

FUJITSU Storage
ETERNUS AB series All-Flash Arrays,
ETERNUS HB series Hybrid Arrays

SANtricity Remote Storage Volumes
Solution Deployment

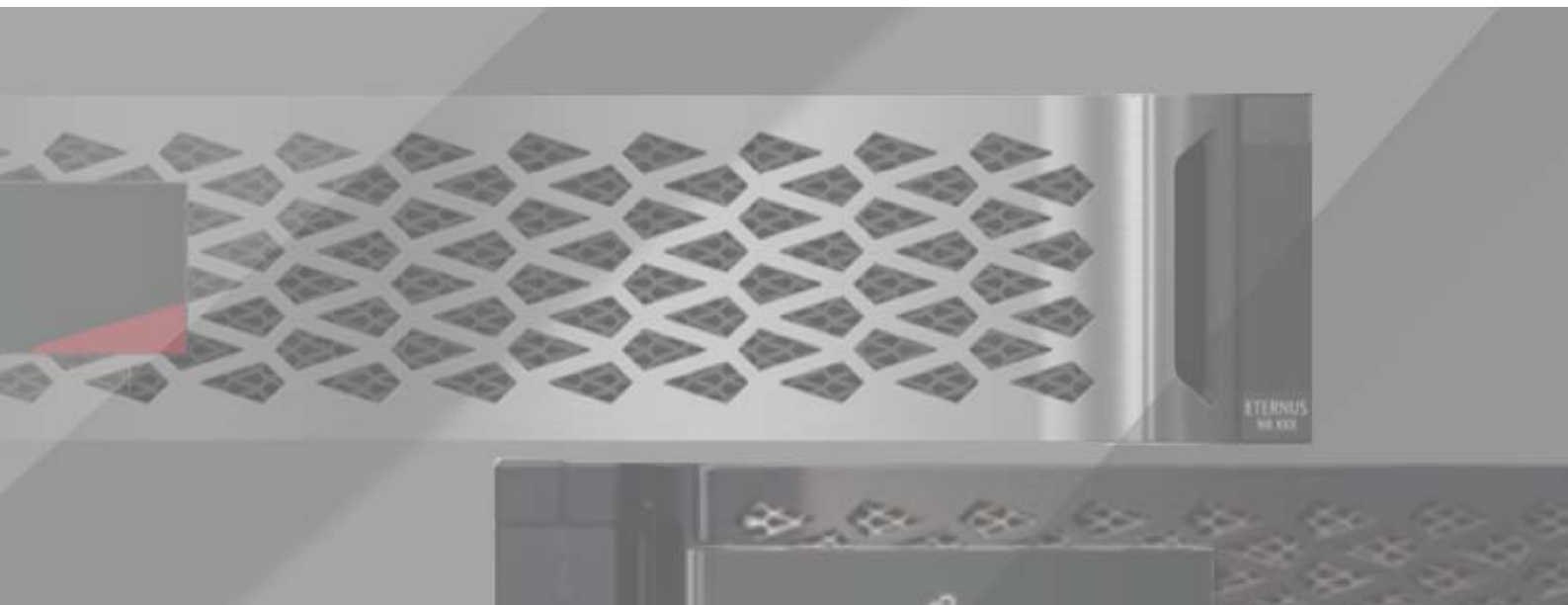


Table of Contents

1. Solution Overview.....	7
Solution Technology	7
Use Case Summary	8
Terminology	8
Remote Storage and ETERNUS AB/HB series Setup Overview	8
Remote Storage Object Overview	9
Remote Storage Volume Overview	9
Remote Storage Volume Settings Overview	10
Import Source Volume Overview	10
Import Destination (Target) Candidates Overview	10
Import Operation Overview	11
Remove Remote Storage Object Overview	14
Remove Remote Storage Volume Overview	14
Remove Import Overview	14
2. Requirements.....	15
Supported Protocols	15
Supported ETERNUS AB/HB series Systems	15
Preparing for Production Imports	15
3. Deployment Procedures	16
Set Up Remote Storage and ETERNUS AB/HB series Storage Systems	16
Import Remote Storage (UI)	20
View Import Progress	26
Modify Remote Storage Connection Settings	31
Remove Remote Storage Object	33
4. Error Handling and Recovery.....	35
ETERNUS AB/HB series Storage System Error Injection	35
UUID Warnings When Mounting Certain File System Types	36

5. Management Interfaces	37
SMcli	37
REST API	37
RemoteStorageUsableInterface Definition	37
RemoteStorageRequest Definition and Example	39
RemoteStorageUpdateRequest Definition and Example	40
RemoteStorageResponse Definition	40
RemoteStorageVolumeRequest Definition and Example	42
RemoteStorageVolumeUpdateRequest Definition and Example	42
RemoteStorageVolumeResponse Definition	43
RemoteVolumeImportRequest Definition and Example	44
RemoteVolumeImportControlRequest Definition and Example	45
RemoteVolumeImport Definition	45
VolumeEx Definition	45
NVSRAM	47
6. Compatibility and Migration	48
Supported Features	48
Drive Migration	48
7. Restrictions and Limitations	49
Limitations	49
Restrictions	50
8. Performance.....	52
Determining Performance	52
Import Performance	53
Performance of I/Os before, during, and after Import	55
9. Conclusion	58

List of Figures

Figure 1	Solution architecture overview	7
Figure 2	iSCSI cabling use case 1: Both import and host I/O traffics are shared by a single iSCSI port on both arrays	18
Figure 3	iSCSI cabling use case 2: The import and host I/Os are using dedicated iSCSI ports (recommended cabling configuration)	18
Figure 4	Cabling use case 3: Import is using iSCSI ports, but the host I/Os are using a different protocol (such as FC)	19

List of Tables

Table 1	SANtricity System Manager state transitions	11
Table 2	SANtricity System Manager actions	12
Table 3	REST API states and operations	12
Table 4	REST API operations.....	13
Table 5	Import state definitions.....	13
Table 6	A ports and B ports are in the same subnet.....	19
Table 7	Usable interfaces API.....	37
Table 8	Remote storage objects APIs	38
Table 9	Remote storage volume APIs.....	41
Table 10	Remote volume import APIs	44
Table 11	External I/O on import results.....	53
Table 12	Import for different sized volumes and frame size results	54
Table 13	Import versus file system copy testing results	54
Table 14	1MB transfer size (highest priority on import)	55
Table 15	512B transfer size (highest priority on import)	56

Preface

This document describes the solution architecture and how to use the FUJITSU ETERNUS AB/HB series storage system to import data from an existing remote storage device.

Copyright 2021 FUJITSU LIMITED

First Edition
July 2021

Trademarks

Third-party trademark information related to this product is available at:

<https://www.fujitsu.com/global/products/computing/storage/eternus/trademarks.html>

Trademark symbols such as ™ and ® are omitted in this document.

About This Manual

Intended Audience

This manual is intended for system administrators who configure and manage operations of the ETERNUS AB/HB, or field engineers who perform maintenance. Refer to this manual as required.

Related Information and Documents

The latest information for the ETERNUS AB/HB is available at:

<https://www.fujitsu.com/global/support/products/computing/storage/manuals-list.html>

Document Conventions

■ Notice Symbols

The following notice symbols are used in this manual:

Caution

Indicates information that you need to observe when using the ETERNUS AB/HB. Make sure to read the information.

Note

Indicates information and suggestions that supplement the descriptions included in this manual.

1. Solution Overview

The SANtricity remote storage volumes feature allows customers to import data from an existing remote storage device onto an ETERNUS AB/HB series volume with minimal downtime. It can be used to help streamline the process for equipment upgrades and/or provide data migration capabilities to move data from non-ETERNUS AB/HB series devices to ETERNUS AB/HB series storage systems.

Solution Technology

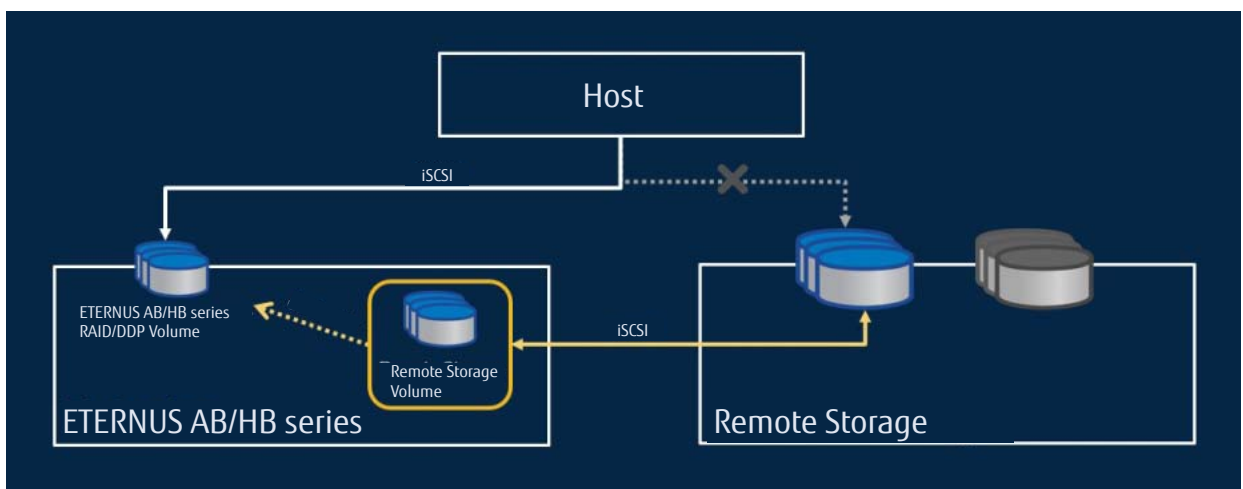
The base requirement for this feature is to support importing data from a remote storage device directly to a local ETERNUS AB/HB series volume. To use this feature, customers must first manually establish an iSCSI connection between the remote storage device and the ETERNUS AB/HB series system. The remote storage object must be created on the local ETERNUS AB/HB series system with one or more IP addresses where the iSCSI Qualified Names (IQNs) of the remote storage devices can be discovered.

With the iSCSI connection in place, the remote storage device can then be mapped to the ETERNUS AB/HB series system. After the mapping is in place, SANtricity System Manager or REST API commands for the ETERNUS AB/HB series system can then be used to initiate and manage the import operation.

During the import operation, the destination volume can be set up to handle the I/Os that the remote storage device was originally handling. Any I/Os going to the destination volume are then propagated back to the remote storage device until the import operation has completed and the import has been disconnected.

[Figure 1](#) shows the technical components of the solution.

Figure 1 Solution architecture overview



Information required for initiating the import operation includes:

- The remote storage system iSCSI IQNs
- The remote storage system iSCSI IP addresses
- The remote storage devices' LUN number

Note

A LUN number is defined by mapping a remote storage device to the ETERNUS AB/HB series system host/initiator on the remote storage system.

The provided information will persist on the ETERNUS AB/HB series system so that it can be used to reestablish the connection after the ETERNUS AB/HB series system recovers from an unexpected failure (reboots, power cycles, and so on).

After it is configured, the remote storage iSCSI IP addresses can be updated, if needed, from either SANtricity System Manager or through REST API commands.

Use Case Summary

This feature allows data to be easily imported through iSCSI from remote storage devices to ETERNUS AB/HB series systems with minimal downtime. As such, this feature is ideal for the following use cases:

- Equipment upgrades
- Hardware refresh

Terminology

The following terms are used in relation to the remote storage volumes feature:

- **iSCSI**
An acronym for Internet Small Computer Systems Interface. It is a protocol that provides block-level access to storage devices by carrying SCSI commands over a TCP/IP network.
- **iSCSI initiator**
The software or hardware that initiates and sends iSCSI commands and data.
- **iSCSI target**
The storage device to which the iSCSI commands and data are sent.
- **IQN**
An acronym for the iSCSI qualified name. It is used to identify iSCSI initiators and targets.
- **Remote storage system**
The storage system that the data initially resides on. The remote storage system can either be an ETERNUS AB/HB series or non-ETERNUS AB/HB series system.
- **Remote storage device**
The physical or logical device on which the data is initially stored. This device is part of the remote storage system. In an ETERNUS AB/HB series storage system, we call this a volume.
- **Remote storage object**
An object that contains information that allows the ETERNUS AB/HB series system to identify and connect to the remote storage system.
- **Remote storage volume**
A standard volume on the ETERNUS AB/HB series system that allows data access to a remote storage device.
- **LUN**
An acronym for logical unit number. It is used to identify a logical unit that can be presented to a host for access.

Remote Storage and ETERNUS AB/HB series Setup Overview

For the initial release, manual setup is required so that both controllers in the ETERNUS AB/HB series system can connect to the remote storage system using the iSCSI protocol. Details on how to perform the setup are provided later in this document.

Remote Storage Object Overview

The remote storage object contains the iSCSI IQN and iSCSI IP addresses for the remote storage system. The remote storage object represents the communication between the remote storage system and ETERNUS AB/HB series system. The remote storage object is created automatically when you use the Import Remote Storage wizard through SANtricity System Manager. While navigating through the wizard, you will see the following information requested:

- Remote storage iSCSI IQN
- Remote storage iSCSI IP addresses

After it is provided, the information is automatically sent to the controller firmware of the ETERNUS AB/HB series system. The controller firmware then uses the information to create the remote storage object.

Some remote storage systems have multiple IQNs. For those systems, multiple remote storage objects are needed.

Remote Storage Volume Overview

After the remote storage object is created and both controllers in the ETERNUS AB/HB series system can successfully communicate with the remote storage, a remote storage volume can then be created on the ETERNUS AB/HB series system. For the initial release of this feature, the remote storage volume is only used for the import operation. Creating the remote storage volume is done in the background by the Import Remote Storage wizard in SANtricity System Manager. Due to that background process, the remote storage volume is not manageable in SANtricity System Manager. After entering the information for the remote storage object (IQN and IP addresses of the remote storage system), the user is then prompted for the LUN for the remote storage device. SANtricity System Manager then makes a REST API call to instruct controller firmware to create a remote storage volume for the selected device. Note that the block size of the remote storage volume and remote storage device must match, and currently only 512-block size is supported.

After it is created, the remote storage volume is treated like any other standard volume on the ETERNUS AB/HB series system with a few exceptions:

- The remote storage volume has the additional capability to be used as a proxy to the remote storage device. This allows it to provide data access so that a data import can be performed from the remote storage device to a volume on the ETERNUS AB/HB series system.
- The remote storage volumes are not candidates for other volume copies (source or targets) or snapshots. In addition, you cannot change the Data Assurance setting if the import is in progress.
- The remote storage volumes cannot be mapped to any hosts. They are reserved strictly for the import operation.

A remote storage object can be associated with multiple remote storage volumes. Each remote storage volume, on the other hand, is associated with only one remote storage object. The remote storage volume is uniquely identified using a combination of the following:

- Remote storage object identifier
- Remote storage device LUN number

During the remote storage volume creation, the controller firmware determines if the remote storage device is accessible using the information provided. If the remote storage device cannot be accessed, then the remote storage volume creation will succeed but the remote storage volume will be marked as offline. No imports can be initiated while the remote storage volume has an offline state. A Recovery Guru procedure will be provided through SANtricity System Manager with instructions for resolving the issue.

Remote Storage Volume Settings Overview

Currently, the only setting that can be changed on the remote storage volume is the preferred owner. This can be changed by using the REST API. However, it is not recommended to change the preferred owner while an import is in progress.

All other settings for the remote storage volume (name, LUN number, and so on) cannot be changed. If a change is needed, then a new remote storage object must be created. This might first require disconnecting the associated remote storage import so that the new volume can be created. If remote a storage import is not present, then the removal of the remote storage volume must be done through REST API commands.

Import Source Volume Overview

The source volume of an import is a remote storage volume. The volume must also meet the following criteria:

- Not part of another import
- Has an online status

Import Destination (Target) Candidates Overview

Using the Import Remote Storage wizard in SANtricity System Manager, the user must select the destination volume for the import operation. The destination volume must meet the following requirements:

- It must be a RAID/DDP volume.
- It must have a capacity that is equal to or larger than the remote storage volume.

Note

Special handling is done when the target volume is larger than the remote storage device. In this case, when the target volume is mapped to the host and while the import is still connected, the host determines that the capacity of the target volume is equal to the capacity of the remote storage device. After the import operation disconnects, the remaining capacity is available for use. If a file system is being used, manual interaction is needed to extend the capacity of the file system to make use of the additional capacity.

- It must have a block size that is the same as the remote storage volume.
- It must not have the following relationships:
 - Volume copy relationships
 - Snapshot copies
 - Mirroring (Async/Sync)
- It must not undergo any reconfiguration operations. For example:
 - Dynamic Volume Expansion
 - Dynamic Capacity Expansion
 - Dynamic Segment Size
 - Dynamic RAID Migration
 - Dynamic Capacity Reduction
 - Defragmentation
- It must have a valid state (optimal).
- It must not be mapped to a host.
- It must not have Flash Read Cached (FRC) enabled.

SANtricity System Manager automatically checks these requirements as part of the Import Remote Storage wizard. Only volumes that meet all the requirements will be presented to the user for destination volume selection.

Caution

The existing data on the selected destination RAID volume will be overwritten permanently when the remote storage import is initiated.

Import Operation Overview

The import operation starts when a call to initiate the import is done through either the Import Remote Storage wizard or through the REST API commands. To initiate the import, you must provide a source volume and a destination volume as well as the import settings (such as import priority). For more information, see the sections titled, "Import source volume overview" and "Import destination (target) candidates overview."

After all the requirements are met and the import starts, the operation's progress is monitored from the View Operations dialog box, from the View Operations In Progress page in SANtricity System Manager, or through the GET import REST API command.

At this point, the destination volume can be mapped to the necessary host so that I/Os can resume. While the import connection is still in place, any I/Os that go to the destination volume also propagate to the remote storage device.

■ SANtricity System Manager operations and actions

Various actions can be performed on the import operation after it has been initiated. SANtricity System Manager allows the following actions based on the current state of the import operation:

Table 1 SANtricity System Manager state transitions

Current state of import	Actions allowed through SANtricity System Manager
Pending	Stop Change Priority
In-Progress	Stop Change Priority
Stopped	Resume Disconnect
Failed	Resume Disconnect
Completed	Disconnect

Definitions and underlying REST API commands for the various actions are listed below:

Table 2 SANtricity System Manager actions

Action	Definitions	REST API	Notes
Stop	Halts the import operation	DELETE /storage-systems/{system-id}/remote-volume-import/{remote-storage-volume-id}	This will free up an active volume copy job and a pending volume copy (import or regular volume copy) in the queue.
Resume	Restarts the import operation from where it last left off	POST /storage-systems/{system-id}/remote-volume-import/{remote-storage-volume-id}	Body: {operation: start}
Change priority	Updates the priority of the import	POST /storage-systems/{system-id}/remote-volume-import/{remote-storage-volume-id}	Body: {priority:<priority_enum>}
Disconnect	Removes the import connection	DELETE /storage-systems/{system-id}/remote-volume-import/{remote-storage-volume-id}	-

REST API commands provide additional state transitions and actions beyond those allowed by SANtricity System Manager. [Table 3](#) shows the full list of the possible states, state transitions, and actions that are allowed through the REST API.

Table 3 REST API states and operations

Import state reported through the REST API	Operations allowed through the REST API
In-Progress	stop change priority delete
Pending	start stop change priority delete
Failed	start stop change priority delete
Halted	start change priority delete
Complete	delete

Table 4 REST API operations

Operation	Definition	REST API	Notes
Start	Starts the import operation from where it last left off at	POST /storage- systems/{system- id}/remote- volume- import/{remote- storage-volume- id}	Body: {operation: start}
Stop	Halt the import operation	POST /storage- systems/{system- id}/remote- volume- import/{remote- storage-volume- id}	Body: {operation: stop}
Change priority	Update the copy priority of the import	POST /storage- systems/{system- id}/remote- volume- import/{remote- storage-volume- id}	Body: {priority:<priority_enum>}
Delete	Remove the import connection	DELETE /storage- systems/{system- id}/remote- volume- import/{remote- storage- volume- id}	-

Table 5 Import state definitions

Import state reported through the REST API	Definition
In-Progress	The data is being copied from the source to the destination (target) volume.
Complete	The import operation has completed.
Halted	The import operation has been stopped.
Failed	The import operation has failed.
Pending	The import operation is in the job queue and has not started yet.

Note

If there is a connection issue while an import is in progress, the controller firmware attempts to reconnect to the remote storage device until a timeout is reached. During the retry process, the import continues to be reported as In-Progress. If the number of retries exceeds its limit, the import operation reports as failed. If an import fails, the host receives I/O errors. While the import is reporting as failed, the controller firmware still checks the connection status. If the connection is reestablished, the import operation automatically transitions back to the In-Progress state and the import resumes from where it left off.

Remove Remote Storage Object Overview

SANtricity System Manager can be used to view or delete remote storage objects from the ETERNUS AB/HB series system. However, for the remote storage object to be deleted, the remote storage volumes associated with it must not be in an import relationship. If they are, deletion of the remote storage object is not allowed.

Remove Remote Storage Volume Overview

The remote storage volume is an intermediate object and is removed automatically after a disconnect is done on the import operation. As a result, remote storage volumes on the ETERNUS AB/HB series system are hidden from user view in SANtricity System Manager.

While the remote storage volume exists, the iSCSI connection between the ETERNUS AB/HB series system and the remote storage device continues to persist. When the remote storage volume is removed, the iSCSI connection to the remote storage device is closed. If the remote storage device needs to be imported again in the future, a new import operation must be created.

Remove Import Overview

The import operation can be deleted at any time. If the operation has a status of In Progress, Failed, or Pending, the import operation is first halted and then the import operation is deleted. The removal of the import operation does not impact the integrity of the source volume, as the source volume is synchronized with the target volume throughout the entire import progress. Removing the import operation also results in deleting the remote storage volume associated with the import operation as mentioned in the prior section.

2. Requirements

The following sections outline the requirements for using the remote storage volumes feature.

Supported Protocols

In the initial release, only the following protocols are supported:

- iSCSI
- IPv4

For up-to-date ETERNUS AB/HB series support and configuration information, please contact your support personnel.

Supported ETERNUS AB/HB series Systems

ETERNUS AB/HB series storage systems must meet the following requirements for the initial release:

- The ETERNUS AB/HB series storage system must support iSCSI connections.
- The system must be running in duplex mode (both controllers present).
- The system must have the remote storage import feature enabled in the Submodel ID (SMID).

■ Hardware requirements

The hardware and connections between the hardware must be set up before SANtricity System Manager or REST API can be used to initiate the import operation.

The minimum hardware required includes the following:

- ETERNUS AB/HB series storage system:
 - SANtricity OS (11.71+)
 - Duplex system
 - iSCSI interfaces that allow connection to the remote storage through both controllers
- Remote storage system/device:
 - iSCSI capable interfaces

Preparing for Production Imports

A test or dry run import is performed before production imports to verify proper storage and fabric configuration. Another reason to perform several test imports is to determine how long the production imports might take and the throughput that can be expected. Otherwise, the number of variables that factor into import time makes it very difficult to accurately estimate.

Note

The test import should be performed a minimum of one week prior to beginning the production data imports. This allows enough time to resolve possible issues such as access and storage connectivity.

3. Deployment Procedures

Deploying the remote storage import solution involves the following tasks:

- Set up remote storage and ETERNUS AB/HB series storage systems
- Cable the storage systems
- Configure the iSCSI Ports
- ETERNUS AB/HB series host definition
- Import remote storage (UI)
- View import progress
 - Change import priority
 - Stop remote storage import
 - Resume import
 - Disconnect remote storage operation
- Modify remote storage connection settings
- Remove remote storage object

Set Up Remote Storage and ETERNUS AB/HB series Storage Systems

Manual steps must be taken so that the ETERNUS AB/HB series storage system can connect to the remote storage system using the supported iSCSI protocol. Before proceeding to SANtricity System Manager to configure the remote storage volumes feature, complete the following steps:

Procedure ►►► ---

- 1** Ensure that each controller of the local ETERNUS AB/HB series storage system has an iSCSI connection to the remote storage system. With this feature, the local ETERNUS AB/HB series storage system acts as an iSCSI initiator that can be set up as a host on the remote storage system. Refer to the sections below for recommended cabling diagrams and setting up iSCSI connections.
- 2** On your local ETERNUS AB/HB series storage system, create a volume as the destination volume for the import operation. Ensure that the volume has a capacity that is equal to or greater than the volume on the remote storage system, has a block size that matches the volume on the remote storage system, and is not mapped.
- 3** If the local destination volume has a capacity that is larger than the volume on the remote storage system, then the additional capacity is not reported to the host. To use the new capacity, a file system expansion operation is required on the host after the import operation completes and is disconnected.
- 4** Set up the local ETERNUS AB/HB series storage system as a host on the remote array using the following ETERNUS AB/HB series storage system information:
iSCSI Qualified Name (IQN) under Settings > System > iSCSI settings > Target IQN.

5 Set the appropriate host type based on the system being used.

Note

- When defining the destination ETERNUS AB/HB series storage system as a host on the remote ETERNUS AB/HB series storage system, a host type of "Factory Default" should be used. Refer to ["ETERNUS AB/HB series host definition" \(page 20\)](#) for more information.
- When defining the destination ETERNUS AB/HB series storage system as a host on a non-ETERNUS AB/HB series storage system, an appropriate host type should be selected based on the options available.

6 Stop all I/Os, unmount any file systems, and remove any assignments to hosts/applications for the selected volume on the remote storage system.

7 Assign the volume to the remote storage system to the newly created local ETERNUS AB/HB series storage system host.

8 Gather the following information from the remote storage array so that the import can be created:

- iSCSI Qualified Name (IQN)
- iSCSI IP address
- The LUN number of the volume on the remote storage system that the data will be copied from

9 Proceed to the Remote Storage tile and select Import to start a new import creation.

Note

- After the import has started, the local destination volume is then available for use.
- The time required to complete the import operation depends on the size of the remote storage system, the priority setting for the import, and the amount of I/O load on both storage systems and their associated volumes.

10 After the import is complete, the local destination volume is a duplicate of the volume on the remote storage system. When you are ready to break the relationship between the two volumes, perform a Disconnect on the import from the Operations In Progress view.

Note

After the import has been disconnected, performance of the local destination volume will return to normal and will no longer be impacted by the remote connection.



■ Cable the storage systems

As part of the setup process, both controllers of the ETERNUS AB/HB series storage system and the I/O host must be cabled to an iSCSI-compatible interface.

Figure 2 iSCSI cabling use case 1: Both import and host I/O traffics are shared by a single iSCSI port on both arrays

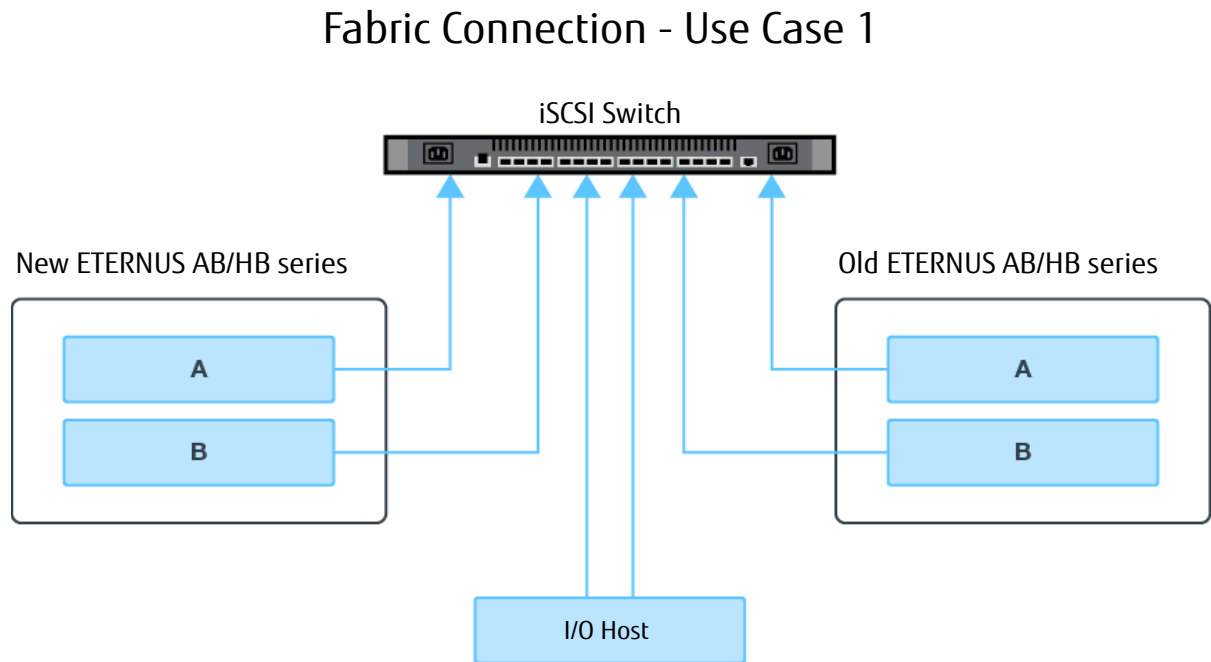


Figure 3 iSCSI cabling use case 2: The import and host I/Os are using dedicated iSCSI ports (recommended cabling configuration)

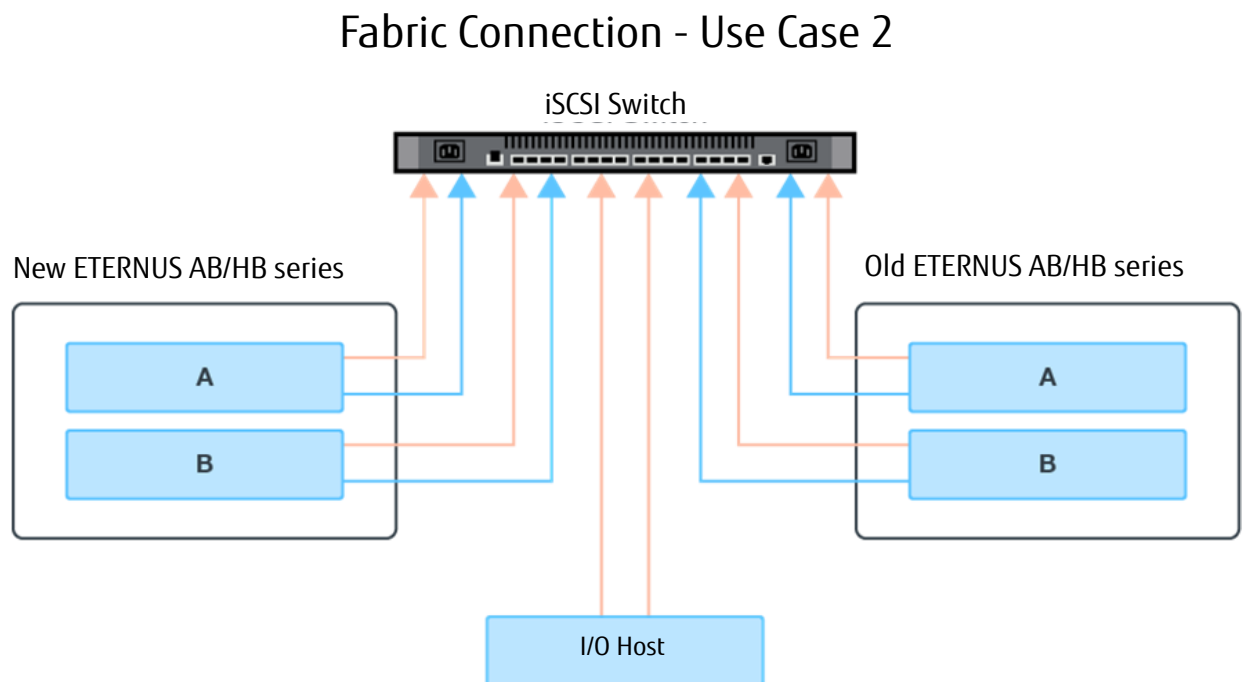
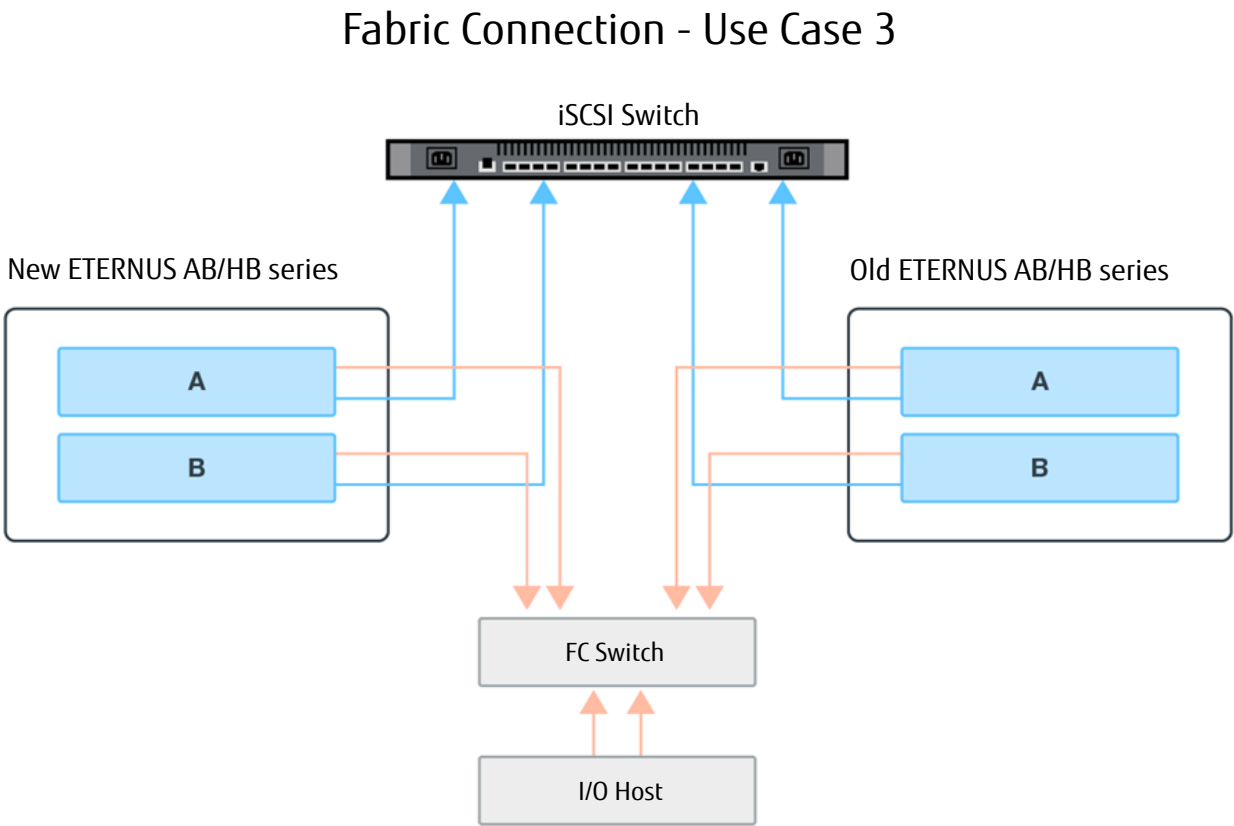


Figure 4 Cabling use case 3: Import is using iSCSI ports, but the host I/Os are using a different protocol (such as FC)



■ **Configure the iSCSI Ports**

There are multiple ways to subnet iSCSI ports. [Table 6](#) shows an example of how to configure the iSCSI ports so that they can be used with the Remote Storage Volumes feature.

Table 6 A ports and B ports are in the same subnet

Source A	Source B	Target A	Target B
10.10.0.100/16	10.10.0.200/16	10.10.0.101/16	10.10.0.201/16

Note

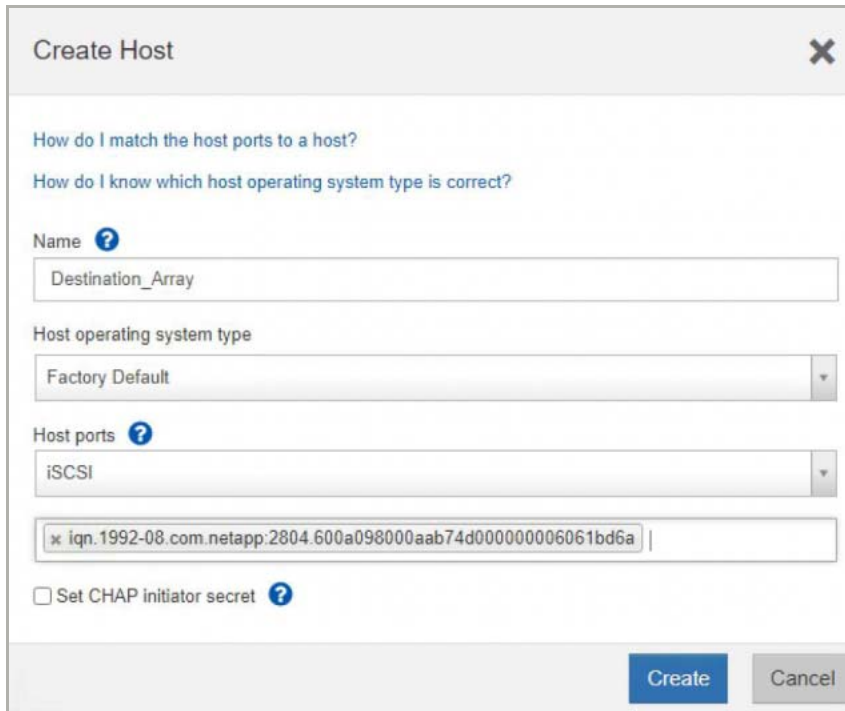
This type of subnetting allows both controllers of the destination array to communicate to both controllers of the remote arrays, essentially providing high availability during import.

■ ETERNUS AB/HB series host definition

The new ETERNUS AB/HB series array must be defined as a host/initiator on the remote storage system. If the data is imported from an existing ETERNUS AB/HB series array, the following steps can be used to define the destination ETERNUS AB/HB series array as a host/initiator.

Procedure ►►►

- 1 Launch SANtricity System Manager for the remote array.
- 2 Click Storage > Hosts and create the host.



- 3 Make sure to obtain the IQN of the destination array from SANtricity System Manager through Settings > System – Target IQN.



Import Remote Storage (UI)

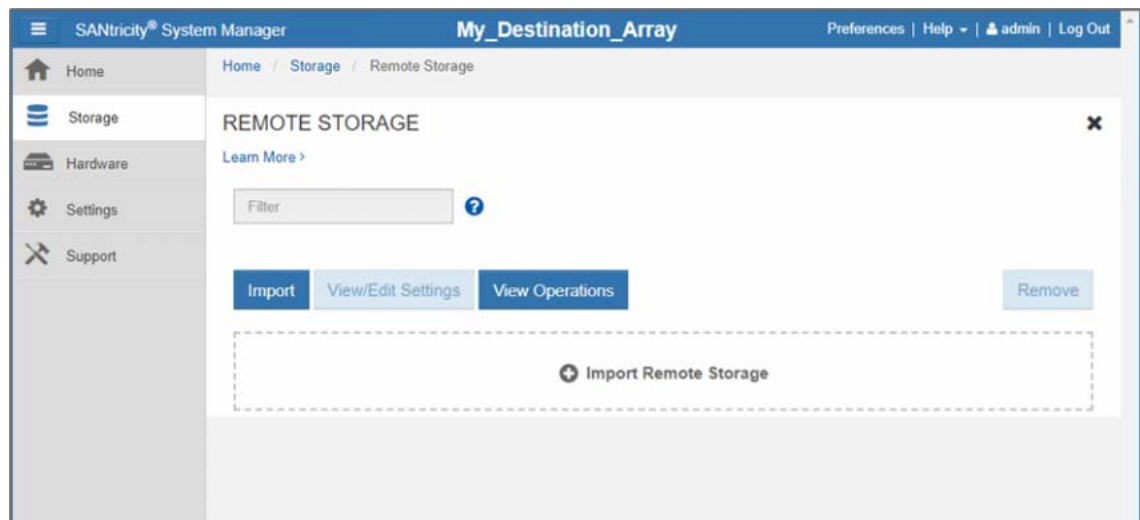
A remote storage import can be started using the Import Remote Storage wizard in SANtricity System Manager. The wizard prompts the user for the IP addresses and the iSCSI IQN of the remote storage system as well as the LUN number for the remote storage device. This information is then sent to the controller firmware to initiate the import.

To start an import operation, complete the following steps:

Procedure ►►►

- 1 From SANtricity System Manager, click Storage.
The Storage screen is displayed.

- 2 Click Remote Storage.
The Remote Storage screen is displayed.



- 3 Click Import Remote Storage.
The Import Remote Storage dialog box is displayed.

The screenshot shows the 'Import Remote Storage' dialog box. It has a title bar with a close button. Below the title bar is a progress indicator with three steps: '1 Configure Source' (active), '2 Configure Target', and '3 Review'. The current step is 'Step 1a - Create remote storage'. The main content area contains the text 'What do I need to know before starting a remote storage import?' and 'I want to create an import using...'. Below this is a 'Name' field with a help icon. Further down is a section titled 'iSCSI connection properties' which includes an 'iSCSI Qualified Name (IQN)' field, an 'IP Address' field, and a 'Port' field (pre-filled with '3260'). There is a '+ Add another IP address' link below the IP field. At the bottom right are 'Close' and 'Next >' buttons.

- 4 Under the Name field, enter the name for the remote storage device.
- 5 Under the iSCSI Qualified Name (IQN) field, enter the IQN for the remote storage device.
- 6 Under the IP Address field, enter the IP address for the remote storage device.

The screenshot shows the 'Import Remote Storage' window with a close button (X) in the top right. It has a progress bar with three steps: '1 Configure Source' (active), '2 Configure Target', and '3 Review'. Below the progress bar, it says 'Step 1a - Create remote storage'. A question 'What do I need to know before starting a remote storage import?' is followed by the text 'I want to create an import using...'. The 'Name' field is labeled with a question mark and contains the text 'My_Source_Array'. Below this is the 'iSCSI connection properties' section. It has an 'iSCSI Qualified Name (IQN)' field with a question mark, containing the text 'iqn.2000-09.com.fujitsu:eternus.600a098000fcda8000000000606bc95c'. Below this are two rows for 'IP Address' and 'Port'. The first row has '192.168.10.121' and '3260'. The second row has '192.168.10.122' and '3260'. Each row has a close button (X) next to the port field. At the bottom of the IP address section is a link '+ Add another IP address'. At the bottom right of the window are 'Close' and 'Next >' buttons.

- 7 Under the Port field, enter the port number for the remote storage device.

Note

By default, the port number is configured to 3260.

- 8 If needed, click +Add another IP address to include an additional IP address for the remote storage device.
- 9 Click Next.
The select remote volume screen is displayed.

- 10** Under the LUN field, select the desired source LUN for the remote storage device.

The screenshot shows a dialog box titled "Import Remote Storage" with a close button (X) in the top right corner. The dialog has a progress bar with three steps: "1 Configure Source" (active), "2 Configure Target", and "3 Review". Below the progress bar, the text "What do I need to know about the remote volume in an import?" is followed by "Select a remote volume from **My_Source_Array...**". The "LUN" section contains a dropdown menu with the text "Select a LUN". At the bottom, there are three buttons: "< Back", "Close", and "Next >".

Import Remote Storage

1 Configure Source 2 Configure Target 3 Review

Step 1b - Select remote volume

What do I need to know about the remote volume in an import?

Select a remote volume from **My_Source_Array...**

LUN

Select a LUN

< Back Close Next >

11 Click Next.

The Configure Target dialog box is displayed.

Import Remote Storage

1 Configure Source 2 Configure Target 3 Review

Why don't I see all my volumes on my destination array?
Select a destination for the remote volume **My_Source_Array_LUN_1...**

Name	Reported Capacity (GiB)	Allocated Capacity (GiB)	Pool/ Volume Group
vol001	64.00	64.00	Volume Group volgrp01
vol002	64.00	64.00	Volume Group volgrp01
vol003	64.00	64.00	Volume Group volgrp01
vol004	64.00	64.00	Volume Group volgrp01

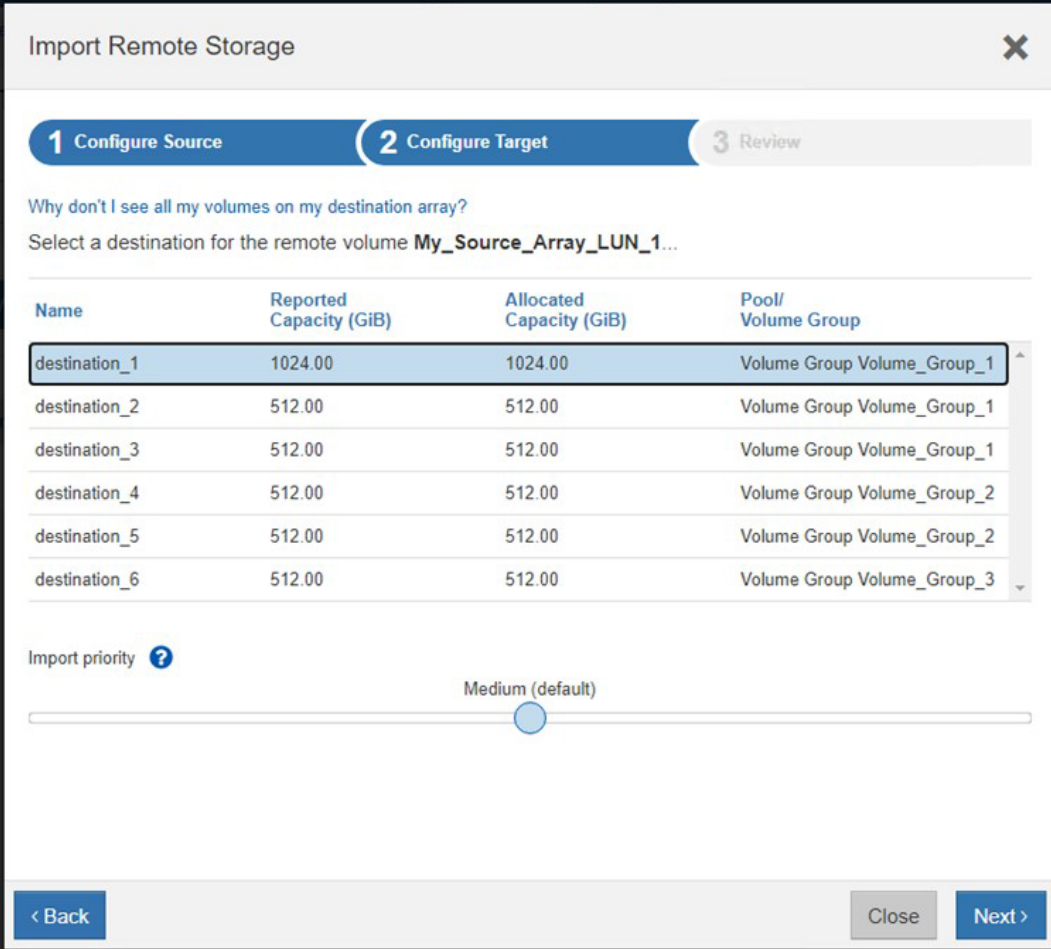
Import priority ?

Medium (default)

< Back Close Next >

12 Select the desired destination volume from the list displayed.

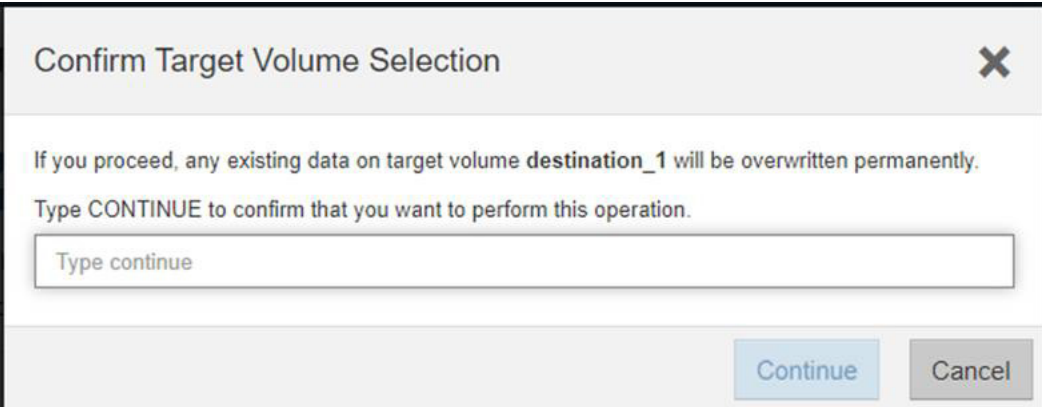
- 13** If needed, change the import priority under the Import Priority field.



The dialog box is titled "Import Remote Storage" and has a close button (X) in the top right corner. It features three tabs: "1 Configure Source" (active), "2 Configure Target", and "3 Review". Below the tabs, a message asks "Why don't I see all my volumes on my destination array?" and instructs to "Select a destination for the remote volume **My_Source_Array_LUN_1...**". A table lists available destination volumes with columns for Name, Reported Capacity (GiB), Allocated Capacity (GiB), and Pool/Volume Group. The first row, "destination_1", is selected. Below the table, the "Import priority" is set to "Medium (default)" on a slider. At the bottom are buttons for "< Back", "Close", and "Next >".

Name	Reported Capacity (GiB)	Allocated Capacity (GiB)	Pool/Volume Group
destination_1	1024.00	1024.00	Volume Group Volume_Group_1
destination_2	512.00	512.00	Volume Group Volume_Group_1
destination_3	512.00	512.00	Volume Group Volume_Group_1
destination_4	512.00	512.00	Volume Group Volume_Group_2
destination_5	512.00	512.00	Volume Group Volume_Group_2
destination_6	512.00	512.00	Volume Group Volume_Group_3

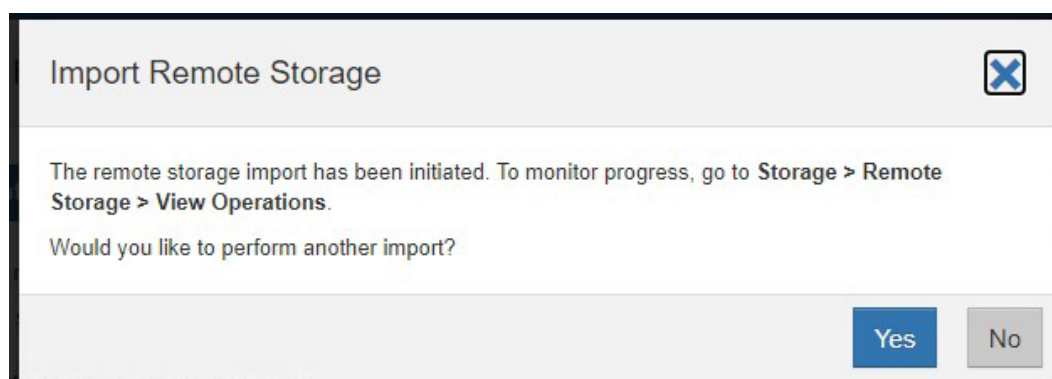
- 14** Click Next.
The Confirm Target Volume Selection dialog box is displayed.
- 15** Verify the destination volume name, and then enter "continue" under the Type Continue field.



The dialog box is titled "Confirm Target Volume Selection" and has a close button (X) in the top right corner. It contains a warning: "If you proceed, any existing data on target volume **destination_1** will be overwritten permanently." Below this, it says "Type CONTINUE to confirm that you want to perform this operation." There is a text input field containing "Type continue". At the bottom right are buttons for "Continue" and "Cancel".

- 16** Click Continue.
The Review dialog box is displayed.
- 17** From the Review page, verify that the specified source, target, and import settings are accurate.

- 18 Click Finish to initiate the import operation.
An Import Remote Storage dialog box is displayed, stating that the remote storage import has been initiated.
- 19 If needed, click Yes under the Import Remote Storage dialog to initiate an additional remote storage import.
- 20 Click No to exit the Import Remote Storage dialog box.



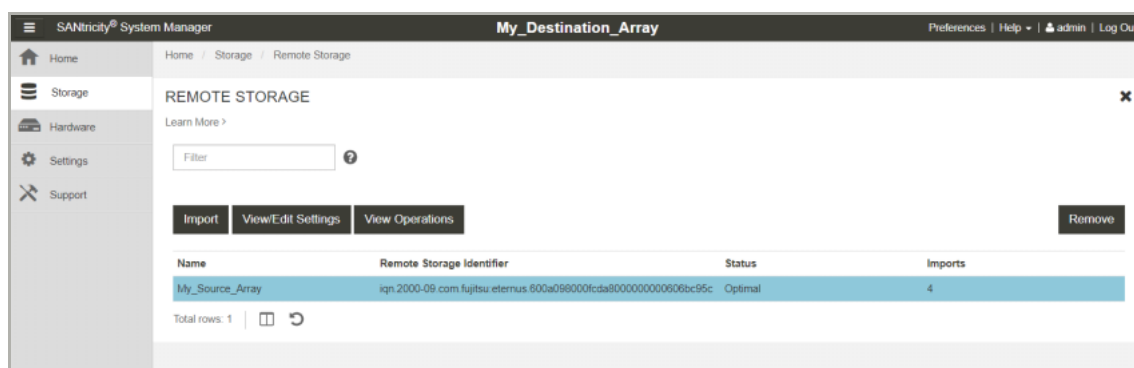
View Import Progress

The status of each remote storage import is viewable from the Remote Storage page of SANtricity System Manager. Various actions can be performed on each import based on its status.

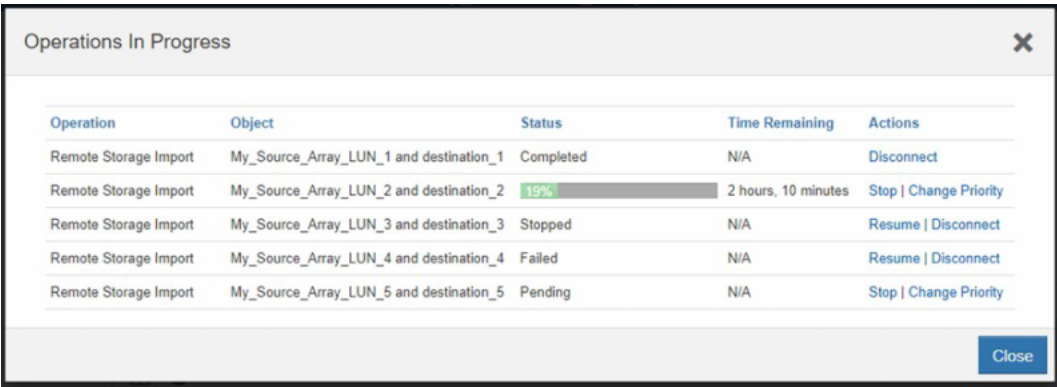
To view the progress of your remote storage imports, complete the following steps.

Procedure ►►►

- 1 In SANtricity System Manager, select Storage.
- 2 Click the Remote Storage tile.



- 3 Click View Operations.
The Operations in Progress dialog box is displayed.



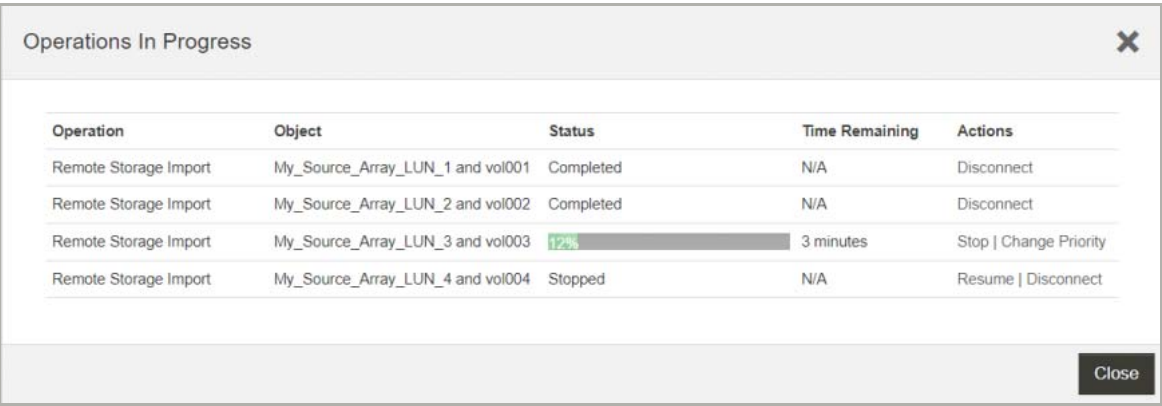
Operation	Object	Status	Time Remaining	Actions
Remote Storage Import	My_Source_Array_LUN_1 and destination_1	Completed	N/A	Disconnect
Remote Storage Import	My_Source_Array_LUN_2 and destination_2	19%	2 hours, 10 minutes	Stop Change Priority
Remote Storage Import	My_Source_Array_LUN_3 and destination_3	Stopped	N/A	Resume Disconnect
Remote Storage Import	My_Source_Array_LUN_4 and destination_4	Failed	N/A	Resume Disconnect
Remote Storage Import	My_Source_Array_LUN_5 and destination_5	Pending	N/A	Stop Change Priority

■ Change import priority

Import priority can be changed directly from the Operations in Progress window on imports that have either an In Progress or Pending status by using the following steps:

Procedure ▶▶▶

- 1 Under the Result List section of the Operations in Progress page, click Change Priority under the Actions column for the corresponding remote storage import.

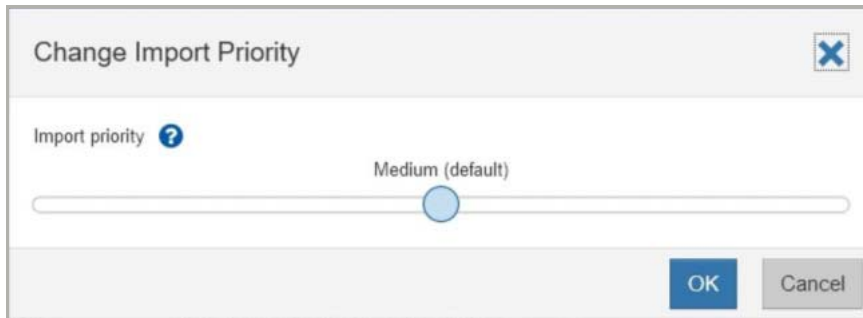


Operation	Object	Status	Time Remaining	Actions
Remote Storage Import	My_Source_Array_LUN_1 and vol001	Completed	N/A	Disconnect
Remote Storage Import	My_Source_Array_LUN_2 and vol002	Completed	N/A	Disconnect
Remote Storage Import	My_Source_Array_LUN_3 and vol003	12%	3 minutes	Stop Change Priority
Remote Storage Import	My_Source_Array_LUN_4 and vol004	Stopped	N/A	Resume Disconnect

The Change Import Priority dialog box is displayed.

2 Under the Import Priority field, select one of the following import priority options:

- Lowest
- Low
- Medium (Default)
- High
- Highest



3 Click OK.

The selected priority is applied to the remote storage import.



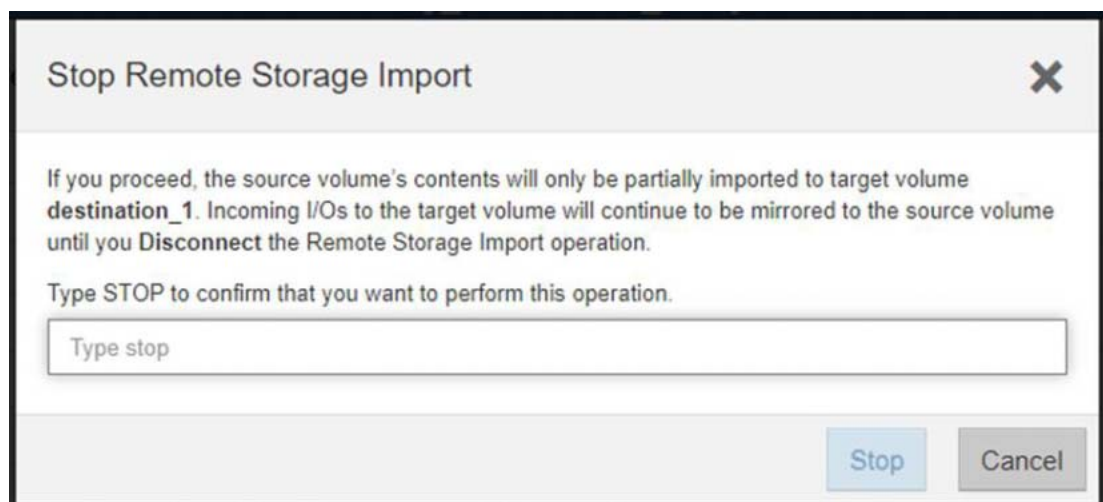
■ Stop remote storage import

An import can be stopped directly from the Operations in Progress page on imports that have either an In Progress or Pending status by using the following steps:

Procedure ►►► —————

1 Under the Result List section of the Operations in Progress page, click Stop in the Actions column for the corresponding remote storage import.

The Stop Remote Storage Import dialog box is displayed.



2 Enter "stop" under the Type Stop field.

- 3 Click Stop.
The remote storage import process is stopped.



■ Resume import

An import can be resumed directly from the Operations in Progress page on imports that have either a failed or stopped status using the following steps:

Note

The resume operation only restarts the import from where it was last stopped and does not restart the import from the beginning of the process. If the import needs to be restarted from the beginning, it must be disconnected and then re-created through the Import Remote Storage wizard.

Procedure ►►►

- 1 Under the List section of the Operations in Progress page, click Resume in the Actions column for the corresponding remote storage import.
The Resume Volume dialog box is displayed.
- 2 Under the Import Priority field, select one of the following import priority options:
 - Lowest
 - Low
 - Medium (Default)
 - High
 - Highest
- 3 Click OK.
The import is resumed using the selected priority.

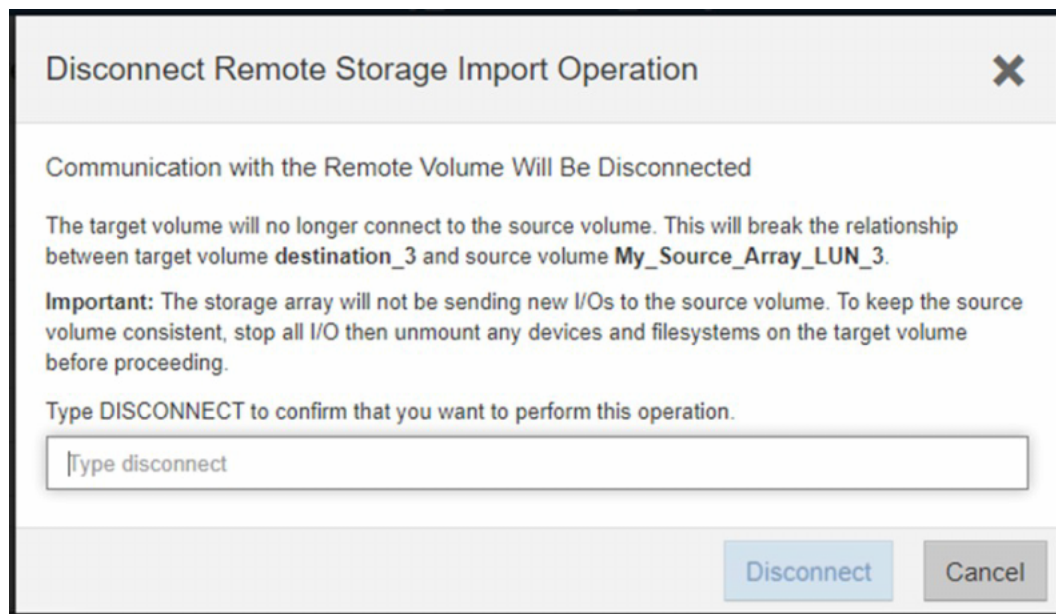


■ Disconnect remote storage operation

An import can be disconnected directly from the Operations in Progress page on imports that have either a Completed, Failed, or Stopped status by using the following steps:

Procedure ►►►

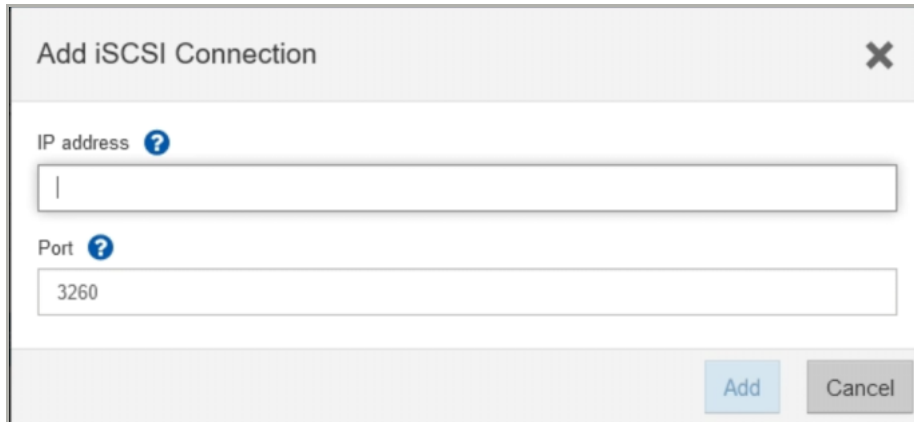
- 1 Under the Result List section of the Operations in Progress screen, click Disconnect in the Actions column for the corresponding remote storage import. Fujitsu recommends that you quiesce host I/Os before disconnecting an import.
The Disconnect Remote Storage Import Operation dialog box is displayed.



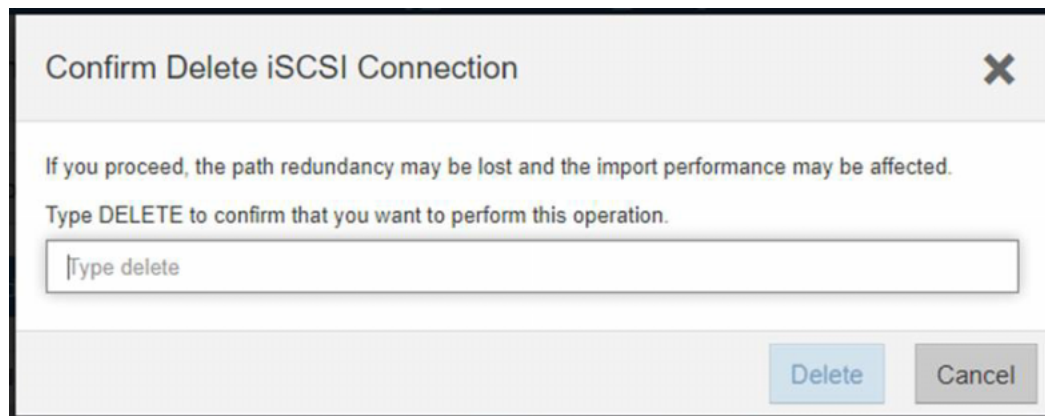
- 2 Enter "disconnect" in the Type Disconnect field.
- 3 Click Disconnect.
The selected remote storage import is disconnected.



- 6** To add a new connection for the remote storage object, click Add.
The Add iSCSI Connection dialog box is displayed.

The dialog box is titled "Add iSCSI Connection" with a close button (X) in the top right corner. It contains two input fields: "IP address" with a question mark icon and a text input field, and "Port" with a question mark icon and a text input field containing the value "3260". At the bottom right, there are two buttons: "Add" (highlighted in blue) and "Cancel" (greyed out).

- 7** Enter the new IP address and port information in the fields provided.
- 8** Select the Add on the Connection Properties tab.
The new connection is added to the remote storage object.
- 9** To remove an existing connection for the remote storage object, select the desired connection from the Connection Properties tab and click Delete.
The Confirm Delete iSCSI Connection dialog box is displayed.

The dialog box is titled "Confirm Delete iSCSI Connection" with a close button (X) in the top right corner. It contains a warning message: "If you proceed, the path redundancy may be lost and the import performance may be affected." followed by the instruction "Type DELETE to confirm that you want to perform this operation." Below this is a text input field containing the text "Type delete". At the bottom right, there are two buttons: "Delete" (highlighted in blue) and "Cancel" (greyed out).

- 10** Enter "delete" under the provided field and then click Delete.
The connection is removed from the remote storage object.
- 11** To modify an existing connection for the remote storage object, click the pencil icon under the Edit column for the desired connection from the Connection Properties tab.

- 12 Enter the revised IP address or port information in the provided fields.

The image shows a 'Remote Storage Settings' dialog box with a close button (X) in the top right. It has two tabs: 'Properties' and 'Connection Properties'. The 'Connection Properties' tab is active. Below the tabs are 'Add' and 'Delete' buttons. A table with the following columns is shown: 'IP Address', 'Port', 'Address Type', and 'Edit'. The 'IP Address' field contains '10.10.1.', the 'Port' field contains '3260', and the 'Address Type' is 'IPv4'. The 'Edit' column contains a checkmark icon and an 'X' icon. Below the table, it says 'Total rows: 1'. At the bottom right are 'Save' and 'Cancel' buttons.

IP Address	Port	Address Type	Edit
10.10.1.	3260	IPv4	✓ ✕

Total rows: 1

- 13 Click the checkmark icon under the Edit column to accept the changes or the X icon to discard the changes.
- 14 After all changes are accepted or discarded, click Save.
The modified connection settings are applied to the remote storage object.

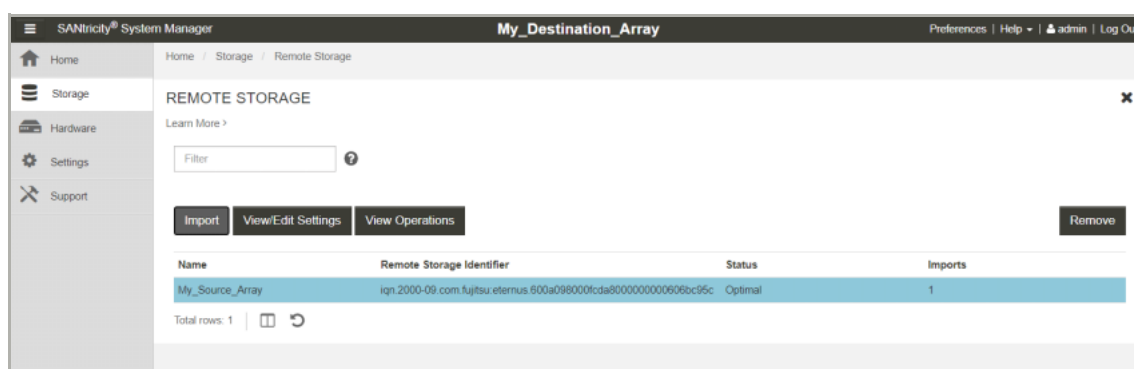


Remove Remote Storage Object

Any configured remote storage object can be removed directly through SANtricity System Manager.

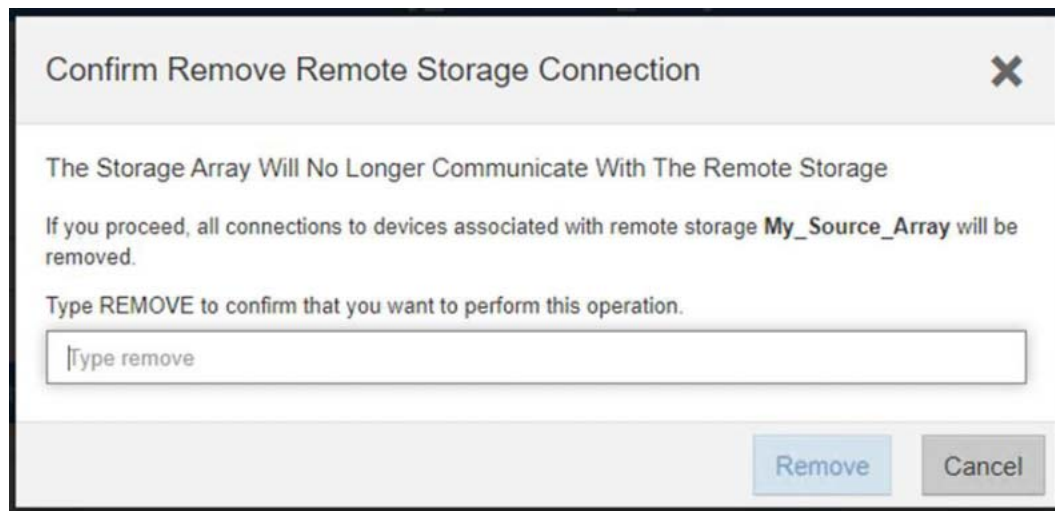
Procedure ►►►

- 1 From SANtricity System Manager, select Storage.
- 2 Click the Remote Storage tile.
- 3 Select the desired remote storage object on the page displayed.



4 Click Remove.

The Confirm Remove Remote Storage Connection dialog box is displayed.



5 Enter "remove" under the Type Remove field.

6 Click Remove.

The selected remote storage object is removed.



4. Error Handling and Recovery

ETERNUS AB/HB series Storage System Error Injection

■ Destination ETERNUS AB/HB series storage system controller unavailable

If a controller is pulled from the destination ETERNUS AB/HB series storage system, all volumes currently owned by the pulled controller, including the remote storage volumes, should transfer ownership to the alternate controller. This behavior should extend to any situation in which the owning controller becomes unavailable (such as controller failure, controller power down, controller reboot, and so on). After the controller is available again, volumes related to the import operation will not automatically fail back to the preferred controller. After the import operation completes, a Recovery Guru is triggered listing manual steps to redistribute the remote storage volumes back to the owning controller. A single controller fault should not disrupt any imports currently in progress.

■ iSCSI login issues from the ETERNUS AB/HB series storage system to the remote storage

Any fault on the remote storage is considered an iSCSI connection issue from the destination ETERNUS AB/HB series storage system. Observed iSCSI connection issues could be caused by the following:

- Network connectivity issues:
 - High latency issues with the network connection
 - Bad component (cable, SFP, and so on)
 - Ethernet port not configured correctly
 - Ethernet switch issue
- Remote storage is unreachable through at least one ETERNUS AB/HB series controller with the provided information (IQN, IP addresses, and so on)

Assuming the recommended cabling is being used, if an error occurs on one of the paths on the remote system, a brief latency spike might be observed, but iSCSI connections should remain intact, and no interruptions should be observed.

If errors occur on all paths to the remote system, then the import operation will fail. The connection issues must be resolved before the import can be resumed. In most cases the import operation will automatically resume. If for some reason the import does not automatically resume, then a manual resume can be performed from SANtricity System Manager on the destination ETERNUS AB/HB series storage system.

UUID Warnings When Mounting Certain File System Types

The UUID of the file system gets copied to the target volume along with all other data during the import operation and can lead to UUID warnings or issues when mounting. This can occur in the scenarios described in the Linux host mapping and VMware datastores sections.

■ Linux host mapping

After an import completes and is disconnected, the target volume and source volume can be mapped to the same Linux host. When mounting both volumes on the same Linux host, a duplicate UUID warning is displayed:

```
[10274.722229] XFS (dm-3): Filesystem has duplicate UUID 93cb1da9-f05b-4767-a92e-387cc1a09c17 - can't mount
```

To resolve this issue, use the following command:

```
mount /dev/mapper/<id> -o rw,nouuid <mount-directory>
```

■ VMware datastores

With VMware datastores, the UUID is compared against the volume identifier. During the import operation, the UUID is updated to reflect the UUID of the source volume, which results in a mismatch. As a result, VMware datastores are restricted. For more information, see "FUJITSU Storage ETERNUS AB series All-Flash Arrays, ETERNUS HB series Hybrid Arrays SANtricity OS 11.70 Product Release Notes".

5. Management Interfaces

SMcli

No new CLI statements are added or updated to support the Remote Volumes feature. Use the REST API commands instead.

REST API

These REST API commands are under Beta, which means that the endpoints can change at some point in the future.

■ Usable interfaces

The following REST API command can be executed to see a list of all interfaces that are available for connecting to remote storage.

Table 7 Usable interfaces API

Method	API URL	Parameters/responses
GET	/storage-systems/{system-id}/remote-storage/usable-interfaces	Input system-id - The unique identifier of the storage-system. This may be the id or the WWN. Output [RemoteStorageUsableInterface]

RemoteStorageUsableInterface Definition

```
Definition{
  "interfaceRef": "string",
  "interfaceType": "iscsi",
  "controllerRef": "string",
  "channelPortRef": "string",
  "oneWayMaxRate": "string",
  "bidirectionalMaxRate": "string",
  "currentInterfaceSpeed": "speedUnknown",
  "maximumInterfaceSpeed": "speedUnknown",
  "linkStatus": "none"
}
```

■ Remote storage objects

The following REST API commands can be used to view, update, add, or delete remote storage objects.

Table 8 Remote storage objects APIs

Method	API URL	Parameters/responses
GET	/storage-systems/{system-id}/remote-storage Gets a list of remote storage objects	Input system-id - The unique identifier of the storage-system. This may be the id or the WWN. Output [RemoteStorageResponse]
GET	/storage-systems/{system-id}/remote-storage/{id} Retrieve a remote storage object	Input system-id - The unique identifier of the storage-system. This may be the id or the WWN. Output [RemoteStorageResponse]
POST	/storage-systems/{system-id}/remote-storage Create a remote storage object	Input system-id - The unique identifier of the storage-system. This may be the id or the WWN. [RemoteStorageRequest] Output [RemoteStorageResponse]
POST	/storage-systems/{system-id}/remote-storage/{id} Update the remote storage object	Input system-id - The unique identifier of the storage-system. This may be the id or the WWN. id - The unique identifier of the remote storage [RemoteStorageUpdateRequest] Output [RemoteStorageResponse]
DELETE	/storage-systems/{system-id}/remote-storage/{id} Delete the specified remote storage object. This will also delete any remote storage volumes associated with the remote storage object specified. If any of the remote storage volumes are used in an import, the deletion will not continue, and an error will be returned.	Input system-id - The unique identifier of the storage-system. This may be the id or the WWN. id - The unique identifier of the remote storage

RemoteStorageRequest Definition and Example

Definition Expand source

```
{
  "name": string, required
  "remoteStorageType": genericTarget, required
  "genericTarget": {
    "connectionType": iscsi, required
    "iscsi": {
      "iqn": string, required
      "iscsiInterfaces": [
        {
          "ipAddress": string, required          "port": number, required
        }
      ]
    }
  }
}
```

Example Expand source

```
{
  "name": "string",
  "remoteStorageType": "genericTarget",
  "genericTarget": {
    "connectionType": "iscsi",
    "iscsi": {
      "iqn": "string",
      "iscsiInterfaces": [
        {
          "ipAddress": "10.10.1.101",          "port": 3260
        }
      ]
    }
  }
}
```

RemoteStorageUpdateRequest Definition and Example

```
Definition Expand source
{
  "genericTarget":
  { "iscsi": {
    "iscsiInterfaces": [
      {
        "ipAddress": string, required      "port": number, required      }
    ]
  }
}

Example Expand source
{
  "genericTarget":
  { "iscsi": {
    "iscsiInterfaces": [
      {
        "ipAddress": "10.10.1.102",      "port": 3260      }
    ]
  }
}
```

RemoteStorageResponse Definition

```
Definition{
  "id" : "string",
  "name": "string",
  "status": "enum",
  "controllerInfo": [
    {
      "controllerId": "string",
      "connectionStatus": "enum",
    }
  ]
  "remoteStorageManagementProperties": {
    "remoteStorageType": "genericTarget",
    "genericTarget": {
      "connectionType": "iscsi",
      "iscsi": {
        "iqn": "string",
        "iscsiInterfaces": [
          {
            "ipAddress": "string",
          }
        ]
      }
    }
  }
}
```


■ Remote storage volume

The following REST API commands can be used to view, update, add, or delete remote storage volumes.

Table 9 Remote storage volume APIs

Method	API URL	Parameters/responses
GET	/storage-systems/{system-id}/remote-storage-volumes Gets a list of remote storage volumes	Input system-id - The unique identifier of the storage-system. This may be the id or the WWN. Output [RemoteStorageVolumeResponse]
GET	/storage-systems/{system-id}/remote-storage-volumes/{id} Gets a remote storage volume	Input system-id - The unique identifier of the storage-system. This may be the id or the WWN. id - The unique identifier of the remote storage volume Output [RemoteStorageVolumeResponse]
POST	/storage-systems/{system-id}/remote-storage-volumes Create a remote storage volume	Input system-id - The unique identifier of the storage-system. This may be the id or the WWN. [RemoteStorageVolumeRequest] Output [RemoteStorageVolumeResponse]
POST	/storage-systems/{system-id}/remote-storage-volumes/{id} Update the specified remote storage volume	Input system-id - The unique identifier of the storage-system. This may be the id or the WWN. id - The unique identifier of the remote storage [RemoteStorageVolumeUpdateRequest] Output [RemoteStorageVolumeResponse]
DELETE	/storage-systems/{system-id}/remote-storage-volumes/{id} Delete the specified remote storage volume	Input system-id - The unique identifier of the storage-system. This may be the id or the WWN. id - The unique identifier of the remote storage volume

RemoteStorageVolumeRequest Definition and Example

Definition Expand source

```
{
  "name": string, required
  "remoteStorageId": string, required
  "owningControllerId": string, optional
  "lunNumber": number, required
}
```

Example Expand source

```
{
  "name": "myRemoteStorageName",
  "remoteStorageId": "44000000600A098000A1BF3000FDA7045F9B4840",
  "owningControllerId": "07000000000000000000000001",
  "lunNumber": 0
}
```

RemoteStorageVolumeUpdateRequest Definition and Example

Definition Expand source

```
{
  "owningControllerId": string, optional
}
```

Example Expand source

```
{
  "owningControllerId": "07000000000000000000000001"
}
```

RemoteStorageVolumeResponse Definition

```
Definition Expand source{
  "id": "string",
  "name": "string",
  "volumeHandle": number,
  "lunNumber": "string",
  "worldWideName": "string",
  "remoteVolumeWorldWideName": "string",
  "currentControllerId": "string",
  "preferredControllerId": "string",
  "blkSize": number,
  "capacity": "string",
  "status": "enum",
  "offlineReason": "enum",
  "remoteStorageId": "string",
  "protectionType": "enum",
  "cache": {
    "cwob": boolean,
    "enterpriseCacheDump": boolean,
    "mirrorActive": boolean,
    "mirrorEnable": boolean,
    "readCacheActive": boolean,
    "readCacheEnable": boolean,
    "writeCacheActive": boolean,
    "writeCacheEnable": boolean,
    "cacheFlushModifier": "enum",
    "readAheadMultiplier": number
  },
  "perms": {
    "mapToLUN": boolean,
    "snapShot": boolean,
    "format": boolean,
    "reconfigure": boolean,
    "mirrorPrimary": boolean,
    "mirrorSecondary": boolean,
    "copySource": boolean,
    "copyTarget": boolean,
    "readable": boolean,
    "writable": boolean,
    "rollback": boolean,
    "mirrorSync": boolean,
    "newImage": boolean,
    "allowDVE": boolean,
    "allowDSS": boolean,
    "concatVolumeMember": boolean,
    "flashReadCache": boolean,
    "asyncMirrorPrimary": boolean,
    "asyncMirrorSecondary": boolean,
    "pitGroup": boolean,
    "cacheParametersChangeable": boolean,
    "allowThinManualExpansion": boolean,
    "allowThinGrowthParametersChange": boolean
  }
}
```

■ Remote volume import

The following REST API commands can be used to view, update, add, or delete import operations.

Table 10 Remote volume import APIs

Method	API URL	Parameters/responses
GET	/storage-systems/{system-id}/remote-volume-import/target-candidates/{remote-storage-volume-id} Locate any potential target volume candidates for an import operation with the given remote storage volume as a source.	Input system-id - The unique identifier of the storage-system. This may be the id or the WWN. remote-storage-volume-id - Identifier of an existing remote storage volume Output [VolumeEx]
GET	/storage-systems/{system-id}/remote-volume-import List all existing volume import operations defined on the system	Input system-id - The unique identifier of the storage-system. This may be the id or the WWN. Output [RemoteVolumeImport]
POST	/storage-systems/{system-id}/remote-volume-import Define a new import operation on a pair of volumes	Input system-id - The unique identifier of the storage-system. This may be the id or the WWN. [RemoteVolumeImportRequest] Output [RemoteVolumeImport]
POST	/storage-systems/{system-id}/remote-volume-import/{remote-storage-volume-id} Modify the parameters or state of an existing import operation	Input system-id - The unique identifier of the storage-system. This may be the id or the WWN. remote-storage-volume-id - Identifier of an existing remote storage volume [RemoteVolumeImportControlRequest] Output [RemoteVolumeImport]
DELETE	/storage-systems/{system-id}/remote-volume-import/{remote-storage-volume-id} Remove a defined import operation	Input system-id - The unique identifier of the storage-system. This may be the id or the WWN. remote-storage-volume-id - Identifier of an existing remote storage volume

RemoteVolumeImportRequest Definition and Example

Definition Expand source

```
{
  "sourceVolumeId": string, required
  "targetVolumeId": string, required
  "priority": enum [lowest, low, medium, high, highest], optional
}
```

Example Expand source

```
{
  "sourceVolumeId": "43000000600A098000AF5B640000306760890A1B",
  "targetVolumeId": "02000000600A098000AF5B6400003056608909EA",
  "priority": "lowest"
}
```

RemoteVolumeImportControlRequest Definition and Example

Definition Expand source

```
{
  "priority": enum [lowest, low, medium, high, highest], optional
  "operation": enum [start, stop, restart], optional
}
```

Example Expand source

```
{
  "priority": "lowest",
  "operation": "start"
}
```

RemoteVolumeImport Definition

Definition Expand source

```
{
  "remoteStorageId": "string",
  "sourceVolumeId": "string",
  "targetVolumeId": "string",
  "copyRef": "string",
  "progressPercent": number,
  "transferRate": number,
  "estimatedCompletionTime": "string",
  "estimatedRemainingTimeInSeconds": "string",
  "startTime": "string",
  "priority": "enum",
  "status": "enum"
}
```

VolumeEx Definition

Definition Expand source

```
{
  "offline": boolean,
  "extremeProtection": boolean,
  "volumeHandle": number,
  "raidLevel": "enum",
  "sectorOffset": "string",
  "worldWideName": "string",
  "label": "string",
  "blkSize": number,
  "capacity": "string",
  "reconPriority": number,
  "segmentSize": number,
  "action": "enum",
  "cache": {
    "cwob": boolean,
    "enterpriseCacheDump": boolean,
    "mirrorActive": boolean,
    "mirrorEnable": boolean,
  }
}
```

```
    "readCacheActive": boolean,
    "readCacheEnable": boolean,
    "writeCacheActive": boolean,
    "writeCacheEnable": boolean,
    "cacheFlushModifier": "enum",
    "readAheadMultiplier": number
  },
  "mediaScan": {
    "enable": boolean,
    "parityValidationEnable": boolean
  },
  "volumeRef": "string",
  "status": "enum",
  "volumeGroupRef": "string",
  "currentManager": "string",
  "preferredManager": "string",
  "perms": {
    "mapToLUN": boolean,
    "snapshot": boolean,
    "format": boolean,
    "reconfigure": boolean,
    "mirrorPrimary": boolean,
    "mirrorSecondary": boolean,
    "copySource": boolean,
    "copyTarget": boolean,
    "readable": boolean,
    "writable": boolean,
    "rollback": boolean,
    "mirrorSync": boolean,
    "newImage": boolean,
    "allowDVE": boolean,
    "allowDSS": boolean,
    "concatVolumeMember": boolean,
    "flashReadCache": boolean,
    "asyncMirrorPrimary": boolean,
    "asyncMirrorSecondary": boolean,
    "pitGroup": boolean,
    "cacheParametersChangeable": boolean,
    "allowThinManualExpansion": boolean,
    "allowThinGrowthParametersChange": boolean
  },
  "mgmtClientAttribute": number,
  "dssPreallocEnabled": boolean,
  "dssMaxSegmentSize": number,
  "preReadRedundancyCheckEnabled": boolean,
  "protectionInformationCapable": boolean,
  "protectionType": "enum",
  "applicationTagOwned": boolean,
  "repairedBlockCount": number,
  "extendedUniqueIdentifier": "string",
  "cacheMirroringValidateProtectionInformation": boolean,
  "expectedProtectionInformationAppTag": number,
  "hostUnmapEnabled": boolean,
  "cachePoolID": number,
  "blkSizePhysical": number,
  "volumeUse": "enum",
  "volumeFull": boolean,
  "volumeCopyTarget": boolean,
  "volumeCopySource": boolean,
```

```
"pitBaseVolume": boolean,
"asyncMirrorTarget": boolean,
"asyncMirrorSource": boolean,
"remoteMirrorSource": boolean,
"remoteMirrorTarget": boolean,
"diskPool": boolean,
"flashCached": boolean,
"increasingBy": "string",
"metadata": [
  {
    "key": "string",
    "value": "string"
  }
],
"dataAssurance": boolean,
"name": "string",
"id": "string",
"objectType": "enum",
"listOfMappings": [
  {
    "lunMappingRef": "string",
    "lun": number,
    "ssid": number,
    "perms": number,
    "volumeRef": "string",
    "type": "enum",
    "mapRef": "string",
    "id": "string"
  }
],
"currentControllerId": "string",
"thinProvisioned": boolean,
"mapped": boolean,
"cacheSettings": {
  "cwob": boolean,
  "enterpriseCacheDump": boolean,
  "mirrorActive": boolean,
  "mirrorEnable": boolean,
  "readCacheActive": boolean,
  "readCacheEnable": boolean,
  "writeCacheActive": boolean,
  "writeCacheEnable": boolean,
  "cacheFlushModifier": "enum",
  "readAheadMultiplier": number
},
"wnn": "string",
"preferredControllerId": "string",
"onlineVolumeCopy": boolean,
"totalSizeInBytes": "string"
}
```

NVSRAM

No NVSRAM changes were done for this feature.

6. Compatibility and Migration

Supported Features

The remote storage volume can only be used for imports. All other features are disabled on the remote storage volume (snapshots, media scan settings, Asynchronous Mirroring, mapping, SSD read cache, and so on).

Drive Migration

When the user moves physical drives, only volumes stored on the physical drives are migrated. Remote storage volumes (drive-less volumes) are not migrated as the result of physical drive migrations.

7. Restrictions and Limitations

Limitations

■ Remote storage object, remote storage volume and import limits

Due to system resource constraints, a limitation is placed on the number of objects related to this feature that can be created or are present on the storage system at any given point in time:

- Remote storage objects
 - Limited to a total of four
- Remote storage volumes
 - Limited to a total of 16
- Import operations
 - Limited to a total of 16 with only eight in-progress at a given time

Note

Remote storage volume imports and volume copies use the same underlying code. As such, volume copies are also included when calculating the number of objects created or are in-progress.

Remote storage objects, import operations, and volume copy operations can all be managed through SANtricity System Manager, so that limits can easily be observed and managed. However, remote storage volumes are hidden from user view. They are automatically created when an import is initiated and automatically deleted when the import is disconnected.

There are a few instances where the remote storage volumes will not get removed automatically when the import operation is disconnected. As a result, the maximum number of remote storage volumes could eventually be reached, which will prevent the creation of new import operations. User intervention is required to remove these remote storage volumes using one of the following options:

- If you are using SANtricity System Manager, the Import Remote Storage wizard automatically detects remote storage volumes that are no longer associated with an import operation and prompts the user to remove them.
- If you are using the REST API, execute the appropriate commands to remove the remote storage volumes that are no longer associated with an import relationship. The delete operation fails if it detects that the remote storage volume specified is in an import relationship.

■ High availability with Multiple IQNs

High availability is not supported on storage systems with two different IQNs. The storage system must have a single IQN with a unique connection and iSCSI sessions to use high availability.

■ Hardware compatibility testing limitations

Any remote storage vendor running with the supported I/O protocol will most likely be compatible to use for a remote storage volume import. However, testing is only being done on a few remote storage vendors and each vendor may have unique ways to set up the communications between the remote storage and ETERNUS AB/HB series storage systems.

■ VMware Datastores support

Importing VMware Datastores is not supported.

Importing raw or pass-through devices are supported with the Remote Storage Volumes with any supported version of an ESXi host.

Restrictions

For a full list of restrictions for this feature, see the SANtricity Product Release Notes.

■ Offline imports not supported

The import is only done online. No option exists to force it offline. If an offline import is desired, do not map the destination volume during the import to prevent the presence of I/O.

■ Web Services proxy not supported

The REST API commands used to manage the import are only available from embedded storage and not through the Web Services proxy for the initial release of this feature.

■ Remote storage volume mappings not supported

In the initial release, remote storage volumes cannot be mapped to any hosts. This functionality is disabled through SANtricity System Manager and is not allowed through the REST APIs. This restriction prevents remote storage volumes from being used for anything other than importing.

■ Multiple remote storage device mappings

Any I/Os from the host to the destination volume are also propagated to the remote storage device while the import connection is present, even if the import has already completed. As such, the remote storage device must not be mapped to multiple hosts. The local ETERNUS AB/HB series system should be the sole owner of the remote storage device. Mapping to multiple hosts can result in data corruption of the remote storage device and/or destination volumes.

■ CHAP secrets not supported

The use of CHAP secrets is not supported in the initial release of this feature.

■ Asynchronous Mirroring not supported during import

Coexistence of Asynchronous Mirroring and Remote Storage are not supported in the initial release of this feature. To switch from using Asynchronous Mirroring to Remote Storage, a deactivate mirroring operation must be performed and the controllers must be rebooted. To switch from using Remote Storage to Asynchronous Mirroring, the existing remote storage objects must be deleted and then the controllers must be rebooted.

■ Flash Read Cache not supported during import

Flash Read Cache (FRC) must be disabled on the destination volumes before they can be used in an import operation. FRC can be reenabled after the import operation has completed and has been disconnected.

■ Remote storage system upgrades not supported during import

It is recommended to not perform any upgrades on the remote storage system during an import operation. Host I/O errors can occur because of the upgrade.

■ Storage systems without ALUA support

Performing imports from storage systems without Asymmetric Logical Unit Access (ALUA) support might lead to I/O errors if access to any controller on either the source storage system or target storage system is lost. Failed imports can be resumed when the path is made available.

8. Performance

Determining Performance

With this feature, I/Os can run to the target volume while an import operation is in progress. An option is provided during remote storage import creation that can be used to set the priority of the import operation. Valid values range from lowest to highest and are used to determine how much of the system resources will be used for the import operation.

If no I/Os will be run to the target volume during the import operation, then a setting of highest should be used for the priority to maximize import performance. If critical I/Os will be run to the target volume during the import operation, then it might be necessary to use a lower setting for the priority while the import is in progress. The setting can then be changed to a higher value after the import operation has completed.

In addition to the priority value, there are a multitude of variables that can either positively or negatively impact performance, including:

- iSCSI configuration and bandwidth on the following devices:
 - Storage systems
 - Hosts
 - Switches
- Source and target storage system configuration and settings include, but are not limited to:
 - Number and type of drives
 - Caching
 - Controller firmware version

To maximize performance for external I/Os during the import operation, it is recommended to do the following:

- Set the import priority to medium or lower. It should be noted that the lower the priority is, the longer the import operation will take to complete.
- Set up a dedicated path from the source storage system to the destination storage system that is only used for import operations and is separate from all other I/O paths.
- Follow all documented guidelines for achieving the best performance for the application and configuration being used.
- Make sure all paths are fully operational.

To maximize performance for the import operation, it is recommended to use the following:

- Suspend or stop all I/Os on the target volume for the duration of the import.
- Set the import priority to highest.
- Set up a dedicated path from the source storage system to the destination storage system that is only used for import operations and is separate from all other I/O paths.
- Enable jumbo frames on the import operations path between the target storage system and the source storage system.
- Make sure all paths are fully operational.

Since not all configurations and settings can be tested, the performance tests were run with a single configuration with specific settings. Individual results might vary based on the configuration being used.

Import Performance

■ Setup and configuration

To test the performance of the import operation, the following setup was used:

- Source volume:
 - Optimal HB5100 storage system running the current controller firmware version
 - 23-drive (Hitachi HUC101818CS4205) dynamic disk pool without PI
 - Read caching enabled with prefetch disabled
 - Write caching enabled with mirroring
- Destination volume:
 - Optimal HB5100 storage system running the current controller firmware version in the same lab location as the source storage system
 - 24-drive (Seagate ST600MM0098) dynamic disk pool without PI
 - Read caching enabled with prefetch disabled
 - Write caching enabled with mirroring
- Import priority:
 - Highest
- Host:
 - Windows 2019
 - MaxTransferLength = 1MB
- Switch:
 - 25Gbps
 - MTU = 1500 (no jumbo frames)

■ Impacts of external I/O on import operations

To determine how much external I/O would impact import operations, the following tests were run on various sized volumes:

Procedure ►►►

- 1 Start the import operation.
- 2 Run I/Os to the destination volume during the first five minutes of the import.
- 3 Allow the import to complete.

During these test runs, the results listed in [Table 11](#) were obtained.

Table 11 External I/O on import results

Volume size	Throughput
100GB	206.6MBps
1024GB	851.8MBps

It was observed during these runs that the performance of the import operation was significantly impacted when external I/O was occurring on the target volume. After the I/Os to the target volume completed, import performance returned to the rates observed in the next section.

■ Imports for different sized volumes and different frame sizes

To determine how much volume size and frame sizes would impact import operations, import operations were performed with a variety of volume sizes and frame sizes. To avoid negatively impacting the import operation, no external I/O was run to the target volume during the import. The results are listed in [Table 12](#).

Table 12 Import for different sized volumes and frame size results

Volume size	MTU size	Throughput
100GB	1500	1292.80MBps
100GB	9000	1347.37MBps
500GB	1500	1185.15 MBps
500GB	9000	1395.10MBps
1024GB	1500	1202.48MBps
1024GB	9000	1367.11MBps

Based on these results, it was determined that volume size does not have much of an impact on import performance. However, when jumbo frames are used (9000 MTU size), it does improve the overall performance of the import operation.

■ Import versus file system copy

Prior to this feature, moving file-based data consisted of doing file system copy operations via a host from the volumes on the source system to the volumes on the destination system. Depending on the amount of data that needed to be transferred, it could take a very long time to complete. Importing can perform much faster than file system copies, but it will import the entire volume, not just the files that need to be transferred. As a result, special considerations need to be taken to determine if a file system copy or a remote storage import would be the most efficient way to transfer the data.

[Table 13](#) shows the testing that was performed for remote storage imports and file system copies. It should be noted that no external I/Os were run to the target volume during the import operation or file system copy.

Table 13 Import versus file system copy testing results

Operation	Amount of data transferred	Duration of operation	Throughput
File system copy	Files: ~8TB of data (using 99.999% of an 8192GB volume)	6 hours and 14 minutes	373.8MBps
Remote storage volume import	8192GB volume	2 hours and 33 minutes	913.0MBps

Based on the observed results, if greater than 41% of the volume capacity needs to be copied/imported, then the Remote Storage import operation will complete faster than doing a file system copy. It should be noted that these results are specific to the configuration being used for this testing. Results might vary with different configurations and settings.

Performance of I/Os before, during, and after Import

■ Setup and configuration

The vdbench tool was used to test the performance I/Os before, during, and after the import operation. For these tests, the following setup was used:

- Source volume:
 - Optimal HB5100 storage system running the current controller firmware version
 - 11-drive (Hitachi HUC101818CS4205) dynamic disk pool without PI
 - Read caching enabled with prefetch disabled
 - Write caching enabled with mirroring
- Destination volume:
 - Optimal HB5100 storage system running the current controller firmware version in the same lab location as the source storage system
 - 11-drive (Seagate ST600MM0098) dynamic disk pool with PI
 - Read caching enabled with prefetch disabled
 - Write caching enabled with mirroring
- Host:
 - Windows 2019
 - MaxTransferLength = 1MB
- Switch:
 - 25Gbps
 - MTU = 1500 (no Jumbo Frames)
- vdbench:
 - Queue depth range = 64
 - Ramp time = 30 seconds
 - Run time = 300 seconds

■ Results

The following scenarios were tested on this setup to determine how much external I/O would be impacted by the import operation. Data was gathered from vdbench both before and during the import operation. It should be noted that most of the testing was done with an import priority of highest. The scenarios that saw the most degradation in I/Os to target volume were rerun with a priority of medium.

Table 14 1MB transfer size (highest priority on import)

Scenario	MBps before import	MBps during import	Diff	IOPs before import	IOPs during import	Diff	Latency before import (ms)	Latency during import (ms)
100% writes 0% reads Sequential IO	1342.7	1,244.2	-7.3%	1,342.7	1,244.2	-7.3%	47.25	50.88
100% writes 0% reads Random I/O	463.3	443.4	-4.3%	463.3	443.4	-4.3%	132.22	143.84

8. Performance

Performance of I/Os before, during, and after Import

Scenario	MBps before import	MBps during import	Diff	IOPs before import	IOPs during import	Diff	Latency before import (ms)	Latency during import (ms)
0% writes 100% reads Sequential I/O	1,570.6	1,378.7	-12.2%	1,570.6	1,378.7	-12.2%	40.84	48.06
0% writes 100% reads Random I/O	585.7	553.2	-5.5%	585.7	553.2	-5.5%	109.24	115.68
50% writes 50% reads Sequential I/O	668.1	565.1	-15.4%	668.1	565.1	-15.4%	95.50	113.93
50% writes 50% reads Random I/O	511.0	602.7	17.9% (*1)	511.0	602.7	17.9% (*1)	124.96	105.84 (*1)

*1: Higher MBps and IOPs along with lower latency during the import are typically the result of I/Os going to cache instead of to the disk.

Based on these results, high MBps workloads (1MB transfer size) seem to be minimally impacted by the import operation.

Note

IMPORT PRIORITY

The scenario that saw the most degradation was 50% writes, 50% reads and sequential I/O. This scenario saw a degradation of 15.4%. When this scenario was re-run with a "medium" import priority, the performance of I/O to the target volume during import increased by 11.6% because the I/Os used more of the cache.

Table 15 512B transfer size (highest priority on import)

Scenario	MBps before import	MBps during import	Diff	IOPs before import	IOPs during import	Diff	Latency before import (ms.)	Latency during import (ms.)
100% writes 0% reads Sequential I/O	50.32	27.17	-46%	103,049.9	55,651.6	-46%	0.61	1.134
100% writes 0% reads Random I/O	0.88	0.44	-50%	1,802.6	898.3	-50%	35.42	71.22
0% writes 100% reads Sequential I/O	44.2	42.0	-5%	90,529.1	86,077.4	-5%	0.71	17.7
0% writes 100% reads Random I/O	3.5	3.2	-10%	7,218.7	6,492.0	-10%	8.86	9.86
50% writes 50% reads Sequential I/O	30.5	32.35	6%(*1)	62,508.5	66,260.6	6%(*1)	1.01	0.96 (*1)
50% writes 50% reads Random I/O	1.5	0.8	-47%	3,073.3	1,637.6	-47%	20.81	39.06

*1: Higher MBps and IOPs along with lower latency during the import are typically the result of I/Os going to cache instead of to the disk.

Based on these results, the import operation impacts on high IOPs workloads (512B transfer size), was much more varied, with throughput reductions anywhere between 5% and 50% depending on the exact workload and import priority setting.

Note

IMPORT PRIORITY

The scenario that saw the most degradation was 100% writes, 0% reads and random I/O. This scenario saw a degradation of 50%. When this scenario was rerun with a medium import priority, the performance of I/O to the target volume during import resulted in only a 22.4% degradation.

9. Conclusion

With this solution, data can be imported from an existing remote storage device onto an ETERNUS AB/HB series volume with minimal downtime. This helps streamline the process for equipment upgrades and/or provides data migration capabilities to move data from remote storage devices to ETERNUS AB/HB series systems.

FUJITSU Storage
ETERNUS AB series All-Flash Arrays,
ETERNUS HB series Hybrid Arrays
SANtricity Remote Storage Volumes Solution Deployment

P3AG-6182-01ENZ0

Date of issuance: July 2021
Issuance responsibility: FUJITSU LIMITED

- The content of this manual is subject to change without notice.
- This manual was prepared with the utmost attention to detail.
However, Fujitsu shall assume no responsibility for any operational problems as the result of errors, omissions, or the use of information in this manual.
- Fujitsu assumes no liability for damages to third party copyrights or other rights arising from the use of any information in this manual.
- The content of this manual may not be reproduced or distributed in part or in its entirety without prior permission from Fujitsu.

FUJITSU