



NetApp XCP Data Migration

NetApp Solutions

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NetApp XCP Data Migration

Best-Practice Guidelines for NetApp XCP

TR-4863: Best-Practice Guidelines for NetApp XCP - Data Mover, File Migration, and Analytics

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This document provides NetApp XCP best-practice guidelines and a test scenario-based solution. These best practices cover the migration workflow for on-premises as well as cloud, file-system analytics, troubleshooting, and performance tuning of XCP. The test-scenario section covers customer use cases and their requirements, the NetApp solution using XCP, and benefits to the customer.

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NetApp XCP

[Previous: Introduction.](#)

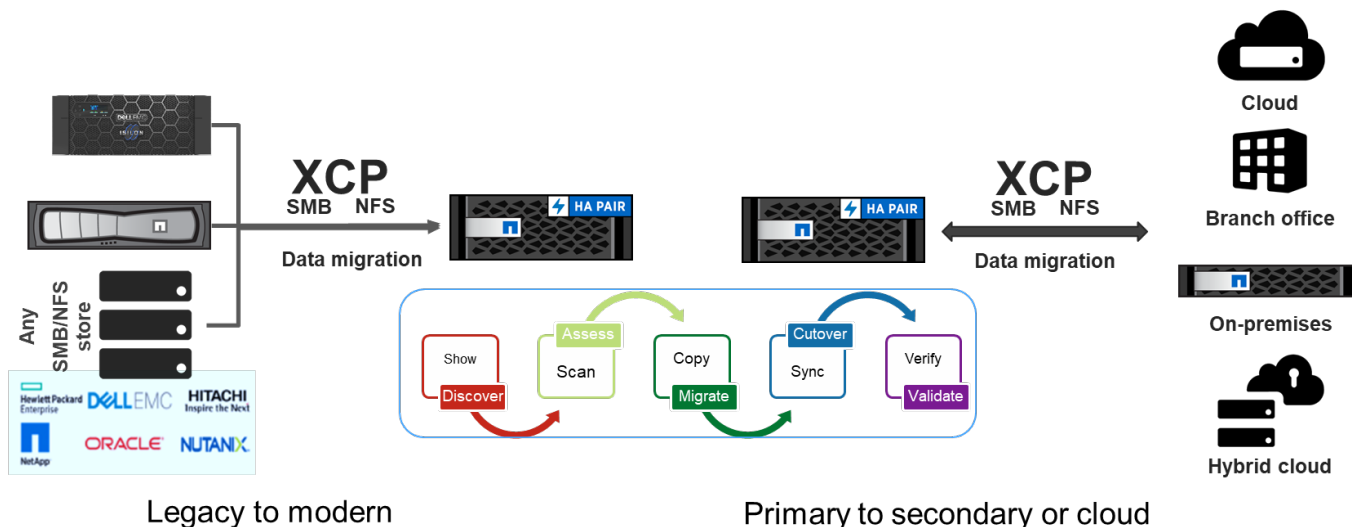
NetApp XCP transfers data by using multithreads and customizable features. It is designed for three major use cases: data move or migration, file-system analytics, and fast directory tree deletion.

Data move or migration

NetApp XCP transfers data from any NAS to NetApp NAS. This process consists of four major operations: scan, copy, sync, and verify. There are some additional features that help the data monitoring and transfer:

- **Scan.** Provides a high-level layout of NAS data.
- **Copy.** Performs a baseline data transfer.
- **Sync.** Performs the incremental data transfer.
- **Verify.** Performs a thorough verification of the target.
- **Show (optional).** Discovers NAS shares.

The following figure illustrates XCP data migration and replication operations.



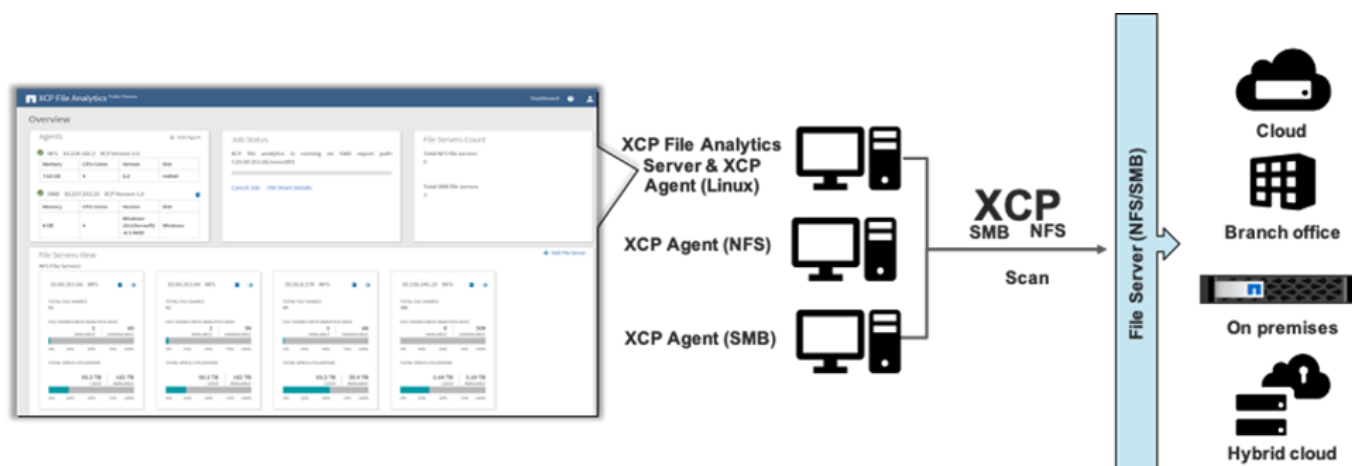
File-system analytics

NetApp XCP natively enables you to identify, scrutinize, and analyze unstructured data to improve insights—a key requirement for enterprise customers who want to use those insights for better planning, to operationalize high-value digital assets, and for data governance through reporting and assessment.

Customers that deal with sensitive data can use NetApp XCP to answer typical operational questions, such as the following:

- Where is my data?
- How much data and what types of files do we have?
- What data is actively used and how much is dormant?

The following figure illustrates the NetApp XCP file analytics communication from the GUI.



Delete

It can be very challenging for storage teams and Electronic Design Automation (EDA) workloads to clean up large directories, whether it's stale data or test data that needs to be cleaned to recover storage space. XCP provides a fast delete functionality that can delete a complete directory tree. The NetApp XCP Delete function removes files and folders from a given NAS path. You can leverage the match filters to delete a specific set of files and folders. For a large number of files and folders, you can use the Force option, which does not require

a confirmation to delete.

Live Source Migration support

Live Source Migration support included in XCP 1.7 allows migration from a data source that is in active use (read and write activity). XCP leaves out files that are being used during the migration job, such as copy and sync running, and skipped files information is captured in the xcp log.

This feature supports changes on the source but does not support changes on the destination. During migration, the destination should not be active. Live Source Migration support is only available for NFS migrations.



No special settings are required for Live Source Migrations.

Prerequisites for XCP

Before you deploy NetApp XCP, the following prerequisites must be met:

1. Verify the NFS ports used by the NFS server by running the following command:

```
rpcinfo -p < NAS IP or on-prem nfs data LIF ip >
```

2. To access the location where you execute the XCP operations, such as on-premises or cloud instances (for example, Azure, AWS, or Google virtual machine [VM] instances), open the firewall ports for the NFS ports.
3. Verify that the NFS port is accessible from the XCP server by using the telnet command `<on-prem nfs data LIF ip or NAS IP > 2049`. The default port is 2049. If your environment has a different port, use that IP.
4. For NFS, verify that the shares are accessible from the XCP server by using the `showmount -e < NAS IP >` command.
5. Increase the number of inodes on the destination volume to more than the file count (number of files) on the source files.
6. Download the XCP license from the [NetApp XCP License Portal](#).
 - a. You must have a NetApp account in mysupport.netapp.com or you can register for free.
 - b. Download the license and have it ready.
7. Create one NFS share on-premises, for each Azure NetApp volume, or for the Cloud Volume Service (premium service level) in cloud for the XCP catalog.
8. Create an NAS volume and configure the share for the data destination.
9. For multiple XCP instances, you must have one or more servers or cloud instances to transfer the data from multiple source folders or files to the destination.
10. The maxdir size (default is 308MB) defines the maximum file count (approximately one million) in a single folder. Increase the maxdir size value to increase the file count. Increasing the value has an effect on additional CPU cycles.
11. In the cloud, NetApp recommends that you have ExpressRoute (Azure), Direct Connect (AWS), or Cloud Interconnect (GCP) between on-premises and cloud.

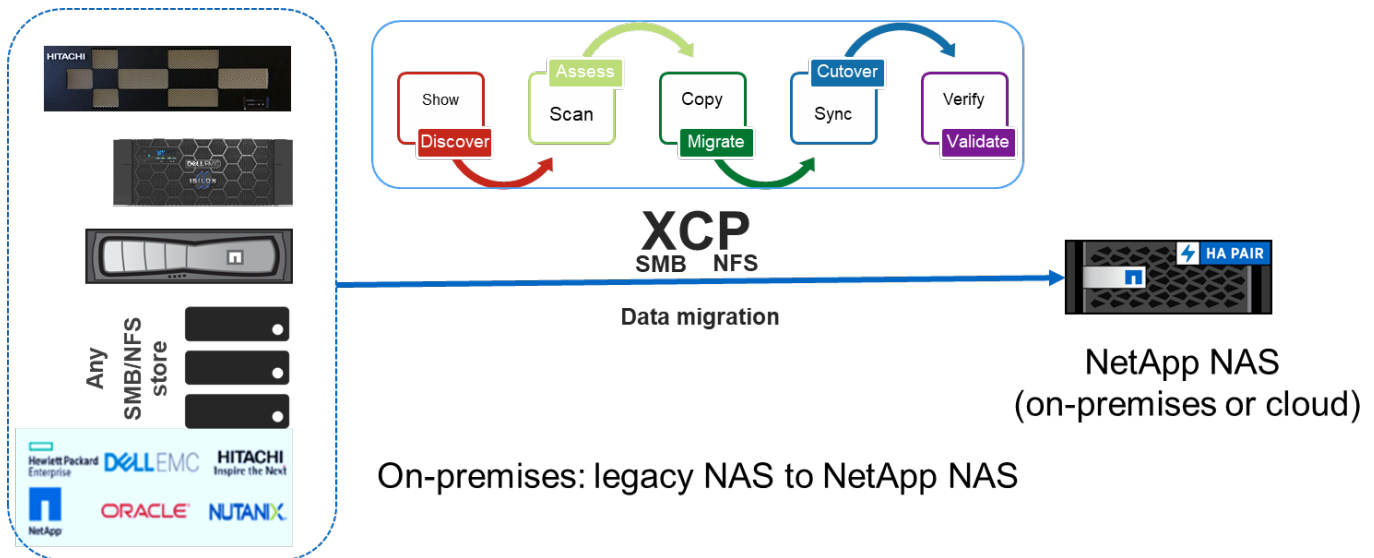
[Next: Migration workflow.](#)

Migration workflow

Previous: [NetApp XCP](#).

Migration has different phases to follow for better planning and completion of the migration. To migrate data from third-party NAS storage or directly attached NAS exported storage using NetApp XCP, follow the migration guidelines provided in this section.

The following figure illustrates the migration workflow from any NAS to NetApp NAS.



On-premises: legacy NAS to NetApp NAS

On-premises

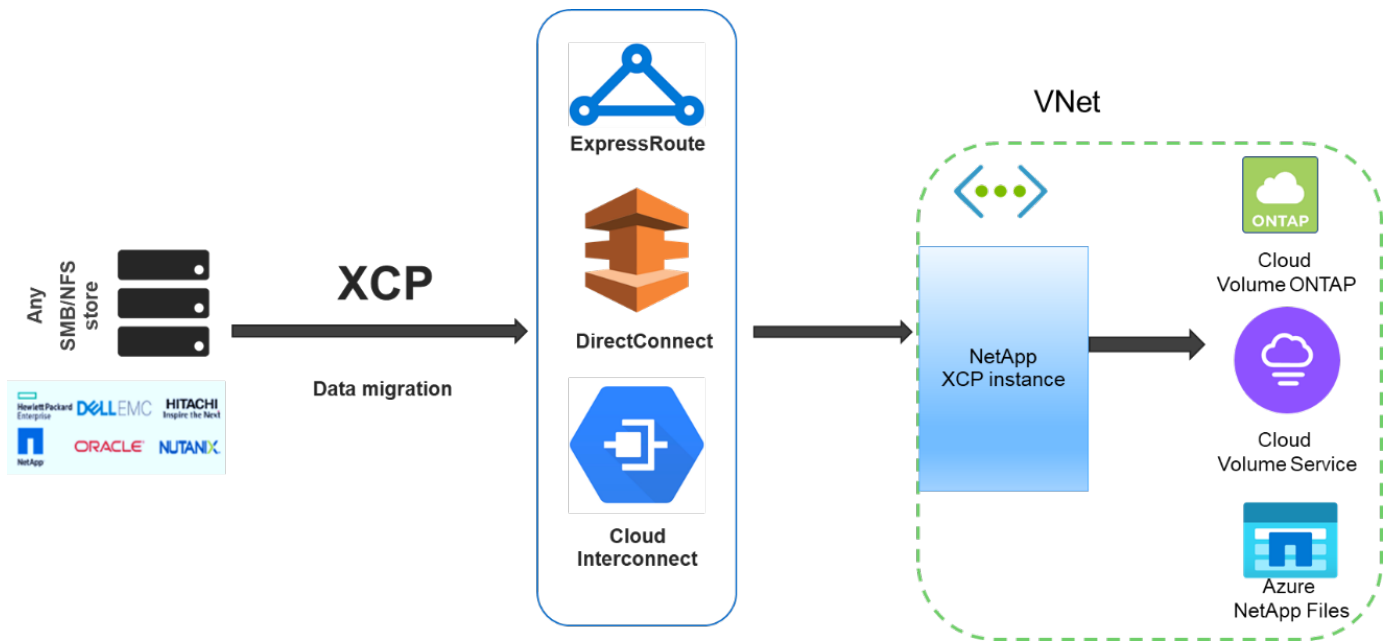
The migration workflow from any NAS to NetApp NAS includes the following steps:

1. Discover the NAS shares and data.
2. Scan the data and produce a report to find the layout of the data.
3. Create a baseline by running the XCP Copy command. For faster migrations, select more XCP instances and split the workload at the subfolder level to initiate parallel migration jobs.
4. For incremental updates, use XCP sync until the change rate is low for the cutover window.
5. Mark the source as read-only to perform a final sync by running the XCP sync command to complete the migration.
6. To verify that the data transferred correctly, compare the source and destination by running the `xcp verify` command.

Cloud

For the cloud, you can follow a similar on-premises migration workflow, if the connectivity between on-premises and the cloud is direct connect (AWS), ExpressRoute (Azure), or cloud interconnect (GCP).

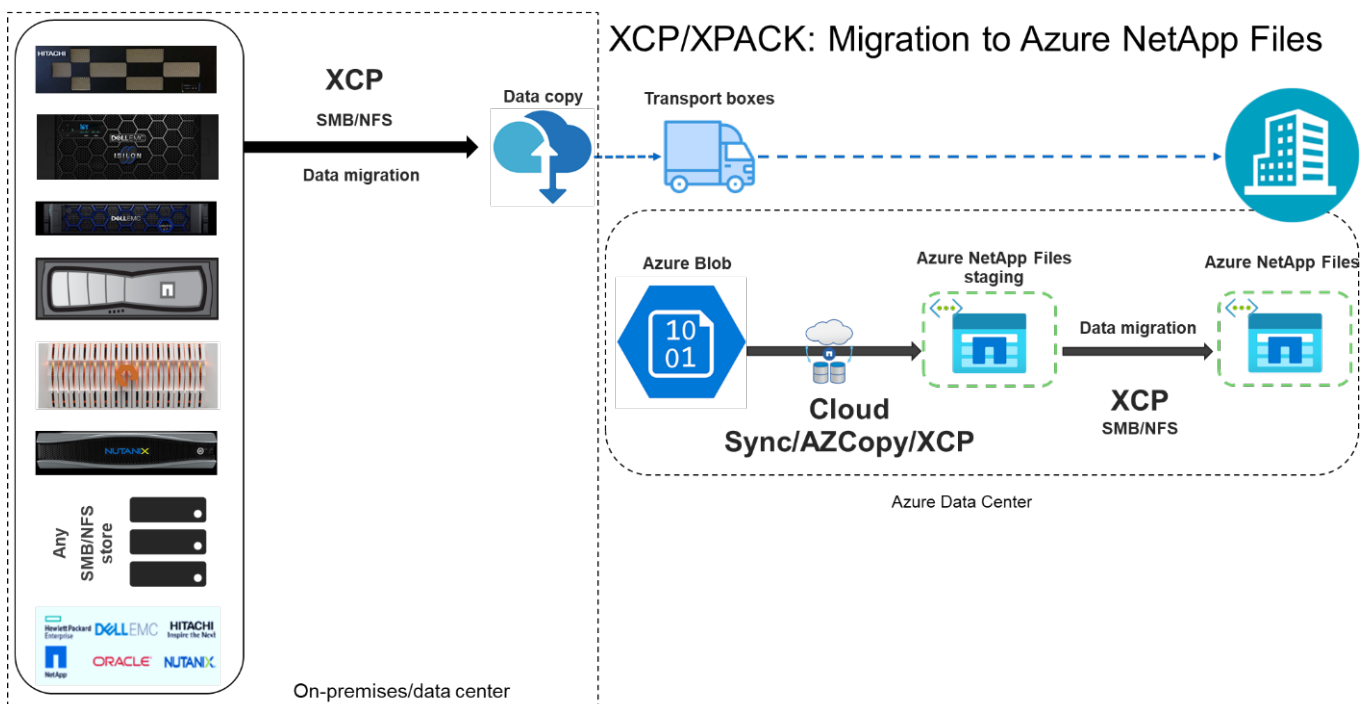
The following figure illustrates the migration workflow from on-premises to the cloud.



Data migration from any storage to cloud

If there is no direct internet connection between on-premises and the cloud, you must transfer the data from on-premises to the cloud through an offline data transport method such as truck. Each cloud service provider has a different method with different terminology to move data to their data center.

The following figure depicts the data mover solution for on-premises to Azure without ExpressRoute.



You can use a similar architecture with the respective components from the various cloud service providers.

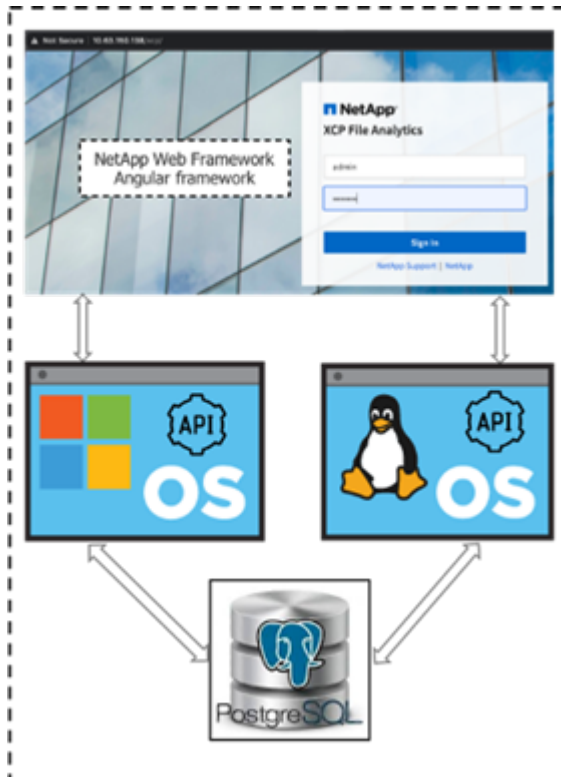
Next: File analytics.

File analytics

Previous: [Migration workflow](#).

The NetApp XCP file analytics GUI helps to run file system scans by using XCP at the back end and visualizing statistics such as graphs and views for any NAS (NFS, SMB) file system. Starting in 1.6, XCP can be run as a service with the help of simple deployment steps by using the Configure and systemctl options. The XCP Configure option guides you to install and configure Postgres and a web server as well as collect credentials. The systemctl option runs XCP as a service for REST API communications from the GUI.

The following figure illustrates the XCP file analytics flow.



For more information about the high-level architecture of XCP file analytics, GUI-based dashboard views such as stats view, and file distribution view details, see the [NetApp XCP 1.6 Delivers Open File Analytics and Infrastructure Improvements](#) blog.

In XCP 1.6, there is a limited GUI for customized graphs. To create the required graphs, you can leverage the CLI by running the `xcp scan` command with matching filters. See the following examples.

1. Generate a list of files modified beyond a year by using `xcp scan` and the `-match` filter with the space consumed.


```

[root@ch-vm-cent7-2 linux]# ./xcp scan -match "modified > 1*year" -l -q
192.168.89.110:/ifs/data_for_analysis > modified_morethan_year
XCP 1.6P1; (c) 2020 NetApp, Inc.; Licensed to Karthikeyan Nagalingam
[NetApp Inc] until Wed Sep  9 13:19:35 2020

xcp: WARNING: CPU count is only 1!

Filtered: 1 did not match

Xcp command : xcp scan -match modified > 1*year -l -q
192.168.89.110:/ifs/data_for_analysis
5,055 scanned, 5,054 matched, 0 error
Speed          : 1.10 MiB in (510 KiB/s), 110 KiB out (49.5 KiB/s)
Total Time    : 2s.
STATUS        : PASSED
[root@ch-vm-cent7-2 linux]#
[root@ch-vm-cent7-2 linux]# cat modified_morethan_year
rwxr-xr-x --- 7056 503          0      512  7y99d
data_for_analysis/benchmarks/benchmarks/udf_TOBAGandTOTUPLE_7_benchmark.
out/6/_SUCCESS
rwxr-xr-x --- 7056 503        270 8.50KiB  7y99d
data_for_analysis/benchmarks/benchmarks/udf_TOBAGandTOTUPLE_7_benchmark.
out/6/part-r-00000
rw-r--r-- --- 7056 503          0      512  7y58d
data_for_analysis/benchmarks/benchmarks/udf_TOBAGandTOTUPLE_7_benchmark.
out/6/SUCCESS.crc
rw-r--r-- --- 7056 503        270 8.50KiB  7y99d
data_for_analysis/benchmarks/benchmarks/udf_TOBAGandTOTUPLE_7_benchmark.
out/6/out_original
rw-r--r-- --- 7056 503        270 8.50KiB  7y99d
data_for_analysis/benchmarks/benchmarks/udf_TOBAGandTOTUPLE_7_benchmark.
out/6/out_sorted
rwxr-xr-x --- 7056 503          0      512  7y99d
data_for_analysis/benchmarks/benchmarks/udf_TOBAGandTOTUPLE_7_benchmark.
out/2/_SUCCESS
rwxr-xr-x --- 7056 503         90 8.50KiB  7y99d
data_for_analysis/benchmarks/benchmarks/udf_TOBAGandTOTUPLE_7_benchmark.
out/2/part-r-00000
...
< console output removed due o page space size >
...

```

2. Find the space used by files that are more than one year old.

```

[root@ch-vm-cent7-2 linux]# ./xcp -du -match "modified > 1*year"

```

```

192.168.89.110:/ifs/data_for_analysis/
XCP 1.6.1; (c) 2020 NetApp, Inc.; Licensed to Karthikeyan Nagalingam
[NetApp Inc] until Wed Sep  9 13:19:35 2020
xcp: WARNING: CPU count is only 1!
52.5KiB
data_for_analysis/benchmarks/benchmarks/Macro_Scope_1_benchmark.out
28.5KiB
data_for_analysis/benchmarks/benchmarks/CollectedGroup_6_benchmark.out
28.5KiB data_for_analysis/benchmarks/benchmarks/Foreach_11_benchmark.out
153KiB
data_for_analysis/benchmarks/benchmarks/SecondarySort_9_benchmark.out
412KiB
data_for_analysis/benchmarks/benchmarks/CoGroupFlatten_6_benchmark.out
652KiB data_for_analysis/benchmarks/benchmarks/Iterator_1_benchmark.out
652KiB
data_for_analysis/benchmarks/benchmarks/LoaderDefaultDir_1_benchmark.out
652KiB data_for_analysis/benchmarks/benchmarks/Order_4_benchmark.out
28.5KiB
data_for_analysis/benchmarks/benchmarks/MapPartialAgg_4_benchmark.out/2
28.5KiB
data_for_analysis/benchmarks/benchmarks/CastScalar_11_benchmark.out/2
1.29MiB data_for_analysis/benchmarks/benchmarks/Order_18_benchmark.out
652KiB
data_for_analysis/benchmarks/benchmarks/FilterBoolean_5_benchmark.out
20.5KiB
data_for_analysis/benchmarks/benchmarks/Macro_DefinitionAndInline_5_benchmark.out/2
628KiB data_for_analysis/benchmarks/benchmarks/Types_29_benchmark.out
...
< console output removed due o page space size >
...
3.18MiB data_for_analysis/benchmarks/benchmarks/hadoop10
340KiB data_for_analysis/benchmarks/benchmarks/Split_5_benchmark.out
5.90GiB data_for_analysis/benchmarks/benchmarks
6.56GiB data_for_analysis/benchmarks
6.56GiB data_for_analysis

Filtered: 488 did not match

Xcp command : xcp -du -match modified > 1*year
192.168.89.110:/ifs/data_for_analysis/
Stats          : 5,055 scanned, 4,567 matched
Speed          : 1.10 MiB in (1.36 MiB/s), 110 KiB out (135 KiB/s)
Total Time     : 0s.
STATUS         : PASSED
[root@ch-vm-cent7-2 linux]#

```

3. Find the total size and graphical view of data that was modified more than one year ago.

```
[root@ch-vm-cent7-2 linux]# ./xcp -stats -match "modified > 1*year"
-html 192.168.89.110:/ifs/data_for_analysis/ >
modified_morethan_year_stats.html
XCP 1.6.1; (c) 2020 NetApp, Inc.; Licensed to Karthikeyan Nagalingam
[NetApp Inc] until Wed Sep 9 13:19:35 2020

xcp: WARNING: CPU count is only 1!

Xcp command : xcp -stats -match modified > 1*year -html
192.168.89.110:/ifs/data_for_analysis/
Stats       : 5,055 scanned, 4,567 matched
Speed       : 1.10 MiB in (919 KiB/s), 110 KiB out (89.1 KiB/s)
Total Time  : 1s.
STATUS      : PASSED
[root@ch-vm-cent7-2 linux]#
```

The following report is a custom example scan of files that were modified more than one year ago.

Command **scan** 192.168.89.110:/ifs/data_for_analysis

Options '-stats': True, '-match': 'modified > 1*year'

Unreadable directories None Unreadable files None

Filters: Unmatched None

Summary 5,055 scanned, 4,567 matched, 1.10 MiB in (924 KiB/s), 110 KiB out (89.7 KiB/s), 1s.

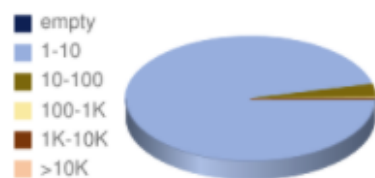
	Count	Used	Avg	Max
All File Types	4,567	6.56 GiB	Name Length	14
Regular Files	3,894	6.56 GiB	File Size	1.72 MiB
Directories	673	2.75 MiB	Directory Entries	7
Symlinks	None	0	File Depth	3
Specials	None	0		6

7056 4,567
Top 5 File Owners

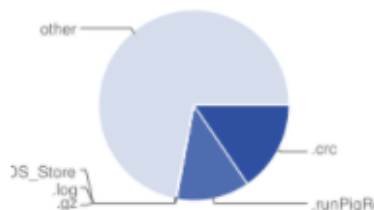


7056 6.56 GiB
Top 5 Space Users

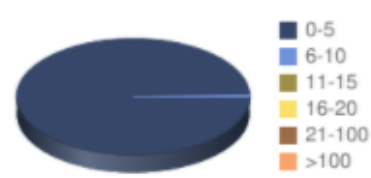
N/A Dedupe Estimate N/A Zero Blocks 0 Hard Links 6 Extensions 1 Groups 1 Users



Directory Entries



Extension Types



File Depth



03-Aug-2020 03:46 PM EDT

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xcp 1.6.1

Next: [Deployment steps](#).

Deployment steps

[Previous: File analytics.](#)

Test bed details

The following table provides the details of the test bed that was used for this deployment and performance validation.

Solution components	Details
XCP version 1.7	<ul style="list-style-type: none">• One Linux server - Linux (RHEL 7.9 or RHEL 8)• One Windows server – Windows Server 2019 standard
NetApp AFF storage array HA pair for the source volume	<ul style="list-style-type: none">• AFF8080• NetApp ONTAP 9• NFS protocol
NetApp AFF storage array HA pair for destination volume	<ul style="list-style-type: none">• AFF A800• ONTAP 9• NFS protocol
Fujitsu PRIMERGY RX2540 server	Each equipped with: <ul style="list-style-type: none">* 48 CPUs* Intel Xeon* 256GB physical memory* 10GbE dual port
Networking	10GbE

Steps for deployment

To deploy NetApp XCP for data transfer, first install and activate the XCP software on the destination location. You can review the details in the [NetApp XCP User Guide](#). To do so, complete the following steps:

1. Meet the prerequisites as detailed in the section (xref) “Prerequisites for XCP.”
2. Download the XCP software from the [NetApp XCP \(Downloads\) page](#).
3. Copy the downloaded XCP tar files to the XCP server.

```
# scp Documents/OneDrive\ -\ NetApp\  
Inc/XCP/software/1.6.1/NETAPP_XCP_1.6.1.tgz
```

4. Untar the tarfile.

```
[root@mastr-53 src]# tar -zxvf NETAPP_XCP_1.6.1.tgz
```

5. Download the license from <https://xcp.netapp.com/license/xcp.xwic> and copy to the XCP server.
6. Activate the license.

```
[root@mastr-53 linux]# ./xcp activate
[root@mastr-53 src]# cp license /opt/NetApp/xFiles/xcp/license
[root@mastr-53 src]# cd /usr/src/xcp/linux/
[root@mastr-53 linux]# ./xcp activate
```

7. Find the source NFS port and destination NFS server. The default port is 2049.

```
[root@mastr-53 ~]# rpcinfo -p 10.63.150.213
[root@mastr-53 ~]# rpcinfo -p 10.63.150.63
```

8. Check the NFS connection. Check the NFS server (for both source and destination) by using telnet to the NFS server port.

```
[root@mastr-53 ~]# telnet 10.63.150.127 2049
[root@mastr-53 ~]# telnet 10.63.150.63 2049
```

9. Configure the catalog.

- a. Create an NFS volume and export NFS for the XCP catalog. You can also leverage the operating system NFS export for XCP catalog.

```
A800-Node1-2::> volume create -vserver Hadoop_SVM -volume xcpcatalog
-aggregate aggr_Hadoop_1 -size 50GB -state online -junction-path
/xcpcatalog -policy default -unix-permissions ---rwxr-xr-x -type RW
-snapshot-policy default -foreground true
A800-Node1-2::> volume mount -vserver Hadoop_SVM -volume
xcpcatalog_vol -junction-path /xcpcatalog
```

- b. Check the NFS export.

```
[root@mastr-53 ~]# showmount -e 10.63.150.63 | grep xcpca
/xcpcatalog (everyone)
```

- c. Update xcp.ini.

```
[root@mastr-53 ~]# cat /opt/NetApp/xFiles/xcp/xcp.ini
# Sample xcp config
[xcp]
catalog = 10.63.150.64:/xcpcatalog

[root@mastr-53 ~]#
```

10. Find the source NAS exports by using `xcp show`. Look for:

```
== NFS Exports ==
== Attributes of NFS Exports ==
```

```
[root@mastr-53 linux]# ./xcp show 10.63.150.127
== NFS Exports ==
<check here>
== Attributes of NFS Exports ==
<check here>
```

11. (Optional) Scan the source NAS data.

```
[root@mastr-53 linux]# ./xcp scan -newid xcpscantest4 -stats
10.63.150.127:/xcpsrc_vol
```

Scanning the source NAS data helps you understand the data layout and find any potential issues for migration. The XCP scanning operation time is proportional to the number of files and the directory depth. You can skip this step if you are familiar with your NAS data.

12. Check the report created by `xcp scan`. Search mainly for unreadable folders and unreadable files.

```
[root@mastr-53 linux]# mount 10.63.150.64:/xcpcatalog /xcpcatalog
base) nkarthik-mac-0:~ karthikeyannagalingam$ scp -r
root@10.63.150.53:/xcpcatalog/catalog/indexes/xcpscantest4
Documents/OneDrive\ -\ NetApp\ Inc\XCP\customers\reports/
```

13. (Optional) Change the inode. View the number of inodes and modify the number based on the number of files to migrate or copy for both catalog and destination volumes (if required).

```
A800-Node1-2::> volume show -volume xcpcatalog -fields files,files-used
A800-Node1-2::> volume show -volume xcpdest -fields files,files-used
A800-Node1-2::> volume modify -volume xcpcatalog -vserver A800-Node1_vs1
-files 2000000
Volume modify successful on volume xcpcatalog of Vserver A800-Node1_vs1.
A800-Node1-2::> volume show -volume xcpcatalog -fields files,files-used
```

14. Scan the destination volume.

```
[root@mastr-53 linux]# ./xcp scan -stats 10.63.150.63:/xcpdest
```

15. Check the source and destination volume space.

```
[root@mastr-53 ~]# df -h /xcpsrc_vol
[root@mastr-53 ~]# df -h /xcpdest/
```

16. Copy the data from source to destination by using `xcp copy` and check the summary.

```
[root@mastr-53 linux]# ./xcp copy -newid create_Sep091599198212
10.63.150.127:/xcpsrc_vol 10.63.150.63:/xcpdest
<command inprogress results removed>
Xcp command : xcp copy -newid create_Sep091599198212 -parallel 23
10.63.150.127:/xcpsrc_vol 10.63.150.63:/xcpdest
Stats          : 9.07M scanned, 9.07M copied, 118 linked, 9.07M indexed,
173 giants
Speed          : 1.57 TiB in (412 MiB/s), 1.50 TiB out (392 MiB/s)
Total Time    : 1h6m.
STATUS        : PASSED
[root@mastr-53 linux]#
```



By default, XCP creates seven parallel processes to copy the data. This can be tuned.



NetApp recommends that the source volume be read only. In real time, the source volume is a live, active file system. The `xcp copy` operation might fail because NetApp XCP does not support a live source that is continuously changed by an application.

For Linux, XCP requires an Index ID because XCP Linux performs cataloging.

17. (Optional) Check the inodes on the destination NetApp volume.


```
A800-Node1-2::> volume show -volume xcpdest -fields files,files-used
vserver          volume  files    files-used
-----
A800-Node1_vs1 xcpdest 21251126 15039685

A800-Node1-2::>
```

18. Perform the incremental update by using `xcp sync`.

```
[root@mastr-53 linux]# ./xcp sync -id create_Sep091599198212
Xcp command : xcp sync -id create_Sep091599198212
Stats       : 9.07M reviewed, 9.07M checked at source, no changes, 9.07M
reindexed
Speed       : 1.73 GiB in (8.40 MiB/s), 1.98 GiB out (9.59 MiB/s)
Total Time  : 3m31s.
STATUS      : PASSED
```

For this document, to simulate real-time, the one million files in the source data were renamed, and then the updated files were copied to the destination by using `xcp sync`. For Windows, XCP needs both source and destination paths.

19. Validate data transfer. You can validate that the source and destination have the same data by using `xcp verify`.

```
Xcp command : xcp verify 10.63.150.127:/xcpsrc_vol 10.63.150.63:/xcpdest
Stats       : 9.07M scanned, 9.07M indexed, 173 giants, 100% found
(6.01M have data), 6.01M compared, 100% verified (data, attrs, mods)
Speed       : 3.13 TiB in (509 MiB/s), 11.1 GiB out (1.76 MiB/s)
Total Time  : 1h47m.
STATUS      : PASSED
```

XCP documentation provides multiple options (with examples) for the `scan`, `copy`, `sync`, and `verify` operations. For more information, see the [NetApp XCP User Guide](#).



Windows customers should copy the data by using access control lists (ACLs). NetApp recommends using the command `xcp copy -acl -fallbackuser\<username> -fallbackgroup\<username or groupname> <source> <destination>`. To maximum performance, considering the source volume that has SMB data with ACL and the data accessible by both NFS and SMB, the target must be an NTFS volume. Using XCP (NFS version), copy the data from the Linux server and execute the XCP (SMB version) sync with the `-acl` and `-nodata` options from the Windows server to copy the ACLs from source data to the target SMB data.

For detailed steps, see [Configuring 'Manage Auditing and Security Log' Policy](#).

[Next: Sizing guidelines.](#)

Sizing guidelines

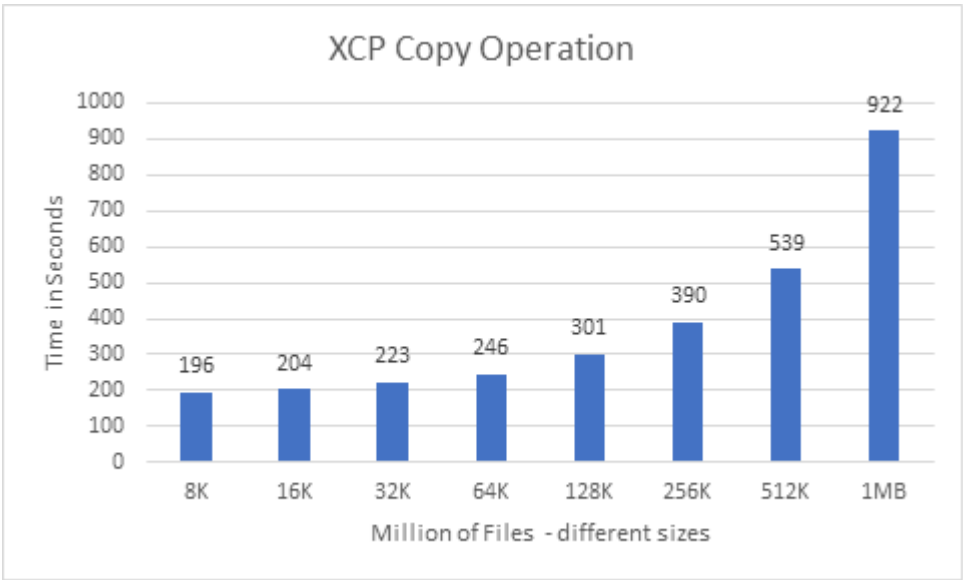
[Previous: Deployment steps.](#)

This section provides the approximate time to perform the XCP copy and XCP sync operations with a different file size of one million files for NFS.

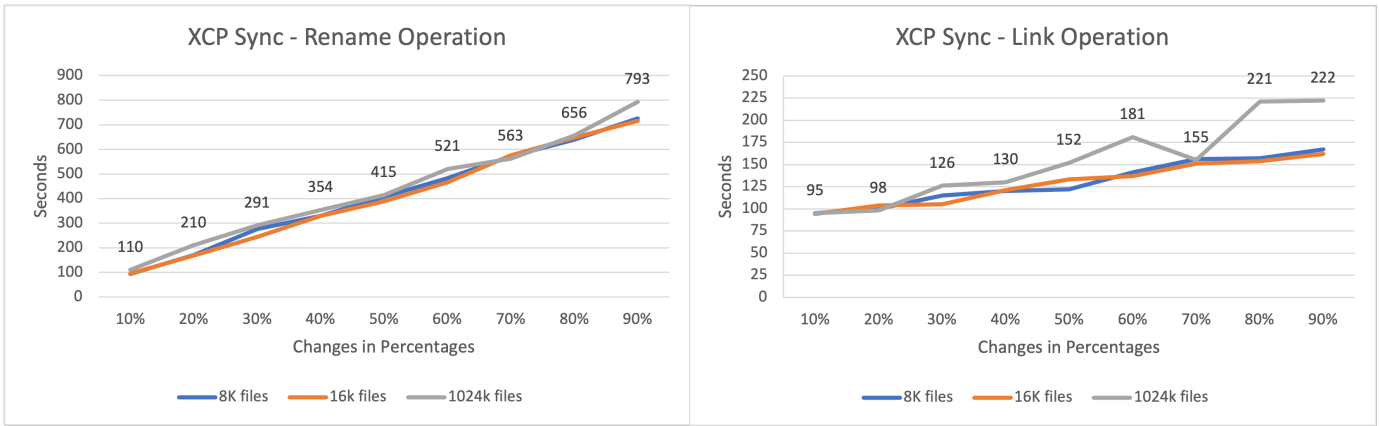
Time estimate based on testing

The tests for the XCP copy and sync operations used the same test bed that was used for deployment. One million files of three sets of 8K, 16K, and 1MB files were created and the changes were performed in real time. The XCP sync function performed the differential incremental updates from the source to the target at the file level. The incremental update operation is one or more of these four operations: rename existing files and folders, append data to existing files, delete files and folders, and include additional hard, soft, and multilinks. For test purposes, we focused on the rename, append, delete, and links operations. In other words, the modification operations such as rename, append, and delete were performed at a change rate of 10% to 90% on one million files.

The following figure shows the results of the XCP copy operation.



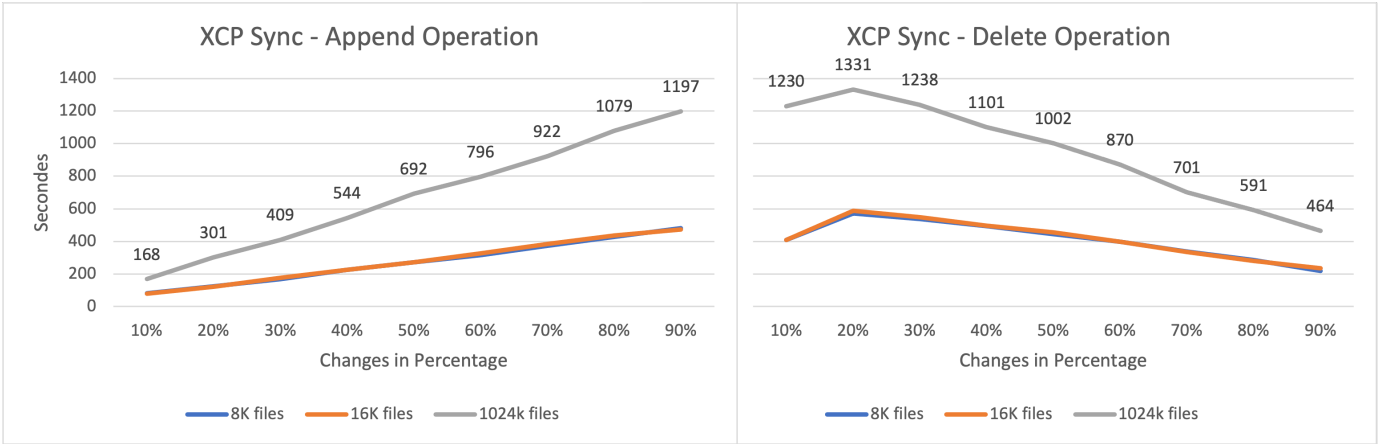
The following figure shows the results of the XCP Sync rename and link operations.



The file size is not propositional to the `xcp sync` completion time for transferring the renamed source files; the graphs are linear.

The link types are soft links, hard links, and multi-links. Soft links are considered normal files. The size of the files is not relevant for the time to complete the XCP sync operation.

The following figures show the results of the XCP sync append and delete operations.

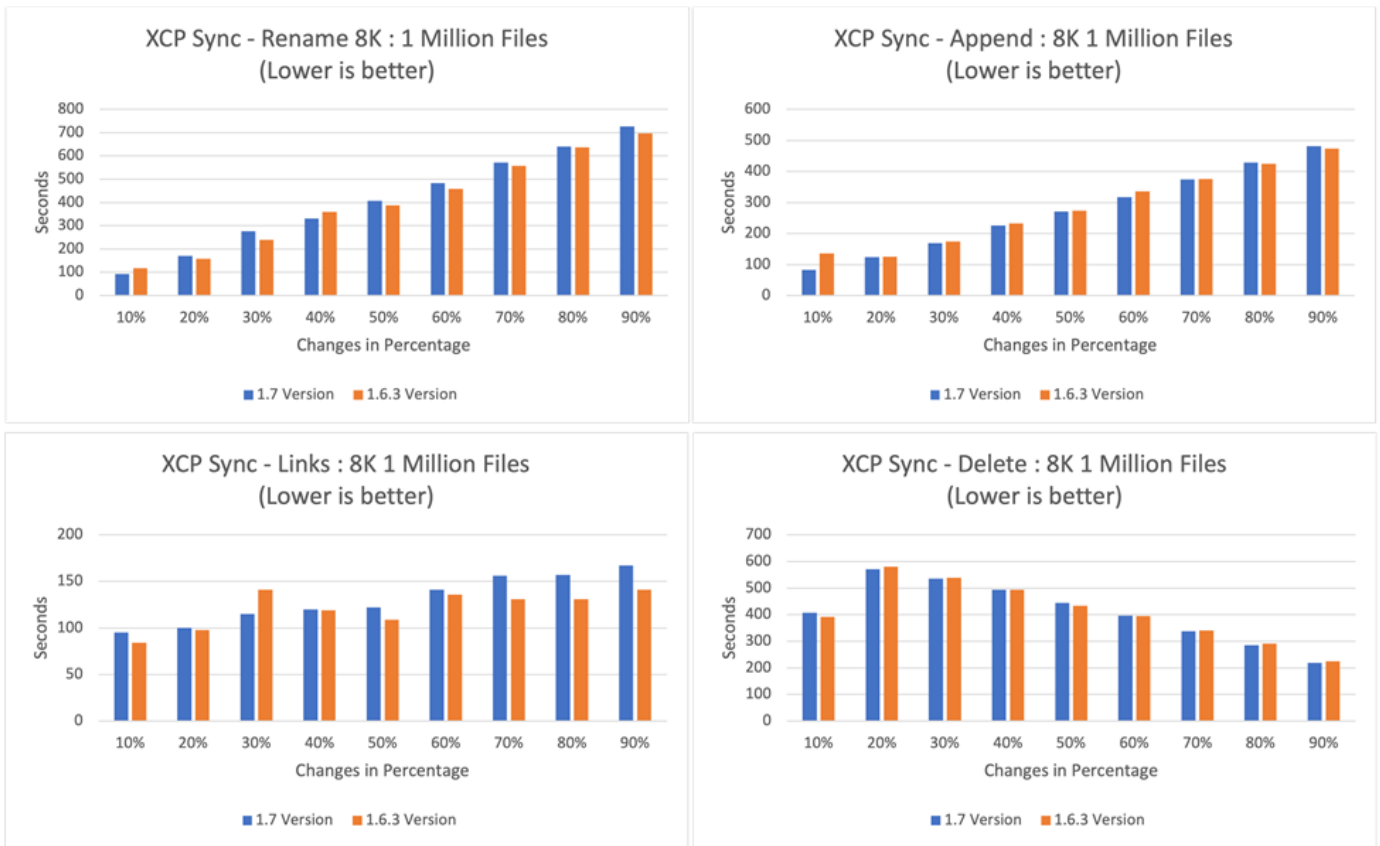


For the append and delete operations, large file sizes take more time compared to small file sizes. The time to complete the operation is linear to the percentage of append and delete changes.

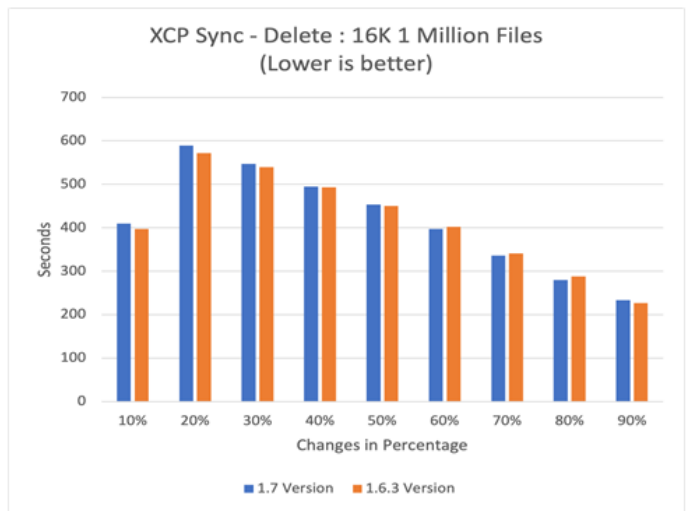
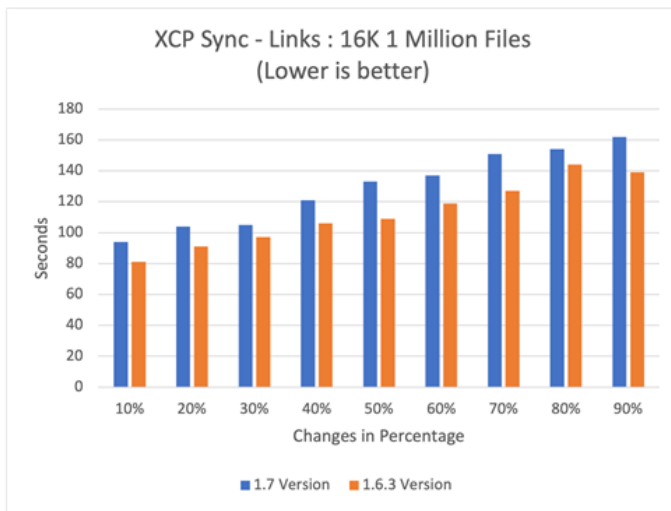
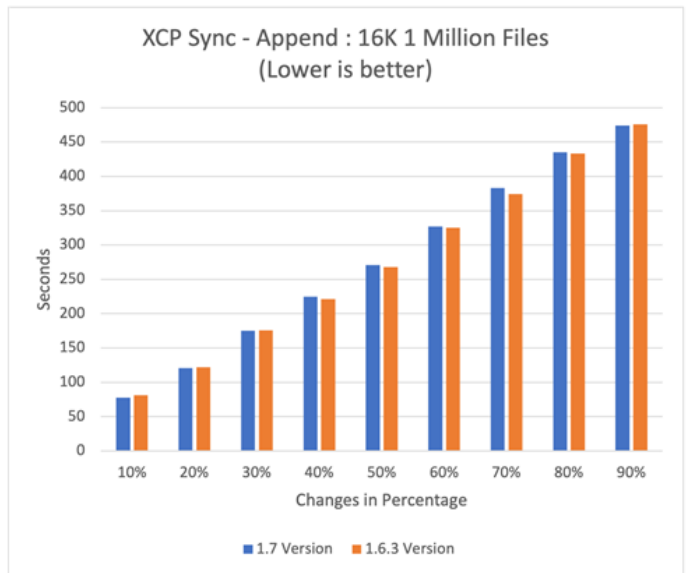
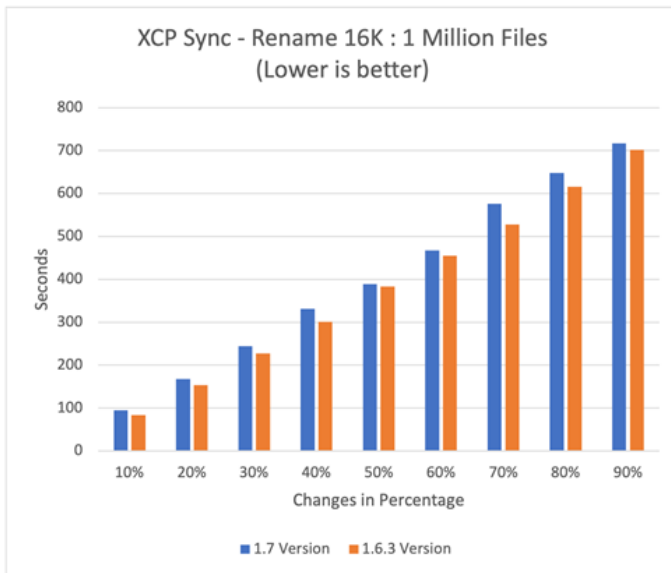
Comparing XCP 1.6.1 to XCP 1.5

Compared to previous versions, XCP 1.6.3 and 1.7 provides improved performance. The following section shows the sync performance comparison between XCP 1.6. 3 and a 1.7 for 8K, 16K, and 1MB size of one million files.

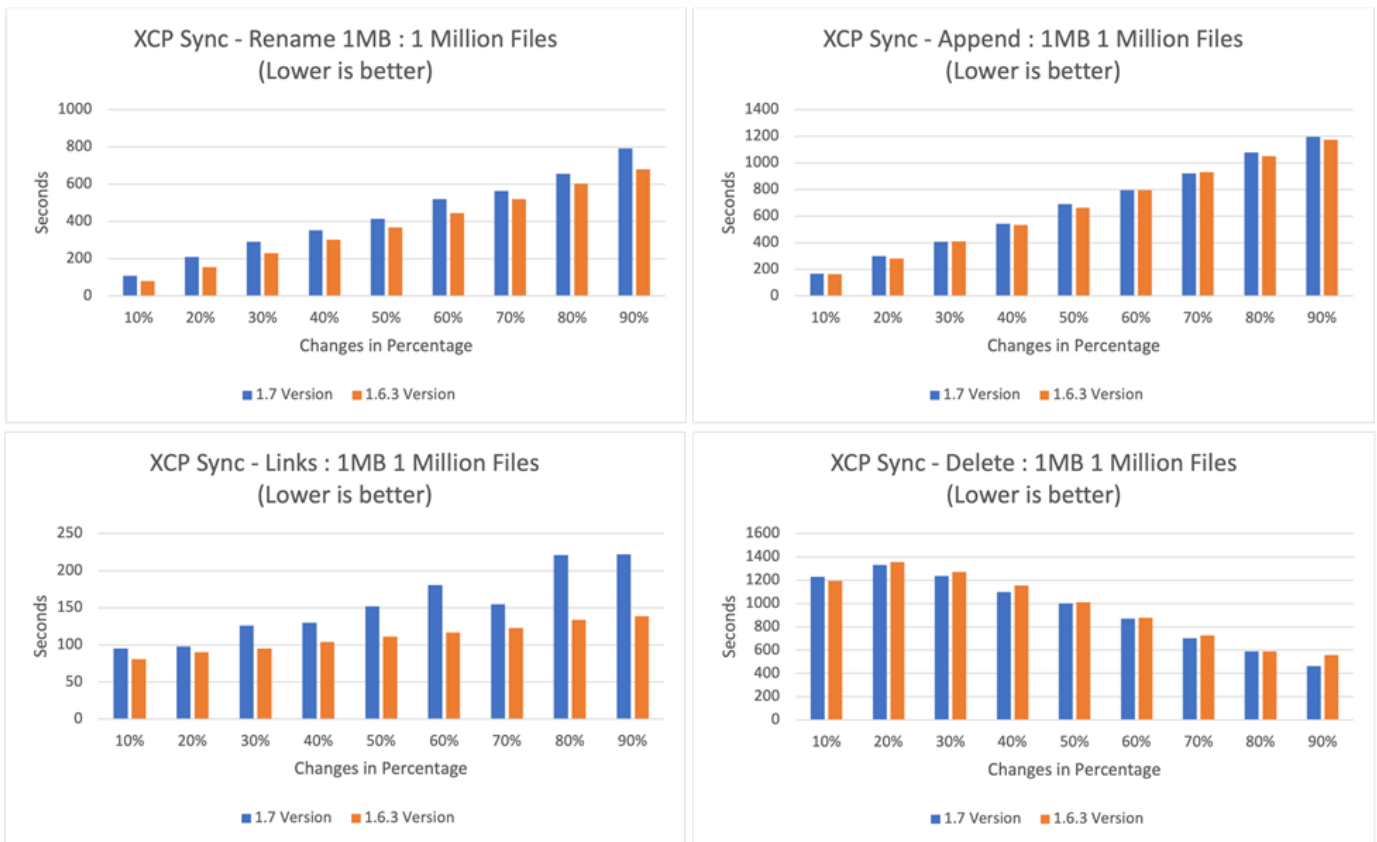
The following figures shows the results of the XCP sync performance for XCP 1.6.3 versus 1.7 (with a 8K size of one million files).



The following figure shows the results of the XCP sync performance for XCP 1.6.1 versus 1.5 (with a 16K size of one million files).



The followign figure shows the results of the XCP sync performance for XCP 1.6.1 versus 1.5 with a 1MB size of one million files.



On average, the XCP 1.7 performance improved on or was similar to XCP 1.6.3 for the `xcp sync` differential incremental update—rename, append, link, and delete operations with a 1MB size of one million files.

Based on this performance validation, NetApp recommends using XCP 1.7 for your data migration on-premises and in the cloud.

[Next: Performance tuning.](#)

Performance tuning

[Previous: Sizing guidelines.](#)

This section provides some of the tuning parameters that help to improve the performance of XCP operations:

- For better scaling and to distribute the workload across multiple XCP instances, split the subfolders for each XCP instance for the migration and data transfer.
- XCP can use maximum CPU resources—the more the CPU cores, the better the performance. Therefore, you should have more CPUs in the XCP server. We lab tested 128GB RAM and 48x core CPUs, which provided better performance than 8x CPUs and 8GB RAM.
- The XCP copy with the `-parallel` option is based on the number of CPUs. The default number of parallel threads (seven) is sufficient for most XCP data transfer and migration operations. For XCP Windows, by default, the number of parallel processes is equal to the number of CPUs.
- 10GbE is a good start for data transfer. However, we tested with 25GbE and 100GbE, which provided better data transfer and are recommended for large file-size data transfer.
- For Azure NetApp Files, the performance varies based on the service level. For more information, see the following table, which shows Azure NetApp Files service levels and performance details.

Service level	Standard	Premium	Ultra
Throughput	16MBps/terabyte (TB)	64MBps/TB	128MBps/TB
Workload types	General purpose file shares, email, and web	BM, databases, and applications	Latency-sensitive applications
Performance explained	Standard performance: 1,000 IOPS per TB (16K I/O) and 16MBps/TB	Premium performance – 4,000 IOPS per TB (16k I/O) and 64MBps/TB	Extreme performance: 8,000 IOPS per TB (16k I/O) and 128MBps/TB

You must choose the right service level based on the throughput and workload types. Most customers start with the Premium level and change the service level based on the workload.

[Next: Customer scenarios.](#)

Customer scenarios

Overview

[Previous: Performance tuning.](#)

This section describes customer scenarios and their architectures.

[Next: Data lake to ONTAP NFS.](#)

Data lake to ONTAP NFS

[Previous: Customer scenarios.](#)

This use case is based on the largest financial customer proof of concept (CPOC) that we have done. Historically, we used the NetApp In-Place Analytics Module (NIPAM) to move analytics data to NetApp ONTAP AI. However, because of recent enhancements and the improved performance of NetApp XCP as well as the unique NetApp data mover solution approach, we reran the data migration using NetApp XCP.

Customer challenges and requirements

Customer challenges and requirements that are worth noting include the following:

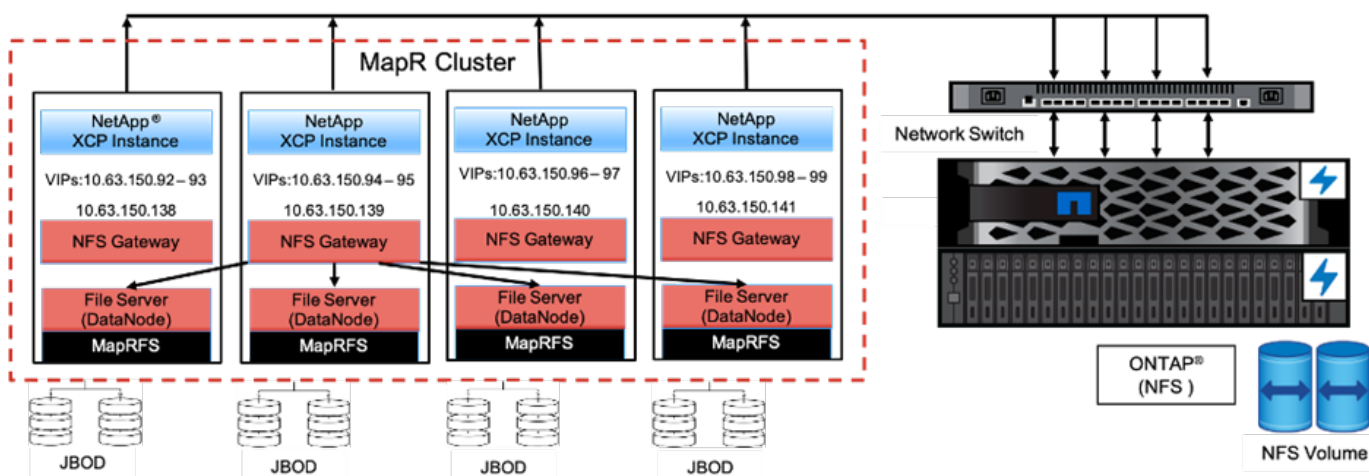
- Customers have different types of data, including structured, unstructured, and semistructured data, logs, and machine-to-machine data in data lakes. AI systems require all these types of data to process for prediction operations. When data is in a data lake-native file system, it is difficult to process.
- The customer's AI architecture is not able to access data from Hadoop Distributed File System (HDFS) and Hadoop Compatible File System (HCFS), so the data is not available to AI operations. AI requires data in an understandable file system format such as NFS.
- Some special processes are required to move data from the data lake because of the large amount of data and high-throughput, and a cost-effective method is required to move the data to the AI system.

Data mover solution

In this solution, the MapR File System (MapR-FS) is created from local disks in the MapR cluster. The MapR NFS Gateway is configured on each data node with virtual IPs. The file server service stores and manages the MapR-FS data. NFS Gateway makes Map-FS data accessible from the NFS client through the virtual IP. An XCP instance is running on each MapR data node to transfer the data from the Map NFS Gateway to NetApp

ONTAP NFS. Each XCP instance transfers a specific set of source folders to the destination location.

The following figure illustrates the NetApp data mover solution for MapR cluster using XCP.



For detailed customer use cases, recorded demos, and test results, see the [Using XCP to Move Data from a Data Lake and High-Performance Computing to ONTAP NFS](#) blog.

For detailed steps on moving MapR-FS data into ONTAP NFS by using NetApp XCP, see Appendix B in [TR-4732: Big Data Analytics Data to Artificial Intelligence](#).

[Next: High-performance computing to ONTAP NFS.](#)

High-performance computing to ONTAP NFS

[Previous: Data lake to ONTAP NFS.](#)

This use case is based on requests from field organizations. Some NetApp customers have their data in a high-performance computing environment, which provides data analytics for training models and enables research organizations to gain insight and understanding of large amount of digital data. NetApp field engineers need a detailed procedure to extract the data from IBM's GPFS to NFS. We used NetApp XCP to migrate the data from GPFS to NFS so that GPUs can process the data. AI typically processes data from a network file system.

For more information about the high-performance computing to ONTAP NFS use case, a recorded demo, and test results, see the [Using XCP to Move Data from a Data Lake and High-Performance Computing to ONTAP NFS](#) blog.

For detailed steps on moving MapR-FS data into ONTAP NFS by using NetApp XCP, see Appendix A: GPFS to NFS—Detailed Steps in [TR-4732: Big Data Analytics Data to Artificial Intelligence](#).

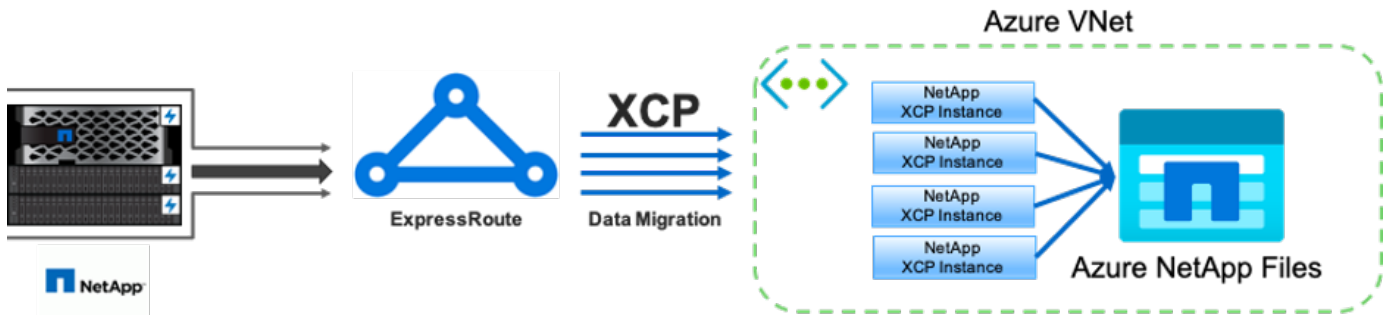
[Next: Using the XCP Data Mover to migrate millions of small files to flexible storage.](#)

Using the XCP Data Mover to migrate millions of small files to flexible storage

[Previous: High-performance computing to ONTAP NFS.](#)

This use case is based on the largest NetApp tourism industry customer for on-premises-to-cloud data migration. Because COVID-19 has reduced demand in the travel industry, customers want to save capital expenses on high-end storage in their on-premises environment for the demand pricing application. This customer has a tight SLA to migrate millions of small files to the cloud.

The following figure depicts data migration from on-premises to Azure NetApp Files for small files.



For more information, see the [NetApp XCP Data Mover Solution: On Premises to Cloud](#) blog.

Next: [Using the XCP Data Mover to migrate large files.](#)

Using the XCP Data Mover to migrate large files

Previous: [Using the XCP Data Mover to migrate millions of small files to flexible storage.](#)

This use case is based on a television network customer. The customer wanted to migrate Oracle Recovery Manager (RMAN) backup files to the cloud and run the Oracle E-Business Suite (EBS) application by using Azure NetApp Files with Pacemaker software. The customer also wanted to migrate their database backup files to on-demand cloud storage and transfer large files (in the range of 25GB to 50GB each) to Azure.

The following figure illustrates the data migration from on-premises to Azure NetApp Files for large files.

For more information, see the [NetApp XCP Data Mover Solution: On Premises to Cloud](#) blog.

Next: [Duplicate files.](#)

Duplicate files

Previous: [Using the XCP Data Mover to migrate large files.](#)

NetApp received a request to find duplicate files from a single volume or multiple volumes. NetApp provided the following solution.

For single volume, run the following commands:

```
[root@mastr-51 linux]# ./xcp -md5 -match 'type==f and nlinks==1 and size
!= 0' 10.63.150.213:/common_volume/nfsconnector_hw_cert/ | sort | uniq -cd
--check-chars=32
XCP 1.5; (c) 2020 NetApp, Inc.; Licensed to Calin Salagean [NetApp Inc]
until Mon Dec 31 00:00:00 2029

176,380 scanned, 138,116 matched, 138,115 summed, 10 giants, 61.1 GiB in
(763 MiB/s), 172 MiB out (2.57 MiB/s), 1m5s

Filtered: 38264 did not match
176,380 scanned, 138,116 matched, 138,116 summed, 10 giants, 62.1 GiB in
(918 MiB/s), 174 MiB out (2.51 MiB/s), 1m9s.
    3 00004964ca155eca1a71d0949c82e37e
nfsconnector_hw_cert/grid_01082017_174316/0/hadoopqe/accumulo/shell/pom.xml
1
    2 000103fbed06d8071410c59047738389
nfsconnector_hw_cert/usr_hdp/2.5.3.0-37/hive2/doc/examples/files/dim-
data.txt
    2 000131053a46d67557d27bb678d5d4a1
nfsconnector_hw_cert/grid_01082017_174316/0/log/cluster/mahout_1/artifacts
/classifier/20news_reduceddata/20news-bydate-test/alt.atheism/53265
```

For multiple volumes, run the following commands:

```
[root@mastr-51 linux]# cat multiplevolume_duplicate.sh
#!/usr/bin/bash

#user input
JUNCTION_PATHS='/nc_volume1 /nc_volume2 /nc_volume3 /oplogarchivevolume'
NFS_DATA_LIF='10.63.150.213'

#xcp operation
for i in $JUNCTION_PATHS
do
echo "start - $i" >> /tmp/duplicate_results
/usr/src/xcp/linux/xcp -md5 -match 'type==f and nlinks==1 and size != 0'
${NFS_DATA_LIF}:$i | sort | uniq -cd --check-chars=32 | tee -a
/tmp/duplicate_results
echo "end - $i" >> /tmp/duplicate_results
done

[root@mastr-51 linux]# nohup bash +x multiplevolume_duplicate.sh &
[root@mastr-51 linux]# cat /tmp/duplicate_results
```

[Next: Specific date-based scan and copy of data.](#)

Specific date-based scan and copy of data

[Previous: Duplicate files.](#)

This solution is based on a customer who needs to copy data based on a specific date. Verify the following details:

Created a file in Y: and checked the scan command to list them.

```
c:\XCP>dir Y:\karthik_test
Volume in drive Y is from
Volume Serial Number is 80F1-E201

Directory of Y:\karthik_test

05/26/2020  02:51 PM    <DIR>          .
05/26/2020  02:50 PM    <DIR>          ..
05/26/2020  02:51 PM                2,295 testfile.txt
                1 File(s)                2,295 bytes
                2 Dir(s)          658,747,392 bytes free
```

```
c:\XCP>
```

```
c:\XCP>xcp scan -match "strftime(ctime,'%Y-%m-%d')>'2020-05-01'" -fmt
"'{}',{}'.format(iso(mtime),name)" Y:\
XCP SMB 1.6; (c) 2020 NetApp, Inc.; Licensed to Calin Salagean [NetApp
Inc] until Mon Dec 31 00:00:00 2029
```

It appears that you are not running XCP as Administrator. To avoid access issues please run XCP as Administrator.

```
2020-05-26_14:51:13.132465,testfile.txt
2020-05-26_14:51:00.074216,karthik_test
```

```
xcp scan -match strftime(ctime,'%Y-%m-%d')>'2020-05-01' -fmt
'{}',{}'.format(iso(mtime),name) Y:\ : PASSED
30,205 scanned, 2 matched, 0 errors
Total Time : 4s
STATUS : PASSED
```

Copy the files based on date (2020 YearMay month first date) from Y: to Z:

```
c:\XCP>xcp copy -match "strftime(ctime,'%Y-%m-%d')>'2020-05-01'" Y:
Z:\dest_karthik
XCP SMB 1.6; (c) 2020 NetApp, Inc.; Licensed to Calin Salagean [NetApp
```

```
Inc] until Mon Dec 31 00:00:00 2029
```

It appears that you are not running XCP as Administrator. To avoid access issues please run XCP as Administrator.

```
30,205 scanned, 3 matched, 0 copied, 0 errors, 5s
```

```
xcp copy -match strftime(ctime,'%Y-%m-%d')>'2020-05-01' Y: Z:\dest_karthik  
: PASSED
```

```
30,205 scanned, 3 matched, 2 copied, 0 errors
```

```
Total Time : 6s
```

```
STATUS : PASSED
```

```
c:\XCP>
```

Check the destination Z:

```
c:\XCP>dir Z:\dest_karthik\karthik_test
```

```
Volume in drive Z is to
```

```
Volume Serial Number is 80F1-E202
```

```
Directory of Z:\dest_karthik\karthik_test
```

```
05/26/2020  02:51 PM    <DIR>          .  
05/26/2020  02:50 PM    <DIR>          ..  
05/26/2020  02:51 PM                2,295 testfile.txt  
                1 File(s)                2,295 bytes  
                2 Dir(s)          659,316,736 bytes free
```

```
c:\XCP>
```

[Next: Creating a CSV file from SMB/CIFS share.](#)

Creating a CSV file from SMB/CIFS share

[Previous: Specific date-based scan and copy of data.](#)

The following command dumps data in the CSV format. You can sum up the size column to get the total size of the data.

```
xcp scan -match "((now-x.atime) / 3600) > 31*day" -fmt "'{ }, { }, { },  
{ }'.format(relpath, name, strftime(x.atime, '%Y-%m-%d-%H:%M:%S'),  
humanize_size(size))" -preserve-atime >file.csv
```

The output should look similar to this example:

```
erase\report_av_fp_cdot_crosstab.csvreport_av_fp_cdot_crosstab.csv20-01-29-10:26:2449.6MiB
```

To scan up to the depth of three subdirectories and provide the result in sorting order, run the `xcp -du` command and dump the size at each directory level up to the depth of three subdirectories.

```
./xcp scan -du -depth 3 NFS_Server_IP:/source_vol
```

To sort, dump the information to a CSV file and sort the information.

```
xcp scan -match "type == d" -depth 3 -fmt "'{}, {}, {}, {}'.format(name, relpath, size)" NFS_Server_IP:/share > directory_report.csv
```

This is a custom report that uses the `-fmt` command. It scans all the directories and dumps the name of the directory, path, and size of directory into a CSV file. You can sort the size column from the spreadsheet application.

[Next: Data migration from 7-Mode to ONTAP.](#)

Data migration from 7-Mode to ONTAP

[Previous: Creating a CSV file from SMB/CIFS share.](#)

This section provides detailed steps for migrating data from NetApp Data ONTAP operating in 7-Mode to ONTAP.

Transitioning 7-Mode NFSv3 storage to ONTAP for NFS data

This section provides the step-by-step procedure in the following table for transitioning a source 7-Mode NFSv3 export to an ONTAP system.

NetApp assumes that the source 7-Mode NFSv3 volume is exported and mounted on the client system and that XCP is already installed on a Linux system.

1. Verify that the target ONTAP system is healthy.

```

CLUSTER::> cluster show
Node                Health  Eligibility
-----
CLUSTER-01          true    true
CLUSTER-02          true    true
2 entries were displayed.
CLUSTER::> node show
Node      Health Eligibility Uptime           Model      Owner      Location
-----
CLUSTER-01
           true   true       78 days 21:01 FAS8060           RTP
CLUSTER-02
           true   true       78 days 20:50 FAS8060           RTP
2 entries were displayed.
CLUSTER::> storage failover show
Node      Partner      Takeover
-----
CLUSTER-01 CLUSTER-02    true    Connected to CLUSTER-02
CLUSTER-02 CLUSTER-01    true    Connected to CLUSTER-01
2 entries were displayed.

```

2. Verify that at least one nonroot aggregate exists on the target system. The aggregate is normal.

```

CLUSTER::> storage aggregate show
Aggregate      Size Available Used% State  #Vols  Nodes      RAID
Status
-----
-----
aggr0          368.4GB   17.85GB   95% online    1 CLUSTER-01
raid_dp,

normal
aggr0_CLUSTER_02_0
              368.4GB   17.85GB   95% online    1 CLUSTER-02
raid_dp,

normal
source         1.23TB    1.10TB   11% online    6 CLUSTER-01
raid_dp,

normal
3 entries were displayed.

```

If there is no data aggregate, create a new one using the `storage aggr create` command.

3. Create a storage virtual machine (SVM) on the target cluster system.

```

CLUSTER::> vservers create -vservers dest -rootvolume dest_root -aggregate
poc -rootvolume-security-style mixed
[Job 647] Job succeeded:
Vserver creation completed
Verify the security style and language settings of the source

Verify that the SVM was successfully created.
CLUSTER::> vservers show -vservers dest
                                Vserver: dest
                                Vserver Type: data
                                Vserver Subtype: default
                                Vserver UUID: 91f6d786-0063-11e5-b114-
00a09853a969
                                Root Volume: dest_root
                                Aggregate: poc
                                NIS Domain: -
                                Root Volume Security Style: mixed
                                LDAP Client: -
                                Default Volume Language Code: C.UTF-8
                                Snapshot Policy: default
                                Comment:
                                Quota Policy: default
                                List of Aggregates Assigned: -
                                Limit on Maximum Number of Volumes allowed: unlimited
                                Vserver Admin State: running
                                Vserver Operational State: running
                                Vserver Operational State Stopped Reason: -
                                Allowed Protocols: nfs, cifs, fcp, iscsi, ndmp
                                Disallowed Protocols: -
                                Is Vserver with Infinite Volume: false
                                QoS Policy Group: -
                                Config Lock: false
                                IPspace Name: Default

```

4. Remove the FCP, iSCSI, NDMP, and CIFS protocols from the target SVM.

```

CLUSTER::> vservers remove-protocols -vservers dest -protocols
fcp,iscsi,ndmp,cifs

```

Verify that NFS is the allowed protocol for this SVM.


```
CLUSTER::> vserver show -vserver dest -fields allowed-protocols
vserver allowed-protocols
-----
dest      nfs
```

5. Create a new read-write data volume on the destination SVM. Verify that the security style, language settings, and capacity requirements match the source volume.

```
CLUSTER::> vol create -vserver dest -volume dest_nfs -aggregate poc
-size 150g -type RW -state online -security-style mixed
[Job 648] Job succeeded: Successful
```

6. Create a data LIF to serve NFS client requests.

```
CLUSTER::> network interface create -vserver dest -lif dest_lif -address
10.61.73.115 -netmask 255.255.255.0 -role data -data-protocol nfs -home
-node CLUSTER-01 -home-port e01
```

Verify that the LIF was successfully created.

```
CLUSTER::> network interface show -vserver dest
```

	Logical	Status	Network	Current	
Current Is					
Vserver	Interface	Admin/Oper	Address/Mask	Node	Port
Home					
dest	dest_lif	up/up	10.61.73.113/24	CLUSTER-01	e0i
true					

7. Create a static route with the SVM, if required.

```
CLUSTER::> network route create -vserver dest -destination 0.0.0.0/0
-gateway 192.168.100.111
```

Verify that the route was successfully created.

```
CLUSTER::> network route show -vserver source
```

Vserver	Destination	Gateway	Metric
dest	0.0.0.0/0	10.61.73.1	20

8. Mount the target NFS data volume in the SVM namespace.

```
CLUSTER::> volume mount -vserver dest -volume dest_nfs -junction-path /dest_nfs -active true
```

Verify that the volume is successfully mounted.

```
CLUSTER::> volume show -vserver dest -fields junction-path
```

vserver	volume	junction-path
dest	dest_nfs	/dest_nfs
dest	dest_root	/

2 entries were displayed.

You can also specify volume mount options (junction path) with the `volume create` command.

9. Start the NFS service on the target SVM.

```
CLUSTER::> vservers nfs start -vserver dest
```

Verify that the service is started and running.

```
CLUSTER::> vservers nfs status
```

The NFS server is running on Vserver "dest".

```
CLUSTER::> nfs show
```

Vserver: dest

General Access:	true
v3:	enabled
v4.0:	disabled
4.1:	disabled
UDP:	enabled
TCP:	enabled
Default Windows User:	-
Default Windows Group:	-

10. Verify that the default NFS export policy was applied to the target SVM.

```
CLUSTER::> vserver export-policy show -vserver dest
Vserver          Policy Name
-----
dest             default
```

11. If required, create a new custom export policy for the target SVM.

```
CLUSTER::> vserver export-policy create -vserver dest -policyname
xcpexportpolicy
```

Verify that the new custom export policy was successfully created.

```
CLUSTER::> vserver export-policy show -vserver dest
Vserver          Policy Name
-----
dest             default
dest             xcpexportpolicy
2 entries were displayed.
```

12. Modify the export policy rules to allow access to NFS clients.

```
CLUSTER::> export-policy rule modify -vserver dest -ruleindex 1
-policyname xcpexportpolicy -clientmatch 0.0.0.0/0 -rorule any -rwrule
any -anon 0
Verify the policy rules have modified
CLUSTER::> export-policy rule show -instance
Vserver: dest
Policy Name: xcpexportpolicy
Rule Index: 1
Access Protocol: nfs3
Client Match Hostname, IP Address, Netgroup, or Domain: 0.0.0.0/0
RO Access Rule: none
RW Access Rule: none
User ID To Which Anonymous Users Are Mapped: 65534
Superuser Security Types: none
Honor SetUID Bits in SETATTR: true
Allow Creation of Devices: true
```

13. Verify that the client is allowed access to the volume.

```
CLUSTER::> export-policy check-access -vserver dest -volume dest_nfs
-client-ip 10.61.82.215 -authentication-method none -protocol nfs3
-access-type read-write
```

Path	Policy	Policy Owner	Policy Owner Type	Rule Index
Access				
/	xcpexportpolicy	dest_root	volume	1
read				
/dest_nfs	xcpexportpolicy	dest_nfs	volume	1
read-write				

2 entries were displayed.

14. Connect to the Linux NFS server. Create a mount point for the NFS exported volume.

```
[root@localhost /]# cd /mnt
[root@localhost mnt]# mkdir dest
```

15. Mount the target NFSv3 exported volume at this mount point.



The NFSv3 volumes should be exported but not necessarily mounted by the NFS server. If they can be mounted, the XCP Linux host client mounts these volumes.

```
[root@localhost mnt]# mount -t nfs 10.61.73.115:/dest_nfs /mnt/dest
```

Verify that the mount point was successfully created.

```
[root@ localhost /]# mount | grep nfs
10.61.73.115:/dest_nfs on /mnt/dest type nfs
(rw,relatime,vers=3,rsize=65536,wsiz=65536,namlen=255,hard,proto=tcp,ti
meo=600,retrans=2,sec=sys,mountaddr=10.61.82.215,mountvers=3,mountport=4
046,mountproto=udp,local_lock=none,addr=10.61.73.115)
```

16. Create a test file on the NFS exported mount point to enable read-write access.

```
[root@localhost dest]# touch test.txt
Verify the file is created
[root@localhost dest]# ls -l
total 0
-rw-r--r-- 1 root bin 0 Jun  2 03:16 test.txt
```



After the read-write test is complete, delete the file from the target NFS mount point.

17. Connect to the Linux client system in which XCP is installed. Browse to the XCP install path.

```
[root@localhost ~]# cd /linux/
[root@localhost linux]#
```

18. Query the source 7-Mode NFSv3 exports by running the `xcp show` command on the XCP Linux client host system.

```
[root@localhost]# ./xcp show 10.61.82.215
== NFS Exports ==
Mounts  Errors  Server
      4      0 10.61.82.215
      Space   Files      Space   Files
      Free    Free      Used    Used Export
23.7 GiB 778,134 356 KiB    96 10.61.82.215:/vol/nfsvol1
17.5 GiB 622,463 1.46 GiB   117 10.61.82.215:/vol/nfsvol
328 GiB 10.8M 2.86 GiB 7,904 10.61.82.215:/vol/vol0/home
328 GiB 10.8M 2.86 GiB 7,904 10.61.82.215:/vol/vol0
== Attributes of NFS Exports ==
drwxr-xr-x --- root wheel 4KiB 4KiB 2d21h 10.61.82.215:/vol/nfsvol1
drwxr-xr-x --- root wheel 4KiB 4KiB 2d21h 10.61.82.215:/vol/nfsvol
drwxrwxrwx --t root wheel 4KiB 4KiB 9d22h 10.61.82.215:/vol/vol0/home
drwxr-xr-x --- root wheel 4KiB 4KiB 4d0h 10.61.82.215:/vol/vol0
3.89 KiB in (5.70 KiB/s), 7.96 KiB out (11.7 KiB/s), 0s.
```

19. Scan the source NFSv3 exported paths and print the statistics of their file structure.

NetApp recommends putting the source NFSv3 exports in read-only mode during `xcp scan`, `copy`, and `sync` operations.

```
[root@localhost /]# ./xcp scan 10.61.82.215:/vol/nfsvol
nfsvol
nfsvol/n5000-uk9.5.2.1.N1.1.bin
nfsvol/821_q_image.tgz
nfsvol/822RC2_q_image.tgz
nfsvol/NX5010_12_node_RCF_v1.3.txt
nfsvol/n5000-uk9-kickstart.5.2.1.N1.1.bin
nfsvol/NetApp_CN1610_1.1.0.5.stk
nfsvol/glibc-common-2.7-2.x86_64.rpm
nfsvol/glibc-2.7-2.x86_64.rpm
nfsvol/rhel-server-5.6-x86_64-dvd.iso.filepart
nfsvol/xcp
nfsvol/xcp_source
nfsvol/catalog
23 scanned, 7.79 KiB in (5.52 KiB/s), 1.51 KiB out (1.07 KiB/s), 1s.
```

20. Copy the source 7-Mode NFSv3 exports to NFSv3 exports on the target ONTAP system.

```
[root@localhost /]# ./xcp copy 10.61.82.215:/vol/nfsvol
10.61.73.115:/dest_nfs
 44 scanned, 39 copied, 264 MiB in (51.9 MiB/s), 262 MiB out (51.5
MiB/s), 5s
 44 scanned, 39 copied, 481 MiB in (43.3 MiB/s), 479 MiB out (43.4
MiB/s), 10s
 44 scanned, 40 copied, 748 MiB in (51.2 MiB/s), 747 MiB out (51.3
MiB/s), 16s
 44 scanned, 40 copied, 1.00 GiB in (55.9 MiB/s), 1.00 GiB out (55.9
MiB/s), 21s
 44 scanned, 40 copied, 1.21 GiB in (42.8 MiB/s), 1.21 GiB out (42.8
MiB/s), 26s
Sending statistics...
44 scanned, 43 copied, 1.46 GiB in (47.6 MiB/s), 1.45 GiB out (47.6
MiB/s), 31s.
```

21. After the copy is finished, verify that the source and destination NFSv3 exports have identical data. Run the `xcp verify` command.

```
[root@localhost /]# ./xcp verify 10.61.82.215:/vol/nfsvol
10.61.73.115:/dest_nfs
44 scanned, 44 found, 28 compared, 27 same data, 2.41 GiB in (98.4
MiB/s), 6.25 MiB out (255 KiB/s), 26s
44 scanned, 44 found, 30 compared, 29 same data, 2.88 GiB in (96.4
MiB/s), 7.46 MiB out (249 KiB/s), 31s
44 scanned, 100% found (43 have data), 43 compared, 100% verified (data,
attrs, mods), 2.90 GiB in (92.6 MiB/s), 7.53 MiB out (240 KiB/s), 32s.
```

If `xcp verify` finds differences between the source and destination data, then the error no such file or directory is reported in the summary. To fix that issue, run the `xcp sync` command to copy the source changes to the destination.

22. Before and during the cutover, run `verify` again. If the source has new or updated data, then perform incremental updates. Run the `xcp sync` command.

```
For this operation, the previous copy index name or number is required.
[root@localhost /]# ./xcp sync -id 3
Index: {source: '10.61.82.215:/vol/nfsvol', target:
'10.61.73.115:/dest_nfs1'}
64 reviewed, 64 checked at source, 6 changes, 6 modifications, 51.7 KiB
in (62.5 KiB/s), 22.7 KiB out (27.5 KiB/s), 0s.
xcp: sync '3': Starting search pass for 1 modified directory...
xcp: sync '3': Found 6 indexed files in the 1 changed directory
xcp: sync '3': Rereading the 1 modified directory to find what's new...
xcp: sync '3': Deep scanning the 1 directory that changed...
11 scanned, 11 copied, 12.6KiB in (6.19KiBps), 9.50 KiB out (4.66KiBps),
2s.
```

23. To resume a previously interrupted copy operation, run the `xcp resume` command.

```

[root@localhost /]# ./xcp resume -id 4
Index: {source: '10.61.82.215:/vol/nfsvol', target:
'10.61.73.115:/dest_nfs7'}
xcp: resume '4': WARNING: Incomplete index.
xcp: resume '4': Found 18 completed directories and 1 in progress
106 reviewed, 24.2 KiB in (30.3 KiB/s), 7.23 KiB out (9.06 KiB/s), 0s.
xcp: resume '4': Starting second pass for the in-progress directory...
xcp: resume '4': Found 3 indexed directories and 0 indexed files in the
1 in-progress directory
xcp: resume '4': In progress dirs: unindexed 1, indexed 0
xcp: resume '4': Resuming the 1 in-progress directory...
  20 scanned, 7 copied, 205 MiB in (39.6 MiB/s), 205 MiB out (39.6
MiB/s), 5s
  20 scanned, 14 copied, 425 MiB in (42.1 MiB/s), 423 MiB out (41.8
MiB/s), 11s
  20 scanned, 14 copied, 540 MiB in (23.0 MiB/s), 538 MiB out (23.0
MiB/s), 16s
  20 scanned, 14 copied, 721 MiB in (35.6 MiB/s), 720 MiB out (35.6
MiB/s), 21s
  20 scanned, 15 copied, 835 MiB in (22.7 MiB/s), 833 MiB out (22.7
MiB/s), 26s
  20 scanned, 16 copied, 1007 MiB in (34.3 MiB/s), 1005 MiB out (34.3
MiB/s), 31s
  20 scanned, 17 copied, 1.15 GiB in (33.9 MiB/s), 1.15 GiB out (33.9
MiB/s), 36s
  20 scanned, 17 copied, 1.27 GiB in (25.5 MiB/s), 1.27 GiB out (25.5
MiB/s), 41s
  20 scanned, 17 copied, 1.45 GiB in (36.1 MiB/s), 1.45 GiB out (36.1
MiB/s), 46s
  20 scanned, 17 copied, 1.69 GiB in (48.7 MiB/s), 1.69 GiB out (48.7
MiB/s), 51s
Sending statistics...
20 scanned, 20 copied, 21 indexed, 1.77 GiB in (33.5 MiB/s), 1.77 GiB
out (33.4 MiB/s), 54s.

```

After `resume` finishes copying files, run `verify` again so that the source and destination storage have identical data.

24. The NFSv3 client host needs to unmount the source NFSv3 exports provisioned from the 7-Mode storage and mounts the target NFSv3 exports from ONTAP. Cutover requires an outage.

Transitioning 7-Mode volume Snapshot copies to ONTAP

This section covers the procedure for transitioning a source 7-Mode volume NetApp Snapshot copy to ONTAP.



NetApp assumes that the source 7-Mode volume is exported and mounted on the client system and that XCP is already installed on a Linux system. A Snapshot copy is a point-in-time image of a volume that records incremental changes since the last Snapshot copy. Use the `-snap` option with a 7-Mode system as the source.

Warning: Keep the base Snapshot copy. Do not delete the base Snapshot copy after the baseline copy is complete. The base Snapshot copy is required for further sync operations.

1. Verify that the target ONTAP system is healthy.

```
CLUSTER::> cluster show
Node                               Health  Eligibility
-----
CLUSTER-01                        true   true
CLUSTER-02                        true   true
2 entries were displayed.
CLUSTER::> node show
Node      Health Eligibility Uptime           Model      Owner      Location
-----
CLUSTER-01
           true  true           78 days 21:01 FAS8060
CLUSTER-02
           true  true           78 days 20:50 FAS8060
2 entries were displayed.
CLUSTER::> storage failover show
Node      Partner      Takeover
-----
CLUSTER-01 CLUSTER-02  true   Connected to CLUSTER-02
CLUSTER-02 CLUSTER-01  true   Connected to CLUSTER-01
2 entries were displayed.
```

2. Verify that at least one nonroot aggregate exists on the target system. The aggregate is normal.

```

CLUSTER::> storage aggregate show
Aggregate      Size Available Used% State  #Vols  Nodes      RAID
Status
-----
-----
aggr0          368.4GB    17.85GB   95% online    1 CLUSTER-01
raid_dp,

normal
aggr0_CLUSTER_02_0
              368.4GB    17.85GB   95% online    1 CLUSTER-02
raid_dp,

normal
source         1.23TB      1.10TB   11% online    6 CLUSTER-01
raid_dp,

normal
3 entries were displayed.

```

If there is no data aggregate, create a new one using the `storage aggr create` command.

3. Create an SVM on the target cluster system.

```

CLUSTER::> vservers create -vservers dest -rootvolume dest_root -aggregate
poc -rootvolume-security-style mixed
[Job 647] Job succeeded:
Vservers creation completed
Verify the security style and language settings of the source

Verify that the SVM was successfully created.
CLUSTER::> vservers show -vservers dest

                Vservers: dest
                Vservers Type: data
                Vservers Subtype: default
                Vservers UUID: 91f6d786-0063-11e5-b114-
00a09853a969

                Root Volume: dest_root
                Aggregate: poc
                NIS Domain: -
                Root Volume Security Style: mixed
                LDAP Client: -
                Default Volume Language Code: C.UTF-8
                Snapshot Policy: default
                Comment:
                Quota Policy: default
                List of Aggregates Assigned: -
                Limit on Maximum Number of Volumes allowed: unlimited
                Vservers Admin State: running
                Vservers Operational State: running
                Vservers Operational State Stopped Reason: -
                Allowed Protocols: nfs, cifs, fcp, iscsi, ndmp
                Disallowed Protocols: -
                Is Vservers with Infinite Volume: false
                QoS Policy Group: -
                Config Lock: false
                IPspace Name: Default

```

4. Remove the FCP, iSCSI, NDMP, and CIFS protocols from the target SVM.

```

CLUSTER::> vservers remove-protocols -vservers dest -protocols
fcp,iscsi,ndmp,cifs
Verify that NFS is the allowed protocol for this SVM.
CLUSTER::> vservers show -vservers dest -fields allowed-protocols
vservers allowed-protocols
-----
dest      nfs

```

5. Create a new read-write data volume on the destination SVM. Verify that the security style, language settings, and capacity requirements match the source volume.

```
CLUSTER::> vol create -vserver dest -volume dest_nfs -aggregate poc
-size 150g -type RW -state online -security-style mixed
[Job 648] Job succeeded: Successful
```

6. Create a data LIF to serve NFS client requests.

```
CLUSTER::> network interface create -vserver dest -lif dest_lif -address
10.61.73.115 -netmask 255.255.255.0 -role data -data-protocol nfs -home
-node CLUSTER-01 -home-port e01
```

Verify that the LIF was successfully created.

```
CLUSTER::> network interface show -vserver dest
```

	Logical	Status	Network	Current	
Current Is					
Vserver	Interface	Admin/Oper	Address/Mask	Node	Port
Home					
dest	dest_lif	up/up	10.61.73.113/24	CLUSTER-01	e0i
true					

7. If required, create a static route with the SVM.

```
CLUSTER::> network route create -vserver dest -destination 0.0.0.0/0
-gateway 192.168.100.111
```

Verify that the route was successfully created.

```
CLUSTER::> network route show -vserver source
```

Vserver	Destination	Gateway	Metric
dest	0.0.0.0/0	10.61.73.1	20

8. Mount the target NFS data volume in the SVM namespace.

```
CLUSTER::> volume mount -vserver dest -volume dest_nfs -junction-path
/dest_nfs -active true
```

Verify that the volume was successfully mounted.

```
CLUSTER::> volume show -vserver dest -fields junction-path
vserver volume    junction-path
-----
dest    dest_nfs  /dest_nfs
dest    dest_root
          /
2 entries were displayed.
```

You can also specify the volume mount options (junction path) with the `volume create` command.

9. Start the NFS service on the target SVM.

```
CLUSTER::> vsriver nfs start -vserver dest
```

Verify that the service is started and running.

```
CLUSTER::> vsriver nfs status
The NFS server is running on Vserver "dest".
CLUSTER::> nfs show
Vserver: dest
      General Access:  true
                   v3:  enabled
                   v4.0: disabled
                   4.1: disabled
                   UDP:  enabled
                   TCP:  enabled
      Default Windows User:  -
      Default Windows Group:  -
```

10. Verify that the default NFS export policy is applied to the target SVM.

```
CLUSTER::> vsriver export-policy show -vserver dest
Vserver          Policy Name
-----
dest             default
```

11. If required, create a new custom export policy for the target SVM.

```
CLUSTER::> vserver export-policy create -vserver dest -policyname
xcpexportpolicy
```

Verify that the new custom export policy was successfully created.

```
CLUSTER::> vserver export-policy show -vserver dest
Vserver          Policy Name
-----
dest             default
dest             xcpexportpolicy
2 entries were displayed.
```

12. Modify the export policy rules to allow access to NFS clients on the target system.

```
CLUSTER::> export-policy rule modify -vserver dest -ruleindex 1
-policyname xcpexportpolicy -clientmatch 0.0.0.0/0 -rorule any -rwrule
any -anon 0
Verify the policy rules have modified
CLUSTER::> export-policy rule show -instance
                                Vserver: dest
                                Policy Name: xcpexportpolicy
                                Rule Index: 1
                                Access Protocol: nfs3
Client Match Hostname, IP Address, Netgroup, or Domain: 0.0.0.0/0
                                RO Access Rule: none
                                RW Access Rule: none
User ID To Which Anonymous Users Are Mapped: 65534
                                Superuser Security Types: none
                                Honor SetUID Bits in SETATTR: true
                                Allow Creation of Devices: true
```

13. Verify that the client has access to the target volume.

```
CLUSTER::> export-policy check-access -vserver dest -volume dest_nfs
-client-ip 10.61.82.215 -authentication-method none -protocol nfs3
-access-type read-write
```

Path	Policy	Policy Owner	Policy Owner Type	Rule Index
Access				
-----	-----	-----	-----	-----
/	xcpexportpolicy	dest_root	volume	1
read				
/dest_nfs	xcpexportpolicy	dest_nfs	volume	1
read-write				

2 entries were displayed.

14. Connect to the Linux NFS server. Create a mount point for the NFS exported volume.

```
[root@localhost /]# cd /mnt
[root@localhost mnt]# mkdir dest
```

15. Mount the target NFSv3 exported volume at this mount point.



The NFSv3 volumes should be exported but not necessarily mounted by the NFS server. If they can be mounted, the XCP Linux host client mounts these volumes.

```
[root@localhost mnt]# mount -t nfs 10.61.73.115:/dest_nfs /mnt/dest
```

Verify that the mount point was successfully created.

```
[root@localhost /]# mount | grep nfs
10.61.73.115:/dest_nfs on /mnt/dest type nfs
```

16. Create a test file on the NFS exported mount point to enable read-write access.

```
[root@localhost dest]# touch test.txt
Verify the file is created
[root@localhost dest]# ls -l
total 0
-rw-r--r-- 1 root bin 0 Jun  2 03:16 test.txt
```



After the read-write test is complete, delete the file from the target NFS mount point.

17. Connect to the Linux client system in which XCP is installed. Browse to the XCP install path.

```
[root@localhost ~]# cd /linux/
[root@localhost linux]#
```

18. Query the source 7-Mode NFSv3 exports by running the `xcp show` command on the XCP Linux client host system.

```
[root@localhost]# ./xcp show 10.61.82.215
== NFS Exports ==
Mounts  Errors  Server
      4      0 10.61.82.215
      Space   Files      Space   Files
      Free    Free      Used    Used Export
23.7 GiB  778,134   356 KiB     96 10.61.82.215:/vol/nfsvol1
17.5 GiB  622,463   1.46 GiB    117 10.61.82.215:/vol/nfsvol
328 GiB   10.8M   2.86 GiB   7,904 10.61.82.215:/vol/vol0/home
328 GiB   10.8M   2.86 GiB   7,904 10.61.82.215:/vol/vol0
== Attributes of NFS Exports ==
drwxr-xr-x --- root wheel 4KiB 4KiB 2d21h 10.61.82.215:/vol/nfsvol1
drwxr-xr-x --- root wheel 4KiB 4KiB 2d21h 10.61.82.215:/vol/nfsvol
drwxrwxrwx --t root wheel 4KiB 4KiB 9d22h 10.61.82.215:/vol/vol0/home
drwxr-xr-x --- root wheel 4KiB 4KiB 4d0h 10.61.82.215:/vol/vol0
3.89 KiB in (5.70 KiB/s), 7.96 KiB out (11.7 KiB/s), 0s.
```

19. Scan the source NFSv3 exported paths and print the statistics of their file structure.

NetApp recommends putting the source NFSv3 exports in read-only mode during `xcp scan`, `copy`, and `sync` operations. In `sync` operation, you must pass the `-snap` option with a corresponding value.


```
[root@localhost /]# ./xcp scan 10.61.82.215:/vol/nfsvol/.snapshot/snap1
nfsvol
nfsvol/n5000-uk9.5.2.1.N1.1.bin
nfsvol/821_q_image.tgz
nfsvol/822RC2_q_image.tgz
nfsvol/NX5010_12_node_RCF_v1.3.txt
nfsvol/n5000-uk9-kickstart.5.2.1.N1.1.bin
nfsvol/catalog
23 scanned, 7.79 KiB in (5.52 KiB/s), 1.51 KiB out (1.07 KiB/s), 1s.
[root@scspr1202780001 vol_acl4]# ./xcp sync -id 7msnap1 -snap
10.236.66.199:/vol/nfsvol/.snapshot/snap10
(show scan and sync)
```

20. Copy the source 7-Mode NFSv3 snapshot (base) to NFSv3 exports on the target ONTAP system.

```
[root@localhost /]# /xcp copy 10.61.82.215:/vol/nfsvol/.snapshot/snap1
10.61.73.115:/dest_nfs
44 scanned, 39 copied, 264 MiB in (51.9 MiB/s), 262 MiB out (51.5
MiB/s), 5s
44 scanned, 39 copied, 481 MiB in (43.3 MiB/s), 479 MiB out (43.4
MiB/s), 10s
44 scanned, 40 copied, 748 MiB in (51.2 MiB/s), 747 MiB out (51.3
MiB/s), 16s
44 scanned, 40 copied, 1.00 GiB in (55.9 MiB/s), 1.00 GiB out (55.9
MiB/s), 21s
44 scanned, 40 copied, 1.21 GiB in (42.8 MiB/s), 1.21 GiB out (42.8
MiB/s), 26s
Sending statistics...
44 scanned, 43 copied, 1.46 GiB in (47.6 MiB/s), 1.45 GiB out (47.6
MiB/s), 31s.
```



Keep this base snapshot for further sync operations.

21. After copy is complete, verify that the source and destination NFSv3 exports have identical data. Run the `xcp verify` command.

```
[root@localhost /]# ./xcp verify 10.61.82.215:/vol/nfsvol
10.61.73.115:/dest_nfs
44 scanned, 44 found, 28 compared, 27 same data, 2.41 GiB in (98.4
MiB/s), 6.25 MiB out (255 KiB/s), 26s
44 scanned, 44 found, 30 compared, 29 same data, 2.88 GiB in (96.4
MiB/s), 7.46 MiB out (249 KiB/s), 31s
44 scanned, 100% found (43 have data), 43 compared, 100% verified (data,
attrs, mods), 2.90 GiB in (92.6 MiB/s), 7.53 MiB out (240 KiB/s), 32s.
```

If `verify` finds differences between the source and destination data, then the error no such file or directory is reported in the summary. To fix that issue, run the `xcp sync` command to copy the source changes to the destination.

22. Before and during the cutover, run `verify` again. If the source has new or updated data, then perform incremental updates. If there are incremental changes, create a new Snapshot copy for these changes and pass that snapshot path with the `-snap` option for sync operations.

Run the `xcp sync` command with the `-snap` option and snapshot path.

```
[root@localhost /]# ./xcp sync -id 3
Index: {source: '10.61.82.215:/vol/nfsvol/.snapshot/snap1', target:
'10.61.73.115:/dest_nfs1'}
64 reviewed, 64 checked at source, 6 changes, 6 modifications, 51.7 KiB
in (62.5
KiB/s), 22.7 KiB out (27.5 KiB/s), 0s.
xcp: sync '3': Starting search pass for 1 modified directory...
xcp: sync '3': Found 6 indexed files in the 1 changed directory
xcp: sync '3': Rereading the 1 modified directory to find what's new...
xcp: sync '3': Deep scanning the 1 directory that changed...
11 scanned, 11 copied, 12.6 KiB in (6.19 KiB/s), 9.50 KiB out (4.66
KiB/s), 2s..
```



For this operation, the base snapshot is required.

23. To resume a previously interrupted copy operation, run the `xcp resume` command.

```
[root@scspr1202780001 534h_dest_vol]# ./xcp resume -id 3
XCP <version>; (c) 2020 NetApp, Inc.; Licensed to xxxxx [NetApp Inc]
until Mon Dec 31 00:00:00 2029
xcp: Index: {source: '10.61.82.215:/vol/nfsvol',/.snapshot/snap1,
target: 10.237.160.55:/dest_vol}
xcp: resume '7msnap_res1': Reviewing the incomplete index...
xcp: diff '7msnap_res1': Found 143 completed directories and 230 in
progress
39,688 reviewed, 1.28 MiB in (1.84 MiB/s), 13.3 KiB out (19.1 KiB/s),
0s.
xcp: resume '7msnap_res1': Starting second pass for the in-progress
directories...
xcp: resume '7msnap_res1': Resuming the in-progress directories...
xcp: resume '7msnap_res1': Resumed command: copy {-newid:
u'7msnap_res1'}
xcp: resume '7msnap_res1': Current options: {-id: '7msnap_res1'}
xcp: resume '7msnap_res1': Merged options: {-id: '7msnap_res1', -newid:
u'7msnap_res1'}
xcp: resume '7msnap_res1': Values marked with a * include operations
before resume
  68,848 scanned*, 54,651 copied*, 39,688 indexed*, 35.6 MiB in (7.04
MiB/s), 28.1 MiB out (5.57 MiB/s), 5s
```

24. The NFSv3 client host must unmount the source NFSv3 exports provisioned from the 7-Mode storage and mount the target NFSv3 exports from ONTAP. This cutover requires an outage.

Migrating ACLv4 from NetApp 7-Mode to a NetApp storage system

This section covers the step-by-step procedure for transitioning a source NFSv4 export to an ONTAP system.



NetApp assumes that the source NFSv4 volume is exported and mounted on the client system and that XCP is already installed on a Linux system. The source should be a NetApp 7-Mode system that support ACLs. ACL migration is supported from NetApp to NetApp only. To copy files with a special character in the name, make sure the source and destination support UTF-8 encoded language.

Prerequisites for migrating a source NFSv4 export to ONTAP

Before you migrate a source NFSv4 export to ONTAP, the following prerequisites must be met:

- The destination system must have NFSv4 configured.
- The NFSv4 source and target must be mounted on the XCP host. Select NFS v4.0 to match the source and target storage and verify that the ACLs are enabled on the source and target system.
- XCP requires the source/target path to be mounted on the XCP host for ACL processing. In the following example, `vol1(10.63.5.56:/vol1)` is mounted on the `/mnt/vol1` path:

```
[root@localhost ~]# df -h
Filesystem                                Size  Used
Avail Use% Mounted on
10.63.5.56:/vol1                          973M  4.2M
969M   1% /mnt/vol1
[root@localhost ~]# ./xcp scan -l -acl4 10.63.5.56:/vol1/
XCP <version>; (c) 2020 NetApp, Inc.; Licensed to XXX [NetApp Inc] until
Sun Mar 31 00:00:00 2029
drwxr-xr-x --- root root 4KiB 4KiB 23h42m vol1
rw-r--r-- --- root root    4    0 23h42m vol1/DIR1/FILE
drwxr-xr-x --- root root 4KiB 4KiB 23h42m vol1/DIR1/DIR11
drwxr-xr-x --- root root 4KiB 4KiB 23h42m vol1/DIR1
rw-r--r-- --- root root    4    0 23h42m vol1/DIR1/DIR11/FILE
drwxr-xr-x --- root root 4KiB 4KiB 23h42m vol1/DIR1/DIR11/DIR2
rw-r--r-- --- root root    4    0 23h42m vol1/DIR1/DIR11/DIR2/FILE
drwxr-xr-x --- root root 4KiB 4KiB 17m43s vol1/DIR1/DIR11/DIR2/DIR22
8 scanned, 8 getacls, 1 v3perm, 7 acls, 3.80 KiB in (3.86 KiB/s), 1.21 KiB
out (1.23 KiB/s), 0s.
```

Subdirectories options

The two options to work with subdirectories are as follows:

- For XCP to work on a subdirectory (/vol1/DIR1/DIR11), mount the complete path (10.63.5.56:/vol1/DIR1/DIR11) on the XCP host.

If the complete path is not mounted, XCP reports the following error:

```
[root@localhost ~]# ./xcp scan -l -acl4 10.63.5.56:/vol1/DIR1/DIR11
XCP <version>; (c) 2020 NetApp, Inc.; Licensed to XXX [NetApp Inc] until
Sun Mar 31 00:00:00 2029
xcp: ERROR: For xcp to process ACLs, please mount
10.63.5.56:/vol1/DIR1/DIR11 using the OS nfs4 client.
```

- Use the subdirectory syntax (mount: subdirectory/qtree/.snapshot), as shown in the example below:

```
[root@localhost ~]# ./xcp scan -l -acl4 10.63.5.56:/vol1:/DIR1/DIR11
XCP <version>; (c) 2020 NetApp, Inc.; Licensed to XXX [NetApp Inc] until
Sun Mar 31 00:00:00 2029
drwxr-xr-x --- root root 4KiB 4KiB 23h51m DIR11
rw-r--r-- --- root root 4 0 23h51m DIR11/DIR2/FILE
drwxr-xr-x --- root root 4KiB 4KiB 26m9s DIR11/DIR2/DIR22
rw-r--r-- --- root root 4 0 23h51m DIR11/FILE
drwxr-xr-x --- root root 4KiB 4KiB 23h51m DIR11/DIR2
5 scanned, 5 getacls, 5 acls, 2.04 KiB in (3.22 KiB/s), 540 out (850/s),
0s.
```

Complete the following steps to migrate ACLv4 from NetApp 7-Mode to a NetApp storage system.

1. Verify that the target ONTAP system is healthy.

```
CLUSTER::> cluster show
Node                Health  Eligibility
-----
CLUSTER-01          true   true
CLUSTER-02          true   true
2 entries were displayed.
CLUSTER::> node show
Node      Health Eligibility Uptime           Model      Owner      Location
-----
CLUSTER-01
           true  true           78 days 21:01 FAS8060           RTP
CLUSTER-02
           true  true           78 days 20:50 FAS8060           RTP
2 entries were displayed.
CLUSTER::> storage failover show
Node      Partner      Takeover
Possible State Description
-----
CLUSTER-01  CLUSTER-02  true   Connected to CLUSTER-02
CLUSTER-02  CLUSTER-01  true   Connected to CLUSTER-01
2 entries were displayed.
```

2. Verify that at least one nonroot aggregate exists on the target system. The aggregate is normal.

```

CLUSTER::> storage aggregate show
Aggregate      Size Available Used% State   #Vols  Nodes      RAID
Status
-----
-----
aggr0          368.4GB   17.85GB   95% online      1 CLUSTER-01
raid_dp,

normal
aggr0_CLUSTER_02_0
              368.4GB   17.85GB   95% online      1 CLUSTER-02
raid_dp,

normal
source         1.23TB    1.10TB   11% online      6 CLUSTER-01
raid_dp,

normal
3 entries were displayed.

```

If there is no data aggregate, create a new one using the `storage aggr create` command.

3. Create an SVM on the target cluster system.

```

CLUSTER::> vservers create -vservers dest -rootvolume dest_root -aggregate
poc -rootvolume-security-style mixed
[Job 647] Job succeeded:
Vserver creation completed
Verify the security style and language settings of the source

```

Verify that the SVM was successfully created.

```

CLUSTER::> vservers show -vservers dest

Vserver: dest
Vserver Type: data
Vserver Subtype: default
Vserver UUID: 91f6d786-0063-11e5-b114-
00a09853a969

Root Volume: dest_root
Aggregate: poc
NIS Domain: -
Root Volume Security Style: mixed
LDAP Client: -
Default Volume Language Code: C.UTF-8
Snapshot Policy: default
Comment:
Quota Policy: default
List of Aggregates Assigned: -
Limit on Maximum Number of Volumes allowed: unlimited
Vserver Admin State: running
Vserver Operational State: running
Vserver Operational State Stopped Reason: -
Allowed Protocols: nfs, cifs, fcp, iscsi, ndmp
Disallowed Protocols: -
Is Vserver with Infinite Volume: false
QoS Policy Group: -
Config Lock: false
IPspace Name: Default

```

4. Remove the FCP, iSCSI, NDMP, and CIFS protocols from the target SVM.

```

CLUSTER::> vservers remove-protocols -vservers dest -protocols
fcp,iscsi,ndmp,cifs

```

Verify that NFS is the allowed protocol for this SVM.

```

CLUSTER::> vservers show -vservers dest -fields allowed-protocols
vservers allowed-protocols
-----
dest      nfs

```

5. Create a new read-write data volume on the destination SVM. Verify that the security style, language settings, and capacity requirements match the source volume.

```
CLUSTER::> vol create -vserver dest -volume dest_nfs -aggregate poc
-size 150g -type RW -state online -security-style mixed
[Job 648] Job succeeded: Successful
```

6. Create a data LIF to serve NFS client requests.

```
CLUSTER::> network interface create -vserver dest -lif dest_lif -address
10.61.73.115 -netmask 255.255.255.0 -role data -data-protocol nfs -home
-node CLUSTER-01 -home-port e01
```

Verify that the LIF was successfully created.

```
CLUSTER::> network interface show -vserver dest
```

	Logical	Status	Network	Current	
Current Is					
Vserver	Interface	Admin/Oper	Address/Mask	Node	Port
Home					
dest	dest_lif	up/up	10.61.73.113/24	CLUSTER-01	e0i
true					

7. If required, create a static route with the SVM.

```
CLUSTER::> network route create -vserver dest -destination 0.0.0.0/0
-gateway 192.168.100.111
```

Verify that the route was successfully created.

```
CLUSTER::> network route show -vserver source
```

Vserver	Destination	Gateway	Metric
dest	0.0.0.0/0	10.61.73.1	20

8. Mount the target NFS data volume in the SVM namespace.


```
CLUSTER::> volume mount -vserver dest -volume dest_nfs -junction-path
/dest_nfs -active true
```

Verify that the volume was successfully mounted.

```
CLUSTER::> volume show -vserver dest -fields junction-path
vserver volume    junction-path
-----
dest    dest_nfs  /dest_nfs
dest    dest_root
        /
2 entries were displayed.
```

You can also specify the volume mount options (junction path) with the `volume create` command.

9. Start the NFS service on the target SVM.

```
CLUSTER::> vserver nfs start -vserver dest
```

Verify that the service is started and running.

```
CLUSTER::> vserver nfs status
The NFS server is running on Vserver "dest".
CLUSTER::> nfs show
Vserver: dest
      General Access:  true
                   v3:  enabled
                   v4.0: enabled
                   4.1: disabled
                   UDP:  enabled
                   TCP:  enabled
      Default Windows User: -
      Default Windows Group: -
```

10. Check that the default NFS export policy is applied to the target SVM.

```
CLUSTER::> vserver export-policy show -vserver dest
Vserver          Policy Name
-----
dest             default
```

11. If required, create a new custom export policy for the target SVM.

```
CLUSTER::> vserver export-policy create -vserver dest -policyname
xcpexportpolicy
```

Verify that the new custom export policy was successfully created.

```
CLUSTER::> vserver export-policy show -vserver dest
Vserver          Policy Name
-----
dest             default
dest             xcpexportpolicy
2 entries were displayed.
```

12. Modify the export policy rules to allow access to NFS clients.

```
CLUSTER::> export-policy rule modify -vserver dest -ruleindex 1
-policyname xcpexportpolicy -clientmatch 0.0.0.0/0 -rorule any -rwrule
any -anon 0
```

Verify that the policy rules have been modified.

```
CLUSTER::> export-policy rule show -instance
Vserver: dest
Policy Name: xcpexportpolicy
Rule Index: 1
Access Protocol: nfs3
Client Match Hostname, IP Address, Netgroup, or Domain: 0.0.0.0/0
RO Access Rule: none
RW Access Rule: none
User ID To Which Anonymous Users Are Mapped: 65534
Superuser Security Types: none
Honor SetUID Bits in SETATTR: true
Allow Creation of Devices: true
```

13. Verify that the client is allowed access to the volume.

```
CLUSTER::> export-policy check-access -vserver dest -volume dest_nfs
-client-ip 10.61.82.215 -authentication-method none -protocol nfs3
-access-type read-write
```

Path	Policy	Policy Owner	Policy Owner Type	Rule Index
Access				
/	xcpexportpolicy	dest_root	volume	1
read				
/dest_nfs	xcpexportpolicy	dest_nfs	volume	1
read-write				

2 entries were displayed.

14. Connect to the Linux NFS server. Create a mount point for the NFS exported volume.

```
[root@localhost /]# cd /mnt
[root@localhost mnt]# mkdir dest
```

15. Mount the target NFSv4 exported volume at this mount point.



The NFSv4 volumes should be exported but not necessarily mounted by the NFS server. If they can be mounted, the XCP Linux host client mounts these volumes.

```
[root@localhost mnt]# mount -t nfs4 10.63.5.56:/vol1 /mnt/vol1
```

Verify that the mount point was successfully created.

```
[root@localhost mnt]# mount | grep nfs
10.63.5.56:/vol1 on /mnt/vol1 type nfs4
(rw,relatime,vers=4.0,rsize=65536,wsiz=65536,namlen=255,hard,proto=tcp,
timeo=600,
retrans=2,sec=sys,clientaddr=10.234.152.84,local_lock=none,addr=10.63.5.
56)
```

16. Create a test file on the NFS exported mount point to enable read-write access.

```
[root@localhost dest]# touch test.txt
```

Verify the file is created.

```
[root@localhost dest]# ls -l
total 0
-rw-r--r-- 1 root bin 0 Jun  2 03:16 test.txt
```



After the read-write test is complete, delete the file from the target NFS mount point.

17. Connect to the Linux client system in which XCP is installed. Browse to the XCP install path.

```
[root@localhost ~]# cd /linux/
[root@localhost linux]#
```

18. Query the source NFSv4 exports by running the `xcp show` command on the XCP Linux client host system.

```

root@localhost]# ./xcp show 10.63.5.56
XCP <version>; (c) 2020 NetApp, Inc.; Licensed to xxx [NetApp Inc] until
Mon Dec 31 00:00:00 2029
getting pmap dump from 10.63.5.56 port 111...
getting export list from 10.63.5.56...
sending 6 mounts and 24 nfs requests to 10.63.5.56...
== RPC Services ==
'10.63.5.56': UDP rpc services: MNT v1/2/3, NFS v3, NLM v4, PMAP v2/3/4,
STATUS v1
'10.63.5.56': TCP rpc services: MNT v1/2/3, NFS v3/4, NLM v4, PMAP
v2/3/4, STATUS v1
== NFS Exports ==
Mounts  Errors  Server
      6      0  10.63.5.56
      Space    Files      Space    Files
      Free      Free      Used      Used Export
94.7 MiB  19,883   324 KiB    107 10.63.5.56:/
971 MiB   31,023   2.19 MiB     99 10.63.5.56:/vol2
970 MiB   31,024   2.83 MiB     98 10.63.5.56:/vol1
9.33 GiB  310,697   172 MiB    590 10.63.5.56:/vol_005
43.3 GiB   1.10M   4.17 GiB   1.00M 10.63.5.56:/vol3
36.4 GiB   1.10M  11.1 GiB   1.00M 10.63.5.56:/vol4
== Attributes of NFS Exports ==
drwxr-xr-x --- root root 4KiB 4KiB 6d2h 10.63.5.56:/
drwxr-xr-x --- root root 4KiB 4KiB 3d2h 10.63.5.56:/vol2
drwxr-xr-x --- root root 4KiB 4KiB 3d2h 10.63.5.56:/vol1
drwxr-xr-x --- root root 4KiB 4KiB 9d2h 10.63.5.56:/vol_005
drwxr-xr-x --- root root 4KiB 4KiB 9d4h 10.63.5.56:/vol3
drwxr-xr-x --- root root 4KiB 4KiB 9d4h 10.63.5.56:/vol4
6.09 KiB in (9.19 KiB/s), 12.2 KiB out (18.3 KiB/s), 0s.

```

19. Scan the source NFSv4 exported paths and print the statistics of their file structure.

NetApp recommends putting the source NFSv4 exports in read-only mode during `xcp scan`, `copy`, and `sync` operations.

```

[root@localhost]# ./xcp scan -acl4 10.63.5.56:/vol1
XCP <version>; (c) 2020 NetApp, Inc.; Licensed to xxx [NetApp Inc] until
Mon Dec 31 00:00:00 2029
vol1
vol1/test/f1
vol1/test
3 scanned, 3 getacls, 3 v3perms, 1.59 KiB in (1.72 KiB/s), 696 out
(753/s), 0s.

```

20. Copy source NFSv4 exports to NFSv4 exports on the target ONTAP system.

```
[root@localhost]# ./xcp copy -acl4 -newid id1 10.63.5.56:/vol1
10.63.5.56:/vol2
XCP <version>; (c) 2020 NetApp, Inc.; Licensed to xxx [NetApp Inc] until
Mon Dec 31 00:00:00 2029
3 scanned, 2 copied, 3 indexed, 3 getacls, 3 v3perms, 1 setacl, 14.7 KiB
in (11.7 KiB/s), 61 KiB out (48.4 KiB/s), 1s..
```

21. After copy is complete, verify that the source and destination NFSv4 exports have identical data. Run the `xcp verify` command.

```
[root@localhost]# ./xcp verify -acl4 -noid 10.63.5.56:/vol1
10.63.5.56:/vol2
XCP <version>; (c) 2020 NetApp, Inc.; Licensed to xxx [NetApp Inc] until
Mon Dec 31 00:00:00 2029
3 scanned, 100% found (0 have data), 100% verified (data, attrs, mods,
acls), 6 getacls, 6 v3perms, 2.90 KiB in (4.16 KiB/s), 2.94 KiB out
(4.22 KiB/s), 0s.
```

If `verify` finds differences between the source and destination data, then the error no such file or directory is reported in the summary. To fix that issue, run the `xcp sync` command to copy the source changes to the destination.

22. Before and during the cutover, run `verify` again. If the source has new or updated data, then perform incremental updates. Run the `xcp sync` command.

```
[root@ root@localhost]# ./xcp sync -id id1
XCP <version>; (c) 2020 NetApp, Inc.; Licensed to xxx [NetApp Inc] until
Mon Dec 31 00:00:00 2029
xcp: Index: {source: 10.63.5.56:/vol1, target: 10.63.5.56:/vol2}
3 reviewed, 3 checked at source, no changes, 3 reindexed, 25.6 KiB in
(32.3 KiB/s), 23.3 KiB out (29.5 KiB/s), 0s.
```



For this operation, the previous copy index name or number is required.

23. To resume a previously interrupted copy operation, run the `xcp resume` command.

```
[root@localhost]# ./xcp resume -id id1
XCP <version>; (c) 2020 NetApp, Inc.; Licensed to xxx [NetApp Inc] until
Mon Dec 31 00:00:00 2029
xcp: Index: {source: 10.63.5.56:/vol3, target: 10.63.5.56:/vol4}
xcp: resume 'id1': Reviewing the incomplete index...
xcp: diff 'id1': Found 0 completed directories and 8 in progress
39,899 reviewed, 1.64 MiB in (1.03 MiB/s), 14.6 KiB out (9.23 KiB/s),
1s.
xcp: resume 'id1': Starting second pass for the in-progress
directories...
xcp: resume 'id1': Resuming the in-progress directories...
xcp: resume 'id1': Resumed command: copy {-acl4: True}
xcp: resume 'id1': Current options: {-id: 'id1'}
xcp: resume 'id1': Merged options: {-acl4: True, -id: 'id1'}
xcp: resume 'id1': Values marked with a * include operations before
resume
  86,404 scanned, 39,912 copied, 39,899 indexed, 13.0 MiB in (2.60
MiB/s), 78.4 KiB out (15.6 KiB/s), 5s 86,404 scanned, 39,912 copied,
39,899 indexed, 13.0 MiB in (0/s), 78.4 KiB out (0/s), 10s
1.00M scanned, 100% found (1M have data), 1M compared, 100% verified
(data, attrs, mods, acls), 2.00M getacls, 202 v3perms, 1.00M same acls,
2.56 GiB in (2.76 MiB/s), 485 MiB out (524 KiB/s), 15m48s.
```

After `resume` finishes copying files, run `verify` again so that the source and destination storage have identical data.

Transitioning 7-Mode SMB storage to ONTAP for CIFS data

This section covers the step-by-step procedure for transitioning a source 7-Mode SMB share to an ONTAP system.



NetApp assumes that the 7-Mode and ONTAP systems are SMB licensed. The destination SVM is created, the source and destination SMB shares are exported, and XCP is installed and licensed.

1. Scan the SMB shares for the files and directories.

```

C:\xcp>xcp scan -stats \\10.61.77.189\performance_SMB_home_dirs
XCP SMB 1.6; (c) 2020 NetApp, Inc.; Licensed to xxxx xxxx[NetApp Inc]
until Mon Dec 31 00:00:00 2029
== Maximum Values ==
Size Depth Namelen Dirsize
15.6MiB 2 8 200
== Average Values ==
Size Depth Namelen Dirsize
540KiB 2 7 81
== Top File Extensions ==
.txt .tmp
5601 2200
== Number of files ==
empty <8KiB 8-64KiB 64KiB-1MiB 1-10MiB 10-100MiB >100MiB
46 6301 700 302 200 252
== Space used ==
empty <8KiB 8-64KiB 64KiB-1MiB 1-10MiB 10-100MiB >100MiB
0 6.80MiB 8.04MiB 120MiB 251MiB 3.64GiB 0
== Directory entries ==
empty 1-10 10-100 100-1K 1K-10K >10k
18 1 77 1
== Depth ==
0-5 6-10 11-15 16-20 21-100 >100
7898
== Modified ==
>1 year >1 month 1-31 days 1-24 hrs <1 hour <15 mins future
2167 56 322 5353
== Created ==
>1 year >1 month 1-31 days 1-24 hrs <1 hour <15 mins future
2171 54 373 5300
Total count: 7898
Directories: 97
Regular files: 7801
Symbolic links:
Junctions:
Special files:
Total space for regular files: 4.02GiB
Total space for directories: 0
Total space used: 4.02GiB
7,898 scanned, 0 errors, 0s

```

2. Copy the files (with or without ACL) from the source to the destination SMB share. The following example shows a copy with ACL.


```

C:\xcp>xcp copy -acl -fallback-user "DOMAIN\gabi" -fallback-group
"DOMAIN\Group" \\10.61.77.189\performance_SMB_home_dirs
\\10.61.77.56\performance_SMB_home_dirs
XCP SMB 1.6; (c) 2020 NetApp, Inc.; Licensed to xxxx xxxx[NetApp Inc]
until Mon Dec 31 00:00:00 2029
7,898 scanned, 0 errors, 0 skipped, 184 copied, 96.1MiB (19.2MiB/s), 5s
7,898 scanned, 0 errors, 0 skipped, 333 copied, 519MiB (84.7MiB/s), 10s
7,898 scanned, 0 errors, 0 skipped, 366 copied, 969MiB (89.9MiB/s), 15s
7,898 scanned, 0 errors, 0 skipped, 422 copied, 1.43GiB (99.8MiB/s), 20s
7,898 scanned, 0 errors, 0 skipped, 1,100 copied, 1.69GiB (52.9MiB/s),
25s
7,898 scanned, 0 errors, 0 skipped, 1,834 copied, 1.94GiB (50.4MiB/s),
30s
7,898 scanned, 0 errors, 0 skipped, 1,906 copied, 2.43GiB (100MiB/s),
35s
7,898 scanned, 0 errors, 0 skipped, 2,937 copied, 2.61GiB (36.6MiB/s),
40s
7,898 scanned, 0 errors, 0 skipped, 2,969 copied, 3.09GiB (100.0MiB/s),
45s
7,898 scanned, 0 errors, 0 skipped, 3,001 copied, 3.58GiB (100.0MiB/s),
50s
7,898 scanned, 0 errors, 0 skipped, 3,298 copied, 4.01GiB (88.0MiB/s),
55s
7,898 scanned, 0 errors, 0 skipped, 5,614 copied, 4.01GiB (679KiB/s),
1m0s
7,898 scanned, 0 errors, 0 skipped, 7,879 copied, 4.02GiB (445KiB/s),
1m5s
7,898 scanned, 0 errors, 0 skipped, 7,897 copied, 4.02GiB (63.2MiB/s),
1m5s

```



If there is no data aggregate, create a new one using the storage aggr create command.

3. Sync the files on the source and destination.

```

C:\xcp>xcp sync -acl -fallback-user "DOMAIN\gabi" -fallback-group
"DOMAIN\Group" \\10.61.77.189\performance_SMB_home_dirs
\\10.61.77.56\performance_SMB_home_dirs
XCP SMB 1.6; (c) 2020 NetApp, Inc.; Licensed to xxxx xxxx[NetApp Inc]
until Mon Dec 31 00:00:00 2029
10,796 scanned, 4,002 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 5s
15,796 scanned, 8,038 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 10s
15,796 scanned, 8,505 compared, 0 errors, 0 skipped, 0 copied, 0

```

```

removed, 15s
15,796 scanned, 8,707 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 20s
15,796 scanned, 8,730 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 25s
15,796 scanned, 8,749 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 30s
15,796 scanned, 8,765 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 35s
15,796 scanned, 8,786 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 40s
15,796 scanned, 8,956 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 45s
8 XCP v1.6 User Guide © 2020 NetApp, Inc. All rights reserved.
Step Description
15,796 scanned, 9,320 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 50s
15,796 scanned, 9,339 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 55s
15,796 scanned, 9,363 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 1m0s
15,796 scanned, 10,019 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 1m5s
15,796 scanned, 10,042 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 1m10s
15,796 scanned, 10,059 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 1m15s
15,796 scanned, 10,075 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 1m20s
15,796 scanned, 10,091 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 1m25s
15,796 scanned, 10,108 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 1m30s
15,796 scanned, 10,929 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 1m35s
15,796 scanned, 12,443 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 1m40s
15,796 scanned, 13,963 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 1m45s
15,796 scanned, 15,488 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 1m50s
15,796 scanned, 15,796 compared, 0 errors, 0 skipped, 0 copied, 0
removed, 1m51s

```

4. Verify that the files were copied correctly.

```

C:\xcp> xcp verify \\10.61.77.189\performance_SMB_home_dirs
\\10.61.77.56\performance_SMB_home_dir
XCP SMB 1.6; (c) 2020 NetApp, Inc.; Licensed to xxxx xxxx[NetApp Inc]
until Mon Dec 31 00:00:00 2029
8 compared, 8 same, 0 different, 0 missing, 5s
24 compared, 24 same, 0 different, 0 missing, 10s
41 compared, 41 same, 0 different, 0 missing, 15s
63 compared, 63 same, 0 different, 0 missing, 20s
86 compared, 86 same, 0 different, 0 missing, 25s
423 compared, 423 same, 0 different, 0 missing, 30s
691 compared, 691 same, 0 different, 0 missing, 35s
1,226 compared, 1,226 same, 0 different, 0 missing, 40s
1,524 compared, 1,524 same, 0 different, 0 missing, 45s
1,547 compared, 1,547 same, 0 different, 0 missing, 50s
1,564 compared, 1,564 same, 0 different, 0 missing, 55s
2,026 compared, 2,026 same, 0 different, 0 missing, 1m0s
2,045 compared, 2,045 same, 0 different, 0 missing, 1m5s
2,061 compared, 2,061 same, 0 different, 0 missing, 1m10s
2,081 compared, 2,081 same, 0 different, 0 missing, 1m15s
2,098 compared, 2,098 same, 0 different, 0 missing, 1m20s
2,116 compared, 2,116 same, 0 different, 0 missing, 1m25s
3,232 compared, 3,232 same, 0 different, 0 missing, 1m30s
4,817 compared, 4,817 same, 0 different, 0 missing, 1m35s
6,267 compared, 6,267 same, 0 different, 0 missing, 1m40s
7,844 compared, 7,844 same, 0 different, 0 missing, 1m45s
7,898 compared, 7,898 same, 0 different, 0 missing, 1m45s,cifs

```

[Next: CIFS data migration with ACLs From a source storage box to ONTAP.](#)

CIFS data migration with ACLs from a source storage box to ONTAP

[Previous: Data migration from 7-Mode to ONTAP.](#)

This section covers the step-by-step procedure for migrating CIFS data with security information from a source to a target ONTAP system.

1. Verify that the target ONTAP system is healthy.

```

C1_sti96-vsim-ucs540m_cluster::> cluster show
Node                               Health  Eligibility
-----
sti96-vsim-ucs540m      true    true
sti96-vsim-ucs540n      true    true
2 entries were displayed.
C1_sti96-vsim-ucs540m_cluster::> node show
Node      Health  Eligibility  Uptime           Model           Owner           Location
-----
sti96-vsim-ucs540m
           true   true        15 days 21:17  SIMBOX          ahammed         sti
sti96-vsim-ucs540n
           true   true        15 days 21:17  SIMBOX          ahammed         sti
2 entries were displayed.
cluster::> storage failover show
Node      Partner      Takeover
-----
sti96-vsim-ucs540m
           sti96-vsim-  true    Connected to sti96-vsim-ucs540n
           ucs540n
sti96-vsim-ucs540n
           sti96-vsim-  true    Connected to sti96-vsim-ucs540m
           ucs540m
2 entries were displayed.
C1_sti96-vsim-ucs540m_cluster::>

```

2. Verify that at least one nonroot aggregate exists on the target system. The aggregate is normal.

```
cluster::*> storage aggregate show
Aggregate      Size Available Used% State   #Vols  Nodes      RAID
Status
-----
-----
aggr0_sti96_vsim_ucs540o
      7.58GB    373.3MB   95% online      1 sti96-vsim-
raid_dp,
                                ucs540o
normal
aggr0_sti96_vsim_ucs540p
      7.58GB    373.3MB   95% online      1 sti96-vsim-
raid_dp,
                                ucs540p
normal
aggr_001    103.7GB    93.63GB   10% online      1 sti96-vsim-
raid_dp,
                                ucs540p
normal
sti96_vsim_ucs540o_aggr1
      23.93GB    23.83GB    0% online      1 sti96-vsim-
raid_dp,
                                ucs540o
normal
sti96_vsim_ucs540p_aggr1
      23.93GB    23.93GB    0% online      0 sti96-vsim-
raid_dp,
                                ucs540p
normal
5 entries were displayed.
```



If there is no data aggregate, create a new one using the `storage aggr create` command.

3. Create an SVM on the target cluster system.

```
cluster::*> vservers create -vservers vs1 -rootvolume root_vs1 -aggregate
sti96_vsim_ucs540o_aggr1 -rootvolume-security-style mixed
```

Verify that the SVM was successfully created.

```
C2_sti96_vsim_ucs540o_cluster::*> vservers show -vservers vs1
Vserver: vs1
Vserver Type: data
Vserver Subtype: default
Vserver UUID: f8bc54be-d91b-11e9-b99c-
005056a7e57e
Root Volume: root_vs1
Aggregate: sti96_vsim_ucs540o_aggr1
NIS Domain: NSQA-RTP-NIS1
Root Volume Security Style: mixed
LDAP Client: esisconfig
Default Volume Language Code: C.UTF-8
Snapshot Policy: default
Data Services: data-nfs, data-cifs,
data-flexcache, data-iscsi
Comment: vs1
Quota Policy: default
List of Aggregates Assigned: -
Limit on Maximum Number of Volumes allowed: unlimited
Vserver Admin State: running
Vserver Operational State: running
Vserver Operational State Stopped Reason: -
Allowed Protocols: nfs, cifs, fcp, iscsi, ndmp
Disallowed Protocols: -
Is Vserver with Infinite Volume: false
QoS Policy Group: -
Caching Policy Name: -
Config Lock: false
Volume Delete Retention Period: 0
IPspace Name: Default
Foreground Process: -
Is Msid Preserved for DR: false
Force start required to start Destination in multiple IDP fan-out case:
false
Logical Space Reporting: false
Logical Space Enforcement: false
```

4. Create a new read-write data volume on the destination SVM. Verify that the security style, language settings, and capacity requirements match the source volume.

```
CLUSTER CLUSTER::> vol create -vserver vs1 -volume dest_vol -aggregate
aggr_001 -size 150g type RW -state online -security-style ntfs
```

5. Create a data LIF to serve SMB client requests.

```
CLUSTER::> network interface create -vserver vs1 -lif sti96-vsim-
ucs540o_data1 -address 10.237.165.87 -netmask 255.255.240.0 -role data
-data-protocol nfs,cifs -home-node sti96-vsim-ucs540o -home-port e0d
```

Verify that the LIF was successfully created.

```
cluster::*> network interface show -vserver vs1
```

Current Is	Logical	Status	Network	Current
Vserver	Interface	Admin/Oper	Address/Mask	Node
Home				Port
vs1	sti96-vsim-ucs540o_data1	up/up	10.237.165.87/20	sti96-vsim-ucs540o e0d
true				

6. If required, create a static route with the SVM.

```
Network route create -vserver dest -destination 0.0.0.0/0 -gateway
10.237.160.1
```

Verify that the route was successfully created.

```
cluster::*> network route show -vserver vs1
```

Vserver	Destination	Gateway	Metric
vs1	0.0.0.0/0	10.237.160.1	20
	::/0	fd20:8b1e:b255:9155::1	20

2 entries were displayed.

7. Mount the target data volume in the SVM namespace.

```
CLUSTER::> volume mount -vserver vs1 -volume dest_vol -junction-path
/dest_vol -active true
```

Verify that the volume is successfully mounted.

```
cluster::*> volume show -vserver vs1 -fields junction-path
vserver volume    junction-path
-----
vs1      dest_vol /dest_vol
vs1      root_vs1 /
2 entries were displayed.
Note: You can also specify the volume mount options (junction path) with
the volume create command.
```

8. Start the CIFS service on the target SVM.

```
cluster::*> vserver cifs start -vserver vs1
Warning: The admin status of the CIFS server for Vserver "vs1" is
already "up".
```

Verify that the service is started and running.

```
cluster::*>
Verify the service is started and running
C2_sti96-vs1m-ucs540o_cluster::*> cifs show
```

Vserver	Server Name	Status Admin	Domain/Workgroup Name	Authentication Style
vs1	D60AB15C2AFC4D6	up	CTL	domain

9. Verify that the default export policy is applied to the target SVM.

```
CLUSTER::> vserver export-policy show -vserver dest
```

Vserver	Policy Name
dest	default

If required, create a new custom export policy for the target SVM.


```
CLUSTER::> vserver export-policy create -vserver vs1 -policyname  
xcpexport
```

10. Modify the export policy rules to allow access to CIFS clients.

```
CLUSTER::> export-policy rule modify -vserver dest -ruleindex 1  
-policyname xcpexportpolicy -clientmatch 0.0.0.0/0 -rorule any -rwrule  
any -anon 0
```

Verify that the policy rules are modified.

```

cluster::*> export-policy rule show -instance
                Vserver: vs1
                Policy Name: default
                Rule Index: 1
                Access Protocol: any
List of Client Match Hostnames, IP Addresses, Netgroups, or Domains:
0.0.0.0/0
                RO Access Rule: any
                RW Access Rule: any
User ID To Which Anonymous Users Are Mapped: 65534
                Superuser Security Types: any
                Honor SetUID Bits in SETATTR: true
                Allow Creation of Devices: true
                NTFS Unix Security Options: fail
Vserver NTFS Unix Security Options: use_export_policy
                Change Ownership Mode: restricted
Vserver Change Ownership Mode: use_export_policy
                Policy ID: 12884901889
                Vserver: vs1
                Policy Name: default
                Rule Index: 2
                Access Protocol: any
List of Client Match Hostnames, IP Addresses, Netgroups, or Domains:
0:0:0:0:0:0:0:0/0
                RO Access Rule: any
                RW Access Rule: any
User ID To Which Anonymous Users Are Mapped: 65534
                Superuser Security Types: none
                Honor SetUID Bits in SETATTR: true
                Allow Creation of Devices: true
                NTFS Unix Security Options: fail
Vserver NTFS Unix Security Options: use_export_policy
                Change Ownership Mode: restricted
Vserver Change Ownership Mode: use_export_policy
                Policy ID: 12884901889
2 entries were displayed.

```

11. Verify that the client is allowed access to the volume.

```
cluster::*> export-policy check-access -vserver vs1 -volume dest_vol
-client-ip 10.234.17.81 -authentication-method none -protocol cifs
-access-type read-write
```

Path	Policy	Policy Owner	Policy Owner Type	Rule Index
Access				
-----	-----	-----	-----	-----
/	default	root_vs1	volume	1
read				
/dest_vol	default	dest_vol	volume	1
read-write				

2 entries were displayed.

12. Connect to the Windows client system where XCP is installed. Browse to the XCP install path.

```
C:\WRSHDNT>dir c:\netapp\xcp
dir c:\netapp\xcp
Volume in drive C has no label.
Volume Serial Number is 5C04-C0C7
Directory of c:\netapp\xcp
09/18/2019  09:30 AM    <DIR>          .
09/18/2019  09:30 AM    <DIR>          ..
06/25/2019  06:27 AM                304 license
09/18/2019  09:30 AM    <DIR>          Logs
09/29/2019  08:45 PM       12,143,105 xcp.exe
                2 File(s)       12,143,409 bytes
                3 Dir(s)  29,219,549,184 bytes free
```

13. Query the source node SMB exports by running the `xcp show` command on the XCP Windows client host system.

```

C:\WRSHDNT>c:\netapp\xcp\xcp show \\10.237.165.71
c:\netapp\xcp\xcp show \\10.237.165.71
XCP SMB 1.6; (c) 2020 NetApp, Inc.; Licensed to XXX [NetApp Inc] until
Mon Dec 31 00:00:00 2029
  Shares   Errors   Server
      6       0      10.237.165.71
== SMB Shares ==
  Space   Space   Current
  Free    Used    Connections Share Path          Folder Path
  9.50GiB 4.57MiB 1          \\10.237.165.71\source_share C:\source_vol
  94.3MiB 716KiB 0          \\10.237.165.71\ROOTSHARE   C:\
  0        0       N/A        \\10.237.165.71\ipc$       N/A
  94.3MiB 716KiB 0          \\10.237.165.71\c$         C:\
== Attributes of SMB Shares ==
  Share                                     Types
Remark
  source_share                             DISKTREE
  test share                              DISKTREE
  test_sh                                  DISKTREE
  ROOTSHARE                               DISKTREE          \"Share mapped
to top of Vserver global namespace, created bydeux_init \"
  ipc$                                     PRINTQ,SPECIAL,IPC,DEVICE
  c$                                       SPECIAL
== Permissions of SMB Shares ==
  Share                                     Entity
Type
  source_share                             Everyone
Allow/Full Control
  ROOTSHARE                               Everyone
Allow/Full Control
  ipc$                                     Everyone
Allow/Full Control
  c$                                       Administrators
Allow/Full Control/

```

14. Run the help command for copy.

```

C:\WRSHDNT>c:\netapp\xcp\xcp help copy
c:\netapp\xcp\xcp help copy
XCP SMB 1.6; (c) 2020 NetApp, Inc.; Licensed to XXX [NetApp Inc] until
Mon Dec 31 00:00:00 2029
usage: xcp copy [-h] [-v] [-parallel <n>] [-match <filter>] [-preserve-
atime]
                [-acl] [-fallback-user FALLBACK_USER]
                [-fallback-group FALLBACK_GROUP] [-root]
                source target
positional arguments:
  source
  target
optional arguments:
  -h, --help            show this help message and exit
  -v                    increase debug verbosity
  -parallel <n>         number of concurrent processes (default: <cpu-
count>)
  -match <filter>       only process files and directories that match
the
                        filter (see `xcp help -match` for details)
  -preserve-atime       restore last accessed date on source
  -acl                  copy security information
  -fallback-user FALLBACK_USER
                        the name of the user on the target machine to
receive
                        the permissions of local (non-domain) source
machine
                        users (eg. domain\administrator)
  -fallback-group FALLBACK_GROUP
                        the name of the group on the target machine to
receive
                        the permissions of local (non-domain) source
machine
                        groups (eg. domain\administrators)
  -root                copy acl for root directorytxt

```

15. On the target ONTAP system, get the list of local user and local group names that you need to provide as values for the fallback-user and fallback-group arguments path.

```

cluster::*> local-user show
(vserver cifs users-and-groups local-user show)
Vserver      User Name      Full Name
Description
-----
vs1          D60AB15C2AFC4D6\Administrator
                                           Built-in
administrator account
C2_sti96-vsim-ucs540o_cluster::*> local-group show
(vserver cifs users-and-groups local-group show)
Vserver      Group Name      Description
-----
vs1          BUILTIN\Administrators      Built-in Administrators
group
vs1          BUILTIN\Backup Operators      Backup Operators group
vs1          BUILTIN\Guests      Built-in Guests Group
vs1          BUILTIN\Power Users      Restricted
administrative privileges
vs1          BUILTIN\Users      All users
5 entries were displayed

```

16. To migrate the CIFS data with ACLs from the source to target, run the `xcp copy` command with the `-acl` and `-fallback-user/group` options.

For the `fallback-user/group` options, specify any user or group that can be found in Active Directory or local user/group to target system.

```

C:\WRSHDNT>c:\netapp\xcp\xcp copy -acl -fallback-user
D60AB15C2AFC4D6\Administrator -fallback-group BUILTIN\Users
\\10.237.165.79\source_share \\10.237.165.89\dest_share
c:\netapp\xcp\xcp copy -acl -fallback-user D60AB15C2AFC4D6\Administrator
-fallback-group BUILTIN\Users \\10.237.165.79\source_share
\\10.237.165.89\dest_share
XCP SMB 1.6; (c) 2020 NetApp, Inc.; Licensed to XXX [NetApp Inc] until
Mon Dec 31 00:00:00 2029
753 scanned, 0 errors, 0 skipped, 0 copied, 0 (0/s), 8s
753 scanned, 0 errors, 0 skipped, 0 copied, 0 (0/s), 13s
753 scanned, 0 errors, 0 skipped, 0 copied, 0 (0/s), 18s
ERROR failed to obtain fallback security principal "BUILTIN\Users".
Please check if the principal with the name "BUILTIN\Users" exists on
"D60AB15C2AFC4D6".
ERROR failed to obtain fallback security principal
"D60AB15C2AFC4D6\Administrator". Please check if the principal with the
name "D60AB15C2AFC4D6\Administrator" exists on "D60AB15C2AFC4D6".
ERROR failed to obtain fallback security principal "BUILTIN\Users".
Please check if the principal with the name "BUILTIN\Users" exists on
"D60AB15C2AFC4D6".
ERROR failed to obtain fallback security principal "BUILTIN\Users".
Please check if the principal with the name "BUILTIN\Users" exists on
"D60AB15C2AFC4D6".
ERROR failed to obtain fallback security principal "BUILTIN\Users".
Please check if the principal with the name "BUILTIN\Users" exists on
"D60AB15C2AFC4D6".
753 scanned, 0 errors, 0 skipped, 0 copied, 0 (0/s), 23s
ERROR failed to obtain fallback security principal
"D60AB15C2AFC4D6\Administrator". Please check if the principal with the
name "D60AB15C2AFC4D6\Administrator" exists on "D60AB15C2AFC4D6".
ERROR failed to obtain fallback security principal
"D60AB15C2AFC4D6\Administrator". Please check if the principal with the
name "D60AB15C2AFC4D6\Administrator" exists on "D60AB15C2AFC4D6".
ERROR failed to obtain fallback security principal
"D60AB15C2AFC4D6\Administrator". Please check if the principal with the
name "D60AB15C2AFC4D6\Administrator" exists on "D60AB15C2AFC4D6".
753 scanned, 0 errors, 0 skipped, 0 copied, 0 (0/s), 28s
753 scanned, 0 errors, 0 skipped, 249 copied, 24.0KiB (4.82KiB/s), 33s
753 scanned, 0 errors, 0 skipped, 744 copied, 54.4KiB (6.07KiB/s), 38s
753 scanned, 0 errors, 0 skipped, 746 copied, 54.5KiB (20/s), 43s
753 scanned, 0 errors, 0 skipped, 752 copied, 54.7KiB (1.23KiB/s), 44s
C:\WRSHDNT>

```

17. If xcp copy results in the error message ERROR failed to obtain fallback security principal, add the destination box in the hosts file (C:\Windows\System32\drivers\etc\hosts).

Use the following format for the NetApp storage destination box entry.

```
<data vservers data interface ip> 1 or more white spaces <cifs server
name>
```

```
cluster::*> cifs show
      Server      Status      Domain/Workgroup Authentication
Vserver  Name      Admin      Name      Style
-----
vs1      D60AB15C2AFC4D6 up      CTL      domain
C2_sti96-vsim-ucs540o_cluster::*> network interface show
      Logical      Status      Network      Current
Current Is
Cluster
      sti96-vsim-ucs540p_clus1
      up/up      192.168.148.136/24 sti96-vsim-ucs540p
      e0a
true
      sti96-vsim-ucs540p_clus2
      up/up      192.168.148.137/24 sti96-vsim-ucs540p
      e0b
true
vs1
      sti96-vsim-ucs540o_data1
      up/up      10.237.165.87/20 sti96-vsim-ucs540o
      e0d
true
      sti96-vsim-ucs540o_data1_inet6
      up/up      fd20:8b1e:b255:9155::583/64
      sti96-vsim-ucs540o
      e0d
true
      sti96-vsim-ucs540o_data2
      up/up      10.237.165.88/20 sti96-vsim-ucs540o
      e0e
true
10.237.165.87 D60AB15C2AFC4D6 -> destination box entry to be added in
hosts file.
```

18. If you still get the error message ERROR failed to obtain fallback security principal after adding the destination box entry in the hosts files, then the user/group does not exist in the target system.


```

C:\WRSHDNT>c:\netapp\xcp\xcp copy -acl -fallback-user
D60AB15C2AFC4D6\unknown_user -fallback-group BUILTIN\Users
\\10.237.165.79\source_share \\10.237.165.89\dest_share
c:\netapp\xcp\xcp copy -acl -fallback-user D60AB15C2AFC4D6\unknown_user
-fallback-group BUILTIN\Users \\10.237.165.79\source_share
\\10.237.165.89\dest_share
XCP SMB 1.6; (c) 2020 NetApp, Inc.; Licensed to XXX [NetApp Inc] until
Mon Dec 31 00:00:00 2029
ERROR failed to obtain fallback security principal
"D60AB15C2AFC4D6\unknown_user". Please check if the principal with the
name "D60AB15C2AFC4D6\unknown_user" exists on "D60AB15C2AFC4D6".
ERROR failed to obtain fallback security principal
"D60AB15C2AFC4D6\unknown_user". Please check if the principal with the
name "D60AB15C2AFC4D6\unknown_user" exists on "D60AB15C2AFC4D6".
ERROR failed to obtain fallback security principal
"D60AB15C2AFC4D6\unknown_user". Please check if the principal with the
name "D60AB15C2AFC4D6\unknown_user" exists on "D60AB15C2AFC4D6".
ERROR failed to obtain fallback security principal
"D60AB15C2AFC4D6\unknown_user". Please check if the principal with the
name "D60AB15C2AFC4D6\unknown_user" exists on "D60AB15C2AFC4D6".
753 scanned, 0 errors, 0 skipped, 0 copied, 0 (0/s), 5s
753 scanned, 0 errors, 0 skipped, 0 copied, 0 (0/s), 10s
753 scanned, 0 errors, 0 skipped, 0 copied, 0 (0/s), 15s
753 scanned, 0 errors, 0 skipped, 284 copied, 27.6KiB (5.54KiB/s), 20s
753 scanned, 0 errors, 0 skipped, 752 copied, 54.7KiB (2.44KiB/s), 22s
C:\WRSHDNT>

```

19. Use `xcp copy` to migrate CIFS data with ACLs (with or without the root folder).

Without the root folder, run the following commands:

```

C:\WRSHDNT>c:\netapp\xcp\xcp copy -acl -fallback-user
D60AB15C2AFC4D6\Administrator -fallback-group BUILTIN\Users
\\10.237.165.79\source_share \\10.237.165.89\dest_share
c:\netapp\xcp\xcp copy -acl -fallback-user
D60AB15C2AFC4D6\Administrator -fallback-group BUILTIN\Users
\\10.237.165.79\source_share \\10.237.165.89\dest_share
XCP SMB 1.6; (c) 2020 NetApp, Inc.; Licensed to XXX [NetApp Inc] until
Mon Dec 31 00:00:00 2029
753 scanned, 0 errors, 0 skipped, 0 copied, 0 (0/s), 5s
753 scanned, 0 errors, 0 skipped, 0 copied, 0 (0/s), 10s
753 scanned, 0 errors, 0 skipped, 0 copied, 0 (0/s), 15s
753 scanned, 0 errors, 0 skipped, 210 copied, 20.4KiB (4.08KiB/s), 20s
753 scanned, 0 errors, 0 skipped, 752 copied, 54.7KiB (2.38KiB/s), 22s
C:\WRSHDNT>

```

With the root folder, run the following commands:

```

C:\WRSHDNT>c:\netapp\xcp\xcp copy -acl -root -fallback-user
D60AB15C2AFC4D6\Administrator -fallback-group BUILTIN\Users
\\10.237.165.79\source_share \\10.237.165.89\dest_share
c:\netapp\xcp\xcp copy -acl -root -fallback-user
D60AB15C2AFC4D6\Administrator -fallback-group BUILTIN\Users
\\10.237.165.79\source_share \\10.237.165.89\dest_share
XCP SMB 1.6; (c) 2020 NetApp, Inc.; Licensed to XXX [NetApp Inc] until
Mon Dec 31 00:00:00 2029
753 scanned, 0 errors, 0 skipped, 0 copied, 0 (0/s), 5s
753 scanned, 0 errors, 0 skipped, 0 copied, 0 (0/s), 10s
753 scanned, 0 errors, 0 skipped, 0 copied, 0 (0/s), 15s
753 scanned, 0 errors, 0 skipped, 243 copied, 23.6KiB (4.73KiB/s), 20s
753 scanned, 0 errors, 0 skipped, 752 copied, 54.7KiB (6.21KiB/s), 25s
753 scanned, 0 errors, 0 skipped, 752 copied, 54.7KiB (0/s), 30s
753 scanned, 0 errors, 0 skipped, 752 copied, 54.7KiB (0/s), 35s
753 scanned, 0 errors, 0 skipped, 752 copied, 54.7KiB (0/s), 40s
753 scanned, 0 errors, 0 skipped, 752 copied, 54.7KiB (0/s), 45s
753 scanned, 0 errors, 0 skipped, 752 copied, 54.7KiB (0/s), 50s
753 scanned, 0 errors, 0 skipped, 752 copied, 54.7KiB (0/s), 55s
753 scanned, 0 errors, 0 skipped, 752 copied, 54.7KiB (0/s), 1m0s
753 scanned, 0 errors, 0 skipped, 752 copied, 54.7KiB (0/s), 1m5s
753 scanned, 0 errors, 0 skipped, 752 copied, 54.7KiB (817/s), 1m8s
C:\WRSHDNT>

```

Next: [Best practice guidelines and recommendations.](#)

Best practice guidelines and recommendations

[Previous: CIFS data migration with ACLs From a source storage box to ONTAP.](#)

- Use the XCP client operating system, which is IMT supported. The IMT supported client is qualified by NetApp.
- Run XCP as a root user in the Linux operating system to perform migration. you can run the xcp command as the sudo user, but it is not supported by XCP.
- Run only one instance of XCP per client. Technically you can run multiple instanced of XCP on the same host from a different location, however this is not a supported practice. Indeed, running many instances might result in failure.
- In the current XCP version, Live Source is not supported. If the source NetApp volume is active and continuously changed by applications and users, you should take a snapshot of the source volume to perform a migration.
- It is a best practice to create a new snapshot with a different name for every incremental sync so that it is easy to create an incremental migration path based on the snapshot name in the event of failure.
- If you are performing a snapshot-based migration, it is a best practice to continue snapshot-based migration until cutover.
- If you have more than 10 million files and you have incremental data change of more than 50%, it is a best practice to use a higher core count and more memory than the minimum recommendation in the installation and administration guide.

[Next: Troubleshooting.](#)

Troubleshooting

[Previous: Best practice guidelines and recommendations.](#)

Error 1: XCP Failed with nfs3 error 70: stale filehandle Error in the xcp.log

Reason and guidance.

Mount the source folder and verify that the folder exists. If it does not exist or if it has been removed, you will receive a `stale filehandle` error, in which case, you can ignore the error.

Error 2: NetApp NFS Destination Volume Has Space, but XCP Failed with nfs3 error 28: no space left on device

Reason and guidance.

1. Check the space of the NFS destination volume by running the `df` command or check the storage.

```
root@workr-140: USER3# df -h /xcpdest
Filesystem                Size  Used Avail Use% Mounted on
10.63.150.127:/xcpsrc_vol 4.3T  1.7T  2.6T  40% /xcpsrc_vol
```

2. Check the inodes in the storage controller.

```
A800-Node1-2::> volume show -volume xcpdest -fields files,files-used
vserver          volume  files    files-used
-----
A800-Node1_vs1  xcpdest 21251126 21251126
A800-Node1-2::>
```

3. If inode is used, increase the number of inodes by running the following command:

```
A800-Node1-2::> volume modify -volume xcpdest -vserver A800-Node1_vs1
-files 40000000
Volume modify successful on volume xcpdest of Vserver A800-Node1_vs1.
A800-Node1-2::> volume show -volume xcpdest -fields files,files-used
vserver          volume  files    files-used
-----
A800-Node1_vs1  xcpdest 39999990 21251126
A800-Node1-2::>
```

Next: [Where to find additional information.](#)

Where to find additional information

Previous: [Troubleshooting.](#)

To learn more about the information described in this document, refer to the following documents and/or websites:

- NetApp XCP blogs
<https://blog.netapp.com/tag/netapp-xcp/>
- NetApp XCP user guide
<https://library-clnt.dmz.netapp.com/documentation/productlibrary/index.html?productID=63064>
- Bigdata Analytics data to Artificial Intelligence – Data mover solution for AI
<https://www.netapp.com/us/media/tr-4732.pdf>

Next: [Version history.](#)

Version history

Previous: [Where to find additional information.](#)

Version	Date	Document version history
Version 1.0	October 2020	Initial release.

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