

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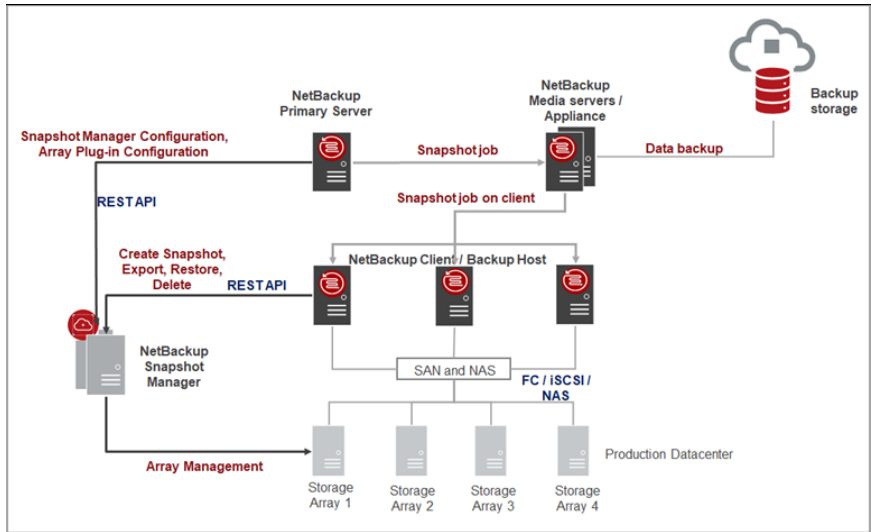
- [About Snapshot Manager for Data Center](#)

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.

Snapshot Manager for Data Center discovers devices on various storage arrays and manages snapshot lifecycle management of these devices. You can connect these devices over Fibre Channel, iSCSI networks (SANs) or as NAS devices using NFS or SMB protocol. When you use NetBackup 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 for Data Center:



Installation and Upgrade

This chapter includes the following topics:

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

Installing and upgrading Snapshot Manager for Data Center

Snapshot Manager for Data Center is installed separately from NetBackup, and it has plug-ins for various storage arrays. You can deploy this component in various ways 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 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.

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

- 3 Right-click **Snapshot Managers**, and select **New Snapshot Managers**.
- 4 In the **New Snapshot Manager for Data Center** dialog, enter hostname and port of Snapshot Manager for Data Center to be added and click **Validate Server** to validate it.

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

- 5 In the **Credentials** pane of the **New Snapshot Manager for Data Center** 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-premises 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-premises storage array environment. After registering the Snapshot Manager for Data Center server with the NetBackup primary server, you must configure the storage array plug-ins to be able to protect your workloads using NetBackup.

You can deploy the Snapshot Manager for Data Center server on-premises to protect storage arrays. You can 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 22. for configuration parameters for each storage array plug-in.

To configure a storage array plug-in, 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 for Data Center where you want to add the plug-in. The **Snapshot Manager for Data Center 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, 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 for Data Center 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 for Data Center 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 for Data Center discovers all the assets: disks, LUNs, volumes, replication relationship and so on, from the storage array. These assets are persisted in the Snapshot Manager for Data Center database and further used for snapshot and replication operations.

Whenever a new storage array plug-in is configured, NetBackup initiates a discovery operation to retrieve the assets from the storage array. Snapshot Manager for Data Center 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 in the **Status** column of the Storage array plug-in, inside the **Snapshot Manager for Data Center Plugin** pane.

Also, you can manually initiate the discovery operation for a specific storage array plug-in.

To manually initiate a discovery operation:

- 1** Right-click the storage array plug-in for which you want to initiate discovery in the **Snapshot Manager for Data Center Plugins** pane.
- 2** Click **Discover Assets**.

This changes the **Status** column of the added storage plug-in to **Discovering**.

You may also initiate the plug-in discovery by 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 for Data Center replication](#)
- [Deployment and architecture](#)
- [Specifying the replication destination in NetBackup](#)
- [Configure NetBackup for replication](#)

About Snapshot Manager for Data Center replication

Snapshot Manager for Data Center can leverage the replication capabilities of storage array vendors by replicating the snapshots. NetBackup discovers the replication infrastructure and the topology configured in the storage array. Using NetBackup, you can 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. NetBackup communicates with the storage array to replicate the snapshot from the primary volume to other volumes configured for replication. 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:

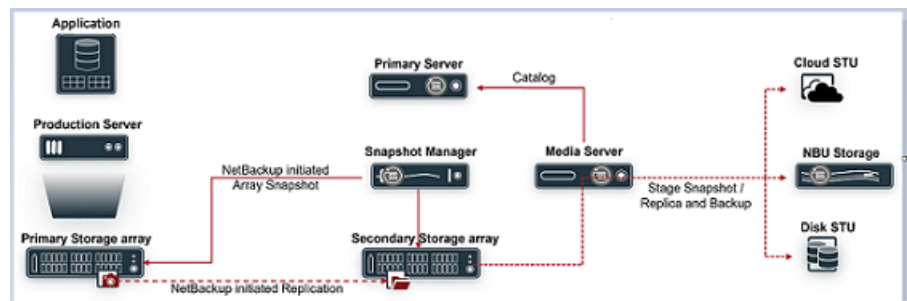
- Unified policy management.
Use the NetBackup console as the one, centralized backup infrastructure to manage the entire lifecycle of your data.

- Snapshot copy management.
Use NetBackup to manage the entire lifecycle of the snapshot. Replication uses storage array plug-ins on the Snapshot Manager for Data Center 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 for Data Center, primary server, media server, and clients refer to the *Snapshot Manager* section, 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 113. 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.
<Vendor>_<ReplicationType> For example: <Vendor>_<Replication> = NetApp_SnapMirror	See “Configure the storage array plug-ins for Snapshot Manager for Data Center” on page 22. 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 17.
2.	Configure Snapshot Manager for Data Center	See “Configuring Snapshot Manager for Data Center” on page 11.
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 22.
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 an 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 115.

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 PowerMax and VMax array](#)
- [Dell EMC PowerFlex array](#)
- [Dell EMC PowerScale \(Isilon\)](#)
- [Dell EMC PowerStore SAN and NAS plug-in](#)
- [Dell EMC XtremIO SAN array](#)
- [Dell EMC Unity Array](#)
- [Fujitsu Eternus AF/DX SAN array](#)
- [HPE RMC plug-in](#)
- [HPE XP plug-in](#)
- [HPE Alletra 9000 SAN array](#)
- [Hitachi NAS array](#)
- [Hitachi SAN array](#)
- [IBM Storwize SAN V7000 plug-in](#)
- [InfiniBox SAN array](#)

- [InfiniBox NAS array](#)
- [NetApp Storage array](#)
- [NetApp E-Series array](#)
- [Nutanix Files array](#)
- [Pure Storage FlashArray SAN](#)
- [Pure Storage FlashBlade plug-in configuration notes](#)
- [PowerMax eNAS 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 PowerMax and VMax array

The NetBackup Snapshot Manager for Data Center plug-in for Dell EMC PowerMax and VMax lets you discover the SAN Volumes on the PowerMax / Vmax array. You can create, delete, export, deport, and restore storage snapshots of a supported Dell EMC PowerMax / VMax that is registered with Dell EMC Unisphere. The plug-in supports the copy-on-write (COW) snapshot type. You must configure this plug-in on the NetBackup primary server.

NetBackup Snapshot Manager uses the REST API SDK Provided by PowerMax/VMax (PyU4V) to communicate with the PowerMax/ VMax assets using the DELL EMC Unisphere APIs. NetBackup Snapshot Manager establishes a connection with the Dell EMC Unisphere on which the PowerMax / VMax array is managed. You can register NetBackup Snapshot Manager as a backup application and use the API endpoints to discover the SAN volumes and the snapshots to back up.

Dell EMC PowerMax and VMax plug-in configuration prerequisites

Before you configure the plug-in, ensure that the following requirements are fulfilled:

- The Minimum Unisphere version required is 9.2.0.1 of Unisphere Management console.
- Array Model supported PowerMax, VMAX-3, VMAX-AFA.
- Array uCode should be above 5978.669.669 for PowerMax OS, HyperMax OS to support 'SnapSet Id'.
- For the list of all the supported versions of Dell EMC PowerMax and VMax, 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 Unisphere for PowerMax and VMax APIs.

Supported CloudPoint operations on Dell EMC PowerMax and VMax

NetBackup Snapshot Manager for Data Center performs the following management operations on the DELL EMC PowerMax and VMax:

Table 5-1 Snapshot Manager for Data Center operations on Dell EMC PowerMax/ VMax plug-in

Snapshot Manager for Data Center operation	Description
Discover assets	NetBackup Snapshot Manager for Data Center discovers all the volumes, Storage groups and Storage group snapshots.

Table 5-1 Snapshot Manager for Data Center operations on Dell EMC PowerMax/ VMax plug-in (*continued*)

Snapshot Manager for Data Center operation	Description
Create snapshot	<p>Dell EMC Unisphere for PowerMax, Unisphere for VMax allows snapshot creation at entire storage group. The storage group snapshot would have single Point in time copy of all the volumes part of the storage group at that time.</p> <p>To create a snapshot on the storage group, NetBackup Snapshot Manager for Data Center initiates a POST REST API call on the Storage group which contains the volumes. A snapshot name is also provided. The API returns the details of the snapshot.</p> <p>To create a snapshot on the volume part of a storage group, NetBackup Snapshot Manager for Data Center creates a POST REST API call on the storage group that contains the specific volume. A snapshot name is also provided. The API returns the details of the snapshot.</p> <p>A typical snapshot created by NetBackup Snapshot Manager has the following naming convention:</p> <p>NB<unique_21digit_number></p> <p>Note: Snapshots are created on the storage group. The only way to distinguish the snapshots is based on which asset the operation was created. If the snapshot is created on a volume, then the snapshot is mapped to volume. If created on a storage group, the snapshot is mapped to the storage group asset.</p>
Delete snapshot	<p>To delete a snapshot, Snapshot Manager for Data Center initiates a DELETE REST API call with the required snapshot details and confirms that the snapshot has been deleted successfully on the array.</p>

Table 5-1 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. <p>While restoring a snapshot to the point in time image on the storage group, all the volumes that were part of the storage group at the time of snapshot creation, are restored to the storage group snapshot state.</p>
Export snapshot	<p>When a snapshot export operation is initiated:</p> <p>Perform the following steps:</p> <ul style="list-style-type: none"> ■ For volume export perform the following steps: <ul style="list-style-type: none"> ■ Fetch the initiators on which you want to perform the export. ■ Create an empty temporary storage group. ■ Add a source volume whose snapshot is to be exported in the storage group. ■ Now, considering temporary storage as source storage group, create an export storage group from snapshot and link the snapshot to the exported storage group. ■ Fetch the Host ID and Port group ID. ■ 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. ■ For storage group export, all the volumes that are part of storage group snapshot are added to new storage group, and attached to the host. <ul style="list-style-type: none"> ■ All the steps performed in volume export is same for storage group export for all the volumes.
Deport snapshot	<p>When a snapshot deport operation is initiated, the exported storage group and the volume(s) inside it, and the temporary storage group used as source for snapshot, all are deleted. It is as revert or clean-up of export snapshot.</p>

DELL EMC PowerMax and VMax Plug-in configuration parameters

The following parameters are required for configuring the DELL EMC PowerMax and VMax Plug-in.

Parameter	Description
Unisphere address	The Unisphere Management console allows to manage all the arrays. You can add any management IP address or the FQDN of the Unisphere Management console.
Unisphere port	An Unisphere Management port through which you can access the console. DELL EMC recommends port 8443. The port is configurable, you can provide any port through which you have access to the Unisphere console.
Array ID	Array ID is the 12-Digit array unique ID array that you want to protect.
User name	Unisphere console user account which has permission to perform snapshot, create storage group, and link the snapshot to all these operations on the PowerMax/VMax array.
Password	The password of the Unisphere user account.

Roles and privileges on Dell EMC Unisphere for PowerMax and VMax

To allow NetBackup to perform snapshot management operations, ensure that the Dell EMC Unisphere user account used for plug-in configuration has the following roles and privileges assigned:

- Create snapshot
- Export snapshot
- Restore snapshot
- Delete snapshot

RBAC is managed using Unisphere for VMAX, Unisphere for PowerMax, or the Solutions Enabler CLI symauth command. Using symauth, a user or group of users, may be mapped to a specific access role, which defines the operations that these users are permitted to perform on the entire VMAX array.

There are currently seven users defined roles that are available with RBAC: **None**, **Monitor**, **PerfMonitor**, **StorageAdmin**, **SecurityAdmin**, **Admin**, and **Auditor**. Following are the base capabilities of these current roles:

- **None:** No capabilities.
- **Monitor:** Performs read-only operations on an array excluding the ability to read the audit log or access control definitions.
- **PerfMonitor:** Includes **Monitor** role permissions and grants additional privileges within the performance component of Unisphere for VMAX application to set up various alerts and update thresholds to monitor array performance.
- **StorageAdmin:** Perform all management and control functions. See the specific permissions pertaining to this role:
 - **SecurityAdmin** Performs security operations (symaudit, symacl, symauth) on an array in addition to all monitor operations. Users or groups assigned the SecurityAdmin or Admin roles can create or delete component-specific authorization rules. The SecurityAdmin also has all Auditor rights.
 - **Admin:** Performs all operations on an array, including security operations and monitor operations. The Admin also has StorageAdmin rights, SecurityAdmin rights, and application performance monitoring privileges.
- **Auditor:** Grants the ability to view, but not modify, security settings for an array (including reading the audit log, symacl list, and symauth) in addition to all monitor operations. This is the minimum role required to view the array audit log.

It is important to clarify that your Storage_Admin role remains your ssuper user, and keeps sole control of provisioning storage on the array.

Dell EMC XtremIO plug-in considerations and limitations

The following considerations and limitations are applicable:

- All the snapshots taken for any volume are read-only. A new re-purpose copy is cloned from the snapshot volume and used for data backup.
- The re-purpose clone copy is made only during export. This copy is deleted based on the scheduled deport from NetBackup or a manually run expire operation. This is a thin-provisioned type copy.
- The limit for any volume name is 128 characters on the array. In case of a re-purpose copy, the maximum length of the volume name is $128 - (23(\text{NB}<\text{unique_21digit_number}>) - 9(\text{Repurpose}) - 2(\text{Dot notations})) = 94$. It is a strict requirement to limit the volume name to 94 characters for successful backup.
- We do not recommend to write data to the re-purpose copy created by NetBackup by manually mapping the copy to a host. You can consider using the re-purpose copies created as an individual volume in NetBackup. You are not recommended

to use the copies starting with the name

```
volume_name.NB<unique_21digit_number>.repurpose.
```

- Don't refresh the re-purpose copy as this changes the data on the copy by refreshing from the parent volume. For example, if you create a snapshot of volume V1, the protection copy is made using `V1.NB<unique_21digit_number>` and the export re-purpose copy is made with the name `V1.NB<unique_21digit_number>.repurpose`. Refreshing a re-purpose copy affects backup and restore.

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 lets you protect the mounted volumes. These volumes are hosted on a Dell EMC PowerFlex array environment. You can configure Snapshot Manager 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 initiates the snapshot to create, export, deport, and delete operations for the exports. You must configure this plug-in on the NetBackup primary server.

Snapshot Manager 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 Rest client. Then uses the SDK methods to discover the volumes and their snapshots that need 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 5-2 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 <code>flexsnap_snap_group</code> with some metadata. The volumes which have 'CMD' in the attributes and without mapping are not discovered.

Table 5-2 CloudPoint operations on the Dell EMC PowerFlex array
(continued)

Snapshot Manager for Data Center operations	Description
Create snapshot	To create a snapshot, CloudPoint initiates 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 initiates 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 initiated, 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 5-3 Dell EMC PowerFlex plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
Plug-in ID	Provide a name for the plug-in.
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 the 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 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: ["/ifs/test_fs1", "/ifs/test_fs1/test_fs2", "/ifs/test_fs1/test_data/test_fs3", "/ifs/smb_03/test_data/dir01"]</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 initiates a POST REST API call on the nfs_export 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> <p><code>SnapshotNB-NB<unique_21digit_number></code></p>

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

Snapshot Manager for Data Center operation	Description
Delete snapshot	To delete a snapshot, NetBackup Snapshot Manager calls the REST API with the required snapshot details. You can see a confirmation when the snapshot is deleted successfully on the array.
Restore snapshot	<p>Snapshot Manager for Data Center uses the JobAPI to revert a snapshot. 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.
Export snapshot	<ul style="list-style-type: none"> ■ When a snapshot export operation is initiated 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 initiated 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 initiated, 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 <code>changelist</code> 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 plug-in 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 SAN and NAS plug-in

NetBackup provides a robust data protection solution for Volumes, Volume Groups, file system NFS exports, and SMB shares on NAS and SAN storage hosts. You can protect mounted iSCSI/FC volumes in SAN environment and NFS exports or SMB shares in NAS environment that are hosted in a PowerStore environment.

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

- Volumes in a SAN environment
- Volume group in a SAN environment
- NFS exports in a NAS environment
- SMB shares in a NAS environment

The Dell EMC PowerStore plug-in uses the Python SDK from Dell EMC: Python-Powerstore (1.4.0) to communicate with the arrays.

Supported NetBackup operation on Dell EMC PowerStore array

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

Table 5-6 Snapshot Manager for Data Center operations on EMC PowerStore arrays

Snapshot Manager for Data Center operation	Description
Discover assets	<p>In SAN environment, NetBackup discovers all the Dell EMC PowerStore primary volumes and volume snapshots present on the array. NetBackup discovers only primary type volumes and skips the clone type volumes. For volume snapshots only the snapshot type volumes are discovered.</p> <p>In NAS environment, NetBackup discovers all the Dell EMC PowerStore NAS servers, file systems, primary NFS exports, and SMB shares along with the file system-snapshots along with some of their directory metadata.</p> <p>NetBackup also discover the nested NFS exports and SMB shares irrespective of the depth.</p>
Create snapshot	<p>In SAN environment, to create a snapshot, NetBackup calls the REST API with the required information and snapshot name. At the time of volume snapshot creation, a new volume having type (snapshot) is created on the array.</p> <p>In NAS environment, to create a snapshot, NetBackup calls a REST API with the required information and snapshot name. Dell EMC PowerStore supports two types of snapshots—protocol and snapshot type. NetBackup initiates 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 NetBackup has the following naming convention:</p> <p>NB<unique_21digit_number></p>

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

Snapshot Manager for Data Center operation	Description
Delete snapshot	<p>In SAN environment, to delete a volume snapshot, NetBackup calls the REST API using SDK method with the required volume snapshot details. A subsequent API call confirms the deletion.</p> <p>In NAS environment, to delete a file system snapshot, NetBackup calls a REST API using SDK method, with the required file system snapshot details. A subsequent API call confirms the deletion.</p>
Restore snapshot	<p>In SAN environment, offers the capability for the PIT rollback and you can use the created snapshot to restore the primary volume. For restore the <code>.snapshot</code> type volume is used.</p> <p>In NAS environment, NetBackup does not support PIT restore operation on the array. You can perform normal restore on any specified location.</p>
Export snapshot	<p>In SAN environment, NetBackup can export using the snapshots created for volumes. When a NetBackup initiates an export call, a new clone type volume is created from the snapshot and used for backup purpose. A host is added to this clone based on the details that are sent by the NetBackup client.</p> <p>In NAS environment, NetBackup supports export operations using the NFS and SMB protocols. When NetBackup initiates a snapshot export operation, based on the selected protocol, a new NFS export or SMB share is created using snapshot and parent export or share local path. The newly created export or share name is same as the snapshot name. Also, the host access configurations are added as read-only on a particular export or share.</p>
Deport snapshot	<p>In SAN environment, the deport snapshot operation removes the hosts added for the cloned volume created during the export call. NetBackup deletes all the hosts that are available on the volume. The newly cloned volume is also deleted during the deport operation.</p>

Dell EMC PowerStore plug-in configuration prerequisites

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

- Ensure that a supported version of Dell EMC PowerStore is installed on the 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 with permissions to invoke the Dell EMC PowerStore REST APIs and perform all snapshot operations on the array. For plug-in registration with NetBackup you can use an administrator or storage administrator user account based on the specific role you want for the owner of backup support.
- To configure the array in NetBackup, use the IP/ FQDN of the array. The current support only provides the ability to configure IPV4. For IPV4 access, provide the management IP. For FQDN, the management FQDN address is:
<https://powerstore-management-company-dell.com>.

Dell EMC PowerStore plug-in configuration parameters

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

Parameter	Description
Plug-in ID	Provide a name for the plug-in.
FQDN / IP address	The array's management IP address, in either IPv4 or The Fully Qualified Domain Name (FQDN).
User name	The Dell EMC PowerStore 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.

Volume group support in Dell EMC PowerStore plug-in

Snapshot Manager for Data Center comes with the capability of discovering all the volume groups and their snapshots. Three types of volume groups are available in PowerStore: Primary, Clone, and Snapshot; but we fetching only the Primary volume groups. Volumes and volume groups are primary assets and each primary asset contains the associated snapshots. The volumes which are selected in the NetBackup policy, those volumes become the members of a volume group on the PowerStore array. When a snapshot operation run, the snapshot set of a volume group is created.

During export, NetBackup creates clone volumes for each volume present in the volume group, and maps all the cloned volumes to the host.

Domain user permissions on the Dell EMC PowerStore array

In a NAS environment, 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.

Considerations and limitations for Dell EMC PowerStore plug-in

The following considerations and limitations are applicable:

In SAN environment:

- Snapshot Manager for Data Center does not discover the cloned volumes during discovery.
- The cloned volumes never expire. You can manually delete the cloned volumes from NetBackup during deport and delete operations.
- Volumes from multiple appliances are not allowed within the same volume group. All Volumes must reside on the same appliance.
- If a protection policy is assigned with a volume group, you cannot assign a protection policy to an individual resource within the group.
- The volume groups do not support mapping and unmapping, the workaround is to attach and detach the host with each volume in the volume group separately.
- Single volume restore operations are only allowed when write order consistency is disabled on the volume group.
- Before restoring a snapshot, you must shut down the application and unmount the file system that is running on the production host. Also, delete the host cache to prevent data corruption during the restore operation.

In NAS environment:

- All snapshots are captured at the file system level and the snapshots are in read-only mode.
- The limit for the file system name is 255 characters. NFS export or SMB share name is 80 characters on the array. For 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 XtremIO SAN array

NetBackup provides robust data protection solution for volumes that are set up on a Storage Area Network (SAN) storage host. NetBackup allows you to protect mounted iSCSI/FC volumes configured on XtremIO SAN array.

The NetBackup Snapshot Manager for Data Center plug-in for Dell EMC XtremIO SAN contains the necessary functional logic that enables NetBackup to discover the SAN volumes on the Dell EMC XtremIO SAN array. It also creates snapshots and perform export, deport, and delete operations for the volumes. You must configure this plug-in on the NetBackup primary server to discover the volumes, perform backup and restore operations.

NetBackup Snapshot Manager uses the REST APIs exposed by Dell EMC XtremIO SAN family to communicate with the SAN assets.

Supported NetBackup Snapshot Manager for Data Center operations on Dell EMC XtremIO

NetBackup Snapshot Manager for Data Center performs the following snapshot management operations on Dell EMC XtremIO.

Table 5-7 CloudPoint operations on the Dell EMC XtremIO SAN array

Snapshot Manager for Data Center operations	Description
Discover assets	<p>The XtremIO array has three types of volumes: Primary, Re-purpose copy, and Protection-copy. You can create the primary volumes manually, and can be of any size based on the limit of the associated. A re-purpose copy is a thin-provisioned volume created from the protection copy during snapshot creation process.</p> <p>NetBackup Snapshot Manager for Data Center discovers the primary volumes and re-purpose copy volumes which have an NAA identifier associated as a volume asset, and a protection-copy as a snapshot asset. For a volumes to be discovered, map it to the host.</p>

Table 5-7 CloudPoint operations on the Dell EMC XtremIO SAN array
(continued)

Snapshot Manager for Data Center operations	Description
Create snapshot	<p>To create a snapshot, NetBackup calls a REST API method with the required snapshot details. The API returns the details of the snapshot.</p> <p>The protection-copy snapshot is read-only.</p> <p>A typical snapshot created by NetBackup Snapshot Manager has the following naming convention:</p> <p>NB<unique_2ldigit_number></p>
Delete snapshot	<p>To delete a snapshot, NetBackup Snapshot Manager calls a REST API method with the required snapshot details. You can confirm that the snapshot is deleted successfully on the array, by making an another call with the same snapshot.</p> <p>If the snapshot is attached to any host then all the mappings are deleted forcefully as a mandatory requirement. This process also deletes the mappings that do not belong to the NetBackup host.</p>
Restore snapshot	<p>NetBackup Snapshot Manager for Data Center offers the ability to restore the snapshots using a Put REST API. You can restore the source volume only with the protection-copy type snapshot. Any PIT rollback uses the snapshot associated to the source volume.</p> <p>You cannot restore a snapshot to a different source volume to which it does not belong. By default, whenever you do a PIT rollback on any source volume, the array creates a re-purpose copy for the same to backup the volume. But NetBackup Snapshot Manager does not create this default re-purpose copy, when the restore is initiated from the console.</p> <p>You can restore any snapshot of any PIT on the volume. Every protection-copy acts as an individual asset and has no dependency on the other snapshot copies.</p>

Table 5-7 CloudPoint operations on the Dell EMC XtremIO SAN array
(continued)

Snapshot Manager for Data Center operations	Description
Export snapshot	NetBackup Snapshot Manager for Data Center supports export snapshot over the iSCSI and FC protocols. When a snapshot export operation is initiated, firstly a re-purpose copy is created using the protection-copy which was created in the create snapshot operation. Once this re-purpose copy is completed, a host is attached to the same. Do the SAN zoning between the host and array that you want to attach with the snapshot.
Deport snapshot	When a snapshot deport operation is initiated, NetBackup Snapshot Manager for Data Center deletes the export mapping created between the host and the re-purpose copy volumes.

Dell EMC XtremIO SAN plug-in configuration pre-requisites

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

- For the list of all the supported versions of Dell EMC XtremIO, refer to the *NetBackup Snapshot Manager* section in the *NetBackup Hardware and Cloud Storage Compatibility List*.
- A user account with permissions to call the Dell EMC XtremIO APIs.

Dell EMC XtremIO SAN plug-in configuration parameters

The following parameters are required for configuring the Dell EMC XtremIO SAN plug-in:

Table 5-8 Dell EMC XtremIO SAN plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
Plug-in ID	Provide a name for the plug-in.
FQDN/ IP Address	The array's IP address, in IPV4 / FQDN format.
User name	A user account that has permissions to perform snapshot operations.

Table 5-8 Dell EMC XtremIO SAN plug-in configuration parameters
(continued)

Snapshot Manager for Data Center configuration parameter	Description
Password	Provide a password to the user account.

Roles and privileges on Dell EMC XtremIO

To allow NetBackup Snapshot Manager to perform snapshot management operations, ensure that the Dell EMC XtremIO user account used for plug-in configuration has the following roles and privileges assigned:

- Create Snapshot
- Export Snapshot
- Restore Snapshot
- Delete Snapshot

There are four predefined user roles in Dell EMC XtremIO:

- Tech - For support people
- Admin - To attach LUN's and so on.
- Configuration - To provision storage
- Read Only - Can perform only read-only task

User with Admin role assigned can perform all the NetBackup Snapshot Manager's snapshot management operations.

Dell EMC XtremIO plug-in considerations and limitations

The following considerations and limitations are applicable:

- All the snapshots taken for any volume are read-only. A new re-purpose copy, cloned from the snapshot volume is used for data backup.
- The limit for any volume name is 128 characters on the array. For a repurpose copy, the maximum length of the volume name is $128 - (23(\text{NB}<\text{unique_21digit_number}>) - 9(\text{Repurpose}) - 2(\text{Dot notations})) = 94$. It is a strict requirement to limit the volume name to 94 characters for successful snapshot.
- Do not write data to the repurpose copy created by NetBackup by manually mapping it to a host. You can consider the re-purpose copies created by them

as an individual volume in NetBackup. Do not use the copies starting with volume_name.NB<unique_21digit_number>.repurpose.

- Do not refresh the repurpose copy, as this changes the data on the image by refreshing from the parent volume. This affects backup and restore.

Dell EMC Unity Array

The NetBackup Snapshot Manager for Data Center Dell EMC Unity plug-in allows you to create, delete, restore, export, and deport snapshots on the Dell EMC Unity storage arrays. The following assets are supported:

- Dell EMC Unity volumes in a SAN environment
- Dell EMC Unity consistency group in a SAN environment
- Dell EMC Unity filesystem in a NAS environment
- Dell EMC Unity NFS exports in a NAS environment
- Dell EMC Unity SMB shares in a NAS environment

The Dell EMC Unity NAS plug-in uses the Storops SDK python library to communicate with the Dell EMC Unity array for NAS and SAN environment. The connection is established to the Dell EMC Unity array through the Storops SDK to discover the above mentioned assets.

Supported NetBackup Snapshot Manager operations on the Dell EMC Unity array

NetBackup Snapshot Manager for Data Center performs the following operations on the Dell EMC Unity.

Table 5-9 Snapshot Manager for Data Center operations on Dell EMC Unity array

Snapshot Manager for Data Center operation	Description
Discover assets	<p>In NAS environment, NetBackup Snapshot Manager for Data Center discovers all the NAS servers, NFS exports, SMB shares, NAS file system, and file system snapshots as assets. NetBackup Snapshot Manager for Data Center calls an SDK method that internally calls the array's API to retrieve the assets mentioned in the list. For NAS discovery, NetBackup Snapshot Manager for Data Center doesn't skip any assets. For example, if the current file system shares NFS and SMB in total are 100, and the snapshot count is 21, then you can find 100 directories and 21 file systems in the NetBackup.</p> <p>In SAN environment, NetBackup Snapshot Manager for Data Center discovers all the volumes, consistency groups, and their corresponding snapshots as assets.</p> <p>Note: NetBackup Snapshot Manager for Data Center discovers all snapshots in NAS and SAN environment, but it can operate on only those snapshots that it creates itself.</p>
Create snapshot	<p>In NAS environment, NetBackup Snapshot Manager for Data Center calls an SDK method to create snapshot of a file system. When a snapshot is initiated, a redirect-on-write (ROW) snapshot of the entire file system is created. The API returns the snapshot details.</p> <p>In a SAN environment, NetBackup Snapshot Manager for Data Center creates a snapshot of a volume and consistency group using the SDK. When a snapshot is initiated, a redirect-on-write (ROW) snapshot of the volume or the consistency group is created.</p> <p>The snapshot name and retention period are not set on the array for these snapshots. A typical snapshot created by NetBackup Snapshot Manager for Data Center has the following naming convention:</p> <p>NB<unique_21digit_number></p> <p>No other entity apart from this snapshot is created on the array as a snapshot-related activity.</p>

Table 5-9 Snapshot Manager for Data Center operations on Dell EMC Unity array *(continued)*

Snapshot Manager for Data Center operation	Description
Delete snapshot	<p>In NAS environment, when a snapshot is deleted, Snapshot Manager for Data Center calls the SDK with the required snapshot details and deletes the file system snapshot.</p> <p>In a SAN environment, when a snapshot is deleted, Snapshot Manager for Data Center calls the SDK with the required snapshot details and deletes the volume or consistency group snapshot.</p>
Restore snapshot	<p>For NAS, NetBackup Snapshot Manager for Data Center does not support PIT restore on file system, NFS share, and SMB Share.</p> <p>For SAN:</p> <ul style="list-style-type: none">■ PIT restores for volume snapshot restores the volume to the snapshot state.■ PIT restores for a volume inside the consistency group is restored to the PIT snapshot state. <p>Note: The latest snapshot is not required for PIT. You can perform the restore operation with old snapshots related to the file system.</p>

Table 5-9 Snapshot Manager for Data Center operations on Dell EMC Unity array *(continued)*

Snapshot Manager for Data Center operation	Description
Export snapshot	<p>In a NAS environment, when a snapshot export is initiated:</p> <ul style="list-style-type: none"> ■ For NFS share snapshot, NetBackup Snapshot Manager for Data Center creates a new NFS share from the file system snapshot and adds host permission for accessing the exported NFS share. The target host is assigned read-only root permissions on the exported NFS snapshot share. NetBackup Snapshot Manager for Data Center also prepares a path to the share level. For NFS share the export path is created with: <code><NAS-server-ip>:<share_name></code>. The rules for the hosts are added as a read-only root on a particular share. <p>Note: Host access is added for a list of hosts present as target in read-only root mode.</p> ■ For SMB share snapshot, NetBackup Snapshot Manager for Data Center creates a new SMB share from the file system snapshot and adds user permission and domain for accessing the exported SMB share. Users are assigned read-only permissions on the exported SMB snapshot share. NetBackup Snapshot Manager for Data Center also prepares a path up to the share level. For SMB share, the shares are created using the path <code>\\<NAS-server-ip>\<share_name></code> and backup is performed. <p>Note: User permissions are added for a particular SMB share in read-only mode.</p> <p>In SAN environment, when a snapshot export is initiated:</p> <ul style="list-style-type: none"> ■ The volume and consistency group snapshots are directly attached to the target host. ■ The export operation is supported using the following the Fibre Channel (FC) protocol.

Table 5-9 Snapshot Manager for Data Center operations on Dell EMC Unity array (*continued*)

Snapshot Manager for Data Center operation	Description
Deport snapshot	<p>In a NAS environment, when a snapshot is deported:</p> <ul style="list-style-type: none"> For NFS share, NetBackup Snapshot Manager for Data Center removes host permissions added to the NFS share and deletes the NFS share created. For SMB share, NetBackup Snapshot Manager for Data Center removes user permissions added to the SMB share and deletes the SMB share created. <p>In a SAN environment, when a snapshot is deported:</p> <ul style="list-style-type: none"> For volume snapshots, NetBackup Snapshot Manager for Data Center detaches the volume snapshot from the host. For consistency group snapshots, NetBackup Snapshot Manager for Data Center detaches the consistency group snapshot from the host.

Dell EMC Unity plug-in configuration prerequisites

Ensure the following:

- Ensure that the supported version of Dell EMC Unity Unisphere is installed on the DELL EMC Unity arrays. For the list of all the supported versions of Dell EMC Unity Unisphere, refer to the *NetBackup Snapshot Manager* section in the *NetBackup Hardware and Cloud Storage Compatibility List (HCL)*.
- A user account exists with the permissions to call the Dell EMC Unity Storops SDK methods and all snapshot operations on the array.

Dell EMC Unity plug-in configuration parameters

The following parameters are required for configuring the Dell EMC Unity plug-in:

Table 5-10 Dell EMC Unity array plug-in configuration parameters

NetBackup configuration parameter	Description
Plug-in ID	Provide a name for the plug-in.
Array IP address	The array's IP address in any of the following formats: IPV4, IPV6, or FQDN.

Table 5-10 Dell EMC Unity array plug-in configuration parameters (*continued*)

NetBackup configuration parameter	Description
User name	A user account that has permission to perform snapshot operations on the Dell EMC Unity array.
Password	The password of the EMC Unity array user account specified earlier.

Considerations and limitations

The following considerations and limitations are applicable:

- All snapshots captured for the file system are in read-only mode. The host is appended as per the existing rules for a particular share.
- The limit for any file system name is 128 characters on the array. For a snapshot copy, the maximum length for the volume name is 128 - 23(NB<unique_21digit_number>) = 103. Limit the volume name to 94 characters for successful snapshot capture.

Fujitsu Eternus AF/DX SAN array

Snapshot Manager for Data Center provides a robust data protection solution for mapped FC/iSCSI volumes that are set up on SAN storage hosts. You can protect volumes that are mapped via FC/iSCSI in a Fujitsu AF/DX environment.

Snapshot Manager for Data Center discovers the SAN volumes on the array, and performs create, export, deport, and delete snapshot operations for volumes.

Snapshot Manager for Data Center uses the REST API of the array to establish connection and perform all the operations.

Supported Snapshot Manager for Data Center operations on Fujitsu Eternus AF/DX SAN models

You can perform the following management operations supported on the Fujitsu AF/DX SAN array:

Table 5-11 CloudPoint operations on Fujitsu Eternus AF/DX SAN array

Snapshot Manager for Data Center operations	Description
Discover assets	NetBackup discovers all the volumes and their snapshots. Volumes are primary assets; each contains the associated snapshots and asset IDs.
Create snapshot	<p>To create a snapshot (snapOPCPlus), NetBackup initiates a POST API call on the volume. The snapshot volume is created on the same appliance as the source volume.</p> <p>A typical snapshot created by NetBackup has the following naming convention: NB<unique_21digit_number></p>
Delete snapshot	<p>Before deleting a snapshot, Snapshot Manager for Data Center performs the following operations:</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>NetBackup calls the REST API with the required snapshot details to delete a snapshot. Then confirms that the snapshot is deleted successfully on the array.</p>
Restore snapshot	NetBackup uses volume snapshot restore API to restore volume snapshot to the point in time image on the volume.
Export snapshot	<p>When a snapshot export operation is initiated, NetBackup attaches the snapshot volume to the host. These are the steps for snapshot export:</p> <ol style="list-style-type: none"> 1 Fetch initiators on which you want to perform the 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.
Deport snapshot	During snapshot export, NetBackup deletes the copy session of the source volume, host connection of snapshot volume, and exported snapshot volume. It is a revert of export snapshot.

Fujitsu Eternus AF/DX plug-in configuration prerequisites

Before you configure the Fujitsu Eternus AF/DX AF/DX plug-in, ensure the following:

- Create one thin provision pool that has a "flexsnap_pool" prefix to store snapshots.
- Ensure that a supported version of Fujitsu Eternus AF/DX plug-in is installed on the Fujitsu Eternus AF/DX arrays.
- For the list of all the supported versions of Fujitsu Eternus AF/DX, refer to the *NetBackup Snapshot Manager* section in the *NetBackup Hardware and Cloud Storage Compatibility List (HCL)*.
- A user account that has the permission to call the Fujitsu Eternus AF/DX APIs and perform all snapshot operations on the array.

Fujitsu Eternus AF/DX SAN plug-in configuration parameters

- 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 five types of access for users: Admin, Storage Admin, Security Admin, Account Admin, and Maintainer. You can also have a customized user which performs all the snapshot management operations.
- To allow NetBackup to perform snapshot management operations, ensure that the Fujitsu Eternus AF/DX user account used for plug-in configuration has the following roles and privileges assigned on the storage array: Create, Delete, Attach, Detach, and Restore.
- Users with the Admin user role assigned can perform all the NetBackup snapshot management operations.

Roles and privileges on Fujitsu AF/DX storage array

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 five types of access for users: Admin, Storage Admin, Security Admin, Account Admin, and Maintainer. You can also have a customized user which can perform all the snapshot management operations.

The Fujitsu AF/DX user account used for plug-in configuration must have the following roles and privileges assigned on the storage array: Create, Delete, Attach, Detach, and Restore.

User with an Admin user role assigned can perform all NetBackup's snapshot management operations.

Consideration and limitations

For create snapshot operation:

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

For 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 the "LUN Expand Mode" option.
Then you can use HLUN up to 4096.

HPE RMC plug-in

NetBackup provides a robust data protection solution for volumes that are set up on a SAN storage host. You can also protect mounted iSCSI/FC volumes that are hosted on a 3PAR, Nimble, and Primera array environments which are configured on RMC.

The Snapshot Manager for Data Center plug-in for HPE RMC contains the necessary functional logic to discover the SAN volumes on the arrays that are configured on RMC. It also has the ability to initiate snapshot create, export, deport, and delete operations for volumes. You must configure the plug-in on the NetBackup primary server to discover the volumes, perform backup, and restore operations.

Snapshot Manager for Data Center uses the REST APIs provided by HPE RMC to communicate with the assets.

Supported Snapshot Manager for Data Center operations on HPE storage arrays

Snapshot Manager for Data Center performs the following snapshot management operations on HPE RMC.

Table 5-12 Snapshot Manager for Data Center operations on assets managed by HPE RMC

Snapshot Manager for Data Center operation	Description
Discover assets	Snapshot Manager for Data Center discovers all the HPE RMC volume sets and their snapshot sets.
Create snapshot	<p>HPE RMC allows to take snapshot of the entire volume set at once. The result of a create snapshot operation is a snapshot set that contains snapshot of every volume in the volume set.</p> <p>To create a snapshot, Snapshot Manager for Data Center calls a Post REST API method with the required information and snapshot name. The API returns the details of the snapshot.</p> <p>A snapshot created by Snapshot Manager for Data Center has the following naming convention:</p> <p>NB<unique_2ldigit_number></p> <p>Snapshots created by Snapshot Manager for Data Center have the description: :vrtscp: <Parent Volume Set Name>.</p>
Delete snapshot	To delete a snapshot set, Snapshot Manager for Data Center calls a REST API method with the required snapshot details. Snapshot Manager for Data Center deletes only those snapshots that it creates itself.
Restore snapshot	To restore a snapshot set, Snapshot Manager for Data Center calls a Post REST API method with the required snapshot details. If the base volume is in attached state, it is detached and then restore is tried. After the restore, volume is re-attached to the same host. With the RMC APIs you can restore a single snapshot from a snapshot set, you can restore any volume from a snapshot set.

Table 5-12 Snapshot Manager for Data Center operations on assets managed by HPE RMC (*continued*)

Snapshot Manager for Data Center operation	Description
Export snapshot	Snapshot Manager for Data Center supports export of snapshots over the iSCSI and FC protocols. When a snapshot export operation is initiated, a new clone volume set is created using the snapshot set. Once this clone is created then a host is attached to the same. It is recommended to do a SAN zoning between the host and array that is required to be attached with the snapshot. Note: NetBackup does not discover the cloned volume set created in the export operation.
Deport snapshot	When a snapshot deport operation is initiated, Snapshot Manager for Data Center deletes the export mapping created between the host and the clone volume set. The intermediate clone volume set is also deleted, once it is detached from the host.

HPE RMC plug-in configuration prerequisites

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

- For the list of all the supported versions of HPE RMC, 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 HPE RMC APIs.

RMC plug-in configuration parameters

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

Table 5-13 HPE RMC plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
Plug-in ID	Provide a name for the plug-in.
IP address	IP address of the computer where RMC is installed.

Table 5-13 HPE RMC plug-in configuration parameters (*continued*)

Snapshot Manager for Data Center configuration parameter	Description
User name	A user account that has permissions to perform snapshot operations on the HPE RMC.
Password	The password of the HPE RMC user account specified earlier.

Roles and privileges on HPE RMC

To allow NetBackup to perform snapshot management operations, ensure that the HPE RMC user account used for plug-in configuration has these roles and privileges:

- Create snapshot
- Export snapshot
- Report snapshot
- Delete snapshot

There are two predefined user roles in HPE RMC:

- Admin: Admin has all the required privileges to perform all the supported operations provided by RMC.
- Member: Members have only view privileges and cannot perform any tasks.

Users with the Admin role assigned can perform all the snapshot management operations.

HPE XP plug-in

Snapshot Manager for Data Center provides robust data protection solution for volumes that are set up on a SAN storage host. NetBackup extends SAN support and allows you to protect mounted iSCSI/FC volumes that are hosted on a HPE XP array.

The Snapshot Manager for Data Center plug-in for HPE XP contains the necessary functional logic that enables NetBackup to discover the SAN volumes on the array, and create, export, deport, and delete snapshots for volumes. Configure this plug-in on the NetBackup primary server to discover the volumes, perform backup, and restore operations.

Snapshot Manager for Data Center 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

NetBackup Snapshot Manager for Data Center performs the following snapshot management operations on HPE XP.

Table 5-14 Snapshot Manager for Data Center operations on assets managed by HPE XP

Snapshot Manager for Data Center operation	Description
Discover assets	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. The LDEVs that have "CMD" in their attributes and those without any logical unit number (LUN) mapped are not discovered.
Create snapshot	For snapshots, Snapshot Manager for Data Center uses HPE XP Fast Snap Pairs and initiates a sequence of REST API requests with the required information and snapshot name. The API returns the details of the snapshot. A typical snapshot created by Snapshot Manager for Data Center has the following naming convention: <code>NB<unique_2ldigit_number></code>
Delete snapshot	To delete a snapshot, Snapshot Manager for Data Center initiates a sequence of REST API requests with the required snapshot details and confirms that the snapshot has been deleted successfully on the cluster.
Restore snapshot	To restore a snapshot, Snapshot Manager for Data Center initiates a REST API request where the fast snap is restored to the parent volume.
Export snapshot	Snapshot Manager for Data Center supports export over iSCSI and FC protocols, using REST API to set LUN path of snapshot.

Table 5-14 Snapshot Manager for Data Center operations on assets managed by HPE XP (*continued*)

Snapshot Manager for Data Center operation	Description
Deport snapshot	When a snapshot deport operation is initiated, Snapshot Manager for Data Center deletes the export created over the snapshot path at the time of Export operations. It essentially reverts the Export operation.

HPE XP plug-in configuration prerequisites

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

- One pool with name starting with `flexsnap_pool` needs to be created to store snapshots. The pool must be large enough to fulfill all snapshot needs.
- For the list of all the supported versions of HPE XP, 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 access the HPE XP APIs.

HPE XP plug-in configuration parameters

Specify the following details when you configure the HPE XP plug-in.

Table 5-15 HPE XP plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
Plug-in ID	Provide a name for the plug-in.
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 user name	HPE XP storage array user account which has 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.

Roles and privileges on HPE XP

To allow NetBackup to perform snapshot management operations, ensure that the HPE XP user account used for plug-in configuration has the below mentioned roles and privileges assigned:

- Create snapshot
- Export snapshot
- Restore snapshot
- Delete snapshot

HPE Alletra 9000 SAN array

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

- HPE Volume
- HPE Snapshot Volume

Snapshot Manager uses HPE Alletra provided WSAPI's to communicate with HPE Alletra assets. It utilizes the latest WSAPI version. The connection is established to the HPE Alletra 9000 array through WSAPI. Then uses the WSAPI endpoints to discover the SAN volumes and the snapshots for backup.

HPE Alletra 9000 SAN plug-in configuration parameters

Before you configure the HPE Alletra 9000 plug-in, verify the following:

- Ensure that a supported version of HPE Alletra 9000 is installed on the HPE Alletra array.
- For the list of all the supported versions of HPE Alletra 9000, refer to the *NetBackup Snapshot Manager* section in the *NetBackup Hardware and Cloud Storage Compatibility List (HCL)*.

Specify the following details when you configure the HPE Alletra 9000 SAN array:

Table 5-16 HPE Alletra 9000 SAN plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
Plug-in ID	Provide a name for the plug-in.
IP address	HPE Alletra 9000 array IP address.

Table 5-16 HPE Alletra 9000 SAN plug-in configuration parameters
(continued)

Snapshot Manager for Data Center configuration parameter	Description
Username	User account which have permission to perform snapshot operations on the HPE Alletra 9000 array.
Password	A password for the user account.

Roles and privileges on HPE 9000 storage array

To allow NetBackup Snapshot Manager to perform snapshot management operations, ensure that the HPE Alletra plug-in user account configuration have the following roles and privileges assigned on the storage array:

- Create snapshots
- Delete snapshots
- Attach snapshots
- Detach snapshots
- Restore snapshots

Considerations and limitations

- All snapshots are captured at a volume level and those snapshots are in read-only mode.
- Create snapshot operation: We do not support clone snapshots as HPE Alletra doesn't allow us to export clone snapshot volume.
- The limit for any volume name is up to 31 characters.

Supported Snapshot Manager for Data Center operations on HPE Alletra 9000 SAN models

NetBackup Snapshot Manager performs the following snapshot management operations on the HPE Alletra 9000 SAN array:

Table 5-17 NetBackup Snapshot Manager operations on the HPE Alletra 9000 SAN array

Snapshot Manager for Data Center operations	Description
Discover assets	<p>NetBackup Snapshot Manager discovers all the volumes (except clone volumes and system volumes) and snapshots. Volumes are primary assets, each contains the associated snapshots and asset IDs.</p>
Create snapshot	<p>NetBackup Snapshot Manager takes a snapshot of HPE volume.</p> <p>To create a snapshot, Data Center initiates a POST API call on the volume.</p> <p>A typical snapshot created have the following naming convention: NB<unique_21digit_number></p>
Delete snapshot	<p>NetBackup Snapshot Manager deletes a snapshot volume. When the delete snapshot operation is initiated, NetBackup Snapshot Manager for Data center deletes the snapshot volume corresponding to the source volume.</p>
Restore snapshot	<p>NetBackup Snapshot Manager restores the parent volume, when you restore a volume from a volume snapshot.</p> <p>When a snapshot restore operation is initiated, NetBackup Snapshot Manager unmaps the source volume and snapshot volume from all the host and host sets.</p> <p>A snapshot volume cannot be restored when it is exported to a host or host set and if the parent volume is exported to hosts or host sets.</p> <p>After completion of the restore operation, NetBackup Snapshot Manager again maps the parent volume and the snapshot volume to all the host and host sets</p>
Export snapshot	<p>When a snapshot export operation is initiated, NetBackup Snapshot Manager attaches a snapshot of the volume to the host.</p> <p>NetBackup Snapshot Manager fetches the initiators where you want to perform the export operations based on the port. Initiator fetches the host ID and then NetBackup Snapshot Manager attaches the snapshot volume to the host.</p>

Table 5-17 NetBackup Snapshot Manager operations on the HPE Alletra 9000 SAN array (*continued*)

Snapshot Manager for Data Center operations	Description
Deport snapshot	When a snapshot deport operation is initiated, NetBackup Snapshot Manager removes the host mapping of exported snapshot volume. It is a revert of the export snapshot operation.

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 5-18 Snapshot Manager for Data Center operations on Hitachi NAS plug-in

Snapshot Manager for Data Center operation	Description
Discover assets	<p>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.</p>
Create snapshot	<p>To create a snapshot, NetBackup Snapshot Manager initiates 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 initiated 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: <code><EVS-server-ip>:<share_name>/<snapshot_name></code> ■ SMB: <code>\\<EVS-server-ip>\<share_name>\@UTC_for_snapshot</code>

Table 5-18 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 initiated, 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.
- To upgrade NetBackup Snapshot Manager from version 10.1 to later versions, you must expire all snapshots before starting the upgrade process.

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 5-19 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 5-19 Snapshot Manager for Data Center operations on EMC PowerStore SAN plug-in (*continued*)

opeSnapshot Manager for Data Centerration	Description
Delete snapshot	<p>When Snapshot Manager for Data Center deletes a snapshot, it performs the following actions:</p> <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	<p>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.</p>
Export snapshot	<p>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.</p>
Deport snapshot	<p>When a snapshot deport operation is initiated, 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.</p>

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 SAN V7000 plug-in

NetBackup lets you protect mounted iSCSI/FC volumes hosted on an IBM Storwize array.

The Snapshot Manager for Data Center plug-in for IBM Storwize can discover the SAN volumes and consistency groups on the array. Additionally, the plug-in can create, export, deport, and delete snapshot operations for volumes and consistency groups. You must configure this plug-in on the NetBackup primary server to perform these operations.

Snapshot Manager for Data Center uses the REST API supported by the IBM Storwize family to communicate with the protected assets.

Supported NetBackup operations on IBM Storwize array

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

Table 5-20 Snapshot Manager for Data Center operations on the IBM Storwize array

Snapshot Manager for Data Center operations	Description
Discover assets	<p>Snapshot Manager for Data Center discovers all the volumes, consistency groups, volume snapshots, and consistency group snapshot present on the array. Snapshot Manager for Data Center discovers only the snapshots created by NetBackup.</p> <p>Note: The snapshot volume is also considered a volume asset, created while creating a snapshot. Snapshot Manager for Data Center discovers the FlashCopy mappings present on the array where the target volume of mapping is considered a snapshot.</p>

Table 5-20 Snapshot Manager for Data Center operations on the IBM Storwize array (*continued*)

Snapshot Manager for Data Center operations	Description
Create snapshot	<p>To create a snapshot, Snapshot Manager for Data Center initiates 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></p> <p>When Snapshot Manager for Data Center calls the REST API for a volume, the following process takes place:</p> <ol style="list-style-type: none"> 1 A new thin-provisioned volume is created on the array. 2 A FlashCopy mapping with snapshot property is created between the source volume (the volume selected in the NetBackup policy) and the target volume created by snapshot manager. This new volume is considered as the snapshot volume for the source volume. 3 After creating a mapping, the start operation is initiated on the array for the mapping and copies data from the source volume to snapshot volume. <p>For creating consistency group snapshots, here is the process:</p> <ol style="list-style-type: none"> 1 A new consistency group is created with the NetBackup generated snapshot name. 2 New thin provisioned volumes are created for every source volume which is a part of the consistency group. 3 Mappings are created between the newly created volumes and the source volumes under the new consistency group. 4 After creating a mapping, the start operation is initiated on the array for the mapping to copy data from the source consistency group to snapshot group. <p>You can specify the volumes that are included in a source volume in a consistency group in the NetBackup policy. In the IBM Storwize array, when the snapshot operation is initiated, the snapshot of that entire consistency group is taken.</p>

Table 5-20 Snapshot Manager for Data Center operations on the IBM Storwize array (*continued*)

Snapshot Manager for Data Center operations	Description
Delete snapshot	When a snapshot deport operation is initiated, Snapshot Manager for Data Center deletes the export mapping created between the host and the volume(s) created during the export operation.
Restore snapshot	To restore a volume snapshot or consistency group snapshot, Snapshot Manager for Data Center calls a PUT REST API method. When a restore is initiated, a new FlashCopy mapping is created where the snapshot volume acts as the source volume and the source volume acts as the target volume. Then the mapping is started as a restore operation. Note: The mappings created during restore operation are deleted automatically after the restore is complete.
Export snapshot	Snapshot Manager for Data Center supports export snapshot over the iSCSI and FC protocols. When a snapshot export operation is initiated, the snapshot volume is attached to the host on the array. Snapshot Manager for Data Center uses the same process for consistency group snapshots. SAN zoning must be done between the host and the array that is required to be attached with the snapshot.
Deport snapshot	To delete a volume or consistency group snapshot, Snapshot Manager for Data Center calls the REST API.

IBM Storwize plug-in configuration prerequisites

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

- For the list of all the supported versions of IBM Storwize, 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 IBM Storwize APIs.
- The port with which the IBM Storwize array is configured is also used for the REST API calls. The default port is 7443.

IBM Storwize plug-in configuration parameters

The following parameters are required for configuring the IBM Storwize plug-in:

Table 5-21 IBM Storwize plug-in configuration parameters

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

Roles and privileges on IBM Storwize

To allow Snapshot Manager for Data Center to perform snapshot management operations, ensure that the IBM Storwize user account used for plug-in configuration has the following roles and privileges assigned:

- Create snapshot
- Export snapshot
- Restore snapshot
- Delete snapshot

Here are the predefined user roles in IBM Storwize:

- Security Administrator—can manage all the Storwize V7000 Unified features and functions.
- Administrator—can manage everything in the system except creating, changing, or removing users or user groups, changing the user group assignment of users, or assigning roles to user groups.
- Export Administrator—can manage the share and export definitions for all supported protocols.
- Storage Administrator—can manage storage, pools, disks, file systems, and file sets.
- Snapshot Administrator—can manage snapshots for file systems, file sets, and peer snapshots.
- System Administrator—can manage the network, system, file modules, tasks, system and alert logs, traces, dumps, performance center, and authentication.

- Copy Operator—can manage all FlashCopy®, Metro Mirror, and Global Mirror relationships, Tivoli® Storage Manager and Tivoli Storage Manager for Space Management integration, NDMP, asynchronous replication, and remote caching.
- Monitor—can only list management information.
- Privileged—can submit native Linux commands with Linux root privilege in addition to all other user role authorized functions.
- Data Access—can clone files.

User with Security Administrator, Administrator, and Privileged role assigned can perform all the snapshot management operations in NetBackup.

IBM Storwize plug-in considerations and limitations

The following considerations and limitations are applicable:

- NetBackup disables vDisk protection to perform the Deport and Delete operations on the array. When these operations are initiated, NetBackup reverts back to the original state. These operations do not interfere with any existing mapping or I/O operations on the array.
- NetBackup overrides the standard warnings on the array regarding FlashCopy mappings. The restore is completed with the warnings.
- The array does not support IPv6 configuration from NetBackup and can only use IPv4/FQDN for all the operations.
- Do not delete the mappings created between the source volume and target volumes. Without these mappings, the snapshot becomes invalid and NetBackup aborts operations.
- Do not delete the mappings between the source volumes and the target volumes. NetBackup cannot restore the snapshot without these mappings.
- Do not interrupt any copying operation of FlashCopy mapping.
- Do not delete the mapping between the source and target volume in the consistency group snapshot. If you delete any mapping between the source volume and target volume, NetBackup cannot restore that source volume.

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 76.

See [“Supported Snapshot Manager for Data Center operations on InfiniBox SAN models”](#) on page 73.

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 5-22 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 5-22 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 initiated, 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 initiated, 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 initiated, 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 5-23 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.

InfiniBox NAS array

NetBackup provides a robust data protection solution for shares that are set up on the Network Attached Storage (NAS) storage host. NetBackup extends NAS support to let you protect the NFS exports and SMB Shares that are hosted on InfiniBox

environment. You can configure Snapshot Manager for Data Center to discover and then perform back up operations on NFS exports and SMB Shares.

Snapshot Manager for Data Center plug-in for InfiniBox have the functional logic that enables NetBackup to discover the NFS exports and SMB Shares on the InfiniBox system. Then initiates snapshot create, export, deport, and delete operations for the exports.

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

1. Snapshot Manager for Data Center uses the REST APIs to communicate with the InfiniBox assets.
2. Snapshot Manager for Data Center establishes a connection with InfiniBox to discover the NFS exports, SMB Shares and its' snapshots for backup.

Supported Snapshot Manager for Data Center operations on InfiniBox NAS models

NetBackup Snapshot Manager performs the following snapshot management operations on the InfiniBox NAS array:

Table 5-24 NetBackup Snapshot Manager operations on the InfiniBox NAS array

Snapshot Manager for Data Center operations	Description
Discover assets	<p>NetBackup Snapshot Manager discovers all the NFS export, SMB shares, file systems, and the snapshots. MASTER and SNAPSHOT are the two types of data sets for file systems.</p> <p>NetBackup Snapshot Manager discovers all the file systems of type MASTER and its' snapshots type SNAPSHOT and snapshot depth is one.</p> <p>NetBackup Snapshot Manager also discovers all NFS export and SMB shares of all file systems of type MASTER.</p>
Create snapshot	<p>To create a snapshot, NetBackup Snapshot Manager initiates a POST Rest API with the required information and snapshot name. The API returns the details of the snapshot. All these snapshots are created at a file system level.</p> <p>A typical snapshot created has the following naming convention: NB<unique_30digit_number></p>

Table 5-24 NetBackup Snapshot Manager operations on the InfiniBox NAS array (*continued*)

Snapshot Manager for Data Center operations	Description
Export snapshot	When a snapshot export operation is initiated, a new NFS export or SMB share is created over the same file system snapshot. The file system path where the backup hosts are added as client with read-only permissions.
Restore snapshot	Snapshot Manager for Data Center does not support restore operation.
Deport snapshot	When a snapshot deport operation is initiated, NetBackup Snapshot Manager deletes the NFS export or SMB share that are created over the snapshot path at the time of the export operation.
Delete snapshot	To delete a snapshot, NetBackupSnapshot Manager initiates a Delete Rest API call with the required snapshot details. Then Snapshot Manager for Data Center confirms that the snapshot is deleted successfully.

InfiniBox NAS plug-in configuration parameters

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

- To view all the supported versions of InfiniDat InfiniBox, 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 InfiniBox APIs on the system.

Specify the following details when you configure the InfiniBox array:

Table 5-25 InfiniBox NAS plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
Plug-in ID	Provide a name for the plug-in.
IP address	InfiniBox NAS array IP address.

Table 5-25 InfiniBox NAS plug-in configuration parameters (*continued*)

Snapshot Manager for Data Center configuration parameter	Description
Username	User account which has permission to perform snapshot operations on the InfiniBox NAS array.
Password	Password for the user account.

Roles and privileges on InfiniBox NAS array

Do the following to allow NetBackup Snapshot Manager to perform snapshot management operations.

- Ensure that the InfiniBox user account has the privileges to perform the following operations on the InfiniBox array:
 - Create snapshot
 - Export snapshot
 - Delete snapshot
- Following are the five predefined user roles in InfiniBox:
 - **READ_ONLY:** A read-only user can only make queries for information. Users with this role cannot make any changes to the system.
 - **TECHNICIAN:** The technician role which has permissions to InfiniBox hardware on the customer premises. The technician role has permissions like the read-only user, with added access rights to hardware-only related API, CLI, and GUI commands.
 - **INFINIDAT:** The Infinidat role is specifically for Infinidat level 3 support engineers. This account is used for customer support only. The Infinidat user has the joint permissions of the admin and technician users, with added access to internal commands.
 - **POOL_ADMIN:** The pool admin has admin rights for specific pools. Within the pool (or pools), the pool admin can provision data sets, map them to hosts, and take snapshots.
 - **ADMIN:** The admin (system administrator) role has permissions to all InfiniBox software functionality. It also includes network administration, provisioning pools and entities, and creating other users.

Note: User with POOL_ADMIN, ADMIN, or INFINIDAT can perform all the NetBackup Snapshot Manager's snapshot management operations.

Domain user permissions on the InfiniBox NAS

Follow the steps to add user permissions to the InfiniBox NAS Active Directory domain:

1. Log on to the InfiniBox web UI.
2. Click **Settings** on the left toolbar and then click the **SMB** tab.
3. Click **Join Domain**.
4. In the **Join Active Directory Domain** window:
 - Enter the FQDN of the Active Directory domain.
 - Enter IP address for each domain controller which is used for InfiniBox communication and then, click **Add**.
 - The IP address is added to the controllers box.
 - Enter the user name and password of an administrator account in the Active Directory domain.
5. Click **Join Domain** to add InfiniBox to the Active Directory domain.

Considerations and limitations for InfiniBox NAS plug-in

Following considerations and limitations are applicable to the InfiniBox NAS environment:

- All snapshots at the file system level are captured and write-protected.
- InfiniBox plug-in does not support mixed type NAS protocol.
- The limit for a file system name is 65 characters, NFS export name is 255 characters, and SMB share name is 65 characters on the array.
- InfiniBox NAS plug-in does not support point-in-time (PIT) rollback restore using snapshots.
- NetBackup Snapshot Manager discovers only a snapshot of depth one.
- NetBackup Snapshot Manager captures all the network space IPs of NAS service type for the snapshot export operations.

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.
- NetApp FlexGroup volumes in 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. All snapshot operations supported on FlexGroup volumes are the same as NAS share snapshots.

All snapshot operations supported on FlexGroup volumes are the same as NAS share snapshots.

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 5-26 Supported NetBackup Snapshot Manager operations on NetApp storage

NetBackup Snapshot Manager operation	Description
Discover assets	<ul style="list-style-type: none"> <li data-bbox="548 442 1213 651"> <p>■ 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.</p> <pre data-bbox="584 598 1122 651">["state":"online","vol_type":"rw", is_snapshot_auto_delete_enabled": "false"]</pre> <p>Note: In a SAN environment, NetBackup can discover only the snapshots that are created using Snapshot Manager, the volumes having "CMD" in their attributes, and the volumes without host mappings discovered.</p> <li data-bbox="548 789 1213 963"> <p>■ 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.</p> <li data-bbox="548 980 1213 1085"> <p>■ 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.</p> <li data-bbox="548 1102 1213 1206"> <p>■ In NAS environment, NetBackup discovers FlexGroup volumes. NetApp provides supports FlexGroup volumes as NAS shares. FlexGroup volume is a scale-out NAS container that provides high performance along with automatic load distribution and scalability.</p>

Table 5-26 Supported NetBackup Snapshot Manager operations on NetApp storage (*continued*)

NetBackup Snapshot Manager operation	Description
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 initiates a LUN snapshot on the NetApp storage, it internally initiates 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 initiated 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: NB<unique_21digit_number> ■ In a NAS environment, NetBackup Snapshot Manager takes a snapshot of the NetApp NFS as well as SMB shares.
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 initiated. 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 5-26 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 initiated, 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 initiated 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 initiated, <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 initiated, 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 initiated, <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 5-26 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 5-27 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	

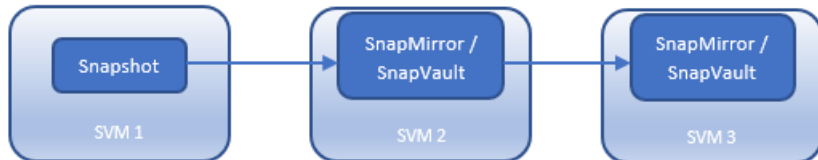
Supported NetApp topologies

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.

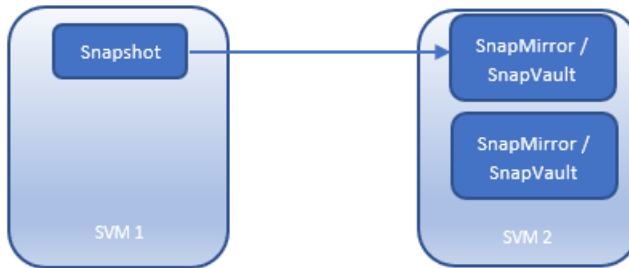
The snapshot can be replicated when you have a single target as destination



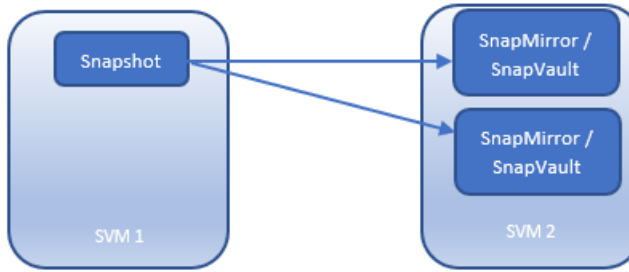
The snapshot can be replicated in a cascaded configuration.



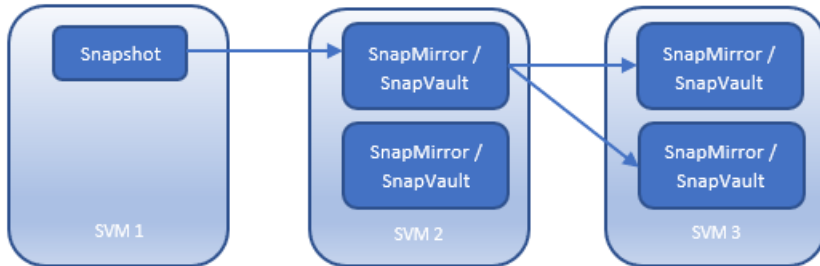
The snapshot can be replicated when you have multiple targets of same or different type configured on the array.



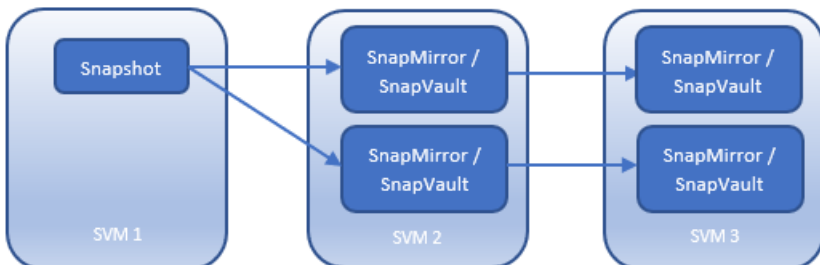
The snapshot can be replicated in a fanout configuration. You can have maximum 8 fanout relationships from a single source volume.



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.

NetApp E-Series array

NetBackup provides a robust data protection solution for Volumes that are set up on a Storage Area Network (SAN) storage host. NetBackup extends SAN support to let you protect mounted iSCSI/FC volumes that are hosted on the NetApp E-series environment.

NetBackup Snapshot Manager for Data Center plug-in for NetApp E-series have the functional logic that enables NetBackup to discover the SAN volumes on the arrays. Then initiates snapshot create, export, deport, and delete operations for the volumes. You must configure this plug-in on the NetBackup primary server to discover the volumes, perform backups, and restore operations.

NetBackup Snapshot Manager for Data Center uses NetApp provided WSAPIs to communicate with the assets.

Supported Snapshot Manager for Data Center operations on NetApp E-Series models

NetBackup Snapshot Manager performs the following snapshot management operations on the NetApp E-Series array:

Table 5-28 NetBackup Snapshot Manager operations on the NetApp E-series array

Snapshot Manager for Data Center operations	Description
Discover assets	NetBackup Snapshot Manager discovers all the NetApp E-Series volumes and the snapshots.
Create snapshot	<p>To create a snapshot, NetBackup Snapshot Manager for Data Center initiates a Post Rest API method with the required information. Then, the API returns the details of the snapshot.</p> <p>NetBackup Snapshot Manager for Data Center creates a snapshot with the following description:</p> <p>:vrtscp: <Parent Volume Name></p> <p>The suffix in the descriptions helps NetBackup Snapshot Manager for Data Center to perform delete operation.</p> <p>For each volume, NetBackup creates a snapshot group with the following naming convention: NBSG <volume_name></p> <p>The snapshot group is created with 40% capacity of the base volume. All snapshots on that volume are created inside this Snapshot Group. When the reserved capacity for a snapshot group is full, it rejects any new writes to the base volume.</p> <p>NetApp E-series volume has limitation of 32 snapshots per volume, post which a create snapshot operation results in an error.</p>
Export snapshot	<p>NetBackup Snapshot Manager exports a snapshot over the iSCSI and FC protocols. When a snapshot export operation initiates, a new snapshot volume is created using a snapshot.</p> <p>The snapshot volume has the following naming convention: SV_snap_seq_no<snapshot sequence no></p> <p>Once the snapshot volume is created then a host is attached to the same. The SAN zoning must be done between the host and array which is required to attach with the snapshot.</p> <p>Note: The discovery of a snapshot volume that is created in the export operation is skipped.</p>

Table 5-28 NetBackup Snapshot Manager operations on the NetApp E-series array (*continued*)

Snapshot Manager for Data Center operations	Description
Deport snapshot	When a snapshot deport operation is initiated, NetBackup Snapshot Manager for Data Center deletes the export mapping which is created between the host and the snapshot volume. Then, it deletes the intermediate snapshot volume once it is detached from the host.
Delete snapshot	To delete a Snapshot, NetBackup Snapshot Manager for Data Center initiates a Delete Rest API method call with the required snapshot details. NetBackup Snapshot Manager for Data Center verifies if the suffix (:vrtscp:) is present, then only a snapshot is allowed to delete. For NetApp E-Series, only an oldest snapshot can be deleted at any point of time. If a snapshot is required to delete, then all snapshots that are created before the chosen snapshot must be deleted first.
Restore snapshot	To restore a snapshot, NetBackup Snapshot Manager for Data Center initiates a Post Rest API method call with the required snapshot details.

NetApp E-Series plug-in configuration parameters

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

- To view all the supported versions of NetApp E-Series, refer to the *NetBackup Snapshot Manager* section, in the *NetBackup Hardware and Cloud Storage Compatibility List (HCL)*.
- A user account which has the permissions to invoke the NetApp E-Series APIs on the system.

Specify the following details when you configure the NetApp E-Series array:

Table 5-29 NetApp E-Series plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
Plug-in ID	Provide a name for the plug-in.

Table 5-29 NetApp E-Series plug-in configuration parameters (*continued*)

Snapshot Manager for Data Center configuration parameter	Description
Proxy/Array IP address	IP address of the computer where NetApp E-series is installed or proxy server address on which array is added.
Port	Port number of the REST API server.
Username	User account which has permission to perform snapshot operations on the NetApp E-Series array.
Password	Password for the user account.
Storage array WWN	WWN of the array

- You can find the storage array WWN in the array details.
- To get the array details, use the following API:
`https://<array / proxy IP>:<port no>/devmgr/v2/storage-systems`

Roles and privileges on NetApp E-Series

Do the following to allow NetBackup Snapshot Manager to perform snapshot management operations.

Ensure that the NetApp E-Series user account which is used for plug-in configuration has the privileges to perform the following operations:

- Create snapshot
- Export snapshot
- Delete snapshot

The RBAC (role-based access control) capabilities include predefined users with one or more roles that are mapped with the user accounts. Each role includes permissions for accessing tasks in Unified Manager or system manager.

Following are the roles defined with the access rights to perform tasks:

- Storage admin: Full read or write access to storage objects on the arrays, but no access to the security configuration.
- Security admin: Access to the security configuration in Access Management and Certificate Management.
- Support admin: Access to all hardware resources on the storage arrays, failure data, and MEL events. No access to the storage objects or security configuration.

- Monitor: Read-only access to all storage objects, but no access to the security configuration.

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 initiate 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	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. Note: Snapshot operations are not supported for nested shares on Nutanix Files File Server.

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

Snapshot Manager for Data Center operation	Description
Create snapshot	<p>To create a snapshot, Snapshot Manager for Data Center initiates 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 initiates 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 initiated, 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>
Deport snapshot	<p>When a snapshot deport operation is initiated, 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.</p>

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

Snapshot Manager for Data Center operation	Description
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 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.
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-initiated 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 FlashArray SAN

NetBackup lets you protect mounted iSCSI/FC volumes present on Pure Storage SAN array. The Snapshot Manager for Data Center plug-in for Pure Storage FlashArray can discover the SAN volumes and protection groups on the array and perform create, export, deport, and delete snapshot operations for volumes and protection groups. You must configure this plug-in on the NetBackup primary server to perform backup and restore operations.

Snapshot Manager for Data Center uses an SDK supported by Pure Storage FlashArray family to communicate with the Pure Storage FlashArray assets.

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

Snapshot Manager for Data Center performs the following snapshot management operations on the Pure Storage SAN arrays:

Table 5-31 Snapshot Manager for Data Center operations on the IBM Storwize array

Snapshot Manager for Data Center operations	Description
Discover assets	Snapshot Manager for Data Center discovers all the volumes, protection groups, protection group snapshots, and volume snapshots.
Create snapshot	To create a snapshot, Snapshot Manager for Data Center initiates a REST API method with the required snapshot details. A snapshot is created with the following naming convention: NB<unique_21digit_number> NetBackup takes the snapshot of the entire protection group of the volumes, as selected in the NetBackup policy.
Delete snapshot	To delete a volume or protection group snapshot, Snapshot Manager for Data Center initiates a REST API call with the required snapshot details.

Table 5-31 Snapshot Manager for Data Center operations on the IBM Storwize array (*continued*)

Snapshot Manager for Data Center operations	Description
Restore snapshot	<p>To restore a volume snapshot or protection group snapshot, Snapshot Manager for Data Center initiates a REST API method with the required snapshot details.</p> <p>Note: Restore of a protection group snapshot restores all the volumes which were part of protection group at the time of taking the snapshots. You cannot restore a single volume when the snapshot is taken on protection group.</p>
Export snapshot	<p>Snapshot Manager for Data Center can perform FC/iSCSI based exports. When a snapshot export operation initiates, a new clone volume is created from the snapshot, and attached to the host. For protection group snapshot too, the clone volumes are created and attached to the host. The SAN zoning must be done between the host and array to be attached with the snapshot.</p>
Deport snapshot	<p>Snapshot Manager for Data Center deletes the export mapping created between the host and the cloned volume(s) created from the volume snapshot or the protection group snapshot.</p>

Pure Storage SAN plug-in configuration pre-requisites

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

- For the list of all the supported versions of Pure Storage FlashArray, refer to the *NetBackup Snapshot Manager* section in the *NetBackup Hardware and Cloud Storage Compatibility List (HCL)*.
- A user account which has the permissions to call the Pure Storage FlashArray APIs.

Pure Storage SAN plug-in configuration parameters

The following parameters are required for configuring the Pure Storage SAN plug-in:

Table 5-32 Pure Storage Flash array plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
Plug-in ID	Provide a name for the plug-in.
IP address / FQDN	The array's management IP address, in IPV4/ FQDN format.
User name	A user account that has permissions to perform snapshot operations.
Password	The password for the user account.

Roles and privileges on Pure Storage FlashArray

To allow NetBackup to perform snapshot management operations, ensure that the Pure Storage FlashArray user account you use for plug-in configuration has the following roles and privileges assigned:

- Create snapshot
- Export snapshot
- Restore snapshot
- Delete snapshot

There are four predefined user roles in Pure Storage FlashArray:

- **readonly**—can perform operations that convey the state of the array. These users cannot alter the state of the array.
- **ops_admin**—can perform the same operations as the **readonly** users, and additionally, enable and disable remote assistance sessions. Ops admin users cannot alter the state of the array.
- **storage_admin**—can perform the storage-related operations, such as administering volumes, hosts, and host groups. Storage admin users cannot perform operations that deal with global and system configurations.
- **array_admin**—can perform the same operations as **storage_admin** users plus array-wide changes dealing with global and system configurations.

Users with the **storage_admin** and **array_admin** roles assigned, can perform all the NetBackup snapshot management operations.

Pure Storage FlashArray plug-in considerations and limitations

The following considerations and limitations apply:

- Do not delete a volume from the array or remove it from the protection group after taking the backup operation. This might cause the restore to fail.
- During the delete operation, if the array has safe mode enabled, the snapshot is not be removed completely from the array. NetBackup destroys the snapshot but does not eradicate.

Pure Storage FlashBlade plug-in configuration notes

Snapshot Manager for Data Center lets you protect NFS and SMB protocols-based file systems that are hosted in a Pure Storage FlashBlade array.

Snapshot Manager for Data Center discovers assets in the Pure Storage FlashBlade array and performs create, export, deport, and delete snapshot operations. You must configure the plug-in on the NetBackup primary server before performing these operations.

Snapshot Manager for Data Center uses the Pure Storage SDK called as purity-fb (1.12.2). Purity-fb calls the Pure Storage FlashBlade family APIs to communicate and protect the Pure Storage FlashBlade assets.

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

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

Table 5-33 Snapshot Manager for Data Center operations on the Pure Storage FlashBlade array

Snapshot Manager for Data Center operations	Description
Discover assets	Snapshot Manager for Data Center discovers all the Pure Storage FlashBlade file system assets and their snapshots. NetBackup calls the array's API to retrieve the assets mentioned in the list.

Table 5-33 Snapshot Manager for Data Center operations on the Pure Storage FlashBlade array (*continued*)

Snapshot Manager for Data Center operations	Description
Create snapshot	<p>To create a snapshot, Snapshot Manager for Data Center calls the SDK with the required snapshot name and details. A snapshot is created with the following naming convention: NB <unique_21digit_number>.</p> <p>Snapshots created by Snapshot Manager for Data Center have the description:</p> <p><i>:vrtscp: <Parent Volume Set Name></i></p> <p>The field name <code>source_id</code> indicates the source file system of the created snapshots on the array.</p> <p>In snapshots you can only provide a suffix to the snapshot name and the prefix is the file system name by default and cannot be changed.</p>
Delete snapshot	To delete a snapshot set, NetBackup calls the SDK with the required snapshot details.
Restore snapshot	Snapshot Manager for Data Center restores snapshots using the SDK methods with different restore paths. Latest snapshot is required for PIT. You cannot perform PIT restore with old snapshots.
Export snapshot	You can export snapshots using SMB and NFS-based exports. When a snapshot export is initiated, a new rule is added for the host as read-only. An export path is generated using the VLAN interface available on the array and this path is shared with NetBackup for mounting.
Deport snapshot	When a snapshot deport operation is initiated, NetBackup removes the export rules added previously for the host.

Pure Storage FlashBlade plug-in configuration prerequisites

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

- You can use the management IP or FQDN of the array through NetBackup to configure the array. The current support provides the ability to configure IPV4 for the array. For IPV4 access provide the management IP. For FQDN, the management FQDN address is: <https://purestorage-flashblade.com>. You can register NetBackup using this FQDN.

- For registration from NetBackup, an Active Directory user having API token is required, who can create, delete, and restore snapshots; attach or detach the file system with hosts.
- You cannot create shares within the Pure Storage FlashBlade array, but you can create the file systems.

Pure Storage FlashBlade plug-in configuration parameters

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

Table 5-34 Pure Storage FlashBlade plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
Plug-in ID	Provide a name for the plug-in.
IP address	The array's IP address, in IPV4 format.
User name	A user account that has permissions to perform snapshot operations on the Pure Storage FlashBlade.
Password	The password of the Pure Storage FlashBlade user account specified earlier.

Roles and privileges for Pure Storage FlashBlade plug-in

To allow NetBackup to perform snapshot management operations, ensure that the Pure Storage FlashBlade user account used for plug-in configuration has the following roles and privileges assigned:

- Create snapshot
- Export snapshot
- Restore snapshot
- Delete snapshot

PowerMax eNAS array

NetBackup provides a robust data protection solution for shares that are set up on a Network Attached Storage (NAS) storage host. NetBackup extends to NAS support which allows you to protect NFS exports and SMB Shares hosted in the PowerMax

eNAS environment. You can configure Snapshot Manager for Data Center to discover and then perform backup operations on NFS exports and SMB shares.

Snapshot Manager for Data Center plug-in for PowerMax eNAS contains the functional logic that enables NetBackup to discover the NFS exports and SMB shares on the PowerMax eNAS system. Then initiates the snapshot to create, export, deport, and delete operations for the exports.

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

- Snapshot Manager for Data Center uses the XML APIs to communicate with the PowerMax eNAS assets.
- Snapshot Manager for Data Center establishes a connection with PowerMax eNAS to discover the NFS exports, SMB shares, and its' snapshots for backup.

Supported Snapshot Manager for Data Center operations on PowerMax eNAS models

NetBackup Snapshot Manager performs the following snapshot management operations on the PowerMax eNAS array:

Table 5-35 NetBackup Snapshot Manager operations on the PowerMax eNAS array

Snapshot Manager for Data Center operations	Description
Discover assets	<p>NetBackup Snapshot Manager for Data Center discovers all the PowerMax Data movers, NFS export, SMB shares, and their file system snapshots.</p> <p>NetBackup Snapshot Manager also discovers all the nested NFS exports and SMB shares irrespective of the depth at which they are created.</p>
Create snapshot.	<p>To create a snapshot, NetBackup Snapshot Manager for Data Center initiates a POST XML API method with the required information and snapshot name.</p> <p>The API returns the details of the snapshot. All these snapshots are at a file system level. A typical snapshot created by NetBackup Snapshot Manager for Data Center has the following naming convention:</p> <p>NB<unique_21digit_number></p>
Restore snapshot	<p>NetBackup Snapshot Manager for Data Center does not support PIT restore operation on the array. Instead, we can perform the normal restore on the specified location.</p>

Table 5-35 NetBackup Snapshot Manager operations on the PowerMax eNAS array (*continued*)

Snapshot Manager for Data Center operations	Description
Export snapshot	<p>NetBackup Snapshot Manager for Data Center supports export operations using the NFS and SMB protocol. When a snapshot export operation is initiated based on the NFS export or SMB. The share export path is created using the snapshot name and then the details are sent to NetBackup. Then, the host access configuration is added as read-only on newly created export/share.</p> <p>Following are the snapshot export path:</p> <ul style="list-style-type: none"> ■ NFS: <server-ip>:/<snapshot_name>/ ■ SMB: \\<server-ip>\<snapshot_name>\
Deport snapshot	<p>When a snapshot deport operation is initiated, Snapshot Manager for Data Center makes a POST XML API call to the PowerMax eNAS array to remove the host access configurations entry that is added during the export operation.</p>
Delete snapshot	<p>To delete a snapshot, NetBackup Snapshot Manager for Data Center initiates a POST XML API call with the required snapshot details.</p> <p>Then, confirms that the snapshot is deleted successfully on the array.</p>

PowerMax eNAS plug-in configuration parameters

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

- Ensure that a supported version of the PowerMax eNAS System Management Unit is installed on the PowerMax eNAS array.
- To view all the supported versions of PowerMax eNAS, refer to the *NetBackup Snapshot Manager* section, in the *NetBackup Hardware and Cloud Storage Compatibility List (HCL)*.
- A user account exists which have permissions to invoke the PowerMax eNAS XML APIs and all snapshot operations on the array.

Specify the following details when you configure the PowerMax eNAS array:

Table 5-36 PowerMax eNAS plug-in configuration parameters

Snapshot Manager for Data Center configuration parameter	Description
Plug-in ID	Provide a name for the plug-in.
Proxy/Array IP address	PowerMax eNAS array's management IP address, in either IPv4 or The Fully Qualified Domain Name (FQDN).
Username	PowerMax eNAS user account which has permission to invoke the eNAS XML APIs to perform all snapshot operations on the array.
Password	Password of the PowerMax eNAS XML API user account which is specified earlier.

Domain user permissions on the PowerMax eNAS array

The domain user must have privileges on the PowerMax eNAS array, to allow NetBackup to perform the backup of NAS share ACLs.

Considerations and limitations for PowerMax eNAS plug-in

Following considerations and limitations are applicable in a PowerMax eNAS environment:

- All snapshots are captured at the file system level and the snapshots are in read-only mode.
- Following are the character limitations on the array:
 - Any file system name is 240 characters.
 - NFS export path maximum length is 1024 characters.
 - SMB shares name length is 80 characters.
- You can enable the Unicode to change the limitations. In case of a snapshot name, the maximum length must be 240 characters.
- PowerMax eNAS plug-in does not support point-in-time (PIT) rollback restore of shares using snapshots.
- Following are the assets which the PowerMax eNAS array does not discover:
 - The shares and export which are created from the snapshot.
 - The shares which don't have the CIFS server linked.

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 5-37 CloudPoint operations on Qumulo plug-in

Snapshot Manager for Data Center operation	Description
Discover assets	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. For example, if the file system directories are [/home, /home/user1, /home/user2, /user1], then the discovered file system are [/home, /user1].
Create snapshot	To create a snapshot, Snapshot Manager for Data Center initiates an SDK method with the required information and snapshot name. The API returns the details of the snapshot. A typical snapshot created by Snapshot Manager for Data Center has the following naming convention: NB<unique_21digit_number>

Table 5-37 CloudPoint operations on Qumulo plug-in (*continued*)

Snapshot Manager for Data Center operation	Description
Delete snapshot	To delete a snapshot, Snapshot Manager for Data Center initiates 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.
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 initiated, 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.

Parameter	Description
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.
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

Permissions

SMB_SHARE_READ

SMB_SHARE_WRITE

SNAPSHOT_READ

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 114.. 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 form 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

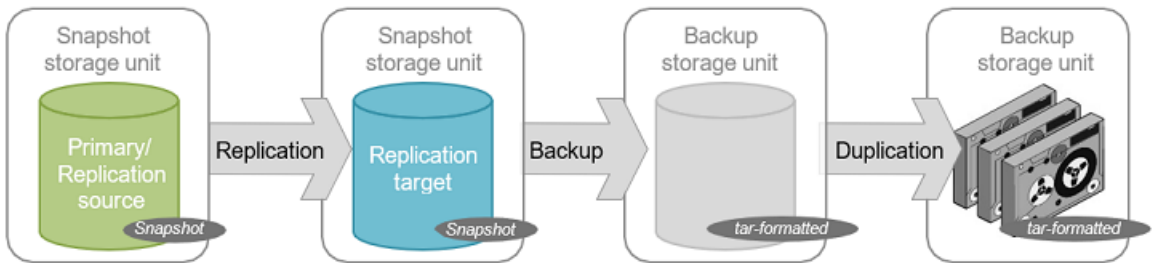


Table 6-1 Example of a storage lifecycle policy configured for snapshots and snapshot replication

Operation order in SLP	Operation	Description
1	Snapshot	<p>Operation 1 creates a snapshot in the primary storage. The snapshot serves as the source for the other operations in the SLP.</p> <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	<p>Operation 2 replicates the snapshot that the first operation created.</p> <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>. <p>Note: <Vendor>_<ReplicationType> is the replication type supported by the storage array vendor.</p>

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 form 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 form 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 form Snapshot** operation.
 - An **Index form 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 check box 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 form Snapshot**, **Duplication**, **Import**, **Index form 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 form snapshot operation uses the snapshot, then snapshot operation uses the storage unit that is selected for the Backup form 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 form Snapshot ■ Index form 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>

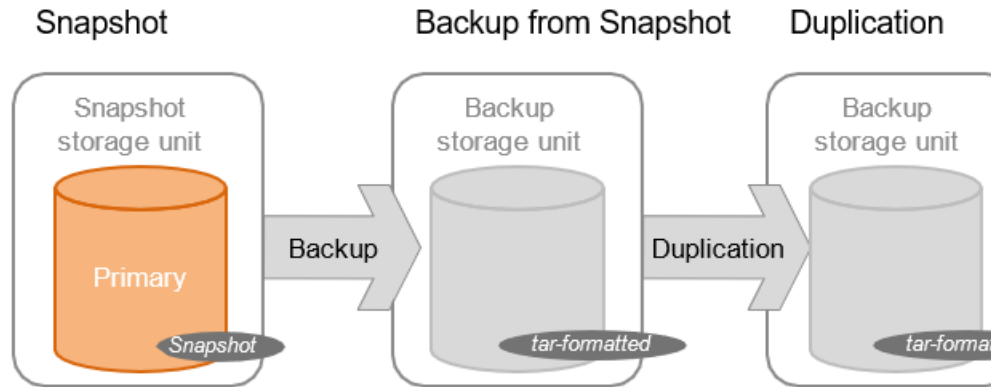
Table 6-2 Snapshot operation characteristics (*continued*)

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.

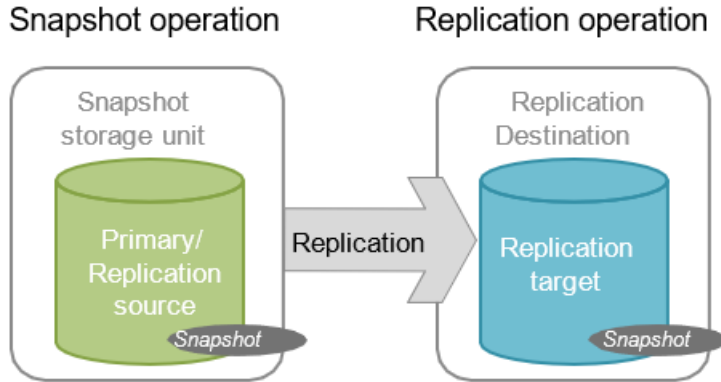


Primary + Replication source snapshot storage unit

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

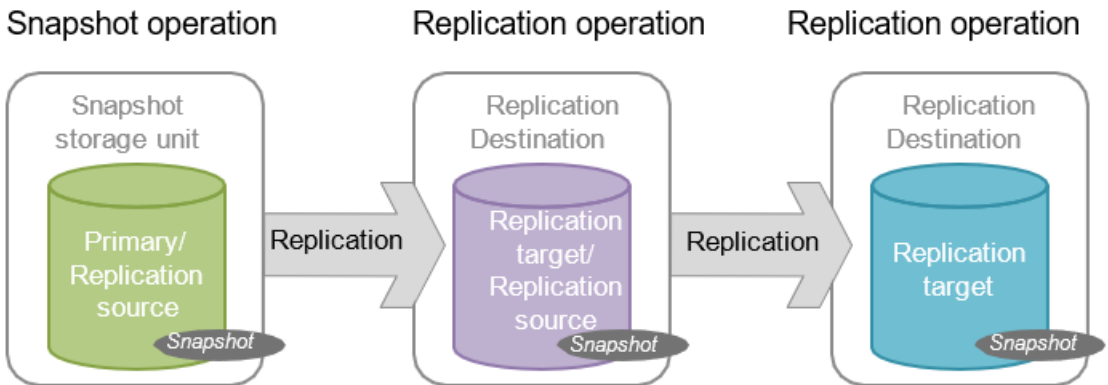
Figure 6-2 SLP that contains a snapshot operation and a replication operation



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.

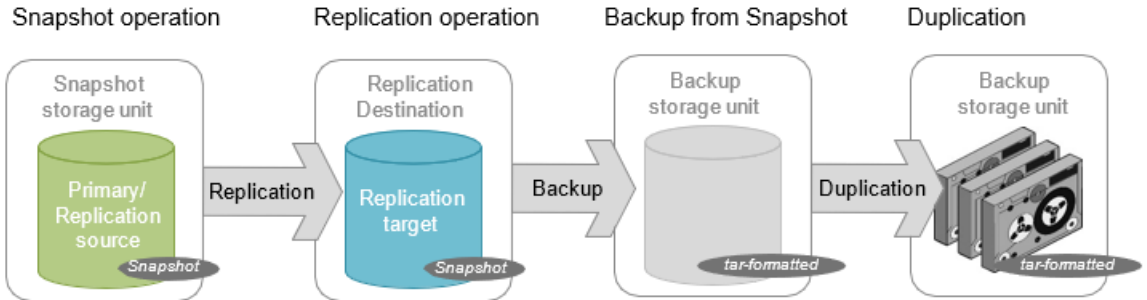
Figure 6-3 SLP that contains a snapshot operation and two replication operations



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

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 form 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 form snapshot operation also creates an image catalog file. An Index from snapshot may not be required if a Backup form 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.

Snapshot restore requires that the snapshot is mounted, regardless of whether an index from snapshot is performed or not.

Table 6-5 Index form 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 form 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 is mounted to create the image catalog file. See "Determining where and when the Index form snapshot operation occurs" on page 122.
Job type	An Index from snapshot operation generates an Index form 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 form snapshot operation occurs

The index from snapshot operation may be time consuming and slow down the system resources. For example, to perform the operation, it is required that the snapshot is mounted or NetBackup gathers content details from the file system to populate the catalog.

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

- Use the Storage lifecycle policy option in **Window** tab to schedule when the **Index form 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 delay to restore operations until earlier snapshots or replications are complete.
- Use the Index from snapshot operation in an SLP only once. You can perform a restore 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 form snapshot operation. The backup from snapshot operation creates an image .ε file. The only exception may be, 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.

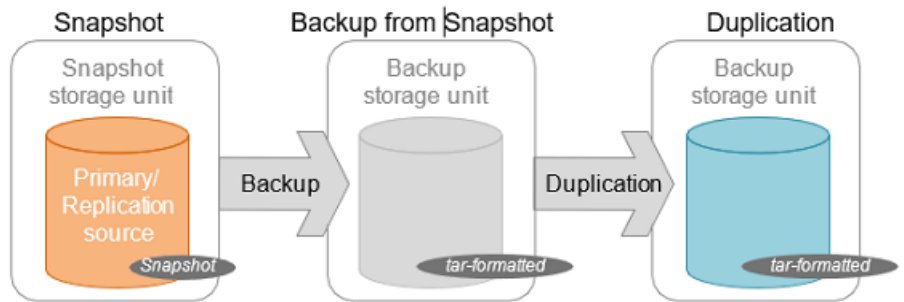
Table 6-6 Backup form snapshot operation characteristics

Characteristic	Description
Storage unit selection	The selection must be a backup storage unit or a backup storage unit group. The selection cannot be a snapshot storage unit or a snapshot storage unit group.
Child of	A Backup from snapshot operation must use a snapshot or replication operation as its source. Therefore, select the snapshot operation in the SLP when adding a Backup from snapshot operation.
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	A Backup from snapshot operation generates a Backup job in the Activity Monitor. 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.
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.

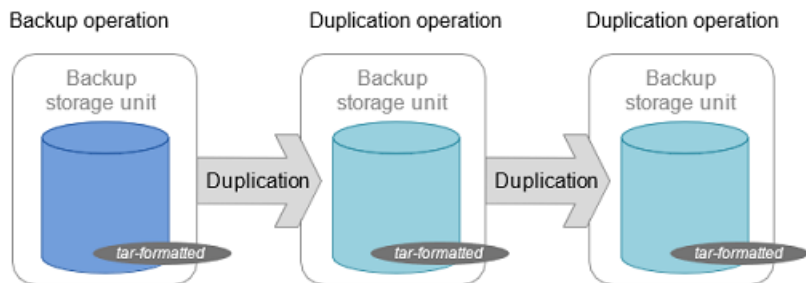
Table 6-7 Duplication operation characteristics

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

Table 6-7 Duplication operation characteristics (*continued*)

Characteristic	Description
Child of	<p>A Duplication operation can be the child of the following operations:</p> <ul style="list-style-type: none"> ■ Backup operation ■ Backup from snapshot operation ■ A Duplication operation <p>Therefore, select one of these operations in the SLP when adding a Duplication operation.</p>
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 form 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 form 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 form snapshot, Index form 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*.