

NetBackup™ Snapshot Manager for Data Center Administrator's Guide

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NetBackup™ Snapshot Manager for Data Center Administrator's Guide

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Introduction

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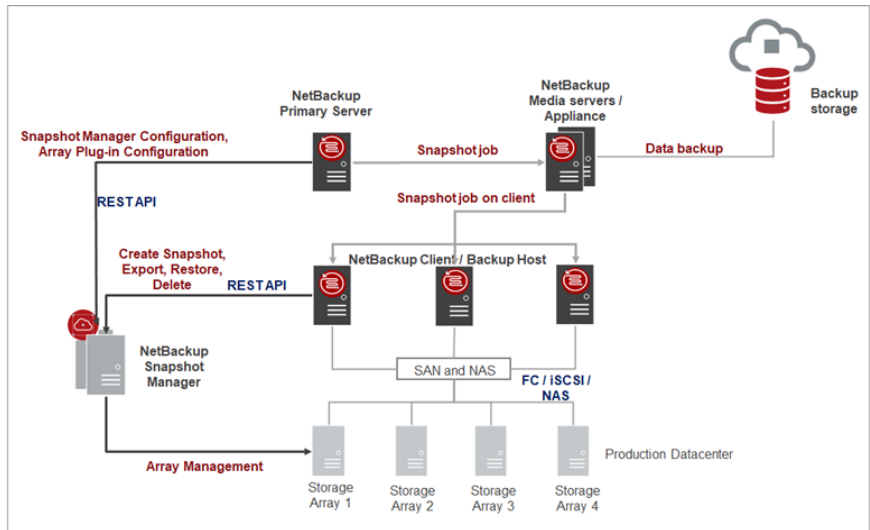
- [About Snapshot Manager for Data Center](#)

About Snapshot Manager for Data Center

Snapshot Manager for Data Center is developed as a micro-services-based application and uses the micro-services model of deployment. It provides a variety of snapshot-based features for NetBackup.

NetBackup interfaces with the Snapshot Manager for Data Center component to discover devices on various storage arrays and for snapshot lifecycle management of these devices. You can connect these devices over Fiber Channel, iSCSI networks (SANs) or as NAS devices using NFS or SMB protocol. When the Snapshot Manager for Data Center is used in an on-premises environment, you can protect the workload data residing on the supported on-premises storage arrays.

Following is the high-level architecture diagram for snapshot management in NetBackup using Snapshot Manager:



Installation and Upgrade

This chapter includes the following topics:

- [Installing and upgrading Snapshot Manager](#)
- [Configuring Snapshot Manager for Data Center](#)
- [Associating NetBackup media server\(s\) with Snapshot Manager for Data Center](#)

Installing and upgrading Snapshot Manager

Snapshot Manager is installed separately from NetBackup, and it has plug-ins for various storage arrays. It can have various forms of deployment like, docker, K8s, deployed along with NetBackup appliance form factor or NetBackup media server.

For installation and configurations related information, refer to the *NetBackup™ Snapshot Manager Install and Upgrade Guide*.

Configuring Snapshot Manager for Data Center

Before using the Snapshot Manager for Data Center to perform snapshot management operations, you need to configure the Snapshot Manager for Data Center component with NetBackup.

To configure the Snapshot Manager for Data Center in NetBackup, perform the following operations using Java UI.

- 1 In the NetBackup Administration Console, in the left pane, click the **Media and Device Management** node.
- 2 Click the **Credentials** node to see the **Snapshot Managers** option.
- 3 Right-click **Snapshot Managers**, and select **New Snapshot Managers**.

- 4 In the **New Snapshot Manager** dialog, enter hostname and port of Snapshot Manager to be added and click **Validate Server** to validate it.

Note: The default port number for Snapshot Manager is 443.

- 5 In the **Credentials** pane of the **New Snapshot Manager** dialog box, enter the username and password to access the Snapshot Manager for Data Center. Click **OK**.

Associating NetBackup media server(s) with Snapshot Manager for Data Center

You can use a media server(s) to perform snapshot management and replication operations in your on-premise environment. To use a media server(s), you must associate one or more media servers to the Snapshot Manager for Data Center. The media server(s) must be in an active state to run the snapshot or replication jobs. The media server that you associate with the Snapshot Manager for Data Center must be associated to your NetBackup primary server as well.

You can associate media servers with the `tpconfig` command in the CLI. Use the command:

```
tpconfig -update -snapshot_manager <snapshot_manager_server_name>
-add_media_server <media_server>
```

To associate multiple media servers, you can run this command once for each server. If you do not associate a media server, the NetBackup primary server is used

You may also associate NetBackup media server with Snapshot Manager for Data Center using NetBackup APIs. To associate NetBackup media server using API, refer to the NetBackup API documentation: <https://swagger.javaws.kubert.vrts.io/>

Configure NetBackup Snapshot Manager storage array plug-ins

This chapter includes the following topics:

- [Configuring Snapshot Manager for Data Center storage array plug-ins](#)
- [Plug-in Discovery](#)

Configuring Snapshot Manager for Data Center storage array plug-ins

Snapshot Manager for Data Center plug-ins are software modules that enable the discovery of your assets in the on-premise storage array environment. After registering the Snapshot Manager for Data Center server with the NetBackup primary server, you must configure the Snapshot Manager for Data Center storage array plug-ins to be able to protect your workloads using NetBackup.

If the Snapshot Manager for Data Center server is deployed on-premise and you want to protect storage arrays, you must use the NetBackup Administration Console (Java UI) to configure the storage array plug-ins. The overall steps to configure different storage array plug-ins are similar, only the configuration parameters vary. See [“Configure the storage array plug-ins for Snapshot Manager for Data Center”](#) on page 21. for configuration parameters for each storage array plug-in.

To configure a storage array plugin, perform the following steps in Java UI:

- 1 In the NetBackup Administration Console, in the left pane, click the **Media and Device Management** node.
- 2 Click the **Credentials** node to see the **Snapshot Managers** option.
- 3 Select the Snapshot Manager where you want to add the plug-in. The **Snapshot Manager plugin** pane is refreshed. Right-click the blank row.
- 4 In the menu, click **New Storage Array Plugin**.
- 5 In the Add New Plugin dialog box, from the **Available Plugins** list, select the plug-in you want to add. Click **Next**.
- 6 In the Configure Plugin dialog box, enter the plug-in ID. Enter the credential details. Click **OK**.

A confirmation message is displayed. The newly added plug-in is listed in the **Snapshot Manager Plugins** pane.

Note: The plug-in ID must be unique and must comprise of A-Z, a-z, 0 9, + , , _ , - characters.

You may also add storage array plug-ins in the Snapshot Manager using NetBackup APIs. For details, refer to the NetBackup API documentation:

<https://swagger.javaws.kubert.vrts.io/>

Plug-in Discovery

Plug-in discovery is a functionality which is available for all the storage arrays supported by Snapshot Manager for Data Center. As a part of the discovery operation, the Snapshot Manager discovers all the assets: disks, LUNs, volumes, replication relationship and so on, from the storage array. These assets are persisted in the Snapshot Manager database and further used for snapshot and replication operations.

Whenever a new storage array plugin is configured, a discovery operation is automatically triggered to fetch all the assets from the storage array. Snapshot Manager automatically schedules the plug-in discovery after every 4 hours. This discovery interval can be configured using the NetBackup API.

You can monitor the status of discovery operation in the **Status** column of the Storage array plugin in the **Snapshot Manager Plugin** pane.

Also, you can manually trigger the discovery operation for a specific storage array plugin.

To manually trigger a discovery operation:

- 1** Right-click on the Storage Array Plugin for which you want to trigger discovery in the **Snapshot Manager Plugins** pane.
- 2** Click **Discover Assets**.

This changes the **Status** column of the added storage plugin to **Discovering**.

You may also trigger the plug-in discovery via NetBackup API. To perform discovery using the NetBackup APIs, refer to the NetBackup API documentation:

<https://swagger.javaws.kubert.vrts.io/>

Storage array replication

This chapter includes the following topics:

- [About Snapshot Manager replication](#)
- [Deployment and architecture](#)
- [Specifying the replication destination in NetBackup](#)
- [Configure NetBackup for replication](#)

About Snapshot Manager replication

Snapshot Manager for Data Center can replicate the storage array snapshots, to leverage the replication capabilities of storage array vendors to provide robust data protection. As a part of replication, Snapshot Manager for Data Center discovers the replication infrastructure and the replication topology that already exists and configured on the storage array. Using NetBackup, you can now replicate the snapshots to a specific replication destination (target) of your choice or you can let NetBackup identify the destination for replicating the snapshots.

Snapshots represent a point-in-time of primary storage data as captured by the storage array. The Snapshot Manager then communicates with storage array to replicate the snapshot from the primary volume to other volumes configured for replication on the storage array. The snapshot can be replicated to multiple volumes within the same storage array or cluster. The snapshots can also be replicated to volumes on other storage arrays or clusters of the same type as the source array.

The replication feature offers a single NetBackup interface for end-to-end data protection management for the following tasks:

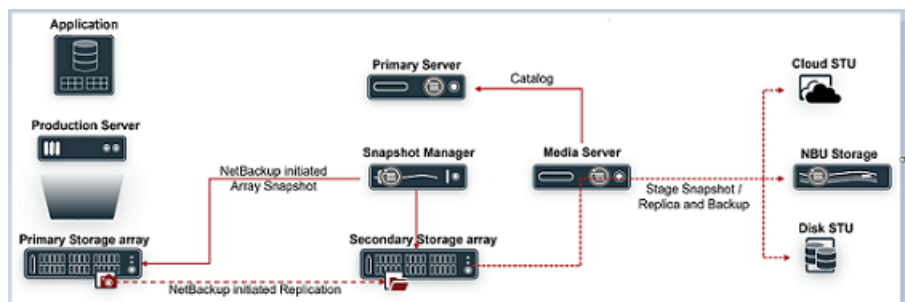
- Unified policy management.
Use the NetBackup console as the one, centralized backup infrastructure to manage the entire lifecycle of all data.

- **Snapshot copy management.**
Use NetBackup to manage the entire lifecycle of the snapshot. Replication uses storage array plug-ins on the Snapshot Manager to perform operations on the assets (volumes, LUNs) residing on the storage array. NetBackup can initiate operations to move, expire, or delete images from the storage array.
The instruction to perform the initial snapshot comes from an operation in a NetBackup Storage Lifecycle Policy (SLP). You can create a single SLP that instructs NetBackup to create the initial snapshot, to replicate the snapshot to several locations, and to indicate a different retention period for each of the replications. Additional instructions (or operations) can be included in the SLP that create a backup from the snapshot, index the snapshot, and more.
- **Snapshot copy monitoring.**
Use NetBackup activity monitor to view each snapshot copy at storage array location.
- **Restore.**
Recovery is available from any storage device in the environment that is defined to NetBackup. This includes recovery from the primary copy (initial snapshot) or any replicated snapshot on the storage array or from any NetBackup created copy residing on de-duped storage.

Deployment and architecture

The replication feature is currently supported for the snapshots created for a NAS storage.

Note: This feature is not supported for snapshots created for SAN storage.



Prerequisites

- You must establish the replication relationship between the source and destination.

- Complete the management host/console setup to manage the storage arrays.
- Configure the required user for admin activities with necessary permissions as required by NetBackup. Refer to the individual storage array section in the *Supported storage arrays in data center* chapter.

Software requirements for replication

For all the supported software versions of Snapshot Manager, primary server, media server, and clients refer to the *Snapshot Manager* section, under *Snapshot Solutions* in the *NetBackup Hardware and Cloud Storage Compatibility List (HCL)*. Snapshot Manager section, under Snapshot Solutions in the NetBackup Hardware and Cloud Storage Compatibility List (HCL).

Specifying the replication destination in NetBackup

Snapshot Manager for Data Center discovers the replication infrastructure and the replication destinations (targets) for all storage arrays for which it supports snapshot replication. This information is discovered as a part of the storage array plug-in discovery operation. For the list of all the storage arrays for which NetBackup supports snapshot replication, refer to the *Snapshot Manager* section in the *NetBackup Hardware and Cloud Storage Compatibility List (HCL)*.

The lifecycle of the snapshot and replica copy is managed using Storage Lifecycle Policy. You can select the required replication destination (target) as a part of replication operation in SLP.

See [“About configuring storage lifecycle policies for snapshots and snapshot replication”](#) on page 92. for details.

The following table describes the supported values for replication destination.

Table 4-1 Replication destination in SLP

Replication destination	Description
Auto	NetBackup automatically identifies the replication destination.
<code><Vendor>_<ReplicationType></code> For example: <code><Vendor>_<Replication></code> = <code>NetApp_SnapMirror</code>	See “Configure the storage array plug-ins for Snapshot Manager for Data Center” on page 21. For the supported replication types for individual storage array.

Configure NetBackup for replication

Perform the steps given in the table in the exact order to configure replication for NetBackup.

Table 4-2 Replication configuration tasks overview

Step	Description	Reference topic
1.	Install or upgrade the required NetBackup software	See “Deployment and architecture” on page 16.
2.	Configure the Snapshot Manager	See “Configuring Snapshot Manager for Data Center” on page 10.
3.	Configure the storage array plug-in. If source and destination volume reside on different array, configure a separate storage array plug-in for source and destination	See “Configure the storage array plug-ins for Snapshot Manager for Data Center” on page 21.
4.	Create a storage unit for any operation that produces non-snapshot copies.	See the <i>NetBackup Administrator's Guide, Volume I</i> .
5.	Configure a SLP. Create a new operation in the SLP for each task that the SLP is configured to perform. For example, create a snapshot operation to perform the initial snapshot and a replication operation to create a copy of the snapshot. Note: Only those SLPs created using web UI or API support Replication	See “Creating a storage lifecycle policy for snapshots and snapshot replication” on page 94.

Table 4-2 Replication configuration tasks overview (*continued*)

Step	Description	Reference topic
6.	<p>Configure a NetBackup backup policy to perform all of the operations indicated in the SLP.</p> <p>To do so, the Policy storage selection configuration in the policy must indicate the SLP that is configured for snapshots and snapshot replication.</p>	<p>See the <i>Replication using D-NAS policy</i> chapter in the <i>NAS Administrator's Guide</i></p> <p>See <i>Protecting VMs using hardware snapshot and replication</i> in the <i>WebUI VMware Admin Guide</i></p>

Storage array plug-ins for Snapshot Manager for Data Center

This chapter includes the following topics:

- [Configure the storage array plug-ins for Snapshot Manager for Data Center](#)
- [Dell EMC PowerFlex array](#)
- [Dell EMC PowerMax and VMax array](#)
- [Dell EMC PowerScale \(Isilon\)](#)
- [Dell EMC PowerStore NAS array](#)
- [Dell EMC PowerStore SAN array](#)
- [Dell EMC XtremIO SAN array](#)
- [Dell EMC Unity array](#)
- [FUJITSU AF/DX array](#)
- [HPE RMC plug-in](#)
- [HPE XP SAN Storage array](#)
- [Hitachi NAS array](#)
- [Hitachi SAN array](#)
- [IBM Storwize array](#)
- [InfiniBox SAN array](#)

- [NetApp storage array](#)
- [Nutanix Files array](#)
- [Pure Storage Flash array](#)
- [Pure Storage FlashBlade NAS array](#)
- [Qumulo NAS array](#)

Configure the storage array plug-ins for Snapshot Manager for Data Center

This chapter describes various storage arrays supported by NetBackup Snapshot Manager. It also describes the configuration parameters required for configuring different storage array plug-ins. The snapshot management operations supported by each of these storage array plug-in are also mentioned in detail.

Dell EMC PowerFlex array

NetBackup provides a robust data protection solution for the volumes that are set up on the storage array. NetBackup extends the SDS support and allows you to protect mounted volumes that are hosted on an Dell EMC PowerFlex array environment. You can configure CloudPoint to discover data, perform backups, and restore operations.

Dell EMC PowerFlex contains the functional logic which enables NetBackup to discover the volumes on the Dell EMC PowerFlex array. Then triggers the snapshot to create, export, deport, and delete operations for the exports. You must configure this plug-in on the NetBackup primary server.

CloudPoint uses the SDK supported by Dell EMC PowerFlex family to communicate with the Dell EMC PowerFlex assets. CloudPoint establishes a connection with Dell EMC PowerFlex array by using RestClient and then uses the SDK methods to discover the volumes and their snapshots that needs to be backed up.

Supported Snapshot Manager for Data Center operations on Dell EMC PowerFlex models

You can perform the following Snapshot Manager for Data Center operations supported on the Dell EMC PowerFlex models:

Table 5-1 CloudPoint operations on the Dell EMC PowerFlex array

Snapshot Manager for Data Center operations	Description
Discover assets	CloudPoint discovers all the array volumes and snapshots inside the snapshot group flexsnap_snap_group with some metadata. The volumes which have 'CMD' in the attributes and without mapping are not discovered.
Create snapshot	To create a snapshot, CloudPoint triggers an SDK method with the required snapshot details. The API returns the details of the snapshot. A typical snapshot created by CloudPoint has the following naming convention: NB<unique_21digit_number>.
Delete snapshot	To delete a snapshot, CloudPoint triggers an SDK method call with the required snapshot details. Then confirms that the snapshot is deleted successfully on the array.
Restore snapshot	CloudPoint offers the ability to restore the snapshots using a SDK method with the different restore paths.
Export snapshot	CloudPoint supports export snapshot over the SDC that is mapped on the parent volume.
Deport snapshot	When a snapshot deport operation is triggered, CloudPoint deletes the SDC mapping created between the host and the volume.

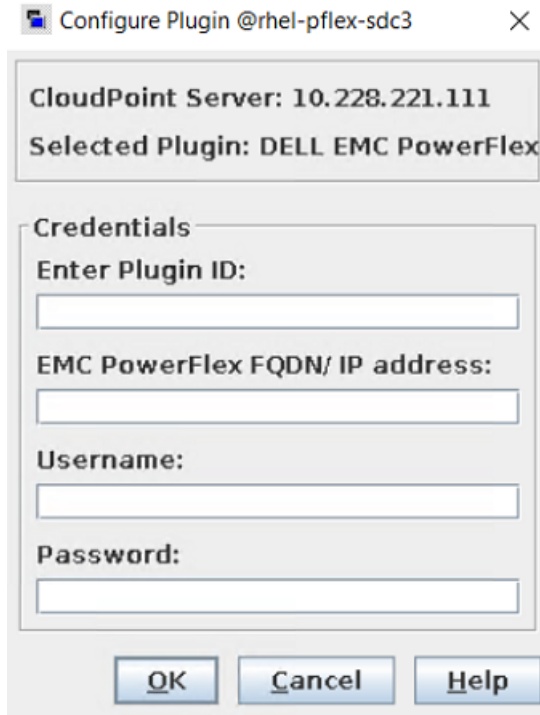
Dell EMC PowerFlex plug-in configuration parameters

Specify the following parameters when you configure the Dell EMC PowerFlex plug-in:

Table 5-2 Dell EMC PowerFlex plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
Plugin ID	Provide a name for the plugin.
FQDN/ IP address	The array's IP address, in IPV4 / FQDN format.
Username	A user account that has permissions to perform snapshot operations on the Dell EMC PowerFlex array.
Password	Provide a password to the user account.

The following screen is displayed when you configure the plug-in using the NetBackup administration console:



Configure Plugin @rhel-pflex-sdc3

CloudPoint Server: 10.228.221.111
Selected Plugin: DELL EMC PowerFlex

Credentials

Enter Plugin ID:

EMC PowerFlex FQDN/ IP address:

Username:

Password:

OK Cancel Help

Dell EMC PowerFlex plug-in considerations and limitations

The following considerations and limitations are applicable:

1. This is a software defined storage, which requires to install the SDC (Storage Data Client) on the host where NetBackup will be configured.
2. The mapping between the volumes and SDC is completed with the help of SDC ID in CloudPoint.
3. The WWN (World Wide Name) is considered for mapping. It is developed using the \$system_id\$volume_id manner because it's not available directly on the array.

Dell EMC PowerMax and VMax array

The CloudPoint plug-in for Dell EMC PowerMax and VMax enables NetBackup to discover the SAN volumes mounted on PowerMax/VMax and then trigger snapshot

create, export, deport, restore and delete operations for those volumes. You must configure this plug-in on the NetBackup primary server.

CloudPoint uses the REST API SDK provided by PowerMax/VMax (PyU4V) to communicate with the PowerMax/ VMax assets. CloudPoint establishes a connection with PowerMax/VMax array by registering itself as a backup application and then uses the API endpoints to discover the SAN volumes and their snapshots that needs to be backed up.

Supported CloudPoint operations on Dell EMC PowerMax and VMax

CloudPoint performs the following management operations on the Dell EMC PowerMax and VMax:

Table 5-3 Snapshot Manager for Data Center operations on Dell EMC PowerMax/ VMax plug-in

Snapshot Manager for Data Center operation	Description
Discover assets	Snapshot Manager for Data Center discovers all the volumes and their snapshots along with their storage group. Note: Snapshot Manager for Data Center only discovers assets with depth as 2.
Create snapshot	To create a snapshot, Snapshot Manager for Data Center triggers a POST API call on the storage group within which the volumes resides, with the required information and snapshot name. A typical snapshot created by Snapshot Manager for Data Center has the following naming convention: NB<unique_21digit_number>
Delete snapshot	To delete a snapshot, Snapshot Manager for Data Center triggers a DELETE REST API call with the required snapshot details and confirms that the snapshot has been deleted successfully on the array.

Table 5-3 Snapshot Manager for Data Center operations on Dell EMC PowerMax/ VMax plug-in (*continued*)

Snapshot Manager for Data Center operation	Description
Restore snapshot	<p>Snapshot Manager for Data Center uses storage group snapshot restore API from Unisphere.</p> <p>To restore a snapshot to the point in time image on the volume.</p> <ol style="list-style-type: none">1 Create an empty temporary storage group.2 Add a volume which is to be restored in the storage group.3 Restore the temporary storage group.4 Delete the temporary storage group.
Export snapshot	<p>When a snapshot export operation is triggered, a volume is carved out of the snapshot and attached to the host on which it is to be exported.</p> <p>Perform the following steps:</p> <ol style="list-style-type: none">1 Fetch the initiators on which you want to perform the export.2 Create an empty temporary storage group.3 Add a source volume whose snapshot is to be exported in the storage group.4 Now, considering temporary storage as source storage group, create an export storage group from snapshot and link the snapshot to the exported storage group.5 Fetch the Host ID and Port group ID.6 Using the export storage group, Host ID and Port group ID, create a masking view group which would attach the exported storage group to the host.
Deport snapshot	<p>When a snapshot deport operation is triggered, Snapshot Manager for Data Center deletes the exported storage group and the volume inside it, and the temporary storage group that is used as a source. It essentially reverts the snapshot export operation.</p>

Dell EMC PowerMax and VMax plug-in configuration prerequisites

Before you configure the plug-in:

- Note the following:

- The minimum Unisphere version required is 9.2.0.1 of Unisphere Management console
- Supported array models are PowerMax, VMAX-3, VMAX-AFA.
- Array uCode should be above 5978.669.669 for PowerMax OS, HyperMax OS to support 'SnapSet Id'.
- Gather the following information about the Dell EMC PowerMax/VMax. You will use these details while configuring the plug-in:

Parameter	Description
Unisphere Address	<p>The Unisphere Management console through which all the arrays are managed.</p> <p>You can add any management IP Address or the FULL Qualified Domain Name (FQDN) of the Unisphere Management console.</p>
Unisphere Port	<p>The Unisphere Management port through which the console is accessed (Dell EMC suggests 8443).</p> <p>You can configure any port through which you can access the Unisphere console.</p>
Array ID	A 12 digit unique Array ID which you want to be protected.
Username	Unisphere console user account that has permissions to perform snapshot operations on the PowerMax/VMax array.
Password	The password of the Unisphere user account specified earlier.

The following screen is displayed when you configure the plug-in using the NetBackup administration console:

Configure Plugin

CloudPoint Server: _____

Selected Plugin: DELL EMC PowerMax and VMax

Credentials

Enter Plugin ID: _____

DELL EMC Unisphere Address: _____

DELL EMC Unisphere Port: _____

Array ID: _____

Username: _____

Password: _____

OK Cancel Help

Dell EMC PowerScale (Isilon)

The NetBackup Snapshot Manager DELL EMC PowerScale / Isilon plug-in allows you create, delete, restore, export, and deport snapshots of the following assets on the DELL EMC PowerScale / Isilon Cluster:

- DELL EMC PowerScale / Isilon NFS exports in a NAS environment.
- DELL EMC PowerScale / Isilon SMB shares in a NAS environment.

The DELL EMC PowerScale / Isilon plug-in uses the REST API SDK provides by DELL EMC PowerScale / Isilon (isilon_sdk_python) to communicate with the DELL EMC PowerScale / Isilon assets.

Supported NetBackup Snapshot Manager Operation on DELL EMC PowerScale (Isilon)

Snapshot Manager for Data Center performs the following management operations on the Dell EMC PowerScale (Isilon):

Table 5-4 Snapshot Manager for Data Center operations on Dell EMC PowerScale (Isilon) plug-in

Snapshot Manager for Data Center operation	Description
Discover assets	<p>NetBackup Snapshot Manager discovers all the NFS export, SMB shares, and their snapshots along with some of their directory metadata from all the Access Zones the user has privileges to access or view. By default, a DELL PowerScale cluster has Single access zone known as System Access Zone and unless you have additional Access Zones, all the NFS export and SMB Shares are in this default Access Zone. The multiple access zone can be mapped to same or different Groupnet (Groupnet -> Subnet -> Pool). During discovery, the Snapshot Manager also associates the relevant SmartConnect of a pool to its NFS export or SMB share.</p> <p>NetBackup Snapshot Manager also discovers all the nested NFS exports and SMB shares irrespective of the depth at which they are created. Mentioned below are few examples of nested shares discovered by Snapshot Manager: <code>["/ifs/test_fs1", "/ifs/test_fs1/test_fs2", "/ifs/test_fs1/test_data/test_fs3", "/ifs/smb_03/test_data/dir01"]</code></p> <p>The discovered NFS export and SMB shares should have valid underlying file system path. The file system directory path should be shared by NFS export, SMB shares.</p>
Create snapshot	<p>To create a snapshot, Snapshot Manager for Data Center triggers a POST REST API call on the <code>nfs_export</code> with the required information and the snapshot name. The API returns the details of the snapshot.</p> <p>A typical snapshot created by Snapshot Manager for Data Center has the following naming convention:</p> <pre>SnapNB-NB<unique_21digit_number></pre>
Delete snapshot	<p>To delete a snapshot, NetBackup Snapshot Manager runs a DELETE REST API call with the required snapshot details. You can see a confirmation when the snapshot is deleted successfully on the array.</p>
Restore snapshot	<p>Snapshot Manager for Data Center uses the JobAPI to revert a snapshot.</p> <p>To revert a snapshot that contains a directory, it is recommended that you create a SnapRevert domain for a directory.</p> <p>To revert a snapshot, perform the following steps:</p> <ol style="list-style-type: none"> 1 Create a SnapRevert domain for the directory. 2 Create a snapshot revert job.

Table 5-4 Snapshot Manager for Data Center operations on Dell EMC PowerScale (Isilon) plug-in (*continued*)

Snapshot Manager for Data Center operation	Description
Export snapshot	<ul style="list-style-type: none">■ When a snapshot export operation is triggered for NFS, a new export is created over the snapshot path: <code>("/ifs/test_fs/.snapshot/NB15985918570166499611/")</code> with the backups host is added as a Root Clients with read-only permissions.■ When a snapshot export operation is triggered for SMB, a new share is created over the snapshot path: <code>("/ifs/test_fs/.snapshot/NB15985918570166499611/")</code> The user and the domain provided while exporting the snapshot is added with privileges to access the SMB share created. The user must be in the domain specified.
Deport snapshot	When a snapshot deport operation is triggered, NetBackup Snapshot Manager deletes the NFS export or SMB share created over the snapshot path at the time of the export operations.

Table 5-4 Snapshot Manager for Data Center operations on Dell EMC PowerScale (Isilon) plug-in (*continued*)

Snapshot Manager for Data Center operation	Description
Create snapshot diff	<p>Snapshot Manager for Data Center uses the JobAPI to create a changelist between snapshots.</p> <p>To create a changelist, perform the following steps:</p> <ol style="list-style-type: none"> 1 Use <code>JobAPI</code> to create a job for creating a changelist between snapshots. 2 Use <code>get_changelist_entries</code> API to fetch changelist entries between snapshots <p>Note: The following important points:</p> <ul style="list-style-type: none"> ■ The <code>get_changelist_entries</code> API is available for OneFS version 8.2.1 and above only. ■ As for creating a changelist we make use of <code>JobAPI</code>. The job engine allows 3 different jobs to run simultaneously. There is a way to allow multiple instances of the <code>ChangelistCreate</code> job to run simultaneously if needed, though the job engine still limits the number of jobs to 3 and some care must be taken so this does not adversely affect the cluster. CLI to allow multiple <code>changelistcreate</code> jobs to run simultaneously. To allow multiple instances of the changelist run the following CLI: <ul style="list-style-type: none"> ■ <code>isi_gconfig -t job-config jobs.types.changelistcreate.allow_multiple_instances=true</code> (the default is false) ■ <code>isi_gconfig -t job-config jobs.types.changelistcreate.allow_multiple_instances'</code>

DELL EMC PowerScale (Isilon) plug-in configuration prerequisites

- Ensure that the SnapshotIQ license is activated on the storage array. This is required to perform snapshot operations.
- Ensure that the SmartConnectIQ license is activated on the storage array. The will enable Snapshot Manager to use the load-balancing and failover capabilities of the Isilon cluster.
- For the list of all the supported Data OneFS versions, refer to the `NetBackup Snapshot Manager` section in the `NetBackup Hardware and Cloud Storage Compatibility List (HCL)`.

Dell EMC PowerScale (Isilon) plug-in configuration parameters

The following parameters are required for configuring the Dell EMC PowerScale / Isilon.

Parameter	Description
Cluster FQDN / IP address	<p>An Isilon cluster consists of three or more hardware nodes.</p> <p>The FQDN or Management IP refers to the range of External IP addresses assigned to the Cluster or to an individual node. This can be found by browsing the PowerScale web console as Cluster Management → Network Configuration → groupnet → subnet → pool → Pool Interface members.</p> <p>You can also provide the SmartConnect FQDN.</p>
Username	A user account that has permissions to perform the snapshot operations on the PowerScale cluster.
Password	The password of the PowerScale (Isilon) user account specified earlier.

Using SmartConnect with Snapshot Manager

SmartConnect is a module that specifies how Isilon Cluster handles connection requests from clients. It balances connection loads to the Isilon cluster and handles connection failover. With SmartConnect, all Isilon servers use a single FQDN for data access. Using this network name provides load balancing when the connection to the cluster is made. This ensures optimal resource utilization and performance during backup operations.

SmartConnect DNS Zone name is smart connect configuration and it can be located by browsing the PowerScale web Console as Cluster Management → Network Configuration → groupnet → subnet → pool → SmartConnect Basic/ Advanced

Even if the plugin is configured with the FQDN or IP which is not a SmartConnect FQDN, NetBackup Snapshot Manager would still export the snapshots using the SmartConnect FQDN.

Roles and privileges on Dell EMC PowerScale (Isilon)

This section describes the privilege required by the Dell EMC PowerScale / Isilon user account, used for plug-in configuration, on the storage array. Privileges in OneFS are assigned through role membership; not directly to the user. You can create a custom role with required privileges and assign it to the user.

Table 5-5 Permissions required by the Isilon user account on the array

Platform API	Read-only
Namespace access	Read-only
Namespace Traverse	Read-only
Network	Read-only
Snapshot	Read/Write
NFS	Read/Write
SMB	Read/Write

Consideration for Dell EMC PowerScale (Isilon)

The following considerations and limitations are applicable:

- Recommend limiting snapshot of directory to 1024 and the Cluster wide Snapshot limit is 20000.
See: <https://www.delltechnologies.com/asset/en-us/products/storage/industry-market/h16857-wp-onefs-best-practices.pdf>
- Avoid creation of snapshots directories that are already referenced by other snapshots. For example, if you create 500 snapshots of /ifs/test_fs1 and 500 snapshots of /ifs/test_fs1/test_fs2, you have created 1000 snapshots of /ifs/test_fs1/test_fs2.

Dell EMC PowerStore NAS array

The Dell EMC PowerStore plug-in allows you create, delete, restore, export, and deport snapshots of the following assets on the Dell EMC PowerStore storage arrays:

- Dell EMC PowerStore NFS exports in a NAS environment.
- Dell EMC PowerStore SMB shares in a NAS environment.

The Dell EMC PowerStore plug-in uses the Python SDK provided by the Dell EMC called as python-powerstore (1.4.0). Python-PowerStore calls the Dell EMC PowerStore family REST APIs to communicate with Dell EMC PowerStore array. The connection is established to Dell EMC PowerStore array through REST API. Then, it uses the SDK methods to discover the NFS exports, SMB shares, and the file system snapshots that need to be backed up.

Supported NetBackup Snapshot Manager operations on Dell EMC PowerStore NAS array

NetBackup Snapshot Manager performs the following snapshot management operations on the Dell EMC PowerStore NAS arrays.

Table 5-6 Snapshot Manager for Data Center operations on EMC PowerStore NAS plug-in

Snapshot Manager for Data Center operation	Description
Discover assets	NetBackup Snapshot Manager discovers all the Dell EMC PowerStore NAS servers, primary NFS exports, and SMB shares and their filesystem-snapshots along with some of their directory metadata. NetBackup Snapshot Manager also discovers the nested NFS exports and SMB shares irrespective of the depth at which they are created.
Create snapshot	<p>To create a snapshot, NetBackup Snapshot Manager triggers a POST REST API using SDK method with the required information and snapshot name. The API returns the details of the snapshot. Dell EMC PowerStore supports two types of snapshots - protocol and snapshot type. NetBackup Snapshot Manager triggers the protocol type snapshots and retention period is not set on the array for these snapshots. All these snapshots are at a file system level.</p> <p>A typical snapshot created by Snapshot Manager for Data Center has the following naming convention:</p> <p>NB<unique_21digit_number></p>
Delete snapshot	<p>To delete a snapshot, NetBackup Snapshot Manager calls the <code>DELETE</code> REST API using SDK method, with the required snapshot details.</p> <p>The API confirms that the snapshot has been deleted successfully on the array.</p>
Restore snapshot	NetBackup Snapshot Manager does not support PIT restore operation on the array. Instead we can perform Normal restore on specified location.
Export snapshot	NetBackup Snapshot Manager supports export operation using the NFS and SMB protocol. When a snapshot export operation is triggered based on selected protocol a new NFS export or SMB share is created using snapshot and parent export/share local path. The newly created export/share name is same as snapshot name. Also the host access configurations are added as read-only on a particular export or share.

Table 5-6 Snapshot Manager for Data Center operations on EMC PowerStore NAS plug-in (*continued*)

Snapshot Manager for Data Center operation	Description
Deport snapshot	When a snapshot deport operation runs, NetBackup Snapshot Manager deletes the NFS export or SMB share created over the snapshot at the time of the export operations.

Dell EMC PowerStore NAS plug-in configuration prerequisites

Before you configure the Dell EMC PowerStore NAS plug-in, verify the following:

- Ensure that a supported version of Dell EMC PowerStore is installed on the Dell EMC PowerStore arrays.
- For the list of all the supported versions of Dell EMC PowerStore, refer to the NetBackup Snapshot Manager section in the NetBackup Hardware and Cloud Storage Compatibility List(HCL).
- A user account exists which has the permissions to invoke the Dell EMC PowerStore REST APIs and all snapshot operations on the array.

Dell EMC PowerStore NAS plug-in configuration parameters

The following parameters are required for configuring the Dell EMC PowerStore NAS plug-in.

Parameter	Description
Plugin ID	Provide a name for the plugin.
Cluster FQDN / IP address	The array's management IP address, in either IPv4 or The Fully Qualified Domain Name (FQDN).
Username	The Dell EMC PowerStore NAS user account that has the permissions to invoke the PowerStore REST APIs to perform all snapshot operations on the array.
Password	The password of the PowerStore NAS user account specified earlier.

Domain user permissions for Dell EMC PowerStore NAS array

The domain user which you use to perform the NAS share backup, must have privileges for the PowerStore array, to allow NetBackup to perform backup of the NAS share ACLs.

Limitations and considerations for Dell EMC PowerStore NAS plug-in

Following considerations and limitations are applicable in a Dell EMC PowerStore NAS environment.

- All snapshots are captured at a file system level and those snapshots are in read-only mode.
- The limit for any file system name is 255 characters, NFS export/SMB share name is 80 characters on the array. In case of a snapshot name, the maximum length must be 255 characters.
- Dell EMC PowerStore plug-in does not support point-in-time (PIT) rollback restore of shares using snapshots.

Dell EMC PowerStore SAN array

NetBackup provides a robust data protection solution for volumes that are set up on the storage array. NetBackup extends the SAN support and allows you to protect mounted iSCSI/FC volumes that are hosted on the Dell EMC PowerStore array environment. You can configure CloudPoint to discover data, perform backups, and restore operations.

Dell EMC PowerStore contains the functional logic which enables NetBackup to discover the SAN volumes on the Dell EMC PowerStore array. Then the plugin triggers the snapshot to create, export, deport, and delete operations for the exports. You must configure this plug-in on the NetBackup primary server.

CloudPoint uses the REST API supported by Dell EMC PowerStore family to communicate with the Dell EMC PowerStore assets. CloudPoint establishes a connection with Dell EMC PowerStore array by using RestClient and then uses the SDK methods to discover the SAN volumes and their snapshots that needs to be backed up.

Supported Snapshot Manager for Data Center operations on Dell EMC PowerStore models

You can perform the following Snapshot Manager for Data Center operations supported on the Dell EMC PowerStore models:

Table 5-7 CloudPoint operations on the Dell EMC PowerStore array

Snapshot Manager for Data Center operations	Description
Discover assets	CloudPoint discovers all the array volumes and snapshots inside the snapshot group flexsnap_snap_group with some metadata. The volumes which are clone types in the respective attributes and without mapping are not discovered.
Create snapshot	To create a snapshot, CloudPoint triggers a SDK method with the required snapshot details. The API returns the details of the snapshot. A typical snapshot created by CloudPoint has the following naming convention: NB<unique_21digit_number>.
Delete snapshot	To delete a snapshot, CloudPoint triggers a SDK method call with the required snapshot details. Then confirms that the snapshot is deleted successfully on the array.
Restore snapshot	CloudPoint offers the ability to restore the snapshots using the SDK method with the different restore paths.
Export snapshot	CloudPoint supports export snapshot over the iSCSI and FC. It uses the SDK to set the LUN path for snapshot.
Deport snapshot	When a snapshot deport operation is triggered, CloudPoint deletes the export mapping created between the host and the volume.

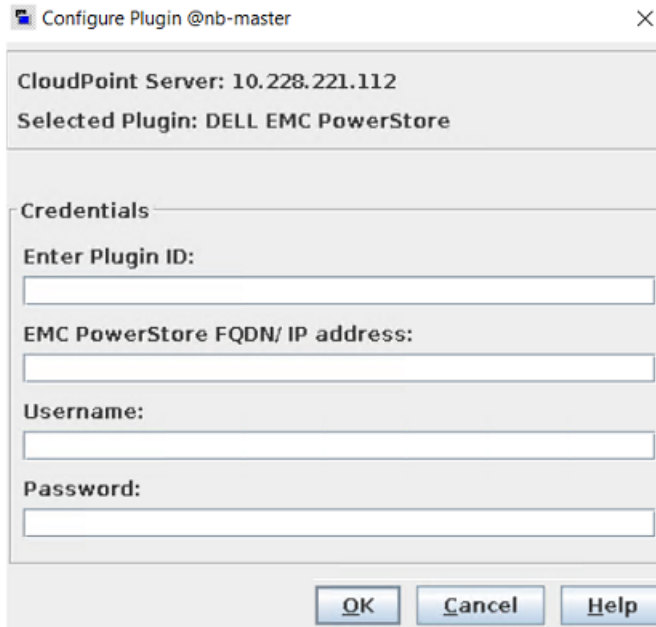
Dell EMC PowerStore plug-in configuration parameters

Specify the following parameters when you configure the Dell EMC PowerStore plug-in:

Table 5-8 Dell EMC PowerStore plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
Plugin ID	Provide a name for the plugin.
FQDN/ IP Address	The array's IP address, in IPV4 / FQDN format.
Username	A user account that has permissions to perform snapshot operations on the Dell EMC PowerStore array.
Password	Provide a password to the user account.

The following screen is displayed when you configure the plug-in using the NetBackup administration console:



Configure Plugin @nb-master

CloudPoint Server: 10.228.221.112
Selected Plugin: DELL EMC PowerStore

Credentials

Enter Plugin ID:

EMC PowerStore FQDN/ IP address:

Username:

Password:

OK Cancel Help

Dell EMC PowerStore plug-in considerations and limitations

The following considerations and limitations are applicable:

1. Cloupoint does not discover the clone type volumes in the discovery process.
2. When a snapshot is triggered, a volume is cloned from that snapshot. Then, the volume is cleaned up after the image expiration happens from Netbackup.
3. There is no retention expiry time for the cloned volumes. The cloned volumes can only be manually deleted from NetBackup in deport and delete operations.

Dell EMC XtremIO SAN array

NetBackup provides a robust data protection solution for the volumes that are set up on the storage array. NetBackup extends SAN support and allows you to protect mounted iSCSI/FC volumes that are hosted on a Dell EMC XtremIO SAN array environment. You can configure CloudPoint to discover the volumes and perform backup and restore operations.

The CloudPoint plug-in for Dell EMC XtremIO SAN contains the functional logic that enables NetBackup to discover the SAN volumes on the Dell EMC XtremIO SAN array. Then trigger snapshot create, export, deport, and delete operations for the exports. You must configure this plug-in on the NetBackup primary server.

CloudPoint uses the Rest API's exposed by Dell EMC XtremIO SAN family to communicate with SAN assets. It utilizes the latest API version V3 which is supported by the array after XMS version 6.0.1. Any firmware below XMS 6.0.1 will not be able to protect the volumes from NetBackup. The connection is a basic auth from the user used to configure the array in NetBackup.

Supported Snapshot Manager for Data Center operations on Dell EMC XtremIO SAN models

You can perform the following Snapshot Manager for Data Center operations supported on the Dell EMC XtremIO SAN models:

Table 5-9 CloudPoint operations on the Dell EMC XtremIO SAN array

Snapshot Manager for Data Center operations	Description
Discover assets	CloudPoint discovers all the array volumes and snapshots inside the snapshot group flexsnap_snap_group with some metadata. The volumes which have 'CMD' in the attributes and without mapping are not discovered.
Create snapshot	To create a snapshot, CloudPoint triggers a Post Rest API method with the required snapshot details. The API returns the details of the snapshot. A typical snapshot created by CloudPoint has the following naming convention: NB<unique_21digit_number>.
Delete snapshot	To delete a snapshot, CloudPoint triggers a Post Rest API method call with the required snapshot details. Then confirms that the snapshot is deleted successfully on the array.
Restore snapshot	CloudPoint offers the ability to restore the snapshots using a Post REST API method with the different restore paths.
Export snapshot	CloudPoint supports export snapshot over the iSCSI and FC. It uses a REST API to set the LUN path for snapshot.
Deport snapshot	When a snapshot deport operation is triggered, CloudPoint deletes the export mapping created between the host and the volume.

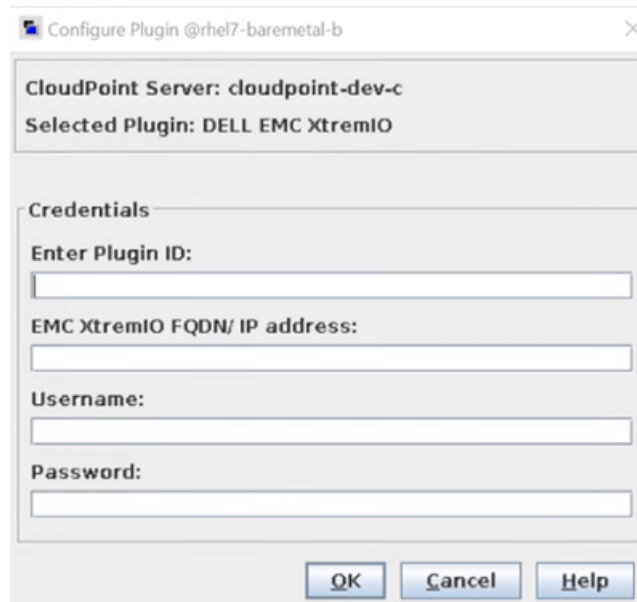
Dell EMC XtremIO SAN plug-in configuration parameters

Specify the following parameters when you configure the Dell EMC XtremIO SAN plug-in:

Table 5-10 Dell EMC XtremIO SAN plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
Plugin ID	Provide a name for the plugin.
FQDN/ IP Address	The array's IP address, in IPV4 / FQDN format.
User name	A user account that has permissions to perform snapshot operations on the Dell EMC XtremIO SAN array.
Password	Provide a password to the user account.

The following screen is displayed when you configure the plug-in using the NetBackup Administration Console:



Configure Plugin @rhel7-baremetal-b

CloudPoint Server: cloudpoint-dev-c
Selected Plugin: DELL EMC XtremIO

Credentials

Enter Plugin ID:

EMC XtremIO FQDN/ IP address:

Username:

Password:

OK Cancel Help

Dell EMC XtremIO SAN plug-in considerations and limitations

The following considerations and limitations are applicable:

1. All the snapshot which are taken for any volume are read-only mode. There is a new re-purpose copy cloned from the volume which is used for data backup.
2. The re-purpose clone copy is only done in the export operation not in the create snapshot directly.

The repurpose clone copy is deleted based on the scheduled deport from NetBackup or manually triggering the expire operation. This is a thin provisioned type copy.

3. The limit for any volume name is 128 characters on the array. So, a user can have the maximum length of volume name is $128 - (23 \text{ (NB<unique_21digit_number>) } - 9 \text{ (Repurpose) } - 2 \text{ (Dot notations)}) = 94$. It is a strict requirement to limit the volume name to 94 characters for a successful snapshot creation.
4. It is strictly advised, not to write the data to repurpose copy created by NetBackup through manual mapping it on to the host server. User created re-purpose copies are considered as an individual volume in NetBackup. But changing the copies starting with `volume_name.NB<unique_21digit_number>.repurpose` is strictly not recommended.
5. Don't refresh the repurpose copy, as it changes the data from the parent volume and backup, and restore operations.

For example: If you have a volume V1 and a snapshot is triggered for the same then the protection copy occurs with the `V1.NB<unique_21digit_number>` format and in the export operation, a repurpose copy occurs with the name `V1.NB<unique_21digit_number>.repurpose`.

Dell EMC Unity array

The CloudPoint plug-in for Dell EMC Unity array plug-in also supports the Network Attached Storage (NAS) storage host and allows you to protect Network File System (NFS) and Server Message Block (SMB) exports that are hosted in a EMC Unity array environment. You can configure CloudPoint to discover and then perform backup and restore operations on NFS and SMB exports.

The plug-in enables NetBackup to discover the NFS exports on the EMC Unity array and then trigger snapshot create, export, deport, and delete operations for those exports. You must configure this plug-in on the NetBackup primary server.

CloudPoint uses the REST API SDK of Storops Version 1.2.8 to communicate with the EMC Unity assets. CloudPoint establishes a connection with EMC Unity array by using RestClient library exposed by SDK and then uses the SDK methods to discover the NFS exports and their snapshots that need to be backed up.

Supported Snapshot Manager for Data Center operations on Dell EMC Unity arrays

CloudPoint performs the following management operations on the Dell EMC Unity arrays.

Table 5-11 Snapshot Manager for Data Center operations on Dell EMC Unity plug-in

Snapshot Manager for Data Center operation	Description
Discover assets	<p>Snapshot Manager for Data Center discovers all the volumes and their snapshots along with their storage group.</p> <p>Note: Snapshot Manager for Data Center only discovers assets with depth as 2.</p>
Create snapshot	<p>To create a snapshot, Snapshot Manager for Data Center triggers an SDK method on the storage group within which the volumes reside, with the required information and snapshot name.</p> <p>A typical snapshot created by Snapshot Manager for Data Center has the following naming convention:</p> <p>NB<unique_21digit_number></p>
Delete snapshot	<p>To delete a snapshot, Snapshot Manager for Data Center triggers an SDK method with the required snapshot details and confirms that the snapshot has been deleted successfully on the array.</p>
Restore snapshot	<p>CloudPoint offers the ability to restore with the help of SDK methods with different restore paths.</p>
Export snapshot	<p>When a snapshot export operation is triggered, a new NFS export is created over the same filesystem path, on which the backups host is added as a client with read-only permissions</p>
Deport snapshot	<p>When a snapshot deport operation is triggered, Snapshot Manager for Data Center deletes the exported storage group created over the snapshot path and the volume inside it, and the temporary storage group that is used as a source. It essentially reverts the snapshot export operation.</p>

You can also perform the following Snapshot Manager for Data Center operations on supported Dell EMC Unity arrays:

- List all the disks.

- Create a copy-on-write (COW) snapshot of a LUN.

Note: Snapshot name can be lowercase or uppercase, can contain any ASCII character, and can include special characters.

- Delete a COW snapshot of a LUN.
- Restore a LUN using a COW snapshot. The snapshot overwrites the original object.

Note: You cannot snapshot LUNs which are under a consistency group. The reason for this limitation is that to restore a single LUN snapshot would restore the entire consistency group.

Snapshot export related requirements and limitations

The following requirements and limitations are applicable in a Dell EMC Unity array environment:

- The host on which the snapshot is to be exported must be attached to the array.

Note: The exported snapshot is attached to the host and is accessible using a world wide name (WWN) that is assigned by the array.

- Snapshot export is supported using the following protocols:
 - Fibre Channel (FC)
 - Internet Small Computer Systems Interface (iSCSI)
- A snapshot cannot be exported multiple times.
- An exported snapshot cannot be deleted.

Dell EMC Unity array plug-in configuration parameters

The following parameters are required when you configure the Dell EMC Unity array plug-in:

Table 5-12 Dell EMC Unity array plug-in configuration parameters

NetBackup configuration parameter	Description
Array IP address	Array IP address that you want to be protected. Both, IPV6 and IPV4 settings are supported.
Username	A user account name that has permissions to perform snapshot operations on the EMC Unity array Ensure that the specified user account has permissions to create, delete, and restore snapshots on the array
Password	The password of the EMC Unity array user account specified earlier.

The following screen is displayed when you configure the plug-in using the NetBackup administration console:

Configure Plugin @sy480g10ch09b02-vm4.vxindia.veritas.com

CloudPoint Server: sy480g10ch09b02-vm7.vxindia.veritas.com
Selected Plugin: DELL EMC Unity

Credentials

Enter Plugin ID:

EMC Unity FQDN/ IP address:

Username:

Password:

OK Cancel Help

Dell EMC Unity plug-in considerations and limitations

- The array does not support share level snapshots. So the snapshots are created at a file level and they have a 1:1 mapping with each other.
- For every backup operation triggered on NetBackup a new share of the type snapshot will be created on the array and this will be automatically cleared once the Deport operation (Expire) is triggered.

Supported Dell EMC Unity arrays

You can use Snapshot Manager for Data Center to discover and protect the following Dell EMC Unity array models.

Table 5-13 Supported EMC arrays

Category	Supported
Array model	Unity 600 Theoretically, other models will work also because Snapshot Manager for Data Center does not include any model-specific coding. Other models include the following: <ul style="list-style-type: none">■ Unity 300 and Unity 300F ("F" indicates that it is a flash array)■ Unity 400 and Unity 400F■ Unity 500 and Unity 500F■ Unity 600F
Software	UnityOS
Firmware version	4.2.1.9535982 or later Refer to the array-specific documentation for more information on firmware versions and how to check the current firmware on your array.
Library	storops Note: Snapshot Manager for Data Center automatically installs all the required libraries during installation.

FUJITSU AF/DX array

NetBackup provides a robust data protection solution for mapped FC/iSCSI volumes that are set up on Storage Area Network (SAN) storage host. NetBackup extends the SAN support to allow you to protect volumes that are mapped via FC/iSCSI in a FUJITSU AF/DX environment.

You can configure CloudPoint to discover data, perform backup, and restore operations on the volumes (Disks/ LUNS/ Volumes) mapped to the host. FUJITSU AF/DX plug-in contains the functional logic that enables NetBackup to discover the SAN volumes mounted on the hosted from FUJITSU. Then the plug-in triggers to create a snapshot, export, deport, restore, and delete operations for those volumes.

You must configure this plug-in on the NetBackup primary server.

1. CloudPoint uses FUJITSU provided REST API to communicate with the FUJITSU assets.
2. CloudPoint registers itself as a backup application to establishes a connection with the FUJITSU array.
3. Then uses the API endpoints to discover SAN volumes and it's snapshots for backup.

Supported Snapshot Manager for Data Center operations on FUJITSU AF/DX models

You can perform the following Snapshot Manager for Data Center operations supported on the FUJITSU AF/DX models:

Table 5-14 CloudPoint operations on FUJITSU AF/DX array

Snapshot Manager for Data Center operations	Description
Discover assets	CloudPoint discovers all the volumes and its snapshots.
Create snapshot	<p>To create a snapshot (snapOPCPlus), CloudPoint triggers a POST API call on the volume. The API returns the details of the snapshot job. using job ID, you can track the ongoing operation.</p> <p>A typical snapshot created by CloudPoint has the following naming convention: NB<unique_21digit_number></p>
Delete snapshot	<p>Delete a volume or snapshot: Before you try deleting a volume, snapshot, ensure that you first detach it from all hosts.</p> <p>Note the following:</p> <ul style="list-style-type: none"> ■ Detach/ snapshot volume from the host (Delete the host connection for that snapshot volume) ■ Delete copy session of it. <p>To delete a volume or snapshot, CloudPoint triggers a delete REST API call with the required snapshot details. Then confirms that the snapshot is deleted successfully on the array.</p>
Restore snapshot	CloudPoint is uses volume snapshot restore API to restore volume snapshot to the point in time image on the volume.
Export snapshot	When a snapshot export operation is triggered, a snapshot volume is attached to the host where it's exported.

Table 5-14 CloudPoint operations on FUJITSU AF/DX array (*continued*)

Snapshot Manager for Data Center operations	Description
Deport snapshot	When a snapshot deport operation is triggered, the copy session of the source volume, host connection of snapshot volume, and exported snapshot volume are deleted. It is a revert of the export snapshot.

Discovery

- When you add the FUJITSU AF/DX plugin in the NetBackup or when the discovery happens, a call goes to the CloudPoint which discovers the assets like volumes, snapshots.
- It discovers all the volumes and snapshots (snapOPCPlus). NetBackup discovers the snapshots which have names like NB<followed chars>.
- Volumes are primary assets, each contains the associated snapshots, and asset ID. Then for the assigned asset ID NetBackup operations are performed.

Snapshot mapping

- Create a new snapshot of a volume - When you create a snapOPCPlus copy session of volume then the targeted volume is referred as **Snapshot Volume** and it represents a point-in-time copy of the source volume. The snapshot volume is created on the same appliance as the source volume.
- To create snapshot, you need a thin provision pool which have a *flexsnap_pool* prefix. if you don't create a thin provision pool with the prefix *flexsnap_pool* then snapshot operation fails.

Export

When a snapshot export operation is triggered, a snapshot volume is attached to the host where the snapshot is exported.

Follow the steps to export a snapshot:

1. Fetch initiators on which you want to perform export.
2. Based on the port and initiator fetch the host ID.
3. Create a new host LUN to map the snapshot volume.
4. Map the snapshot volume to the host.

FUJITSU AF/DX plug-in configuration parameters

- User - Role-based access control rights allow users to have different privileges. This provides a means to segregate administration roles to align better with skill

sets and responsibilities. There are 5 types of access for users: admin, storage admin, security admin, account admin, and maintainer.

- You need user roles who can perform operations like create, modify, delete, attach, detach, snapshot, restore, clone.
- IP Address/FQDN - The IP/FQDN which is used to access the GUI for the array can be used to configure the array in NetBackup. the user needs to provide the management IP. Example, If the management IP is 10.221.xxx.xx, the user can register the array with NetBackup using IP - 10.221.xxx.xx.

Specify the following parameters when you configure the FUJITSU AF/DX plug-in:

Table 5-15 FUJITSU AF/DX plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
IP Address	The array's IP address.
Username	User account which has permission to perform snapshot operations on the FUJITSU array.
Password	A password for the user account.

The following screen is displayed when you configure the plug-in using the NetBackup administrator console:

The screenshot shows a Windows-style dialog box titled "Configure Plugin @etnnbuclient02.etn.local". Inside the dialog, there is a section for "CloudPoint Server: etnnbucp-1" and "Selected Plugin: FUJITSU ETERNUS AF/DX Storage". Below this is a "Credentials" section with four input fields: "Enter Plugin ID:", "FUJITSU ETERNUS FQDN/ IP address:", "Username:", and "Password:". At the bottom of the dialog are three buttons: "OK", "Cancel", and "Help".

FUJITSU AF/DX plug-in considerations and limitations

Create snapshot operation:

- We must have a thin provision pool.
- Source volume types are Standard, TPV, FTV, and WSV (except for the system volume).
- The destination volume type must be TPV only.
- The maximum number of snapshots (SnapOPC+ Sessions) that can be created per volume is 512.

Host connection (mapping):

- Available HLUNs are between 0 and 255.
- If you want to use 256 or more HLUNs/Volumes to the host, change the LUN address of the host response to **Host Response** (flat space address) or you can enable **LUN Expand Mode** option.
- Then you can use HLUN up to 4096.

HPE RMC plug-in

The Snapshot Manager for Data Center plug-in for Hewlett Packard Enterprise (HPE) Recovery Manager Central (RMC) lets you create, delete, and restore snapshots of disks on all HPE storage systems that are supported by RMC. The plug-in supports clone and copy-on-write (COW) snapshot types.

Note: You can restore a COW snapshot, but not a clone snapshot.

See [“RMC plug-in configuration parameters”](#) on page 52.

See [“Supported HPE storage systems”](#) on page 53.

See [“Supported Snapshot Manager for Data Center operations on HPE storage arrays”](#) on page 49.

Supported Snapshot Manager for Data Center operations on HPE storage arrays

Snapshot Manager for Data Center supports the following operations on assets managed by HPE RMC:

Table 5-16 Snapshot Manager for Data Center operations on assets managed by HPE RMC

Snapshot Manager for Data Center operation	Description
Discover assets	<p>Snapshot Manager for Data Center discovers all the volumes that are created on the array. If a volume is part of a multi-volume volume set, Snapshot Manager for Data Center scans the volume set and extracts the individual volume information and then creates a list of all the unique volumes that are part of the volume set.</p> <p>For snapshots, Snapshot Manager for Data Center scans all the snapshot sets and links each snapshot to its originating parent volume.</p>

Table 5-16 Snapshot Manager for Data Center operations on assets managed by HPE RMC (*continued*)

Snapshot Manager for Data Center operation	Description
Create snapshot	<p>Snapshot Manager for Data Center takes snapshots of all the volumes on the array.</p> <p>When Snapshot Manager for Data Center takes a snapshot, it internally triggers a copy-on-write (COW) snapshot of the entire volume. If a volume is part of a multi-volume volume set, Snapshot Manager for Data Center takes a snapshot of the entire volume set and creates a snapshot set. The snapshot set contains snapshots of all the volumes that are part of that volume set. However, Snapshot Manager for Data Center associates that snapshot set only with the volume that was selected for the snapshot operation. Even if the volume set contains additional volumes, the snapshot set is associated only with the volume that was selected.</p> <p>For example, consider a volume set that contains three volumes, <code>vol-1</code>, <code>vol-2</code>, and <code>vol-3</code>. If you use Snapshot Manager for Data Center to create a snapshot of <code>vol-1</code>, Snapshot Manager for Data Center creates a snapshot set that includes snapshots of all the volumes in that volume set. But the snapshot set is marked as a snapshot of <code>vol-1</code> (the selected volume) even though the snapshot set includes additional snapshots belonging to the other volumes, <code>vol-2</code>, and <code>vol-3</code>.</p>
Delete snapshot	<p>Snapshot Manager for Data Center deletes the snapshot or the snapshot set (if parent volume is part of a volume set).</p> <p>You can use Snapshot Manager for Data Center to delete only those snapshots that are created using Snapshot Manager for Data Center. If your RMC environment includes other snapshots, then Snapshot Manager for Data Center can discover those snapshots, but the delete operation is not allowed for those snapshots.</p>

Table 5-16 Snapshot Manager for Data Center operations on assets managed by HPE RMC (*continued*)

Snapshot Manager for Data Center operation	Description
Restore snapshot	<p>When you restore a snapshot, Snapshot Manager for Data Center only restores the particular snapshot corresponding to the selected volume. The snapshot set is a COW snapshot that can contain other snapshots belonging to the additional volumes in the volume set. However, Snapshot Manager for Data Center only restores the snapshot for the selected volume. The other snapshots are not used during the restore operation.</p> <p>Ensure that the parent volume is unmounted from the target host before initiating a snapshot restore.</p>
Export snapshot	<p>When a snapshot export operation is triggered, Snapshot Manager for Data Center creates a new volume from the snapshot and then attaches the new volume to the target host.</p> <p>If the selected snapshot is a snapshot set, then while creating a new volume, Snapshot Manager for Data Center creates a new volume set from the snapshot set. Even if the new volume set contains multiple volumes, Snapshot Manager for Data Center attaches only the volume that corresponds to the snapshot that was selected for the export. The other volumes are not used in the export operation.</p> <p>The export operation is supported using the following protocols:</p> <ul style="list-style-type: none">■ Fibre Channel (FC)■ Internet Small Computer Systems Interface (iSCSI)
Deport snapshot	<p>When a snapshot deport operation is triggered, Snapshot Manager for Data Center detaches the volume from the target host and then deletes that volume. If the volume is part of a multi-volume volume set, then the entire volume set is detached and deleted from the host.</p>

Note: For a snapshot of a volume set, use name patterns that are used to form the snapshot volume name. Refer to VV Name Patterns in the *HPE 3PAR Command Line Interface Reference* available from the HPE Storage Information Library.

HPE RMC plug-in considerations and limitations

Consider the following when you configure the HPE EMC plug-in:

- When you delete snapshots using Snapshot Manager for Data Center, only the snapshots that are managed by Snapshot Manager for Data Center are available for deletion. You cannot use NetBackup to delete snapshots that are not created using Snapshot Manager for Data Center.
- NetBackup operations are supported only on disks and volumes. Even if the volumes are grouped as a volume set, Snapshot Manager for Data Center discovers and presents the volume set in the form of the individual volumes that are part of the volume set.

If you create a snapshot of a volume that belongs to a multi-volume volume set, Snapshot Manager for Data Center creates a snapshot set that includes snapshots of all the volumes in that volume set. The snapshot operation therefore results in the creation of additional snapshots and those are not tracked by Snapshot Manager for Data Center.

If you want to use Snapshot Manager for Data Center to protect volume sets, Veritas recommends that you configure a single volume in the volume set.

RMC plug-in configuration parameters

The following parameters are required for configuring the Snapshot Manager for Data Center plug-in:

Table 5-17 RMC plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
IP address	The IP address of the RMC server
Username	The RMC administrator user account
Password	The password for the RMC admin user account

Before configuring the plug-in, ensure that the user account that you provide to Snapshot Manager for Data Center has an admin role assigned on the RMC server.

Supported HPE storage systems

Table 5-18 Supported RMC version

Category	Supported
RMC software version	<ul style="list-style-type: none">■ 6.0 or later■ 6.2 or later (for HPE Nimble)

Table 5-19 Supported RMC-managed storage systems

Category	Supported
Arrays	<ul style="list-style-type: none">■ HPE 3PAR StoreServ■ HPE Nimble Storage

HPE XP SAN Storage array

The CloudPoint plug-in for HPE XP (XP7 and XP8) enables NetBackup to discover SAN volumes on the HPE XP array and then trigger snapshot create, export, deport, delete, and restore operations for them. You must configure this plug-in on the NetBackup primary server.

CloudPoint uses the REST API hosted on HPE XP Configuration Manager to communicate with the HPE XP storage arrays. It establishes a connection with HPE XP storage array by creating sessions in HPE XP Configuration Manager and uses the REST APIs to discover the SAN volumes and their snapshots that need to be backed up.

Supported Snapshot Manager for Data Center operations on HPE XP storage arrays

CloudPoint performs the following management operations on the HPE XP Storage array:

Table 5-20 Snapshot Manager for Data Center operations on assets managed by HPE XP

Snapshot Manager for Data Center operation	Description
Discover assets	<p>Snapshot Manager for Data Center discovers the Logical Devices (LDEV) created on the storage array and snapshots inside the snapshot group named similar to <code>flexsnap_snap_group</code> along with some of their metadata.</p> <p>The LDEVs that have "CMD" in their attributes and those without any logical unit number (LUN) mapped are not discovered.</p>
Create snapshot	<p>For snapshots, Snapshot Manager for Data Center uses HPE XP Fast Snap Pairs and triggers a sequence of REST API requests with the required information and snapshot name. The API returns the details of the snapshot.</p> <p>A typical snapshot created by CloudPoint has the following naming convention: <code>NB<unique_21digit_number></code></p>
Delete snapshot	<p>To delete a snapshot, CloudPoint triggers a sequence of REST API requests with the required snapshot details and confirms that the snapshot has been deleted successfully on the cluster.</p>
Restore snapshot	<p>To restore a snapshot, CloudPoint triggers a REST API request where the fast snap is restored to the parent volume.</p>
Export snapshot	<p>Export over iSCSI and FC is supported by CloudPoint. Cloudpoint uses REST API to set LUN path of snapshot.</p>
Deport snapshot	<p>When a snapshot deport operation is triggered, CloudPoint deletes the export created over the snapshot path at the time of Export operations. It essentially reverts the Export operation.</p>

HPE XP plug-in configuration parameters

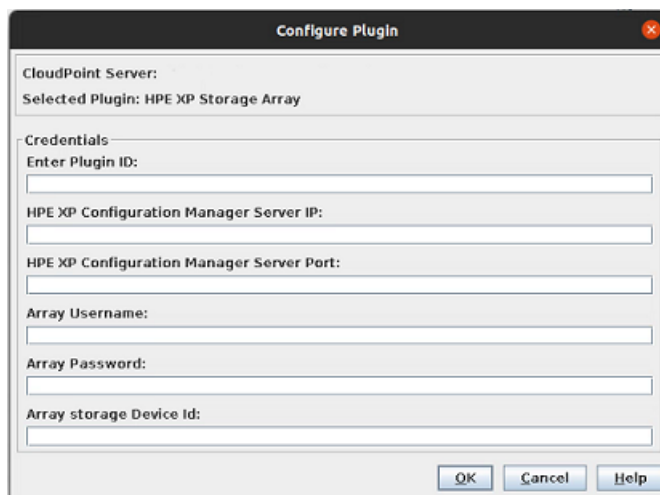
Before configuring the plug-in, make sure to create a pool with the name prefixed with `flexsnap_pool` on the storage array to store snapshots.

Gather the following information about the HPE XP array. You will need to use these details while configuring the plug-in.

Table 5-21 HPE XP plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
HPE XP Configuration Manager Server IP	IP of the HPE XP Configuration Manager REST server which is configured with the storage array to be used.
HPE XP Configuration Manager Server Port	Port on which the HPE XP Configuration Manager REST server is hosted.
Array Username	HPE XP Storage array user account which have permissions for snapshot operations.
Array Password	The password associated with the array username.
Array Storage Device ID	Storage device ID of the array that is already registered with the HPE XP Configuration Manager.

The following screen is displayed when you configure the plug-in using the NetBackup administration console:



Configure Plugin

CloudPoint Server:
Selected Plugin: HPE XP Storage Array

Credentials

Enter Plugin ID:

HPE XP Configuration Manager Server IP:

HPE XP Configuration Manager Server Port:

Array Username:

Array Password:

Array storage Device Id:

OK Cancel Help

HPE XP plug-in considerations and limitations

- CloudPoint uses a snapshot group while creating snapshots, So maximum number of snapshots in CloudPoint for an array is 8192.
- The pool created must be large enough to accommodate all the snapshot needs.

Hitachi NAS array

The Hitachi NAS plug-in lets you create, delete, restore, export, and deport snapshots of the following assets on the Hitachi NAS storage arrays:

- Hitachi NAS NFS exports in a NAS environment.
- Hitachi NAS SMB shares in a NAS environment.

The Hitachi NAS plug-in uses the REST API's exposed by Hitachi NAS family to communicate with Hitachi NAS array. It uses the latest API version V7 which supports Hitachi NAS platform 13.5 or later arrays. The firmware lower than version 13.5 are not able to protect the assets from NetBackup. The connection is established to Hitachi NAS array through REST API. Then NetBackup uses the API endpoints to discover the NFS exports, SMB shares, and the file system snapshots that need to be backed up.

Supported NetBackup Snapshot Manager operations on Hitachi NAS array

NetBackup Snapshot Manager performs the following snapshot management operations on the Hitachi NAS arrays.

Table 5-22 Snapshot Manager for Data Center operations on Hitachi NAS plug-in

Snapshot Manager for Data Center operation	Description
Discover assets	NetBackup Snapshot Manager discovers all the Hitachi NAS EVS servers, NFS export, SMB shares, and their filesystem-snapshots along with some of their directory metadata. NetBackup Snapshot Manager will also discover all the nested NFS exports and SMB shares irrespective of the depth at which they are created.

Table 5-22 Snapshot Manager for Data Center operations on Hitachi NAS plug-in (*continued*)

Snapshot Manager for Data Center operation	Description
Create snapshot	<p>To create a snapshot, NetBackup Snapshot Manager triggers a POST REST API method with the required information and snapshot name. The API returns the details of the snapshot. All these snapshots are at a file system level.</p> <p>A typical snapshot created by Snapshot Manager for Data Center has the following naming convention:</p> <p>NB<unique_21digit_number></p> <p>SnapNB is application-specific filter ID to speed up searching for future retrieval. This is a mandatory field needed to add in payload while snapshot creation using REST API. The snapshots created using REST API are not visible directly on the array GUI, you must select the filter named as By Application.</p>
Delete snapshot	<p>To delete a snapshot, NetBackup Snapshot Manager calls the <code>DELETE</code> REST API using SDK method, with the required snapshot details.</p> <p>The API confirms that the snapshot has been deleted successfully on the array.</p>
Restore snapshot	<p>NetBackup Snapshot Manager does not support PIT restore operation on the array. Instead we can perform Normal restore on specified location.</p>
Export snapshot	<p>NetBackup Snapshot Manager supports export operation using the NFS and SMB protocol. When a snapshot export operation is triggered a export path is created using snapshot directory and snapshot name For NFS export the host access configuration are added as read-only on a particular export or share. For SMB share the user and domain provided while exporting the snapshot is added with privileges to access the SMB share created.</p> <ul style="list-style-type: none">■ NFS: <EVS-server-ip>:<share_name>/<snapshot/><snapshot_name>■ SMB: \\<EVS-server-ip>\<share_name>\@UTC_for_snapshot

Table 5-22 Snapshot Manager for Data Center operations on Hitachi NAS plug-in (*continued*)

Snapshot Manager for Data Center operation	Description
Deport snapshot	<p>When a snapshot deport operation is triggered, Snapshot Manager for Data Center makes a PUT REST API call to the Hitachi NAS array, and does following:</p> <ul style="list-style-type: none">■ For NFS, removes the host access configurations entry that was added during the export operation.■ For SMB, removes the privileges provided to user to access the SMB share created.

Hitachi NAS plug-in configuration prerequisites

Before you configure the Hitachi NAS plug-in, verify the following:

- Ensure that a supported version of HNAS System Management Unit is installed on the Hitachi NAS arrays.
- For the list of all the supported versions of HNAS System Management Unit, refer to the NetBackup Snapshot Manager section in the NetBackup Hardware and Cloud Storage Compatibility List HCL).
- A user account exists which have the permissions to invoke the Hitachi NAS REST APIs and all snapshot operations on the array.

Hitachi NAS plug-in configuration parameters

The following parameters are required for configuring the Hitachi NAS plug-in.

Parameter	Description
Plug-in ID	Provide a name for the plug-in.
NAS Manager Server IP / FQDN	The array's NAS Manager Server or REST Server IP address, in either IPV4 or The Fully Qualified Domain Name (FQDN).
Port	Port number of the REST API server.
User name	The Hitachi user account that has the permissions to invoke the Hitachi NAS REST APIs to perform all snapshot operations on the array.

Parameter	Description
Password	The password of the Hitachi NAS REST API user account specified earlier.

Domain user permissions for Hitachi NAS array

The domain user which you use to perform the NAS share backup, must have privileges for the Hitachi NAS array, to allow NetBackup to perform backup of the NAS share ACLs.

Limitations and considerations for Hitachi NAS plug-in

Following considerations and limitations are applicable in a Hitachi NAS environment.

- All snapshots are captured at a file system level and those snapshots are in read-only mode.
- The limit for any file system name is 255 characters, NFS export/SMB share name is 80 characters on the array. In case of a snapshot name, the maximum length must be 256 characters.
- Sometimes backup from snapshot and normal restore jobs are shown as partial success on the NetBackup activity monitor due to the NDMP file access permissions.
- A file system of selected NFS export/SMB share must be in the Mounted state on array, as Not mounted state file system affects the snapshot operations.
- Hitachi NAS plug-in does not support point-in-time (PIT) rollback restore of shares using snapshots.

Hitachi SAN array

The Snapshot Manager for Data Center plug-in for Hitachi lets you create, delete, export, deport, and restore storage snapshots of a supported Hitachi storage array that is registered with Hitachi Configuration Manager (HCM). The plug-in supports the Thin Image (HTI) snapshot type. You must configure this plug-in on the NetBackup primary server.

Snapshot Manager for Data Center uses the REST API SDK hosted on Hitachi Configuration Manager to communicate with the Hitachi Storage arrays. Snapshot Manager for Data Center establishes a connection with the Hitachi Storage array by creating sessions in Hitachi Configuration Manager. It also uses the REST APIs to discover the SAN volumes and their snapshots that need backup.

Supported NetBackup Snapshot Manager operations on Hitachi SAN array

NetBackup Snapshot Manager performs the following snapshot management operations on the Hitachi SAN arrays.

Table 5-23 Snapshot Manager for Data Center operations on EMC PowerStore SAN plug-in

opeSnapshot Manager for Data Centerration	Description
Discover assets	<p>Snapshot Manager for Data Center discovers all the Logical Devices (LDEV) created on the storage array. The primary LDEV objects appear as disk assets. The secondary LDEV objects that are part of a Thin Image (TI) pair appear under snapshots.</p> <p>One or more LDEV objects are grouped in a logical entity called pool. For the Snapshot Manager for Data Center Hitachi plug-in to work, you must create a pool named `flexsnap_pool` on the storage array.</p> <p>The LDEVs that have "CMD" in their attributes and those without any logical unit number (LUN) mapped are not discovered.</p>
Create snapshot	<p>NetBackup takes a snapshot of all the LDEV objects that are attached to a hostgroup.</p> <p>When Snapshot Manager for Data Center takes a snapshot, it performs the following actions:</p> <ul style="list-style-type: none">■ Creates a new LDEV object of the same size as the original (base) LDEV.■ Puts the base LDEV and the new LDEV into a Thin Image (TI) pair. The base LDEV is the primary LDEV and the new LDEV is the secondary LDEV.■ Splits the TI pair to create a point-in-time snapshot of the base LDEV and then updates the snapshot LUN path to point to the secondary LDEV.■ Attaches the snapshot to the same hostgroup where the base LDEV is attached. <p>A typical snapshot created by Snapshot Manager for Data Center has the following naming convention: NB<unique_21digit_number></p>

Table 5-23 Snapshot Manager for Data Center operations on EMC PowerStore SAN plug-in (*continued*)

opeSnapshot Manager for Data Centerration	Description
Delete snapshot	When Snapshot Manager for Data Center deletes a snapshot, it performs the following actions: <ul style="list-style-type: none">■ Deletes the snapshot.■ Removes the LUN path to the secondary LDEV associated with the snapshot.■ Deletes the secondary thin LDEV.
Restore snapshot	Snapshot Manager for Data Center performs a restore operation on a thin image snapshot of LDEV. All the data in the primary LDEV is overwritten by the data from the secondary LDEV.
Export snapshot	When NetBackup exports a snapshot, Snapshot Manager for Data Center searches for the target host based on the World Wide Name (WWN) or the iSCSI Qualified Name (IQN) specified in the export request. After the host is identified on the storage array, Snapshot Manager for Data Center updates the path attribute of the secondary LDEV with the target host, where the snapshot is to be exported. Once the target host is added to the secondary LDEV host ports, the exported snapshot is immediately visible on the target host.
Deport snapshot	When a snapshot deport operation is triggered, Snapshot Manager for Data Center removes the target host from the secondary LDEV path attribute. Once the target host entry is removed from the secondary LDEV host ports, the exported snapshot is no longer visible on the target host and the deport operation is complete.

Hitachi SAN plug-in configuration prerequisites

Before you configure the Hitachi SAN plug-in, verify the following:

- Ensure that you create a pool named *flexsnap_pool* on the Hitachi storage array. This is required for the Snapshot Manager for Data Center plug-in to work.
- Create a snapshot group named *flexsnap_default_group* on the storage array. If you do not create this snapshot group, the plug-in automatically creates it during the configuration.

- Ensure that the Hitachi storage arrays are registered with Hitachi Configuration Manager (HCM). Snapshot Manager for Data Center uses the HCM REST APIs to communicate with the storage arrays.
- Ensure that the Hitachi storage array have the necessary licenses that are required to perform snapshot operations.
- Ensure that the user account that you provide to the Snapshot Manager for Data Center has general read permissions, as well as the permissions to create, delete, export, deport and restore snapshots on the storage array.
- For the list of all the supported versions of Hitachi Storage arrays, refer to the NetBackup Snapshot Manager section in the NetBackup Hardware and Cloud Storage Compatibility List (HCL).

Hitachi SAN plug-in configuration parameters

The following parameters are required for configuring the Hitachi SAN plug-in.

Parameter	Description
Plug-in ID	Provide a name for the plug-in.
Hitachi Configuration Manager Server IP	IP of the Hitachi Configuration Manager REST server which is configured with the storage array to be used. The URL has the following format: <code>protocol://host-name:port-number/ConfigurationManager</code>
Hitachi Configuration Manager Server port	Port on which Hitachi Configuration Manager REST server is hosted.
Array User name	The name of the user account that has access to the Hitachi storage array. In addition to general read permissions, the user account must have the permissions to create, delete, export, deport and restore snapshots on the storage array.
Array Password	The password for the user account that is used to access the Hitachi storage array.
Array Storage Device ID	ID of the storage array device that is already registered with the Hitachi Configuration Manager.

Limitations and considerations for Hitachi SAN plug-in

Following considerations and limitations are applicable in a Hitachi SAN environment.

- The export operation is supported using the following protocols:
 - Fibre Channel (FC)
 - Internet Small Computer Systems Interface (iSCSI)
- Snapshot Manager for Data Center uses a snapshot group while creating snapshots, so maximum number of snapshots in the Snapshot Manager for Data Center for an array is 8192 per pool.
- The Thin Image Pool must be large enough to accommodate all snapshot needs.

IBM Storwize array

NetBackup provides a robust data protection solution for the volumes that are set up on the storage array.

NetBackup extends SAN support to protect the mounted iSCSI/FC volumes that are hosted on an IBM Storwize array environment.

You can configure CloudPoint to discover data, perform backup, and restore operations.

The CloudPoint plug-in for IBM Storwize contains the functional logic that enables NetBackup :

1. To discover the SAN volumes on the IBM Storwize array
2. Then triggers the snapshot to create, export, deport, and delete the operations for the exports.

Note: You must configure this plug-in on the NetBackup primary server.

1. CloudPoint uses the REST API supported by IBM Storwize family to communicate with the IBM Storwize assets.
2. Using SDK exposed RestClient library CloudPoint establishes a connection with IBM Storwize
3. Then uses the SDK methods to discover the SAN volumes and its' snapshots that needs to be backed up.

Supported Snapshot Manager for Data Center operations on IBM Storwize models

You can perform the following Snapshot Manager for Data Center operations supported on the IBM Storwize SAN models:

Table 5-24 CloudPoint operations on the IBM Storwize array

Snapshot Manager for Data Center operations	Description
Discover assets	CloudPoint discovers all the array volumes and snapshots inside the snapshot group flexsnap_snap_group with some metadata. Volumes with the CMD attributes and without mapping are not discovered
Create snapshot	To create a snapshot, CloudPoint triggers a Post Rest API method with the required snapshot details. The API returns with the snapshot details. A snapshot is created with the following naming convention: NB<unique_21digit_number>
Delete snapshot	To delete a snapshot, CloudPoint triggers a Post Rest API method with the required snapshot details. Then confirms that the snapshot is deleted on the array.
Restore snapshot	CloudPoint restores the snapshot using a Post Rest API method with different restore paths.
Export snapshot	CloudPoint supports export snapshot over the iSCSI and FC. It uses a REST API to set the LUN path for snapshot.
Deport snapshot	When a snapshot deport operation is triggered, CloudPoint deletes the export mapping created between the host and the volume.

IBM Storwize plug-in configuration parameters

Specify the following parameters when you configure the IBM Storwize SAN plug-in:

Table 5-25 IBM Storwize plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
Plugin ID	Provide a name for the plugin.
FQDN/ IP Address	The array's IP address, in IPV4 / FQDN format.
Port	Port on which IBM Storwize is configured.
Username	A user account that has permissions to perform snapshot operations on the IBM Storwize array.
Password	Provide a password to the user account.

IBM Storwize plug-in considerations and limitation

The following considerations and limitations are applicable:

1. During the delete and deport operations the array is not allowed to perform the operations until the vDisk protection is disabled. So, NetBackup disables the vDisk protection when these operations are triggered and then return to the original state. These operations doesn't have any impact on the existing mapping or I/O operations performed on the array.
2. During the restore operation a standard warning about the FlashCopy mapping is displayed on the array. Then NetBackup restores the volume irrespective of the same behavior observed on the array side.
3. The array doesn't support ipV6 configuration from NetBackup and can only use ipV4 for all its' operations.

InfiniBox SAN array

The Snapshot Manager for Data Center plug-in for InfiniBox lets you create, delete, restore, export, and deport snapshots of the SAN volumes (virtual disks) that are part of storage pools on the INFINIDAT InfiniBox storage arrays.

Snapshot Manager for Data Center supports all the InfiniBox storage arrays that are compatible with InfiniSDK.

InfiniBox plug-in configuration prerequisites

Before you configure the InfiniBox plug-in, perform the following steps on the storage system:

- Ensure that the InfiniBox storage arrays have the necessary licenses that are required to perform snapshot operations.
- Ensure that the user account that you provide to Snapshot Manager for Data Center has administrative privileges to all the storage pools that you wish to protect using Snapshot Manager for Data Center.

See [“InfiniBox SAN plug-in configuration parameters”](#) on page 68.

See [“Supported Snapshot Manager for Data Center operations on InfiniBox SAN models”](#) on page 65.

Supported Snapshot Manager for Data Center operations on InfiniBox SAN models

Snapshot Manager for Data Center supports the following operations on the InfiniBox SAN storage array:

Table 5-26 Supported Snapshot Manager for Data Center operations on InfiniBox SAN array

Snapshot Manager for Data Center operation	Description
Discover assets	<p>Snapshot Manager for Data Center discovers all the SAN volumes (virtual disks) that are part of storage pools that are created on the InfiniBox storage array. The plug-in sends a request to the array to return a list of all the volumes that have the type set as <code>PRIMARY</code>. Such volumes are considered as base volumes and appear as disk assets.</p> <p>To discover snapshot objects, the plug-in sends a request to the array to return a list of all the volumes that have the type set as <code>SNAPSHOT</code> and the depth attribute set as 1. Such volumes are considered as snapshots.</p> <p>InfiniBox arrays support creating a snapshot of a snapshot. The depth attribute identifies the snapshot type. A snapshot depth value greater than 1 indicates that it is a snapshot of an existing snapshot. Snapshot Manager for Data Center does not support discovery and operations on snapshot volumes that have a depth value other than 1.</p>
Create snapshot	<p>Snapshot Manager for Data Center takes a snapshot of all the SAN volumes that are part of a storage pool. When a snapshot is created, Snapshot Manager for Data Center plug-in uses InfiniSDK to send a <code>create_snapshot</code> method request on the selected volume and passes a snapshot name as an argument in that request.</p> <p>The InfiniBox array creates a snapshot volume, sets the type as <code>SNAPSHOT</code> and the depth attribute value as 1, and returns that information to Snapshot Manager for Data Center.</p>
Delete snapshot	<p>When a snapshot is deleted, Snapshot Manager for Data Center plug-in sends a <code>delete_snapshot</code> method request on the parent volume that is associated with the snapshot and passes the snapshot volume name as an argument in that request. The InfiniBox array deletes the specified snapshot associated with the parent volume.</p>

Table 5-26 Supported Snapshot Manager for Data Center operations on InfiniBox SAN array (*continued*)

Snapshot Manager for Data Center operation	Description
Restore snapshot	<p>When a snapshot restore operation is triggered, Snapshot Manager for Data Center first gets details about the parent volume that is associated with the snapshot that is being restored. Snapshot Manager for Data Center plug-in then sends the <code>restore_snapshot</code> method request on the parent volume and passes the selected snapshot as an argument in that request.</p> <p>The array uses the selected snapshot to perform the restore on the parent volume. All the data in the parent volume is overwritten by the data in the snapshot volume.</p>
Export snapshot	<p>When a snapshot export operation is triggered, Snapshot Manager for Data Center searches for the target host based on the world wide name (WWN) or the iSCSI Qualified Name (IQN) specified in the export request. After the host is identified, Snapshot Manager for Data Center plug-in sends a <code>map_volume</code> method request on the target host and passes the selected snapshot ID as an argument in that request.</p> <p>The InfiniBox array returns a LUN ID as a response to the restore request. Snapshot Manager for Data Center stores the LUN ID and the target host ID mapping information internally in the Snapshot Manager for Data Center database. The export operation also creates a new virtual asset of type <code>disk:snapshot:export</code> and that is saved in the Snapshot Manager for Data Center database.</p>
Deport snapshot	<p>When a snapshot deport operation is triggered, Snapshot Manager for Data Center first gets the target host ID from the database. The Snapshot Manager for Data Center plug-in then sends a <code>unmap_volume</code> method request on the target host and passes the selected snapshot ID as an argument in that request. The InfiniBox array removes the snapshot volume mapping from the specified target host.</p>

InfiniBox plug-in and snapshot related requirements and limitations

Consider the following when you configure the InfiniBox plug-in:

- The InfiniBox plug-in supports discovery and snapshot operations only on volume snapshots that have the depth attribute value set to 1. Volume snapshots that have the depth attribute value other than 1 are not supported.
- All parent volume objects and snapshot objects on an InfiniBox array are unique. While creating a snapshot of a volume, if an object with the same name already exists on the array, the create operation fails. You must ensure that the snapshot names are unique.
- When you delete snapshots using Snapshot Manager for Data Center, only the snapshots that are managed by Snapshot Manager for Data Center are available for deletion. You cannot use Snapshot Manager for Data Center to delete snapshots that are not created using Snapshot Manager for Data Center.
- The snapshot export operation is supported using the following protocols:
 - Fibre Channel (FC)
 - Internet Small Computer Systems Interface (iSCSI)

InfiniBox SAN plug-in configuration parameters

The following parameters are required for configuring the Snapshot Manager for Data Center InfiniBox SAN array:

Table 5-27 InfiniBox SAN plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
InfiniBox System IP Address	The IP address of the InfiniBox storage array.
Username	The name of the user account that has access to the InfiniBox storage array. The user account must have administrative privileges (POOL_ADMIN role) to the storage pools on the array.
Password	The password of the user account that is used to access the InfiniBox storage array.

NetApp storage array

The NetBackup Snapshot Manager NetApp plug-in allows you create, replicate, delete, restore, export, and deport snapshots of the following assets on the NetApp storage arrays:

- NetApp Logical Unit Number (LUNs) storage units in a SAN environment.
- NetApp Volumes ONTAP serves data to clients and hosts from logical containers called FlexVol volumes.
- NetApp NFS volumes in a NAS environment.
- NetApp SMB shares in a NAS environment.

Note: Snapshot replication is currently supported for snapshots created for NAS storage. This solution is not supported for snapshots created for SAN storage.

The NetApp plug-in uses NetApp Manageability SDK (NMSDK) which internally consumes the NetApp ZAPI interface supported by NetApp family to communicate with the NetApp array. For Data ONTAP version 9.10 and above, the NetApp plug-in uses the REST API interface supported by NetApp family to communicate with the NetApp array.

Supported NetBackup Snapshot Manager operations on NetApp storage

NetBackup Snapshot Manager performs the following snapshot management operations on the NetApp storage arrays:

Table 5-28 Supported NetBackup Snapshot Manager operations on NetApp storage

NetBackup Snapshot Manager operation	Description
Discover assets	<ul style="list-style-type: none">■ In a SAN environment, NetBackup Snapshot Manager for Data Center discovers the Volumes, LUNs that are created from storage volumes. Only LUNs whose status is online, read-write operations are enabled, and the Snapshot auto delete parameter is set to false, are discoverable. <pre>[{"state": "online", "vol_type": "rw", "is_snapshot_auto_delete_enabled": "false"}]</pre>Note: In a SAN environment, NetBackup Snapshot Manager for Data Center can discover only the snapshots that are created using NetBackup Snapshot Manager. Volumes which are having "CMD" in their attributes and volumes without host mappings discovered.■ In a NAS environment, NetBackup Snapshot Manager discovers all the NFS shares and volumes with security style UNIX and mixed mode on the NetApp storage. It also discovers SMB shares with Windows security style. The shares must have an active <code>junction_path</code> configured so that NetBackup Snapshot Manager can discover them.■ In a NAS environment, NetBackup Snapshot Manager discovers all the Data Protection volumes with NFS shares, volumes with security style UNIX as well as mixed mode, and the SMB shares with Windows security style.
Create snapshot	<ul style="list-style-type: none">■ In a SAN environment, NetBackup Snapshot Manager takes a snapshot of the NetApp volumes and LUNs. When NetBackup Snapshot Manager triggers a LUN snapshot on the NetApp storage, it internally triggers a redirect-on-write (ROW) snapshot of the entire volume to which the LUN belongs. If the volume contains multiple LUNs, the snapshot includes data from all the LUNs that reside on that volume. When a Volume Snapshot is triggered on the NetApp Storage, it creates a redirect-on-write (ROW) snapshot of the entire volume and returns the snapshot data of that volume. A typical snapshot created by NetBackup Snapshot Manager has the following naming convention: <code>NB<unique_21digit_number></code>■ In a NAS environment, NetBackup Snapshot Manager takes a snapshot of the NetApp NFS as well as SMB shares.

Table 5-28 Supported NetBackup Snapshot Manager operations on NetApp storage (*continued*)

NetBackup Snapshot Manager operation	Description
Delete snapshot / Delete replicated snapshot	<ul style="list-style-type: none">■ In a SAN environment, when you delete a LUN snapshot, NetBackup Snapshot Manager internally deletes the snapshot of one or more volumes to which the LUN belongs. When you delete a Volume snapshot, NetBackup Snapshot Manager for Data center deletes the snapshot corresponding to the Volume.■ In a NAS environment, NetBackup Snapshot Manager deletes the snapshot of the share.
Restore snapshot	<ul style="list-style-type: none">■ In a SAN environment, when you restore a LUN from a snapshot, NetBackup Snapshot Manager only restores the particular LUN on which the restore is triggered. The LUN snapshot is a ROW snapshot of the underlying volume, and that volume can contain multiple additional LUNs. Even if the snapshot contains data from multiple LUNs, the restore is performed only for the selected LUN. Data on the other LUNs remains unchanged.■ When you restore a Volume from a Volume snapshot, NetBackup Snapshot Manager restores the snapshot copy to the read-write Volume. Replacing the current working copy of the volume i.e. all underlying LUNs of the volume with snapshot. This results in the Volume state to that of snapshot copy.■ In a NAS environment, NetBackup Snapshot Manager restores the volume using the specified snapshot.

Table 5-28 Supported NetBackup Snapshot Manager operations on NetApp storage (*continued*)

NetBackup Snapshot Manager operation	Description
Export snapshot / Export replicated snapshot	<ul style="list-style-type: none">■ In a SAN environment, when a NetBackup snapshot export operation is triggered, NetBackup Snapshot Manager creates a LUN from the snapshot and attaches it to target host. The target host is assigned read-write privileges on the exported LUN.■ When a snapshot export operation is triggered for a Volume snapshot, NetBackup Snapshot Manager creates a volume from the snapshot and attaches all the LUNs associated with the Volume to target. The export operation is supported using the following protocols:<ul style="list-style-type: none">■ Fiber Channel (FC)■ Internet Small Computer Systems Interface (iSCSI)■ In a NAS environment, when a snapshot export operation is triggered,<ul style="list-style-type: none">■ For NFS Share snapshot, a new rule is created in the export policy and is assigned to the exported snapshot that is available as a network share. The target host is assigned read-only privileges on the exported snapshot share.■ For SMB Share snapshot, a new share is created from the snapshot and the user and domain privileges to access the SMB Share created. The specified user must be in the domain provided.■ In a NAS environment, the export operation is supported using the NFS and SMB protocol. <p>Note: NetBackup Snapshot Manager does not modify the SVM's default export policy. The export operation will fail if the volume is attached only to the default export policy on NetApp. You must assign the NAS volume to a non-default export policy.</p>
Deport snapshot / Deport replicated snapshot	<ul style="list-style-type: none">■ In a SAN environment, when a snapshot deport operation is triggered, NetBackup Snapshot Manager removes the LUN mapping from the target host and then deletes the LUN.■ In a NAS environment, when a snapshot deport operation is triggered.<ul style="list-style-type: none">■ For NFS Share snapshot, Snapshot Manager for Data Center deletes the new rule created in the export policy when the snapshot was exported.■ For SMB Share snapshot, Snapshot Manager for Data Center deletes the SMB share created from the snapshot.

Table 5-28 Supported NetBackup Snapshot Manager operations on NetApp storage *(continued)*

NetBackup Snapshot Manager operation	Description
Replicate snapshot	<ul style="list-style-type: none">■ In a NAS environment, NetBackup Snapshot Manager replicates a snapshot of the NetApp NFS and SMB shares to a destination target array.■ A typical replica snapshot created by NetBackup Snapshot Manager has the name as that of source snapshot name and naming convention:NB<unique_21digit_number>
Restore replica snapshot	In a NAS environment, NetBackup Snapshot Manager PIT restores for Replica snapshot is not supported.

NetApp plug-in configuration prerequisites

Before you configure the NetApp plug-in, verify the following:

- Ensure that the NetApp storage arrays have the necessary NetApp licenses that are required to perform snapshot operations.
- For replication, ensure SnapMirror and SnapVault license are enabled on the storage array.
- For the list of all the supported Data ONTAP versions, refer to the NetBackup Snapshot Manager section in the NetBackup Hardware and Cloud Storage Compatibility List (HCL).
- For NAS environment, ensure that the NetApp shares are configured using an active `junction_path`.
- For replication, data-protection volume should also have the active `junction_path` configured.

NetApp plug-in configuration parameters

The following parameters are required for configuring the NetApp NAS and SAN plug-in:

Table 5-29 NetApp plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
Array IP address or FQDN	The cluster management IP address or the Fully Qualified Domain Name (FQDN) of the NetApp storage array or filer.
Username	A NetApp user account that has permissions to perform snapshot operations on the NetApp storage array or filer.
Password	The password of the NetApp user account.

Roles and privileges on NetApp storage array for the ZAPI interface

To allow NetBackup Snapshot Manager to perform snapshot management operations, ensure that the NetApp user account used for plug-in configuration has the below mentioned roles and privileges assigned on the storage array:

- Ensure that the NetApp user account has the privileges to perform the following operations on the NetApp array:
 - Create snapshot
 - Delete snapshot
 - Restore snapshot
- Ensure that the NetApp user account is configured with `http` and `ontapi` access methods.
- Ensure that the NetApp user account has the following roles assigned:
 - Default: readonly
 - lun: all
 - volume snapshot: all
 - vservers export-policy: all
 - vservers cifs: all (required for SMB protocol only)
 - snapmirror: all (required privileges in role to perform replication operations)

Refer to NetApp documentation for instructions on how to create users and roles and assign permissions.

Roles and privileges on NetApp storage array for REST interface

For Data ONTAP version 9.10 and above, the NetApp plug-in uses the REST API interface to communicate with NetApp array. In order to allow NetBackup Snapshot Manager to perform snapshot management operations, ensure that the NetApp user account used for plug-in configuration has the below mentioned roles and privileges assigned on the storage array.

API	Access level
/api/cluster	Read/Write
/api/network/ip/interfaces	Read-Only
/api/protocols/cifs/shares	Read/Write
/api/protocols/nfs/export-policies	Read/Write
/api/protocols/san/igroups	Read/Write
/api/protocols/san/lun-maps	Read/Write
/api/snapmirror/relationships	Read/Write
/api/storage/luns	Read/Write
/api/storage/volumes	Read/Write
/api/svm/svms	Read-Only

Refer to NetApp documentation for instructions on how to create users and roles and assign permissions.

Domain user permissions on the NetApp array

The domain user which you use to perform the NAS share backup, must have privileges for the NetApp array, to allow NetBackup to perform backup of the NAS share ACLs.

To assign privileges on the NetApp array:

- 1 Log in to the OnCommand System Manager console.
- 2 Navigate to the respective SVM where you are creating the SMB volumes or shares.
- 3 Click SVM setting in the right pane.
- 4 Click **Windows** under **Host Users and Groups** in left navigation pane. The **Groups** and **Users** tabs opens in the right pane.

- 5
- In the **Groups** tab click **BUILTIN\Backup Operators** and select **Edit** option at the top.
- 6
- In the **Modify** dialog, in the **Members** frame, add your domain user and select the following Privileges:

SetBackupPrivilege, SetRestorePrivilege, and SetSecurityPrivilege.

Configuring a dedicated LIF for NetBackup operation

NetApp NAS-based volume snapshots are exposed to NetBackup over NAS protocols. NetBackup reads these snapshots using any available Data LIF on the respective Storage Virtual Machines (SVM). If required, you can configure a Data LIF that is dedicated for NetBackup access.

While configuring a Data LIF, use the prefix "**nbu_nas_**" in the interface name for the SVM. If such a Data LIF exists, NetBackup automatically uses only that LIF for accessing the snapshots.

Note: This is an optional step. If configured, the backup reads are restricted via the dedicated LIF. If not configured, volume snapshots are accessed via any available DATA LIF of the corresponding SVM.

Snapshot Replication

NetBackup Snapshot Manager Replication can replicate snapshots on a NetApp cluster mode array. Clustered Data ONTAP (cDOT) is used to replicate snapshots between storage virtual machines (SVMs or vServers) and between cDOT clusters.

The current support is for NAS only. The NetBackup Snapshot Manager supports NetApp synchronous as well as asynchronous replication. For synchronous replication, Sync and StrictSync policies are supported. For asynchronous replication, policies like DPDefault, MirrorAllSnapshots, MirrorAndVault, MirrorLatest, Unified7year and XDPDefault are supported.

The supported policies are represented as 'NetApp_SnapMirror' and 'NetApp_SnapVault' replication type within NetBackup. Users can choose these replication types as the replication destination in SLP to replicate the snapshots to the desired replication destination.

Following table depicts the differentiation of various policies under NetApp_SnapMirror and NetApp_SnapVault.

Policy type	Policy name	Replication type
Asynchronous	DPDefault	NetApp_SnapMirror
	MirrorAllSnapshots	
	MirrorLatest	
	MirrorAndVault	NetApp_SnapVault
	XDPDefault	
	Unified7Years	
Synchronous	Sync	NetApp_SnapMirror
	StrictSync	

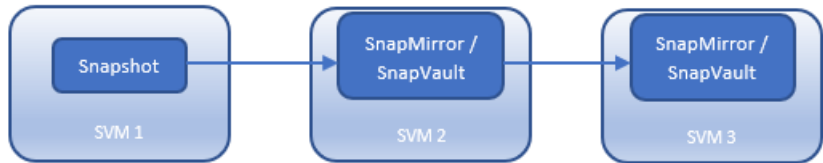
Supported NetApp topologies

The following scenarios describe the NetApp topologies that NetBackup Snapshot Manager Replication supports. All begin with a snapshot of the data on the primary volume.

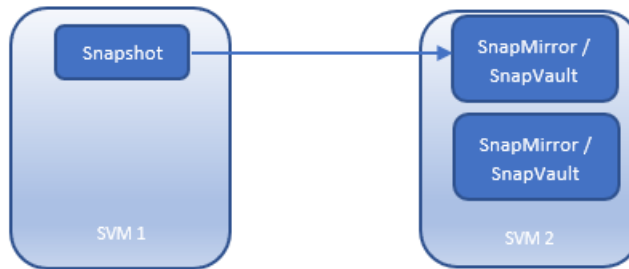
The snapshot can be replicated when you have a single target as destination



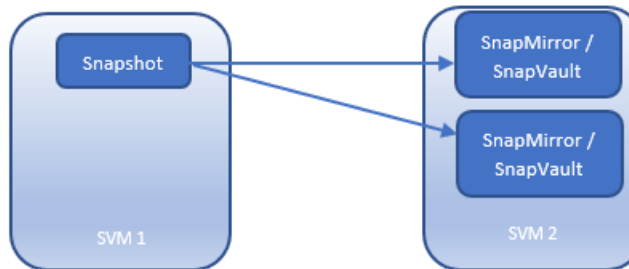
The snapshot can be replicated in a cascaded configuration.



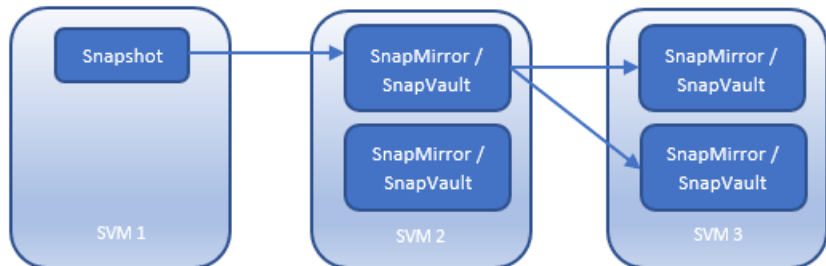
The snapshot can be replicated when you have multiple targets of same or different type configured on the array.



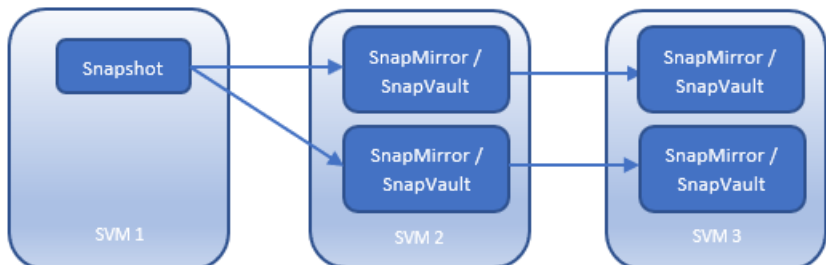
The snapshot can be replicated in a fanout configuration. You can have maximum 8 fanout relationships from a single source volume.



The snapshot can be replicated once and then further replicated in a fanout configuration.



The snapshot replications can fanout first and later cascade further.



Considerations for NetApp plug-in

The following requirements and limitations are applicable in a NetApp environment:

- The NetBackup Snapshot Manager snapshot export operation fails for shares that are assigned the default array export policy. Ensure that you assign a different export policy (other than the default) to the share before you run the export operation.
- Auto delete option should be disabled on the following volumes:

```
volume snapshot autodelete modify -vserver <vserverName> -volume  
<Volume Name> -enabled false -trigger volume
```
- If old snapshot is selected during PIT rollback, all new snapshots created after that snapshot is deleted automatically from array.
- Fanout of replication topology is not supported with synchronous replication.
- You can have maximum eight fanout relationships from a single source volume.

Nutanix Files array

NetBackup provides a robust data protection solution for shares that are set up on a Network Attached Storage (NAS) storage host. NetBackup extends this NAS support and allows you to protect file services that are hosted in a Nutanix Files environment. You can configure Snapshot Manager for Data Center to discover and then perform backup and restore operations on Nutanix Files shares that are exposed as Network File System (NFS) exports.

The Snapshot Manager for Data Center plug-in for Nutanix Files contains the necessary functional logic that enables NetBackup to discover the shares on the Nutanix Files server and then trigger snapshot create, export, deport, and delete operations for those shares. You must configure this plug-in on the NetBackup primary server. Snapshot Manager for Data Center uses the Nutanix REST APIs to communicate with the Nutanix Files File Server. Snapshot Manager for Data Center establishes a connection with Nutanix Files File Server by registering itself as a backup application and then uses the API endpoints to discover the shares and their snapshots that need to be backed up.

Supported Snapshot Manager for Data Center operations on Nutanix Files File Server

Snapshot Manager for Data Center performs the following management operations on the Nutanix Files File Server:

Table 5-30 Snapshot Manager for Data Center operations on Nutanix Files File Server

Snapshot Manager for Data Center operation	Description
Discover assets	<p>Snapshot Manager for Data Center discovers all the shares and their snapshots along with some of their metadata. Shares that have CFT_BACKUP capabilities are eligible for snapshot diff based incremental backups.</p> <p>Note: Snapshot operations are not supported for nested shares on Nutanix Files File Server.</p>
Create snapshot	<p>To create a snapshot, Snapshot Manager for Data Center triggers a POST REST API call on the <code>/mount_targets</code> API with the required share information and snapshot name. The API returns the details of the snapshot (also referred as the mount target snapshot). Snapshot Manager for Data Center keeps polling the snapshot details until the snapshot state changes to successful (or error in case failure).</p> <p>A typical snapshot created by NetBackup Snapshot Manager has the following naming convention: NB<unique_21digit_number></p>
Delete snapshot	<p>To delete a snapshot, Snapshot Manager for Data Center triggers a DELETE REST API call with the required snapshot details in the following format:</p> <p><code>/mount_target_snapshot/:snapshot_uuid</code></p> <p>Snapshot Manager for Data Center keeps polling the snapshot UUID until it returns a 404 Not Found error code. This code confirms that the snapshot has been deleted successfully.</p>
Restore snapshot	<p>Snapshot Manager for Data Center does not support this operation.</p>
Export snapshot	<p>When a snapshot export operation is triggered, the backups host is added to the partner server that is registered during the plug-in configuration. A PUT REST API call is made to the partner server with the required mount target details. Snapshot Manager for Data Center keeps polling the partner server to confirm the success of the operation.</p>

Table 5-30 Snapshot Manager for Data Center operations on Nutanix Files File Server (*continued*)

Snapshot Manager for Data Center operation	Description
Deport snapshot	When a snapshot deport operation is triggered, Snapshot Manager for Data Center makes a PUT REST API call to the partner server to remove the mount target entry that was added during the export operation. Snapshot Manager for Data Center keeps polling the partner server to confirm the success of the operation.
Create snapshot diff	Nutanix Files provides an API that allows to create a diff between two snapshots of a share. This process is called as Changed File Tracking (CFT). When a request to create a snapshot diff is made, Snapshot Manager for Data Center makes a REST API call to generate the CFT between two snapshots, and then retrieves and stores the CFT data on the Snapshot Manager for Data Center server. CFT based backups are supported only for top-level shares. Nested shares are not supported.

Nutanix Files plug-in configuration prerequisites

Before you configure the plug-in, do the following:

- Ensure that a supported version of Nutanix Files is installed on the Nutanix arrays.
- For the list of all the supported versions of Nutanix Files, refer to the NetBackup Snapshot Manager section in the NetBackup Hardware and Cloud Storage Compatibility List(HCL).
- A user account exists which has the permissions to invoke the Nutanix Files REST APIs on the File Server.

Nutanix Plug-in configuration parameters

Specify the following details when you configure the Nutanix Files array:

Parameter	Description
Plug-in ID	Provide a name for the plug-in.
FQDN/ IP Address	The Fully Qualified Domain Name (FQDN) of the Nutanix Files File Server.

Parameter	Description
User name	The user account that has the permissions to invoke the Nutanix Files REST APIs on the File Server.
Password	The password of the Nutanix REST API user account specified earlier.

Domain user permissions on the Nutanix Files array

The domain user which you use to perform NAS share backup, must have the required privileges for the Nutanix array. These privileges allow NetBackup to perform backup of the NAS share ACLs.

To assign privileges on the Nutanix array:

- 1 Log on to the prism console.
- 2 Open the file servers list, and click the file server where you want to create your SMB shares.
- 3 Select **User Mapping** in the **Protocol Management** link in the right corner.
- 4 Click **Next** multiple times, till the **Explicit Mapping** dialog appears.
- 5 Click **Add One to One Mapping** and add your domain user and add NFS ID, save and click **Next**.

You must add one domain user to the default mapping. Save the details.

- 6 Click **Manage Roles** in right pane for selected file server.
- 7 Add your domain user in the **Add Admins** section and select **Role** as *Backup admin: Backup access only*.
- 8 Save and close the dialog.

Nutanix Files plug-in considerations and limitations

The following considerations and limitations are applicable:

- Snapshot operations are not supported for nested shares on Nutanix Files File Server. A nested share is a share that is itself a subdirectory in an existing file share. NetBackup does not support snapshot creation for such nested shares.
- Nutanix Files File Server does not support point-in-time (PIT) rollback restore of shares using snapshots. You can use NetBackup assisted restore of shares' data.
- The maximum snapshot limit for a Nutanix Files share is 20. The maximum snapshot limit defines the maximum number of policy-triggered snapshots that

are retained for the specified share. When the maximum count is reached, the oldest snapshot is deleted, when the policy creates the next snapshot. You may want to consider the policy schedule and retention for NetBackup's policy protecting Nutanix File shares.

- Nested shares do not have Changed File Tracking (CFT) based backup support.
- Snapshot operations on nested shares are disabled.
- The same file server should not be configured on two separate NSM instances. If such a configuration is done, then there are chances of image import and cleanup failing.

Pure Storage Flash array

NetBackup provides a robust data protection solution for volumes that are set up on the storage array. NetBackup extends the SAN support and allows you to protect mounted volumes that are hosted on the Pure Storage Flash array environment. You can configure Snapshot Manager for Data Center to discover data, perform backups, and restore operations.

Flash array contains the functional logic which enables NetBackup to discover the SAN volumes on the Pure Storage Flash array. Then the plugin triggers the snapshot to create, export, deport, and delete operations for the exports. You must configure this plug-in on the NetBackup primary server.

Supported Snapshot Manager for Data Center operations on Pure Storage Flash array models

You can perform the following Snapshot Manager for Data Center operations on supported Pure Storage Flash array models:

- Discover and list all volumes.
- Create a clone snapshot of a volume.

Note: A snapshot name comprises of "Diskname+ snapshotname". Snapshot suffix must be between 1 through 63 characters in length and can be alphanumeric. The snapshot name must begin and end with a letter or number. The suffix must include at least one letter or '-'.

- Delete a clone snapshot.
- Restore the original volume from a snapshot. The snapshot overwrites the original volume.

- Export a snapshot.
When a snapshot export operation is triggered, Snapshot Manager for Data Center creates a new volume from the snapshot and attaches it to the target host using the Fibre Channel (FC) protocol. The target host is assigned read-write privileges on the exported snapshot volume.
- Deport a snapshot.
When a snapshot deport operation is triggered, Snapshot Manager for Data Center detaches the exported snapshot volume from the target host and then deletes the volume.

Pure Storage Flash array plug-in configuration parameters

Specify the following parameters when you configure the Pure Storage Flash array plug-in:

Table 5-31 Pure Storage Flash array plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
IP Address	The array's IP address
Username	The user name used to access the array
Password	The password used to access the array

Before you configure the plug-in, ensure that the specified user account has permissions to create, delete, and restore snapshots on the array.

Limitations and considerations

The following requirements and limitations are applicable for snapshot export and deport operations in a Pure Storage array environment:

- You cannot export a snapshot multiple times.
- You cannot delete an exported snapshot.

Pure Storage FlashBlade NAS array

NetBackup provides a robust data protection solution for the file systems that are set up on the storage host. NetBackup extends the NAS support to protect the file systems based on the following protocols:

Network File System (NFS) and Server Message Block (SMB) hosted on the Pure Storage FlashBlade array environment.

You can configure CloudPoint to discover data, perform backup, and then restore operations on NFS and SMB file systems.

Pure Storage FlashBlade plug-in contains a functional logic which enables NetBackup to discover the file systems on the Pure FlashBlade array. Then the plug-in triggers the snapshot to create, export, deport, and delete operations for file systems.

Note: You must configure the Pure Storage FlashBlade plug-in on the NetBackup primary server.

1. CloudPoint uses the REST API SDK of purity-fb version 1.12.2 to communicate with the Pure Storage FlashBalade assets.
2. Using SDK exposed RestClient library CloudPoint establishes a connection with Pure Storage FlashBlade array.
3. Then uses the SDK methods to discover the file systems and its' snapshots which need to be backed up.

Supported Snapshot Manager for Data Center operations on Pure Storage FlashBlade models

You can perform the following Snapshot Manager for Data Center operations supported on the Pure Storage FlashBlade models:

Table 5-32 CloudPoint operations on the Pure Storage FlashBlade array

Snapshot Manager for Data Center operations	Description
Discover assets	CloudPoint discovers all the Pure Storage FlashBlade share paths and its snapshots.
Create snapshot	To create a snapshot, CloudPoint triggers the SDK method with the required snapshot name and details. The API returns with the snapshot details. A snapshot is created with the following naming convention: NB <unique_21digit_number>.
Delete snapshot	To delete a snapshot, CloudPoint triggers the SDK method with the required snapshot details. Then confirms that the snapshot is deleted on the array.

Table 5-32 CloudPoint operations on the Pure Storage FlashBlade array
(continued)

Snapshot Manager for Data Center operations	Description
Restore snapshot	CloudPoint restores the snapshot using the SDK methods with different restore paths.
Export snapshot	When an export snapshot is triggered, a new read-only rule is added to the host in the file system for which the snapshot is created. Before a snapshot is created an export path is generated using the VLAN interface available on the array. Then the path is shared with Netbackup for mounting.
Deport snapshot	When a snapshot deport operation is triggered, CloudPoint deletes the NFS export rule created for the host.

Pure Storage FlashBlade plug-in configuration parameters

Specify the following parameters when you configure the Pure Storage FlashBlade plug-in:

Table 5-33 Pure Storage FlashBlade plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
Plugin ID	Provide a name for the plugin.
IP Address	The array's IP address, in IPV4 format.
API Token	Provide the unique API token generated for a user.

Pure Storage FlashBlade plug-in considerations and limitations

You cannot create shares within the Pure Storage FlashBlade array, but you can create the file systems.

Qumulo NAS array

NetBackup provides a robust data protection solution for the shares that are set up on a Network Attached Storage (NAS) storage host. NetBackup extends this NAS support and lets you protect NFS exports that are hosted in a Qumulo environment.

You can configure Snapshot Manager for Data Center to discover and then perform backup and restore operations on Network File System (NFS) exports.

The Snapshot Manager for Data Center plug-in for Qumulo contains the necessary functional logic that enables NetBackup to discover the NFS exports on the Qumulo cluster. NetBackup then create, export, deport, and delete snapshot operations for those exports. You must configure this plug-in on the NetBackup primary server.

Snapshot Manager for Data Center uses the REST API SDK Qumulo (qumulo-api) provides to communicate with the Qumulo assets. Snapshot Manager for Data Center establishes a connection with Qumulo by using the RestClient library exposed by SDK. NetBackup, then uses the SDK methods to discover the NFS exports and their snapshots that need to be backed up.

Supported Snapshot Manager for Data Center operations on Qumulo plug-in

Snapshot Manager for Data Center performs the following management operations on the Qumulo plug-in:

Table 5-34 CloudPoint operations on Qumulo plug-in

Snapshot Manager for Data Center operation	Description
Discover assets	<p>Snapshot Manager for Data Center discovers all the Qumulo file system paths and their snapshots along with some of their metadata. Single depth discovery is supported.</p> <p>For example, if the file system directories are [/home, /home/user1, /home/user2, /user1], then the discovered file system are [/home, /user1].</p>
Create snapshot	<p>To create a snapshot, Snapshot Manager for Data Center triggers an SDK method with the required information and snapshot name. The API returns the details of the snapshot.</p> <p>A typical snapshot created by Snapshot Manager for Data Center has the following naming convention:</p> <p>NB<unique_21digit_number></p>
Delete snapshot	<p>To delete a snapshot, Snapshot Manager for Data Center triggers an SDK method call with the required snapshot details. Then Snapshot Manager for Data Center confirms that the snapshot has been deleted successfully on the cluster.</p>

Table 5-34 CloudPoint operations on Qumulo plug-in (*continued*)

Snapshot Manager for Data Center operation	Description
Restore snapshot	Snapshot Manager for Data Center does not support this operation.
Export snapshot	When NetBackup exports a snapshot, a new NFS export is created over the same file system path on which the backup host is added as a client with the read-only permission.
Deport snapshot	When a snapshot deport operation is triggered, Snapshot Manager for Data Center deletes the NFS export created over the snapshot path at the time of the export operation.
Create snapshot diff	Snapshot Manager for Data Center does not support this operation.

Qumulo plug-in configuration prerequisites

Before you configure the plug-in, verify the following:

- Ensure that the Qumulo Core version is supported.
- For the list of all the supported versions of Qumulo, refer to the NetBackup Snapshot Manager section in the *NetBackup Hardware and Cloud Storage Compatibility List (HCL)*.
- A user account exists which has the permissions to call the Qumulo APIs on the Cluster.

Qumulo Plug-in configuration parameters

Specify the following details when you configure the Qumulo cluster.

Parameter	Description
Plug-in ID	Provide a name for the plug-in.
FQDN/ IP address	You can add any management IP address or the Fully Qualified Domain Name (FQDN) of the Node. You can also use Qumulo DNS round robin FQDN here.
User name	A user account that has permissions to perform snapshot operations on the Qumulo cluster.

Parameter	Description
Password	The password of the Qumulo user account specified earlier.

Permissions and privileges on Qumulo cluster

To allow NetBackup to perform snapshot management operations, ensure that the Qumulo user account used for plug-in configuration has the appropriate roles and privileges assigned on the storage array.

The NetApp user account must have the privileges to perform the following operations on the NetApp array:

- Create snapshot
- Export Snapshot
- Delete snapshot

There are three predefined user roles in Qumulo

- Administrators - Full access and control of the cluster.
- Data-Administrators - Full access and control of data and files on the cluster including: SMB/NFS, snapshots, quotas, file system, and file system permissions. Does not include access to the web UI.
- Observers - Read-only access for all APIs and UI on the cluster

Users with administrators or Data-administrators role assigned can perform all the NetBackup snapshot management operations.

These are the Custom User Role Permissions required to perform all the NetBackup snapshot management operations.

Permissions

CLUSTER_READ

FILE_FULL_ACCESS

NFS_EXPORT_READ

NFS_EXPORT_WRITE

SMB_SHARE_READ

SMB_SHARE_WRITE

SNAPSHOT_READ

Permissions

SNAPSHOT_WRITE

Domain user permissions on the Qumulo cluster

To create domain user permissions:

- 1 Log on to the Qumulo Core web UI.
- 2 Select the **Cluster** menu and click **Active Directory** under **Authentication and Authorization**.
- 3 Configure the following mandatory fields:
 - **Domain Name:** Name of your domain. Example: `ad.example.com`.
 - **Domain Username:** The user account or service account you uses to authenticate against the domain.
 - **Domain Password:** The password for the user account or service account.
- 4 Optionally, configure the following two optional fields:
 - **NetBIOS name:** If your domain's NetBIOS name is different from your domain name, then enter the domain's NetBIOS name in this field.

Note: If you attempt to join the domain and get an error message similar to this "Sorry, the NetBIOS name (QUMULO) is incorrect". Your domain's NetBIOS is different from your domain name.

- **Organizational Unit (OU):** Obtained this information from your Systems Administrator. If unknown, leave it blank, and Qumulo attempts to join the domain without an OU specified.
- 5 Click **Yes** to use your AD as your primary time server.
- 6 Select the option to use Active Directory for POSIX attributes.
 - Use in environments where 'user objects' in Active Directory are assigned UNIX UID, and the GID attributes to allow the cluster to properly enforce permissions, regardless of the protocol used to access the data.
 - For additional details, see the [Using Active Directory for POSIX attributes](#) article.
- 7 If desired, enter your Base DN(s) in the field provided.
- 8 Click **Join**.

Configuring a dedicated VLAN for NetBackup access

Qumulo NAS-based volume snapshots are exposed to NetBackup over NAS protocols. NetBackup reads these snapshots using any available network.

In Qumulo, you can create multiple VLANs. If required, you can configure a VLAN that is dedicated for NetBackup access. While configuring a VLAN, use "nbu_nas" as the name of the network. If such a VLAN exists, NetBackup uses that VLAN route for accessing the snapshots.

Qumulo plug-in considerations and limitations

The following considerations and limitations are applicable:

- Snapshot operations are not supported for nested shares on Qumulo file server. A nested share is a share that is itself a subdirectory in an existing file share. NetBackup does not support snapshot creation for such nested shares.
- Qumulo file server does not support point-in-time (PIT) rollback restore of shares using snapshots. You can use NetBackup assisted restore of share's data.

Configuring storage lifecycle policies for snapshots and snapshot replication

This chapter includes the following topics:

- [About configuring storage lifecycle policies for snapshots and snapshot replication](#)
- [Creating a storage lifecycle policy for snapshots and snapshot replication](#)
- [Operation types in a storage lifecycle policy](#)
- [Retention types for storage lifecycle policy operations](#)

About configuring storage lifecycle policies for snapshots and snapshot replication

A storage lifecycle policy (SLP) contains instructions in the form of storage operations, to store data. Operations are added to the SLP that determine how the data is stored and copied or replicated. For example, the NetBackup administrator creates an operation that determines where the data exists as a snapshot, as a replication, or as a duplication. The administrator also determines the retention of the data at each storage unit or storage unit group.

An SLP that is configured for snapshots or snapshot replication must contain a specific, hierarchical combination of operations.

See [Figure 6-1](#) on page 93. It represents an SLP for a replication scenario. In the example, the following operations are used:

- A **Snapshot** operation creates a snapshot.
- A **Replication** operation replicates the snapshot to another volume.
- A **Backup From Snapshot** operation creates a tar-formatted backup from the snapshot.
- A **Duplication** operation copies the backup to tape.

[Table 6-1](#) describes the four types of operations that are required in this example replication scenario.

Figure 6-1 Figure of four types of operations in this example replication scenario

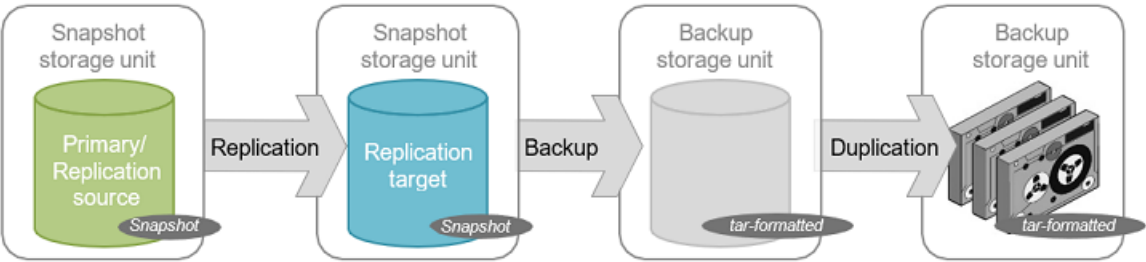


Table 6-1 Example of a storage lifecycle policy configured for snapshots and snapshot replication

Operation order in SLP	Operation	Description
1	Snapshot	Operation 1 creates a snapshot in the primary storage. The snapshot serves as the source for the other operations in the SLP. <ul style="list-style-type: none">■ The operation must be a Snapshot operation.■ The storage unit can be any of the following type: Snapshot, Advanced-Disk or MSDP storage unit
2 (Child to operation 1)	Replication	Operation 2 replicates the snapshot that the first operation created. <ul style="list-style-type: none">■ The operation must be a Replication operation.■ The storage must be any one of the following: Auto or <Vendor>_<ReplicationType>. Note: <Vendor>_<ReplicationType> is the replication type supported by the storage array vendor.

Table 6-1 Example of a storage lifecycle policy configured for snapshots and snapshot replication (*continued*)

Operation order in SLP	Operation	Description
3 (Child to operation 2)	Backup From Snapshot	<p>Operation 3 creates a tar-formatted backup copy of the snapshot.</p> <ul style="list-style-type: none"> ■ The operation must be a Backup From Snapshot operation. This operation creates a backup image from the snapshot. ■ The storage must be a backup storage unit.
4 (Child to operation 3)	Duplication	<p>Operation 4 makes a duplicate copy from the tar-formatted backup copy. In this example, the copy is duplicated to tape media.</p> <ul style="list-style-type: none"> ■ The operation must be a Duplication operation. This operation creates a backup copy of the tar-formatted image. ■ The storage must be a backup storage unit.

After the SLP is configured for different operations, the NetBackup administrator configures a backup policy that points to the snapshot SLP.

The **SLP Parameters** host properties in the **NetBackup Administration Console** allow administrators to customize how SLPs are maintained and how SLP jobs run.

Creating a storage lifecycle policy for snapshots and snapshot replication

Use the following procedure to configure a storage lifecycle policy that creates snapshots and snapshot replications with Snapshot Manager for Data Center. Only those options that are necessary to configure an SLP for Snapshot Manager Replication are listed. You can use the NetBackup web UI to configure a storage lifecycle policy to create snapshots and snapshot replication. In Java UI, SLP creation does not support replication.

To configure a storage lifecycle policy to create snapshots and snapshot replication

- 1 On the left, click **Storage Lifecycle Policies** under **Storage**.
- 2 Click **Add** on the right-pane.
- 3 Enter a **Storage lifecycle policy name**.
- 4 Click **Add** to add operations to the SLP. The operations are the instructions for the SLP to follow and apply to the data that is specified in the backup policy.

- 5 In the **Properties** tab of the **New operation** page, select **Snapshot** from the **Operation** drop-down menu.

This **Snapshot** operation creates a snapshot of the primary data and serves as the source for other operations in the SLP. For example:

- A **Replication** operation.
- A **Backup From Snapshot** operation.
- An **Index From Snapshot** operation.

- 6 In the **Destination Storage** drop-down menu, select a storage unit. NetBackup displays only those storage units that are configured to contain primary snapshots.

- 7 Select the **Retention type** and the **Retention period** for the data in this storage unit. The **Retention period** option does not appear for all **Retention type** selections. Click **Create**.

- 8 To replicate the primary snapshot, create a **Replication** operation that is based on the snapshot. Select the checkbox in the row of the snapshot, and click **Add child**.

- 9 In the **Operation** drop-down menu, select **Replication**.

- 10 Under **Destination storage attributes**, select a **Replication target** that is configured to contain replicated snapshots. NetBackup displays only those targets that can act as target destinations.

- 11 Select the **Retention type** and the **Retention period** for the data in this storage unit.

- 12 The **Window** tab displays for the following operation types: **Backup From Snapshot**, **Duplication**, **Import**, **Index From Snapshot**, and **Replication**.

Create a window during which secondary operations can run.

- 13 Click **OK** to create the SLP.

Continue to create operations, depending on the needs of your environment.

To cascade storage operations in the SLP, make sure to select the correct parent operation as the source for the child operation. If the correct operation is not selected, you unintentionally perform an operation on an incorrect source.

Operation types in a storage lifecycle policy

The **Operation** selections are the instructions in the storage lifecycle policy. This section describes the purpose of each operation.

Snapshot operation in an SLP

A **Snapshot** operation creates a point-in-time, read-only, disk-based copy of data. NetBackup provides several types of snapshots, depending on the device where the snapshot occurs.

Use a **Snapshot** operation as the first operation in a storage lifecycle policy for a Snapshot Manager for Data Center snapshot and replication operations

Table 6-2 Snapshot operation characteristics

Characteristic	Description
Storage unit selection	<p>The Snapshot operation does not write data to a NetBackup storage unit. However, you need to select a storage unit to specify the media server to use to launch the snapshot job. Use these storage units for snapshot operation:</p> <ul style="list-style-type: none">■ Snapshot label■ Media Server Deduplication Pool storage unit■ AdvancedDisk storage unit <p>Considerations for 'Snapshot' label as the storage unit:</p> <ul style="list-style-type: none">■ If the SLP contains only a Snapshot operation, then NetBackup uses any available media server above NetBackup version 10.0.1 to launch the snapshot job.■ If a subsequent Replication operation uses the Snapshot, then the same media server performs Snapshot and Replication operation.■ If a subsequent Backup From Snapshot operation uses the Snapshot, then Snapshot operation uses the storage unit that is selected for the Backup From Snapshot operation <p>Note: To use the Snapshot label all the NetBackup hosts must be version 10.1 or above.</p>
Child of	<p>A Snapshot operation cannot serve as the child of any other operation. Therefore, do not click on any other operation in the SLP when adding a Snapshot operation.</p>
Source for	<p>A Snapshot operation can be the source for the following operations:</p> <ul style="list-style-type: none">■ Backup From Snapshot■ Index From Snapshot■ Replication operation
Hierarchy notes	<p>If a Snapshot operation appears in an SLP, it must be first in the operations list.</p>
Job type	<p>A Snapshot operation generates a Snapshot job in the Activity Monitor.</p>

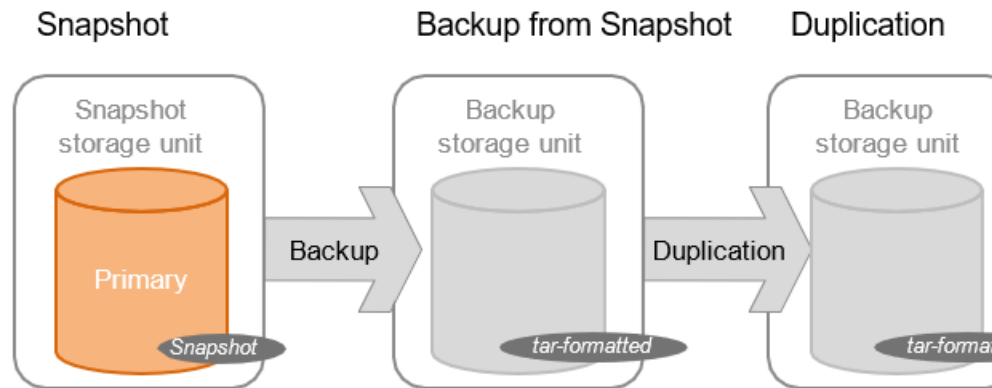
Table 6-2 Snapshot operation characteristics (*continued*)

Characteristic	Description
Window	Snapshot operations do not offer the option to create an SLP window.

Primary snapshot storage unit

A snapshot operation can use a Primary snapshot storage unit. That is, the storage unit represents a AdvancedDisk storage unit, Media Server Deduplication Pool storage unit or a Snapshot label.

The following figure shows an SLP that contains one primary-only Snapshot operation, one Backup from Snapshot operation, and one Duplication operation. The Backup From Snapshot operation is used to create a backup from the snapshot on the primary-only Snapshot operation. After the backup is created, it is duplicated to a Duplication operation.

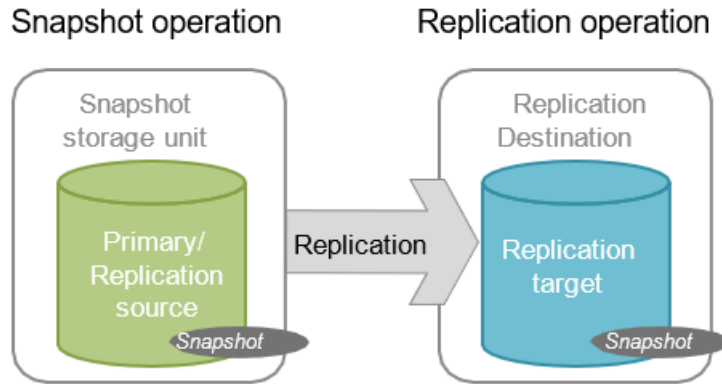


Primary + Replication source snapshot storage unit

An SLP operation can use a primary storage unit for snapshot and Auto or Vendor supported replication type for replication destination. If the snapshot is to be used by a subsequent replication operation only, then the same media server is used for Snapshot and Replication operation.

The following figure shows an SLP that contains a 'Snapshot' as the storage unit for snapshot operation and one Replication target snapshot storage unit as another operation.

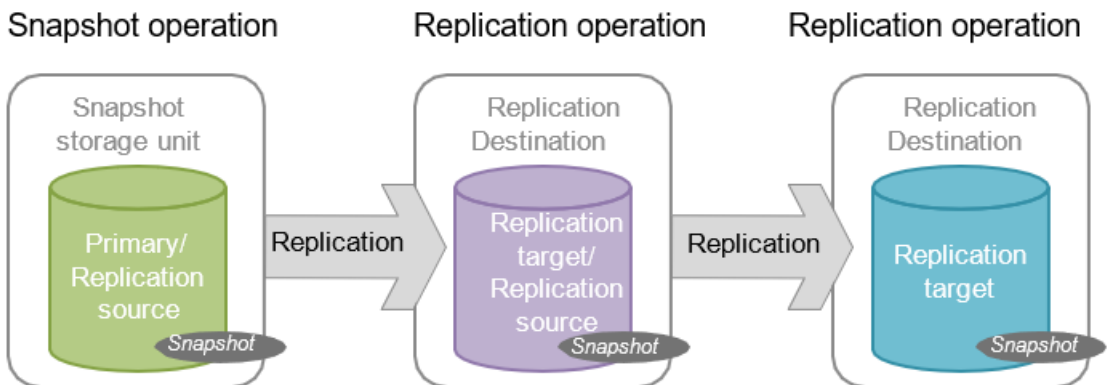
Figure 6-2 SLP that contains a Snapshot operation and a Replication operation



Primary + Replication source + Replication target storage unit

An SLP operation can use a primary storage unit for snapshot and Auto or Vendor supported replication type for replication destination.

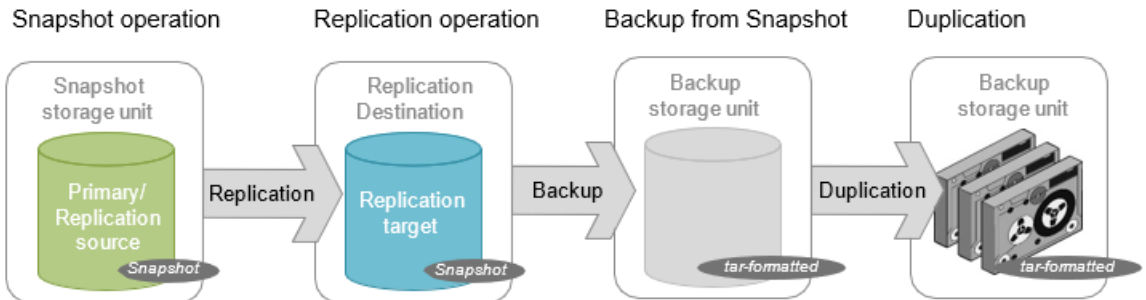
Figure 6-3 SLP that contains a Snapshot operation and two Replication operations



Replication target snapshot storage unit

An SLP operation can use a primary storage unit for snapshot and Auto or Vendor supported replication type for replication destination. It can also have backup from snapshot operation with a backup storage unit.

Figure 6-4 SLP that contains a Snapshot operation, a Replication operation, a Backup From Snapshot operation, and a Duplication operation



Replication operation in an SLP

Use the **Replication** operation for the following types of replication:

- NetBackup Snapshot Manager for Data Center Replication to replicate a snapshot.
- NetBackup Auto Image Replication to replicate a backup.

Table 6-3 Replication operation characteristics

Characteristic	Description
Storage unit selection	<p>Under Destination storage attributes:</p> <p>For Snapshot Manager replication, below mentioned destinations are supported:</p> <ul style="list-style-type: none"> ■ Auto ■ <Vendor>_<ReplicationType>
Child of	<p>Click the appropriate operation when adding a Replication operation.</p> <p>Using Snapshot Manager Replication, a Replication operation can be the child of a Snapshot operation or the child of another Replication operation.</p>

Table 6-3 Replication operation characteristics (*continued*)

Characteristic	Description
Source for	A Replication operation can be the source for the following operations: <ul style="list-style-type: none"> ■ Replication ■ Backup From Snapshot ■ Index from snapshot
Job type	A Replication operation generates a Replication job in the Activity Monitor .
Window	An SLP window can be created for a Replication operation.

Index from snapshot operation in an SLP

The Index From Snapshot operation indexes the contents of existing snapshots. When NetBackup indexes a snapshot, it creates an image catalog file in the NetBackup catalog for each snapshot. The presence of an image catalog file assists the user when a file needs to be restored from the snapshot, as described in table.

Table 6-4 Restore operation

Type of restore	Where performed	Description	Requirements
Live browse restore	NetBackup Backup, Archive, and Restore interface	You can navigate the directory structure to locate and select the files for restore.	During a live browse restore, NetBackup automatically mounts the snapshot so that you can see what files it contains. Mounting and unmounting the snapshot can be time-consuming.

The Backup From Snapshot operation also creates an image catalog file. An Index from Snapshot may not be required if a Backup From Snapshot occurs frequently enough for the restore needs in your environment. For example, if the Backup from snapshot runs once per week but file restores are required daily, consider using the Index from Snapshot feature.

The actual restore of the snapshot requires that the snapshot be mounted, regardless of whether an Index from Snapshot has been performed or not.

The actual restore of the snapshot requires that the snapshot be mounted, regardless of whether an **Index from Snapshot** has been performed or not.

Table 6-5 Index From Snapshot operation characteristics

Characteristic	Description
Storage unit selection	The Index from snapshot operation does not write data to a storage unit. However, a storage unit selection is needed to select the media server that to be used to access the snapshot. As a best practice, use the storage unit from the Snapshot or Replication operation that is the source for this operation.
Child of	When an Index From Snapshot operation appears in an SLP, it must be the child of a Snapshot or Replication operation. Therefore, select either a Snapshot or a Replication operation in the SLP when adding an Index From Snapshot operation.
Source for	While an Index from Snapshot operation cannot be the source for any operation, a Replication operation can follow it.
Hierarchy notes	The Index from snapshot operation can consume system resources and requires that each snapshot be mounted to create the image catalog file. See "Determining where and when the Index From Snapshot operation occurs" on page 101.
Job type	An Index from snapshot operation generates an Index From Snapshot job in the Activity Monitor .
Window	An SLP window can be created for an Index from snapshot operation.

Consider the following items before using the Index from snapshot operation:

- Standard, NAS-Data-Protection, and VMware backup policy types support the use of storage lifecycle policies that contain the Index from snapshot operation.

Determining where and when the Index From Snapshot operation occurs

Including the Index from snapshot operation requires some consideration as the operation can consume system resources and require additional time to perform. For example, to perform the operation can require that a snapshot be mounted or that NetBackup gather content details from the file system to populate the catalog.

To help mitigate the extra resource and time that the operation may take, the system administrator can control when and where the Index from snapshot operation runs:

- Use the storage lifecycle policy **Window** tab to schedule when the **Index From Snapshot** operation can run. Schedule the operation to run when it is least likely to interfere with other jobs.
- Use the following points to determine where to position the Index from snapshot operation in the SLP operations list:

- Each NetBackup environment needs to determine where the operation works best in a specific SLP. To place the Index from snapshot operation too early (toward the top of the operations list), may consume time when the restore capabilities are not needed. To place the operation toward the end of the operations list may cause the administrator to delay a restore until earlier snapshots or replications complete.
- Use the Index from snapshot operation in an SLP only once. A restore can be performed from any snapshot after one image .*ε* file is created.
- Any operations list that includes a Backup from snapshot operation does not need an Index From Snapshot operation. The Backup from snapshot operation creates an image .*ε* file. The only exception is if the index is needed for restores before the Backup from snapshot operation occurs.

Backup from snapshot operation in an SLP

Use the Backup from snapshot operation to create a tar-formatted copy of the snapshot. The new copy is a backup copy. The process is sometimes referred to as a *snapdupe* job.

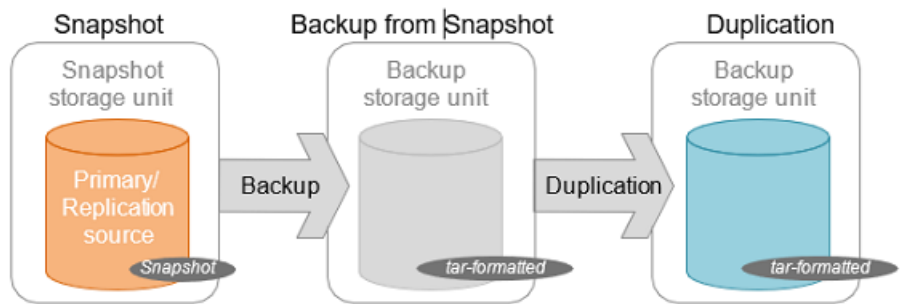
Table 6-6 Backup From Snapshot operation characteristics

Characteristic	Description
Storage unit selection	<p>The selection must be a backup storage unit or a backup storage unit group.</p> <p>The selection cannot be a snapshot storage unit or a snapshot storage unit group.</p>
Child of	<p>A Backup from snapshot operation must use a Snapshot or Replication operation as its source.</p> <p>Therefore, select the Snapshot operation in the SLP when adding a Backup from snapshot operation.</p>
Source for	A Backup from snapshot operation can be the source for a Duplication operation.
Hierarchy notes	An SLP may contain more than one backup from snapshot operation. If the first backup from snapshot operation fails with an unrecoverable error, NetBackup does not attempt the second one. For a NAS-Data-Protection policy, the SLP supports only one backup from snapshot operation.

Table 6-6 Backup From Snapshot operation characteristics (*continued*)

Characteristic	Description
Job type	<p>A Backup from snapshot operation generates a Backup job in the Activity Monitor.</p> <p>The Backup job that results from the Backup from snapshot operation is under the control of the SLP Manager. If an SLP window is configured, the Backup job runs during the configured SLP window. If no SLP window is configured, the Backup job can run at any time; possibly outside of the backup window as configured in the backup policy. You may experience a slight degradation in performance on the client or the client storage device while NetBackup accesses the snapshot.</p>
Window	An SLP window can be created for a Backup from snapshot operation.

Figure 6-5 SLP that contains a Backup from snapshot operation



Duplication operation in an SLP

Use the Duplication operation to create a copy of a Backup, a Backup from Snapshot, or another Duplication operation. A media server performs the operation and writes the copy.

Note: Use the Replication operation to create a copy of a Snapshot operation.

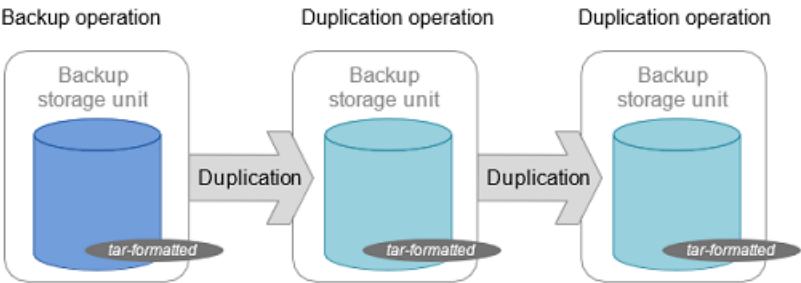
Table 6-7 Duplication operation characteristics

Characteristic	Description
Storage unit selection	<p>The selection must be a backup storage unit or a backup storage unit group.</p> <p>The selection cannot be a snapshot storage unit or a snapshot storage unit group.</p>

Table 6-7 Duplication operation characteristics (continued)

Characteristic	Description
Child of	A Duplication operation can be the child of the following operations: <ul style="list-style-type: none">■ Backup operation■ Backup from snapshot operation■ A Duplication operation Therefore, select one of these operations in the SLP when adding a Duplication operation.
Source for	A Duplication operation can be the source for a Duplication operation.
Hierarchy notes	When a Duplication operation appears in an SLP, it cannot be the first operation.
Job type	A Duplication operation generates a Duplication job in the Activity Monitor .
Window	An SLP window can be created for a Duplication operation.

Figure 6-6 SLP that contains one Backup operation and two Duplication operations



Retention types for storage lifecycle policy operations

The **Retention type** for an operation in a storage lifecycle policy determines how long the data is kept on that storage media.

Note: You can set the Retention types for storage lifecycle policy operations from the NetBackup web UI.

Table 6-8 Operation and retention type configurations

Retention type	Backup operation	Snapshot operation	Replication operation	Backup From Snapshot operation	Duplication operation
Fixed	Valid	Valid	Valid	Valid	Valid
Expire after copy	Valid	Valid	Valid	Valid	Valid
Maximum Snapshot limit	Invalid	Valid; SLP honors the policy setting.	Invalid	Invalid	Invalid
Target retention	Invalid	Invalid	Valid if the first operation in the SLP is an Import and if the storage is of the backup type.	Invalid	Valid if the first operation in the SLP is an Import.

Note: Retention is not associated with the **Index From Snapshot** operation because the operation does not create any copy.

Expire after copy retention type for SLP operations

The Expire after copy retention indicates that after all direct (child) copies of an image are successfully duplicated to other storage, the data on this storage is expired. The last operation in the SLP cannot use the **Expire after copy** retention type because no subsequent copy is configured. Therefore, an operation with this retention type must have a child.

It is not recommended that you enable Expire after copy retention for any storage units that are to be used with SLPs with either of the following: Accelerator or synthetic backups. The Expire after copy retention can cause images to expire while the backup runs. To synthesize a new full backup, the SLP backup needs the previous backup image. If the previous image expires during the backup, the backup fails.

For VCT enabled incremental backups, the previous snapshot is required to generate the file change list with respect to current snapshot. The Expire after copy retention expires the previous snapshot after the backup associated with that snapshot is complete.

Note: Although synthetic backups do support the use of storage lifecycle policies, SLPs cannot be used for the multiple copy synthetic backups method.

If a policy is configured to use an SLP for the backup, the retention that is indicated in the SLP is the value that is used. The Retention attribute in the schedule is not used.

Expire after copy retention type cannot be used for the snapshot operation when a sync replication stage is added in the SLP.

An image copy with an Expire after copy retention is expired as soon as all of its direct child copies have been successfully created. Any mirrored children must also be eligible for expiration.

Fixed retention type for SLP operations

The Fixed retention indicates that the data on the storage is retained for the specified length of time, after which the backups or snapshots are expired.

An image copy with a Fixed retention is eligible for expiration when all of the following criteria are met:

- The Fixed retention period for the copy has expired.
- All child copies have been created.
- All child copies that are mirror copies are eligible for expiration.

The **Fixed** retention period is always marked from the original backup time of the image. For example, if a tape device is down, causing a 2-day delay in creating a duplicate tape copy, the expiration time of the duplicate copy is not different due to the 2-day delay. The expiration time of the duplicate copy is still x days from the time that the original backup was completed. It does not matter when the copy was created.

If the replica copy has any dependency on its source copy and Fixed retention type is selected for the replica copy, then whichever copy (snapshot or any replica copy) in the SLP has the highest retention level, that copy's retention level is set as the retention level for the snapshot copy and all the replica copies in the SLP.

Maximum snapshot limit retention type for SLP operations

The **Maximum snapshot limit** determines the maximum number of snapshots that can be stored for a particular policy and client pair.

When the maximum is reached, the next snapshot causes the oldest job-complete snapshot to be deleted. A snapshot job is considered to be complete once all of its configured dependent copies are complete. (Dependent copies are created as a

result of Backup From Snapshot, Index From Snapshot, or Replication operations.) The practice is referred to as *rotation*. This retention type applies only to snapshots, and not to backups.

For example, Policy P1 contains two clients: C1 and C2. After the policy runs four times, it creates four snapshot images for C1 and four images for C2. If the **Maximum snapshot limit** is set to four, when the policy runs for the fifth time, NetBackup deletes the first snapshot that was created for both C1 and C2 to accommodate the fifth snapshot.

The **Maximum snapshots** parameter in the **Perform snapshot backups Options** dialog determines the maximum number of snapshots. To access the dialog box, click **Options** under Snapshot Client section in the backup policy.

Troubleshooting

This chapter includes the following topics:

- [Troubleshooting](#)

Troubleshooting

For troubleshooting and log related information, refer to the *NetBackup™ Snapshot Manager Install and Upgrade Guide*.