



Data Migration for SAN Enterprise Apps

by Mike Kieran, NetApp Technical Marketing Engineer

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Introduction

Enterprise IT today is a world of constant innovation, with an endless stream of new business possibilities, new challenges, and new technologies.

Applications are the cornerstone of this transformation, and to succeed, they have to be intuitive, responsive, and fast. That's why so many enterprises today are upgrading to flash and NVMe storage systems that deliver high performance and low latency.

In the most common use case, an IT organization analyzes its existing infrastructure and confirms that it would be more cost effective to retire some of the older disk-based storage arrays and replace them with faster, more powerful systems.

This is especially true for enterprise workloads like Oracle, Microsoft SQL Server, and SAP HANA databases, as well as the business-critical apps they support—for enterprise resource planning (ERP), customer relationship management (CRM), OLTP, and more.

These use cases typically involve SAN workloads, and over the past few years, NetApp has grown to become the fastest-growing SAN vendor worldwide by revenue. As a result, more and more companies are looking to find the most efficient way to transition from legacy storage systems to new NetApp® ONTAP® configurations.

But migrating workloads from one system to another is not a “one size fits all” situation. How can your organization make the move as efficiently and nondisruptively as possible?

The key is **data migration**.

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Data Migration Team

Though some customers rely on their internal IT staff to manage migration projects, most find it worthwhile to engage a professional services team, either from NetApp or from one of our channel partners. These experts have real-world experience across many different IT environments and vertical markets, so they're well positioned to advise on the advantages and disadvantages of different migration strategies.

Whether the data migration project is managed in-house or with assistance from professional services consultants, your project team should include people representing all aspects of the process:

- IT or infrastructure architects, to design the overall application and data storage architecture
- Data storage managers or administrators, to understand each workload's capacity and maintenance requirements
- Database managers, if data from Oracle, Microsoft SQL Server, or other databases is being migrated

- Data protection specialists, to confirm that all the data is backed up and recoverable before migration starts
- Line-of-business owners, who often are closest to the application's end users and understand what's needed to ensure a nondisruptive experience
- You'll also need a project manager with overall responsibility for keeping the migration on track and for maintaining a punch list of all tasks.



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Data Migration Process

Thousands of organizations have successfully used a five-step migration process to move their data from legacy storage environments to modern all-flash data centers.

Discover. Information is collected about all the hosts, storage, and fabrics in the environment.

Analyze. The data is used to determine the optimal migration approach for each application's data.

Plan. Migration plans are created and tested, the destination storage device is provisioned, and migration tools are configured.

Execute. Data is migrated, and host remediations are performed.

Verify. The new system configurations are validated and documented.

The same basic steps are often organized into a different structure. For instance, the NetApp Professional Services experts divide the process into six steps: Scope, Initiate, Discover, Design, Implement, and Close.

Others use six different steps: Assessment, Discovery, Design, Deployment, Knowledge Transfer, and Follow-Up. The work breakdown structure might be different, but each methodology results in a high-performance SAN configured to address the customer's specific business challenges and opportunities.



Migration Process: Discovery

The discovery phase focuses on collecting all the information needed for host remediation and creating migration plans.

NetApp solutions engineers, channel partners, and customers typically rely on NetApp Active IQ® OneCollect software to collect data on all the hosts, switches, and storage devices in an organization’s IT environment. In addition to data migration, the OneCollect data is also useful for troubleshooting, solution validation, and deciding on when to implement upgrades.

The key benefits to Active IQ OneCollect are:

- It provides detailed information about the hosts, switches, and storage devices from many different manufacturers.
- It supports various data collection methods, including solution-based, device-based, or component-based collection; automatic discovery by IP range; or import of device credentials from a file.
- It streamlines the data migration process by analyzing your environment and revealing the best migration methods—for example, by identifying host and snap relationships.

The Brocade division of Broadcom also provides a free SAN Health tool that identifies components, software, and operating system versions on SAN switches (Brocade and Cisco MDS), storage products (NetApp, Dell EMC, Hitachi, HPE, and IBM), and host bus adapters (HBAs, from Emulex and QLogic). You can learn more about SAN Health [here](#).

The screenshot shows the 'Data View' tab in the OneCollect interface. It displays a table of storage components for a specific cluster. The table is organized into several sections: 'ONTAP Summary', 'Clusters', and 'Nodes'.

Cluster: ONTAP - 10.193.67.30												
ONTAP Summary												
Cluster	Node	Location	Vendor	Model	Serno	CPUMicrocode	PartnerName	Aggrs	Volumes	Qtrees	Luns	To
aff	aff-01	RTP GDL	NetApp	AF-F8040	721609000065	1808	aff-02	1	1	0	0	39
aff	aff-02	RTP GDL	NetApp	AF-F8040	721609000066	1808	aff-01	6	153	65	61	234
aff	tme-a800-01	RTP GDL	NetApp	AFF-A800	941834000263	33554512	tme-a800-02	2	1	0	0	262
aff	tme-a800-02	RTP GDL	NetApp	AFF-A800	941834000271	33554512	tme-a800-01	2	2	1	0	262
Clusters												
Cluster	cDOT Version	UUID		Serial Number	Location	Nodes		High Avail Configure				
aff	9.6X2	aaa939d5-0655-11e6-99c2-00a0989efb43		1-80-000011	RTP GDL	aff-01 aff-02 tme-a800-01 tme-a800-02		false				
Nodes												
Cluster	Node Name	System ID	System Model	Vendor	Serial Number	Partner System ID	Partner System Name	UUID				
aff	aff-01	05369908	AF8040	NetApp	72160900006	0536990611	aff-02	2d471872-0652-11e6				

Figure 1: OneCollect Data view

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Migration Process: Analysis

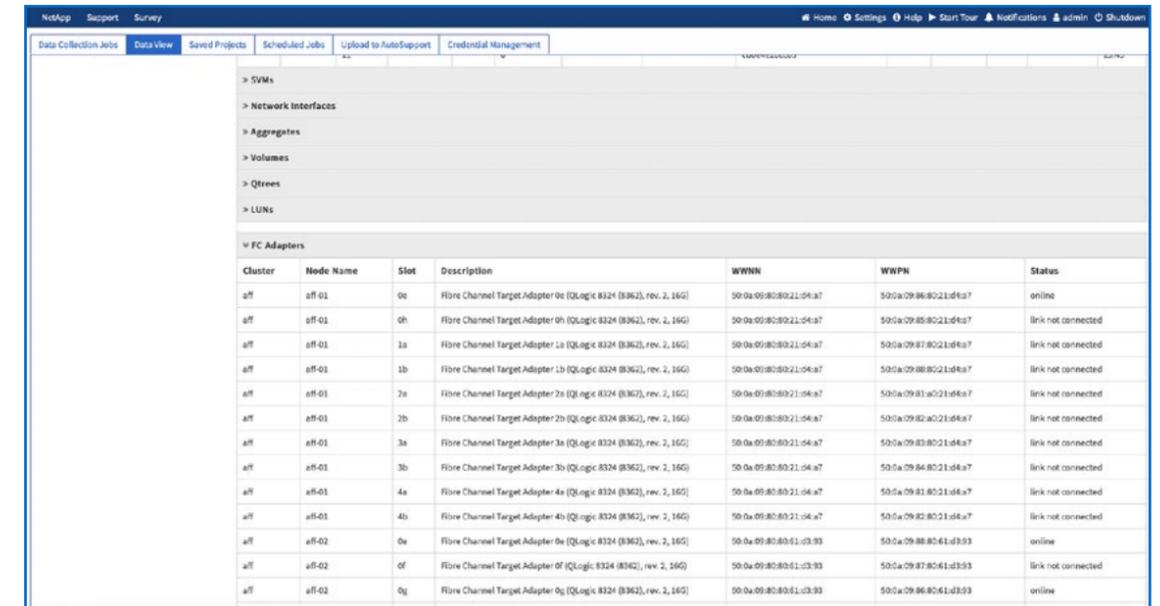
This phase focuses on analyzing the data collected during the discovery stage. You want to be certain that all the hosts are structured properly to allow the data to be migrated.

The first step is to parse the data collected by Active IQ OneCollect during the discovery stage, using the NetApp Unified Parser tool. For each host, the Unified Parser takes the configuration data that was gathered during discovery and compares it to the Interoperability Matrix Tool (IMT) to plan a target configuration.

After you identify a target configuration, you can conduct a gap analysis to identify specific remediation requirements. You're looking for the differences between the current configuration and the target configuration.

During the analysis phase, you also determine whether you need to install any additional software on the hosts.

Also, it might be necessary to define and create additional zoning to support source and destination array communication and to support post-migration host access.



Cluster	Node Name	Slot	Description	WWNN	WWPN	Status
aff	aff-01	0e	Fibre Channel Target Adapter 0e (QLogic 8324 (8362), rev. 2, 16G)	50:0a:09:80:21:04:a7	50:0a:09:86:80:21:d4:a7	online
aff	aff-01	0h	Fibre Channel Target Adapter 0h (QLogic 8324 (8362), rev. 2, 16G)	50:0a:09:80:21:04:a7	50:0a:09:85:80:21:d4:a7	link not connected
aff	aff-01	1a	Fibre Channel Target Adapter 1a (QLogic 8324 (8362), rev. 2, 16G)	50:0a:09:80:21:04:a7	50:0a:09:87:80:21:d4:a7	link not connected
aff	aff-01	1b	Fibre Channel Target Adapter 1b (QLogic 8324 (8362), rev. 2, 16G)	50:0a:09:80:21:04:a7	50:0a:09:88:80:21:d4:a7	link not connected
aff	aff-01	2e	Fibre Channel Target Adapter 2e (QLogic 8324 (8362), rev. 2, 16G)	50:0a:09:80:21:04:a7	50:0a:09:81:a0:21:d4:a7	link not connected
aff	aff-01	2b	Fibre Channel Target Adapter 2b (QLogic 8324 (8362), rev. 2, 16G)	50:0a:09:80:21:04:a7	50:0a:09:82:a0:21:d4:a7	link not connected
aff	aff-01	3a	Fibre Channel Target Adapter 3a (QLogic 8324 (8362), rev. 2, 16G)	50:0a:09:80:21:04:a7	50:0a:09:83:80:21:d4:a7	link not connected
aff	aff-01	3b	Fibre Channel Target Adapter 3b (QLogic 8324 (8362), rev. 2, 16G)	50:0a:09:80:21:04:a7	50:0a:09:84:80:21:d4:a7	link not connected
aff	aff-01	4a	Fibre Channel Target Adapter 4a (QLogic 8324 (8362), rev. 2, 16G)	50:0a:09:80:21:04:a7	50:0a:09:81:80:21:d4:a7	link not connected
aff	aff-01	4b	Fibre Channel Target Adapter 4b (QLogic 8324 (8362), rev. 2, 16G)	50:0a:09:80:21:04:a7	50:0a:09:82:80:21:d4:a7	link not connected
aff	aff-02	0e	Fibre Channel Target Adapter 0e (QLogic 8324 (8362), rev. 2, 16G)	50:0a:09:80:81:03:93	50:0a:09:88:80:61:d3:93	online
aff	aff-02	0f	Fibre Channel Target Adapter 0f (QLogic 8324 (8362), rev. 2, 16G)	50:0a:09:80:81:03:93	50:0a:09:87:80:61:d3:93	link not connected
aff	aff-02	0g	Fibre Channel Target Adapter 0g (QLogic 8324 (8362), rev. 2, 16G)	50:0a:09:80:81:03:93	50:0a:09:86:80:61:d3:93	online

Figure 2: OneCollect Data View showing HBAs

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Migration Process: Planning

During this phase, you create detailed project plans for how to get each host from its current state to the target configuration determined during the analysis phase. Each plan must include specific steps required, timelines, change-control requests, scheduling windows, and any related activities.

It's a good idea to break the remediation tasks into smaller, more manageable chunks with detailed step-by-step plans and schedules. This level of detail helps facilitate planning and allows you to better manage the entire migration project.

During the planning phase, you'll also want to try several dry-run migrations to:

- Confirm that everything is properly configured and no part of the process is broken.
- Enable the engineers performing the migrations to get comfortable with the workflow.

- Determine **Foreign LUN Import (FLI)** throughputs. After you've completed several test migrations, you will be able to extrapolate across your environment to get time estimates for various parts of the data migration process.

Other activities during the planning phase can include:

- On the source array, creating and modifying LUN masks to allow destination access to the LUNs being imported.
- On the data fabric, creating zones for migration and post-migration connectivity.
- On the destination array, creating initiator groups (igroups) to allow host access to the new LUNs.

The key to a successful planning process is to run enough test migrations to verify all configurations and to accurately predict how long the entire data migration will take.

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Migration Process: Execution

In the execution phase, data moves from the legacy arrays to NetApp arrays by means of the NetApp FLI utility, which is built into the ONTAP storage operating system. We'll explore the FLI utility in more detail later.

Because you're changing the physical location of the data, at some point the data will not be accessible to users and applications. It's important that you inform the system's users about the timing and extent of the data outage well in advance. The length of the outage is determined by the type of FLI migration you are performing, the number of LUNs, and the total volume of data. Fortunately, you'll have identified the length of the outage during the previous planning phase, so you can take appropriate measures to protect the continuity of key workloads and to ensure an excellent user experience.

The high-level summary of the execution phase is:

- Discover source LUNs and mount them using your destination array.
- Create new LUNs on the destination array.

- Create LUN relationships between the source and destination LUNs.

The key steps in the process include:

- Before transferring data, you need to review the host event logs to find and correct any problems that could interrupt the process.
- You must reboot the hosts to make sure that they have no underlying issues before major reconfiguration occurs.
- After the source LUNs are visible on the destination storage, you can create and execute migration jobs.
- After migrations are complete (FLI in offline mode) or the FLI LUN relationship is established (FLI in online mode), you can zone the host to the destination storage and map the new LUNs.
- Finally, host remediation can begin for drivers, multipath software, and any other updates that you identified in the analysis phase.

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Migration Process: Verification

During the verification phase, you confirm that source and destination LUNs are identical.

Verification is a binary block-by-block comparison and must be done with the destination LUN offline. The length of the disruption should be approximately the same amount of time it took to perform the original import.

Complete verification is optional, but NetApp strongly recommends that you verify a representative sample of LUNs to prove that the migrations undertaken were successful.

In addition to verifying that source and destination LUNs are exact copies, you will also want to verify that your hosts, switches, and ONTAP arrays are in supported configurations, as confirmed by the IMT.



Figure 3: Verification is a crucial part of data migration

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Data Migration Tools

No two organizations have the same IT priorities, infrastructure, data centers, virtualization strategies, or workloads. Although most run their business-critical workloads in a SAN environment, many also have important workloads running on file-based NAS systems. Therefore, you can accomplish data migration projects using many different tools and methods.

For instance, application-based solutions are sometimes a good choice when you're migrating enterprise databases such as Oracle and Microsoft SQL Server, and the data is being retained with a single application's environment. Similarly, in VMware environments, vSphere's Storage vMotion utility is often a good way to move data between datastores without any downtime.

Organizations that run some NAS (file-based) workloads have several options for migrating data, including XCP and Robocopy. The professional services organizations with extensive data migration experience typically have assembled their own portfolios of specialized tools and techniques,

which can greatly increase the efficiency of the entire process.

These tools and methods have all been proven valuable in a wide range of use cases. However, most data migration scenarios involve storage systems from multiple vendors, and that's where the FLI feature built into NetApp ONTAP really shines.

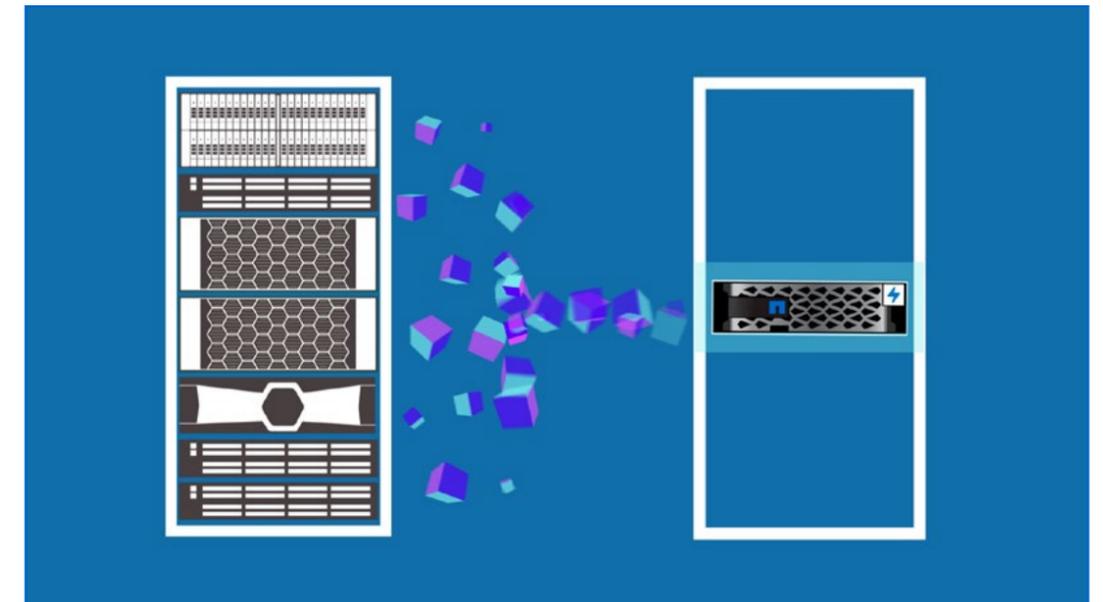


Figure 4: Block data transfer via Foreign LUN Import

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Foreign LUN Import (FLI)

FLI is a data migration utility that's fast, efficient, and works with virtually all third-party devices.

Data from the NetApp AutoSupport® system shows that hundreds of customers have successfully migrated tens of thousands of LUNs and multiple petabytes of data by using FLI, from legacy systems made by Dell EMC, HPE, IBM, Hitachi, Pure Storage, and others.

To avoid the hassle and potential risk involved in upgrading to newer systems, IT organizations often hold on to inefficient and outdated storage equipment that they'd really like to replace. FLI removes both the hassle and the risk; that's why it's so popular.

For example, one NetApp customer in the financial services industry recently faced the challenge of migrating more than 3PB of Oracle and SQL Server databases—without affecting the user experience for its customers worldwide. Working

with NetApp Professional Services consultants, the customer used FLI to complete the switchover within budget, on time, and with zero complaints from its users.

FLI is strictly a block-based tool; file, record, NFS, and CIFS-based migrations are not supported. All FLI migrations operate at the LUN level.

Key benefits of FLI include:

- Support for both offline and online migrations
- Operating system independence: it doesn't rely on volume managers or OS utilities
- Compatibility with all major FC fabrics and storage arrays
- Support for native multipath and load balancing

How FLI Works

In a nutshell, FLI works by placing an ONTAP array as an initiator (a storage host) in front of a third-party storage array. Then it mounts the LUNs to be migrated and performs a block-for-block copy of the data in the original LUN to a new LUN hosted by ONTAP.

FLI supports both offline and online modes. In **offline mode**:

- The host is disconnected from its LUNs and is offline until the migration is complete.
- When data migration is complete, the host is remediated and then pointed at the new NetApp hosted LUN.
- The disruption window is approximately the time the migration takes to copy the source LUN to the destination.

In **online mode**:

- First, the NetApp LUN is presented to the host.
- The NetApp LUN is synchronized with the source LUN before cutover.

- Reads go to the new NetApp LUN and are redirected to the foreign LUN.
- Writes are split to the foreign LUN and the NetApp LUN
- The disruption window is the amount of time it takes to repoint the host to the new LUN.

FLI can be used exclusively or in combination with other migration processes, which gives you the flexibility to optimize your migration strategies.

Customers data migrated via FLI	200+
Petabytes of data transferred	100+
Number of LUNs transferred	300,000+

Figure 5: Foreign LUN Import by the numbers (as of September 2019)

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NetApp Professional Services

For organizations that can benefit from NetApp's extensive experience in building tier 1 SAN systems, we provide a complete suite of Professional Services for SAN that can speed your transition process and accelerate time to value.

NetApp technology and business experts work with your internal teams to deliver a SAN solution aligned to your organization's business operations and cloud strategy, with the security you need to protect critical business data. After the solution is deployed, NetApp offers additional services to help customers integrate their new SAN solution into their IT environment, and to optimize applications and processes.

NetApp recently introduced a pre-packaged SAN Startup Service to help customers deploy a reliable and effective SAN solution. The service includes design, implementation, and validation of purchased components for business-critical applications, providing value to new or existing NetApp SAN customers as well as customers migrating from other platforms.

The SAN Startup Service includes:

- Discovery and assessment of the production environment
- Creation of storage design documents; validation of network configuration
- Deployment and integration: advanced SAN implementation
- Data protection advice and best practices
- Migration advice and best practices
- Knowledge transfer
- Project management
- Follow-up services: tools installation, customer calls to interpret or discuss reports

NetApp also has channel partners around the world with specialized expertise in different industries, workloads, and use cases. These partners deliver a wide range of SAN design, implementation, and management services.

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With the proper tools and processes, your company can quickly and efficiently migrate data from legacy environments to modern ONTAP SAN systems with minimal disruption.

You can learn more about NetApp's leading SAN solutions, including the new All SAN Array systems, here:

- Technical Report TR-4080:
[Best Practices for Modern SAN](#)
Provides an overview of how ONTAP manages block storage, with details on each version of ONTAP 9.x.
- Technical Report TR-4515:
[A Guide to Building Tier 1 Modern SANs](#)
Provides implementation and best practice recommendations for SAN configuration, lifecycle planning, and operational monitoring tools.

To learn more about how to migrate data with the NetApp FLI utility, refer to:

- Technical Report TR-4380:
[SAN Migration Using Foreign LUN Import](#)
How to migrate data to a new SAN with the Foreign LUN Import (FLI) utility built into ONTAP.
- ONTAP Documentation Center:
[Foreign LUN Import Technical FAQ](#)
Provides answers to questions about supportability, performance and scalability, configuration, training, troubleshooting, and implementation.

Whatever business you're in, when it's time to upgrade your business-critical enterprise applications, moving data to a NetApp ONTAP SAN is a productive and painless experience.

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