUN.

```
DataMig-cmode::*> vol create -vserver datamig flivol aggr1 -size 10g
[Job 5465] Job succeeded: Successful

DataMig-cmode::*> lun create -vserver datamig -path /vol/flivol/testlun1 -ostype linux -foreign-disk
83017542001A

Created a LUN of size 2g (2147483648)

DataMig-cmode::*>
```

26. List the test LUN and verify the size of the LUN with the source LUN.

```
DataMig-cmode::*> lun show
Vserver   Path                            State   Mapped   Type        Size
--------- ------------------------------- ------- -------- -------- --------
datamig   /vol/flivol/testlun1            online  unmapped linux         2GB

DataMig-cmode::*>
```

> **Support Note**
>
> For FLI offline migration, the LUN must be online to map it to an igroup and then must be offline before creating the LUN import relationship.

27. Create test igroup of protocol FCP without adding any initiators.

```
DataMig-cmode::*> lun igroup create -vserver datamig -igroup testig1 -protocol fcp -ostype linux
DataMig-cmode::*> lun igroup show -vserver datamig -igroup testig1
          Vserver Name: datamig
           Igroup Name: testig1
              Protocol: fcp
               OS Type: linux
Portset Binding Igroup: -
           Igroup UUID: 466c6779-fb11-11e3-8364-00a0982fe130
                  ALUA: true
            Initiators: -
```

28. Map the test LUN to the test igroup.

```
DataMig-cmode::*> lun map -vserver datamig -path /vol/flivol/testlun1 -igroup testig1
DataMig-cmode::*> lun mapping show
Vserver    Path                                      Igroup   LUN ID  Protocol
---------- ---------------------------------------- -------  ------  --------
datamig    /vol/flivol/testlun1                      testig1       0  fcp
```

29. Offline the test LUN.

```
DataMig-cmode::*> lun offline -vserver datamig -path /vol/flivol/testlun1
```

```
DataMig-cmode::*> lun show
Vserver   Path                            State   Mapped   Type        Size
--------- ------------------------------- ------- -------- -------- --------
datamig   /vol/flivol/testlun1            offline mapped   linux         2GB
```

30. Create import relationship with test LUN and foreign LUN.

```
DataMig-cmode::*> lun import create -vserver datamig -path /vol/flivol/testlun1 -foreign-disk
83017542001A

DataMig-cmode::*> lun import show -vserver datamig -path /vol/flivol/testlun1
vserver foreign-disk   path                operation admin operational percent
                                         in progress state state       complete
-------------------------------------------------------------------------------
datamig 83017542001A   /vol/flivol/testlun1
                                           import    stopped
                                                           stopped            0
```

31. Start the migration (import).

```
DataMig-cmode::*> lun import start -vserver datamig -path /vol/flivol/testlun1
```

32. Monitor the import progress.

```
DataMig-cmode::*> lun import show -vserver datamig -path /vol/flivol/testlun1
vserver foreign-disk   path                operation admin operational percent
                                         in progress state state       complete
-------------------------------------------------------------------------------
datamig 83017542001A   /vol/flivol/testlun1
                                           import    started
                                                           in_progress       89
```

33. Check the import job is completed successfully.

```
DataMig-cmode::*> lun import show -vserver datamig -path /vol/flivol/testlun1
vserver foreign-disk   path                operation admin operational percent
                                         in progress state state       complete
-------------------------------------------------------------------------------
datamig 83017542001A   /vol/flivol/testlun1
                                           import    started
                                                           completed        100
```

34. Start the verify job to compare source and destination LUNs. Monitor the verify progress.

```
DataMig-cmode::*> lun import verify start -vserver datamig -path /vol/flivol/testlun1

DataMig-cmode::*> lun import show -vserver datamig -path /vol/flivol/testlun1
vserver foreign-disk   path                operation admin operational percent
                                         in progress state state       complete
-------------------------------------------------------------------------------
datamig 83017542001A   /vol/flivol/testlun1
                                           verify    started
                                                           in_progress       44
```

35. Check the verify job is complete without any errors.

```
DataMig-cmode::*> lun import show -vserver datamig -path /vol/flivol/testlun1
vserver foreign-disk   path                operation admin operational percent
                                         in progress state state       complete
-------------------------------------------------------------------------------
datamig 83017542001A   /vol/flivol/testlun1
                                           verify    started
                                                           completed        100
```

36. Delete the import relationship to remove the migration job.

```
DataMig-cmode::*> lun import delete -vserver datamig -path /vol/flivol/testlun1

DataMig-cmode::*> lun import show -vserver datamig -path /vol/flivol/testlun1
There are no entries matching your query.
```

37. Unmap the test LUN from the test igroup.


```
DataMig-cmode::*> lun unmap -vserver datamig -path /vol/flivol/testlun1 -igroup testig1
```

38. Online the test LUN.

```
DataMig-cmode::*> lun online -vserver datamig -path /vol/flivol/testlun1
```

39. Mark the foreign LUN attribute to false.

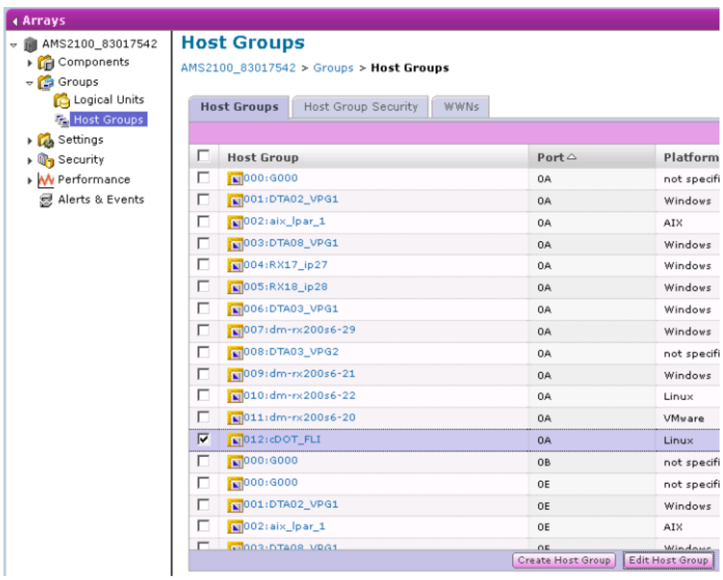
```
DataMig-cmode::*> storage disk modify { -serial-number 83017542001A } -is-foreign false
```

Support Note

Do not remove the host group created on source storage with clustered Data ONTAP initiator ports. The same host group is reused during migrations from that source array.

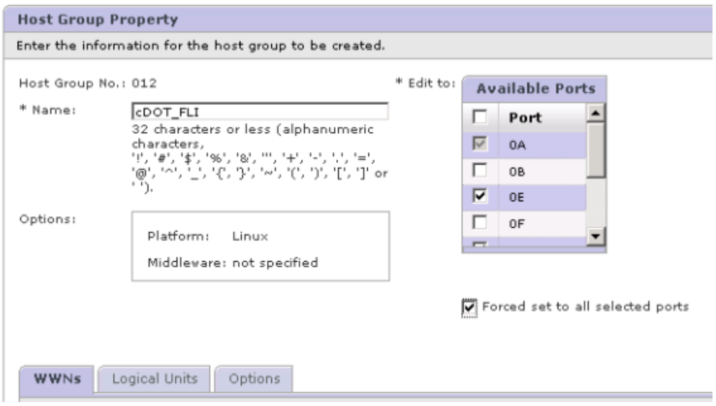
40. Remove test LUN from source storage.
    a. Log in to Hitachi Storage Navigator Modular as a system.
    b. Select AMS 2100 array and click Show and Configure Array.
    c. Log in using root.
    d. Select Groups -> Host Groups.
    e. Select cDOT_FLI Igroup and click Edit Host Group.

Figure 49) HDS Storage Navigator: display host groups



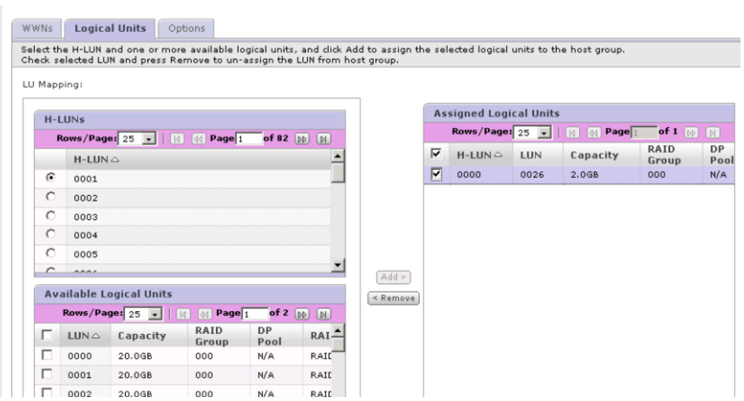
    f. In the Edit Host Group window, select all target ports chosen to map the test LUN and select the Forced Set to All Selected Ports option.

Figure 50) HDS Storage Navigator: display host group properties



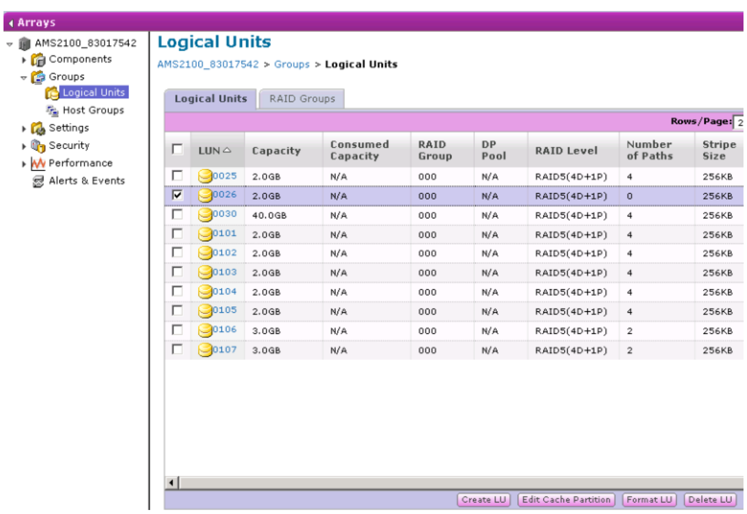
g. Select the Logical Units tab. Select the test LUN from the Assigned Logical Units window and select Remove to remove the LUN mapping. Click OK to continue.

Figure 51) HDS Storage Navigator: assign LUNs to host groups



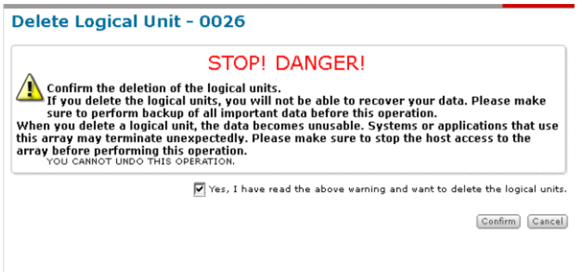
h. Do not remove the host group and continue deleting the test LUN. Select Logical Units. Select the test LUN created in the previous step (LUN0026). Click Delete LUN to delete the LUN.

Figure 52) HDS Storage Navigator: remove LUNs from host groups (continued)



i. Click Confirm to delete the test LUN.

Figure 53) HDS Storage Navigator: delete LUN



41. Delete the test LUN on the destination storage.
    a. Log in to the clustered Data ONTAP storage through SSH using admin user.
    b. Offline the test LUN with the `lun offline` command on the NetApp storage system.
    c. Note: Make sure you do not select another host LUN.

```
DataMig-cmode::*> lun offline -vserver datamig -path /vol/flivol/testlun1
```

    d. Destroy the test LUN with the `lun destroy` command on the NetApp storage system.

```
DataMig-cmode::*> lun destroy -vserver datamig -path /vol/flivol/testlun1
```

    e. Offline the test volume with the `vol offline` command on the NetApp storage system.

```
DataMig-cmode::*> vol offline -vserver datamig -volume flivol
Volume "datamig:flivol" is now offline.
```

    f. Destroy the test volume with the `vol destroy` command on the NetApp storage system.

```
DataMig-cmode::*> vol destroy -vserver datamig -volume flivol

Warning: Are you sure you want to delete volume "flivol" in Vserver "datamig" ? {y|n}: y
Volume "datamig:flivol" destroyed.

DataMig-cmode::*>
```

Support Note

A test migration should be performed on all combinations of source and destination arrays before proceeding with the production migrations.

Appendix G: The FLI Interoperability Matrix Tool (IMT)

The FLI IMT is very similar to the FlexArray IMT but was added as a distinctly different Interoperability tool in order to more aggressively support the source array's NetApp qualifies to work with FLI. Unlike FlexArray there isn't a very long term and much stricter interoperability requirement. Because of this, the FLI IMT was created to allow FLI more flexibility to support a greater number of source arrays. The list of supported Backend Arrays for FLI (both offline and online) is much larger than the existing support for Backend arrays by FlexArray Virtualization. To check for a supported configuration for FLI follow the steps below:

1. Go to http://mysupport.netapp.com/matrix/#search

2. Search for the array model

3. Select the solution “Foreign LUN Import (FLI) Back-end Interoperability”

4. Select the FAS model, ONTAP version to determine the supported configurations

5. For front end supported host configuration click on build end to end view with “FAS SAN host”

6. For switch supported configuration click on build end to end view for “San-Switch” from “FAS San host” tab.

Appendix H: Sample Site Survey and Planning worksheet

During the analysis and planning phases of the migration methodology you will need to document your existing configuration, target configurations, gaps and remediation plans. To support the documentation and planning you will want to create and complete a Site Survey and Planning worksheet.

This appendix is here to assist you in creating and documenting your planning by providing a sample of what that spreadsheet might contain.

We recommend creating a spreadsheet with the following tabs:

1. Contact Sheet
2. Questionnaire
3. Switches
4. Storage Devices (Source)
5. Storage Devices (Destination)
6. Hosts
7. HBA and Zone Information
8. Source LUNs
9. Storage Groups
10. LUN Details
11. NetApp LUN Layouts
12. Migration Schedule
13. Aggregate Status
14. FAS Config
15. SDS CLI Scripts

Now lets take a look at samples of each of these tabs. Below are examples of the information each of the tabs should contain.

1. Contacts

Table 27) Site Survey and Planning worksheet: Contacts tab

Migration Project Contact Information					
Resource Name	Organization	Project Role	Office Phone	Cell Phone	Email

2. Questionnaire

Table 28) Site Survey and Planning worksheet: Questionnaire tab

Migration Project Information		
Project Type	☐ Data Migration ☐ Other	
Data Migration Objectives	[Objectives]	
Source Devices	Storage: [Storage Type] No. of Devices: [No. of arrays] Thin-provisioned: ☐ Yes ☐ No	Enumerate all devices
Client Devices	Operating Sytem: [OS Version] SAN boot: ☐ Yes ☐ No MPIO: [MPIO Version] HBAs: [HBA Vendor, Model, Firmware]	
Fabric Switches	Vendor: Model: Firmware: No. of Ports:	
Current Protocols	☐ FCP ☐ iSCSI	
Volume Manager	Vendor: Product: Version:	

Destination Devices (Storage)	Storage: [Storage] No. [Number] Thin-provisioned: ☐ Yes ☐ No	For this service, NetApp filers only
Amount of Data to be Migrated (in TB)	[Amount of Data]	Summary and detail (each source device)
Number of LUNs	[Number of LUNs]	Summary and detail (each source device)
Data Reorganization	☐ Yes ☐ No	Does the customer desire to move volumes/directories/folders/files into different data structures as part of the migration?
Outage Expectations	Outage Window ☐ Pre-defined ☐ Flexible Standard Maintenance window polices : [Info]	Number and durations of outages that can be utilized. Please list maintenance windows, if any
Desired Timeframe for Completion	[Desired Timeframe for Completion] [Time Sensitivities]	
Other Relevant Information	[Other Relevant Information]	
Customer Organization Name and Location (City and State)		

3. Switches

Table 29) Site Survey and Planning worksheet: switches tab

Switches							
Current							NetApp Recommended
Host Name	IP Address	Vendor	Model	Fabric Name	VSAN/ Domain	Firmware	Firmware
C9506-1-A	10.x.x.x	Cisco	9506	Prod A	10	3.3(5a)	

4. Storage Devices (Source)

Table 30) Site Survey and Planning worksheet: storage devices (source) tab

Storage Systems									
Array Name	IP Address	Vendor	Array Model	Microcode FW/ Data ONTAP	Controller/Node	Port Name	WWPN	Fabric Name	Target Type
AMS2100	10.x.x.x	Hitachi	AMS 2100	0893/B-X	Controller0	0a	50060E80xxxxxxxx	Production Fabric A	Source
AMS2100	10.x.x.x	Hitachi	AMS 2100	0893/B-X	Controller0	0e	50060E80xxxxxxxx	Production Fabric B	Source
AMS2100	10.x.x.x	Hitachi	AMS 2100	0893/B-X	Controller1	1a	50060E80xxxxxxxx	Production Fabric A	Source
AMS2100	10.x.x.x	Hitachi	AMS 2100	0893/B-X	Controller1	1e	50060E80xxxxxxxx	Production Fabric B	Source

5. Storage Devices (Destination)

Table 31) Site Survey and Planning worksheet: storage devices (destination) tab

Storage Systems										
Cluster Name	IP Address	Array Model	Data ONTAP	vserver	Port Type	Port Name	LIF Name	WWPN	Fabric Name	Target Type
DataMig-cDOT	10.x.x.x	FAS8080	8.3.1	datamig	Target	0c	miglif1	20:01:00:a0:98:2f:xx:xx	Prod A	Target
DataMig-cDOT	10.x.x.x	FAS8080	8.3.1	datamig	Target	0d	miglif2	20:01:00:a0:98:2f:xx:xx	Prod B	Target

Storage Systems										
Cluster Name	IP Address	Array Model	Data ONTAP	Controller/ Node	Port Type	Port	LIF Name	WWPN	Fabric Name	Target Type
DataMig-cDOT	10.x.x.x	FAS8080	8.3.1	DataMig-01	Initiator	0a	n/a	50:0a:09:81:00:xx:xx:xx	Prod A	Target
DataMig-cDOT	10.x.x.x	FAS8080	8.3.1	DataMig-01	Initiator	0b	n/a	50:0a:09:81:00:xx:xx:xx	Prod B	Target

Note: For FLI migration, Initiator ports of NetApp Target storage are zoned with Source storage target ports.

6. Hosts

Table 32) Site Survey and Planning worksheet: hosts tab

Hosts							
Current	NetApp Recommended						
Host Name	Driver	Firmware	HUK	MPIO	SnapDrive	SnapManager	Hotfixes
dm-rx200s6-21							
dm-rx200s6-22							
dm-rx200s6-20							

7. HBA and Zone Information

Table 33) Site Survey and Planning worksheet: HBA and zone information tab

Fabric Details							
Host Name	**Description**	**WWPN**	**Fabric Name**	**VSAN/ Domain**	**Port Number**	**Pre-migration Zone Membership**	**Post-migration Zone Membership**
dm-rx200s6-21	HBA0	21:00:00:24:ff:xx:xx:xx	Prod A	10	fc2/3	rx21_AMS2100	rx21_flicDOT
dm-rx200s6-21	HBA1	21:00:00:24:ff:xx:xx:xx	Prod B	10	fc2/3	rx21_AMS2100	rx21_flicDOT

8. Source LUNs

Table 34) Site Survey and Planning worksheet: Source LUNs tab

Source LUNs									
Masked LUNs					**All LUNs**		**Alignment**		
Storage Group Name	**Host LUN ID**	**Array LUN ID**	**Thick/ Thin**	**UID**	**LUN Name**	**UID**	**Starting Sector**	**Partition Offset**	**Custom Prefix**
dm-rx200s6-21	0	30	Thick	60060e801046b96004f2bf46000000 1e	LUN30			36805017 6	0
dm-rx200s6-21	1	14	Thick	60060e801046b96004f2bf46000000 0e	LUN14			33619968	0
dm-rx200s6-21	2	15	Thick	60060e801046b96004f2bf46000000 0f	LUN15			33619968	0

9. Storage Groups

Table 35) Site Survey and Planning worksheet: storage groups tab

Storage Groups			
Source			Destination
Host Name	Storage Group	WWPN	iGroup Commands
dm-rx200s6-21	dm-rx200s6-21	21:00:00:24:ff:30:14:c5 21:00:00:24:ff:30:14:c4	igroup create -ostype windows -protocol fcp -vserver datamig -igroup dm-rx200s6-21 -initiator 21:00:00:24:ff:30:14:c4,21:00:00:24:ff:30:14:c5
dm-rx200s6-22	dm-rx200s6-22	21:00:00:24:ff:30:04:85 21:00:00:24:ff:30:04:84	igroup create -ostype linux -protocol fcp -vserver datamig -igroup dm-rx200s6-22 -initiator 21:00:00:24:ff:30:04:85,21:00:00:24:ff:30:04:84
dm-rx200s6-20	dm-rx200s6-20	21:00:00:24:ff:30:03:ea 21:00:00:24:ff:30:03:eb	igroup create -ostype vmware -protocol fcp -vserver datamig -igroup dm-rx200s6-20 -initiator 21:00:00:24:ff:30:03:ea,21:00:00:24:ff:30:03:eb

10. LUN Details

Table 36) Site Survey and Planning worksheet: LUN details tab

LUN Details																		
Source																		
Host Name	Storage Group	Operating System	Clustered	Storage Controller	Mount Point	Physical Drive Number	Port	Bus	Target	LUN	PG80 SN	PG83 SN / UID	LUN Size (GB)	Starting Offset	LUN Type	Aligned	Custom Prefix (Blocks)	Custom Prefix (Bytes)
dm-rx200s6-21	dm-rx200s6-21	Microsoft Windows Server 2012 R2 Datacenter	No	AMS2100	C:	PHYSICALDRIVE0	2	0	0	0		60060e801046b96004f2bf460000001e	40	0	windows	Aligned	0	0
dm-rx200s6-22	dm-rx200s6-22	Red Hat Enterprise Linux Server release 5.10	No	AMS2100	/	sda	0	0	0	0		60060e801046b96004f2bf4600000010	20		linux	Aligned	0	0
dm-rx200s6-20	dm-rx200s6-20	ESXi 5.5.0 build-1331820	No	AMS2100	BootLUN_Datastore	naa.60060e801046b96004f2bf4600000014	0	0	0	0		60060e801046b96004f2bf4600000014	20		vmware	Aligned	0	0
dm-rx200s6-20	dm-rx200s6-20	ESXi 5.5.0 build-1331820	No	AMS2100	VM_Datastore	naa.60060e801046b96004f2bf4600000015	0	0	0	1		60060e801046b96004f2bf4600000015	40		vmware	Aligned	0	0

11. NetApp LUN Layouts

Table 37) Site Survey and Planning worksheet: NetApp LUN layouts tab

NetApp LUN Information									
Storage Controller	Aggregate	Volume Name	Volume Size	Volume Guarantee	Snap Reserve	LUN Name	S/N	LUN Type	Custom Prefix

NetApp LUN Layouts (continued)

LUN Description	GB Size	LUN Reservation	Fractional Reserve	Volume Autosize	Snap Auto Delete	iGroup	LUN ID	Host Type	Drive Letter	Host

12. Migration Schedule

Table 38) Site Survey and Planning worksheet: migration schedule tab

Migration Schedule							
Migration Date	Host	OS	Application	Storage Controller	LUN UID	LUN Size	Status

13. Aggregate Status

Table 39) Site Survey and Planning worksheet: aggregate status tab

NetApp Aggregate Information					
Controller	Aggregate	Total Size (GB)	Used Capacity (GB)	Available (GB)	Previous to Build out

14. FAS Config

Table 40) Site Survey and Planning worksheet: FAS config tab

Cluster Name	Cluster Management IP Address	Cluster Management Credentials Available	OnCommand System Manager Host	
			IP Address	Credentials Available

Network Ports					
Node	Interface Name	Port type	Port speed	VLAN Name / ID	IFGRP

Vserver Name	Type	Protocols	Aggregate	Vserver Root Volume

Vserver	Volume	Aggregate	Size	SAN	
				LUN Name	LUN Size

Vserver Network Interfaces					
Vserver	Interface Name	Interface Role	IP address / Netmask	Home Node / Home Port	Failover Group

Vserver FCP Target Ports

Vserver	FCP Port Name	WWPN	WWNN	Home Node	Home Port

Node FCP Initiator Ports					
Node Name	FCP Port Name	WWPN	WWNN	Home Node	Home Port

15. SDS CLI Scripts

Table 41) Site Survey and Planning worksheet: SDS CLI scripts tab

Controller 1	Controller 2
vol size vol0 aggr0 108g	
snap reserve bootcampvol 0	
snap reserve vol0 20	
snap autodelete bootcampvol on	
snap autodelete bootcampvol commitment try	
snap autodelete bootcampvol trigger volume	
snap autodelete bootcampvol target_free_space 20	
snap autodelete bootcampvol defer_delete user_created	
snap autodelete vol0 on	
snap autodelete vol0 commitment try	
snap autodelete vol0 trigger volume	
snap autodelete vol0 target_free_space 20	
snap autodelete vol0 defer_delete user_created	
vol autosize bootcampvol on	
vol autosize vol0 on	
vol options bootcampvol try_first volume_grow	
vol options bootcampvol fractional_reserve 100	

vol options vol0 try_first volume_grow	
vol options vol0 fractional_reserve 100	
qtree security /vol/bootcampvol unix	
qtree security /vol/vol0 ntfs	
snap sched bootcampvol 0 0 0	
snap sched vol0 0 2 6@8,12,16,20	
# LUN mapping skipped for /vol/qavol_narayan/testlun since LUN is not mapped to an iGroup.	
# LUN mapping skipped for /vol/bootcampvol/dm25_boot_lun since LUN is not mapped to an iGroup.	
# LUN mapping skipped for /vol/bootcampvol/dm25_data1_lun since LUN is not mapped to an iGroup.	
# LUN mapping skipped for /vol/bootcampvol/dm25_data2_lun since LUN is not mapped to an iGroup.	
# LUN mapping skipped for /vol/bootcampvol/dm26_boot_lun since LUN is not mapped to an iGroup.	
# LUN mapping skipped for /vol/bootcampvol/dm26_data1_lun since LUN is not mapped to an iGroup.	
# LUN mapping skipped for /vol/bootcampvol/dm26_data2_lun since LUN is not mapped to an iGroup.	
# LUN mapping skipped for /vol/bootcampvol/dm27_boot_lun since LUN is not mapped to an iGroup.	
# LUN mapping skipped for /vol/bootcampvol/dm27_data1_lun since LUN is not mapped to an iGroup.	
# LUN mapping skipped for /vol/bootcampvol/dm27_data2_lun since LUN is not mapped to an iGroup.	

Additional Resources

- nSANity and Offline FLI videos
https://www.brainshark.com/netapp/vu?pi=zGtz4tR1nz2MvUz0
- Online FLI video
http://video.corp.netapp.com/viewerportal/video/video.vp?programId=esc_program%3A19622&contentAssocId=association%3A70427
- 7-Mode Transition Tool 2.0 SAN Host Transition and Remediation Supplemental Guide
https://library.netapp.com/ecm/ecm_get_file/ECMP1659113
- Download WFA
http://mysupport.netapp.com/NOW/download/software/ocwfa/3.0P1
- WFA documentation
http://mysupport.netapp.com/documentation/docweb/index.html?productID=61914&language=en-US
- Instructions for downloading WFA predefined automation packs
https://library.netapp.com/ecmdocs/ECMP1644816/html/GUID-6899D6D4-DB28-4D0A-B3F6-D29A8544247D.html
- WFA automation store
http://automationstore.netapp.com/pack-list.shtml

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