

TECHNICAL WHITE PAPER

# Next-generation Snapshots and Replication with FlashArray and Veeam 12

A modern, fully integrated solution for snapshot, backup, replication, and offloading the snapshots from replication sites.

# Contents

<b>Introduction</b>	3
How to Use This Guide	3
<b>Veeam Backup &amp; Replication v12 and Universal API Version 2</b>	3
<b>Solution Architecture</b>	3
<b>Pure Storage Veeam Plugin v2</b>	3
<b>Setting Up Veeam Pure Storage Infrastructure and Backup Infrastructure</b>	4
Hardware Environment	5
Software Environment	5
<b>Use Cases</b>	5
Use Case 1: Performing a Snapshot-only Job and Replicating It to Secondary Storage (Async Replication)	5
Use Case 2: Performing Backup from the Snapshot Replicated to the Secondary Storage (Asynchronous Replication)	8
Use Case 3: Veeam Backup from Secondary Storage with Asynchronous Replication on FlashArray	12
Use Case 4: Performing Snapshot Offload to FlashBlade NFS	17
Use Case 5: Ransomware Protection with SafeMode	20
<b>Conclusion</b>	22
<b>About the Author</b>	23
<b>Appendix</b>	23
Veeam Pure Storage Infrastructure and Backup Infrastructure	23
Use Case: Performing Snapshot-only Jobs and Replicating Them to Secondary Storage (Async Replication)	24
Use Case: Veeam Backup from Secondary Storage with Synchronous Replication on FlashArray	27
Use Case: FlashArray Snapshot Offload to NFS	28



## Introduction

Maintaining backups to safeguard critical data against deletion is essential to a strong strategy to secure your organization from ransomware attacks. However, the overhead on production systems due to manageability, integration with backup software, and even stunning virtual machines (VMs) has increased complexity for storage administrators.

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## How to Use This Guide

The purpose of this guide is to provide an understanding of the technological challenges that can be addressed by Universal API (USAPI) version 2 as well as the recommended steps for setup, configuration, and operation.

## Veeam Backup & Replication v12 and Universal API Version 2

Pure Storage® and Veeam have jointly engineered a simple and modern solution integrating Pure Storage FlashArray//C™ and FlashArray//X™ with Veeam Backup & Replication.

With the release of Veeam 12, PureStorage and Veeam have jointly engineered the next generation of the Universal API to deliver enhanced capabilities and streamline the user experience to enable Veeam 12 to orchestrate FlashArray snapshots and replication. This unique capability allows Veeam to orchestrate the creation of a FlashArray snapshot, replicate that snapshot to another FlashArray, and then perform a backup from the replicated snapshot. This not only offloads highly-intensive backup operations from production systems, but also delivers increased resiliency as the snapshot copies can be replicated off-site before being backed up to a Veeam repository.

Further protection is provided by Pure Storage SafeMode™ Snapshot technology. SafeMode, a built-in feature of the Purity Operating Environment, helps guard against attacks, accidental deletion, or even rogue admins by adding additional security safeguards. From the moment Veeam orchestrates the creation of a FlashArray snapshot of mission-critical VMs, SafeMode can secure them. SafeMode also secures the replicated copy and the snapshots of the Veeam backup repository.

## Solution Architecture

Veeam's Pure Storage integration (vSphere only) creates fast backups from storage snapshots for quick and efficient item-level recovery; leverage Pure Storage snapshots and replicated snapshots to create a robust, enterprise-level data protection solution. Veeam Backup & Replication lets you leverage Pure Storage snapshots as a part of a comprehensive backup and recovery strategy, where snapshots and image-level backups complement each other. In order to successfully achieve all the features of Veeam universal storage application integration, you would need to upgrade the Veeam backup and recovery server to version 12 and download USAPI plugin v2 and install it.

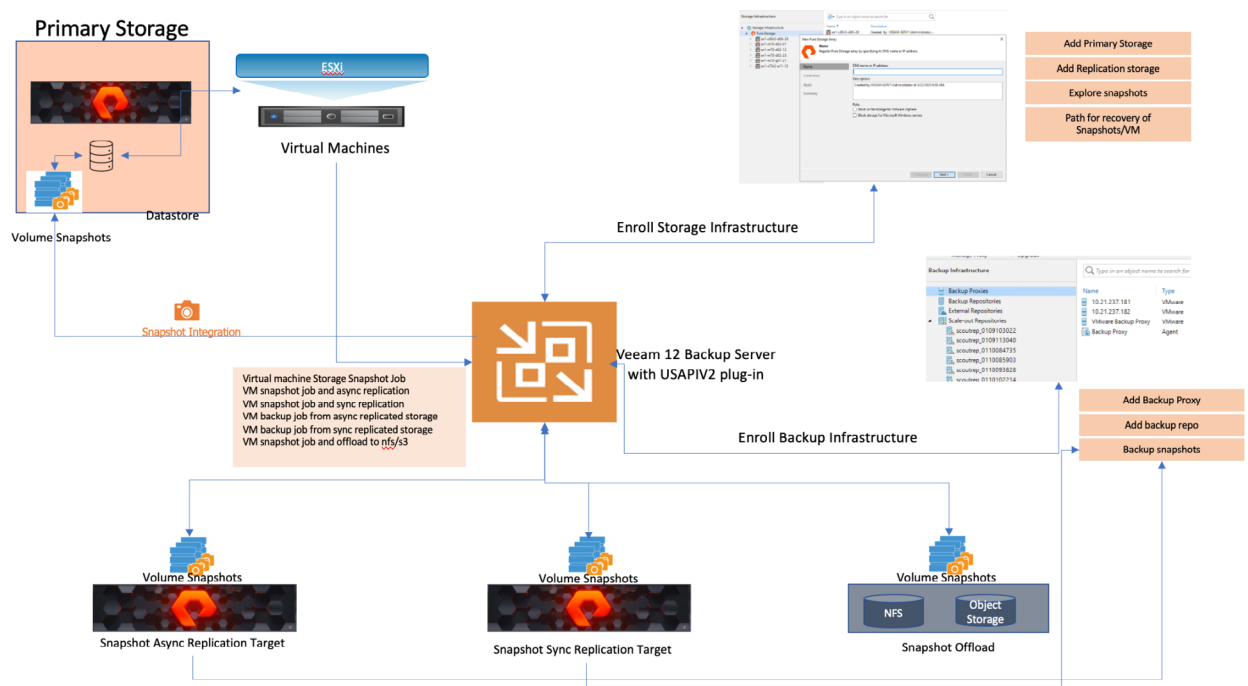
## Pure Storage Veeam Plugin v2

One of the most significant features with Veeam Backup & Replication is the Universal Storage API, which enables Pure Storage to integrate their storage to allow Veeam to take the volume level snapshots and later can be used to replicate it to another FlashArray via protection groups on the array level. The plugin is available on the Veeam site to download and install. For installation guide please refer to this [link](#).



Once the plugin is installed, enroll the Pure Storage FlashArray™ primary and secondary (replica site) in the storage infrastructure on the Veeam server. Registering the storage enables Veeam to perform the volume snapshot, replication, or backup and recovery options.

The following diagram illustrates the Veeam Backup & Replication server deployment specifically focuses on the Universal Storage Application Programming Interface Version 2 (USAPIv2) integration.



**FIGURE 1** Veeam Backup & Replication server deployment with the Universal Storage Application Programming Interface Version 2 (USAPIv2)

The source in this instance is a virtual machine hosted on a datastore which is served from all-flash FlashArray systems. For Veeam to run snapshot jobs on SAN volumes where virtual machines reside, the storage array needs to be registered in Veeam backup & Replication, under the Storage Infrastructure view.

## Setting Up Veeam Pure Storage Infrastructure and Backup Infrastructure

To configure the Veeam Pure Storage & Backup Infrastructure see the appendix section [here](#).

With Veeam plugin v2, the following backups workflow scenarios are supported:

- Application-consistent backup from storage snapshots
- Application-consistent backup from storage snapshot from async-replicated FlashArray storage
- Application-consistent backup from storage snapshot from sync replicated Flasharray storage





## Hardware Environment

To successfully use Veeam USAPI Plugin for Pure Storage, you need the following hardware environment:

- Windows server for Veeam install base, please see [this link](#) for details on supportability
- (Veeam Proxy server and backup repository)
- Pure Storage FlashArray as primary source
- Pure Storage FlashArray as replication target (optional, for replication purposes)
- Any NFS target or S3 target (optional, for offloading the snapshots)

## Software Environment

The following are the Software requirements to successfully deploy Veeam USAPIv2:

- Purity version 6.3 (specifically for Veeam snapshot offload) and above
- Veeam Backup & Replication server version 12
- Veeam USAPI v2 plugin for Pure Storage

## Use Cases

### Use Case 1: Performing a Snapshot-only Job and Replicating It to Secondary Storage (Async Replication)

#### Description

Snapshot-only jobs create a chain of storage snapshots on the primary storage array and optionally perform the replication to the secondary Pure Storage array for longer retention and for disaster recovery purposes. To successfully run the snapshot only jobs and asynchronous replication of the snapshots to another Pure Storage FlashArray, it is required to first configure the asynchronous replication and protection group setup of the primary storage FlashArray.

#### Value Proposition

The following are business implications from Veeam replication to secondary storage:

- Limits the IO and network bandwidth on the Primary storage and snapshot backups can be performed from replica target arrays
- Ability to restore to primary storage using reverse replication of snapshots to the original source
- Replication snapshot can be converted into a new volume and can be exposed as a new Datastore to service dev/test purposes
- Instant recovery of the virtual machine from the replica target array

## Reference Architecture



The following diagram illustrates the Veeam asynchronous replication snapshot job workflow. The Veeam virtual machine snapshot-only job will enroll the virtual machines in the job, it internally maps the FlashArray volumes supporting those VM's, takes a coordinated VMware snapshot followed immediately by a FlashArray snapshot, deletes the VMware snapshot, and then replicates the FlashArray snapshots to the FlashArray replication target specified in the protection group associated with the volumes.

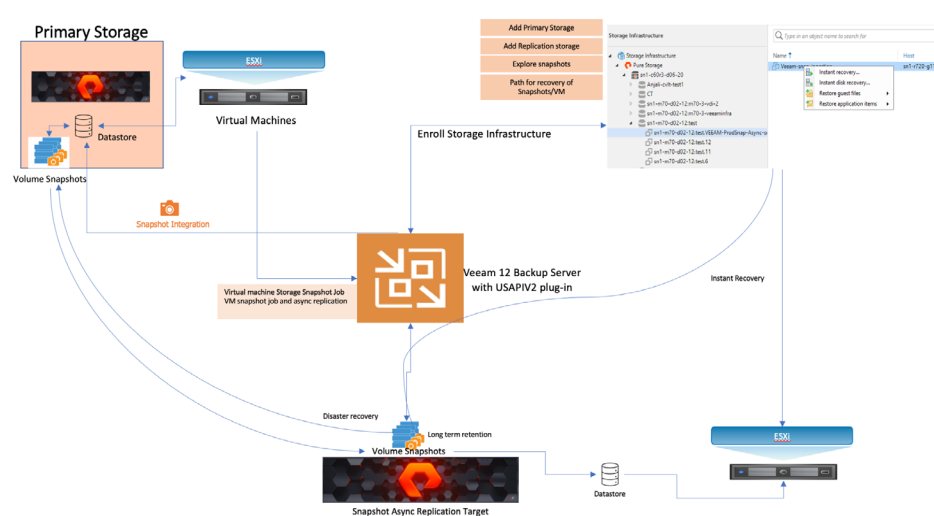


FIGURE 2 Veeam snapshot job with option of replicating to secondary storage with Pure Storage FlashArray

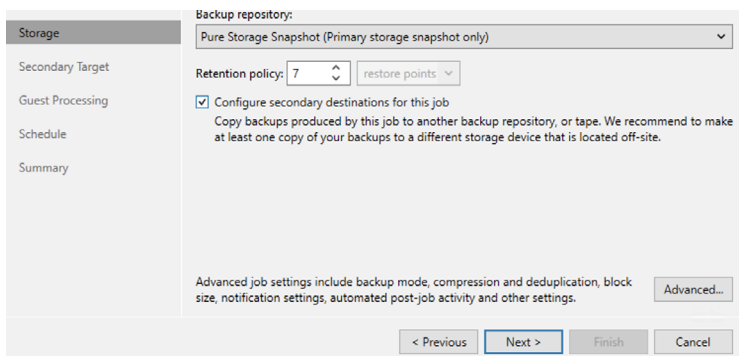
## Setting Up the Configuration

There are two main configuration steps for setup—Step 1—setup and configure [Asynchronous replication](#) and then Step (2) configure Veeam backup jobs, this is explained in the next section.

## Setup Veeam Snapshot and Replication Job

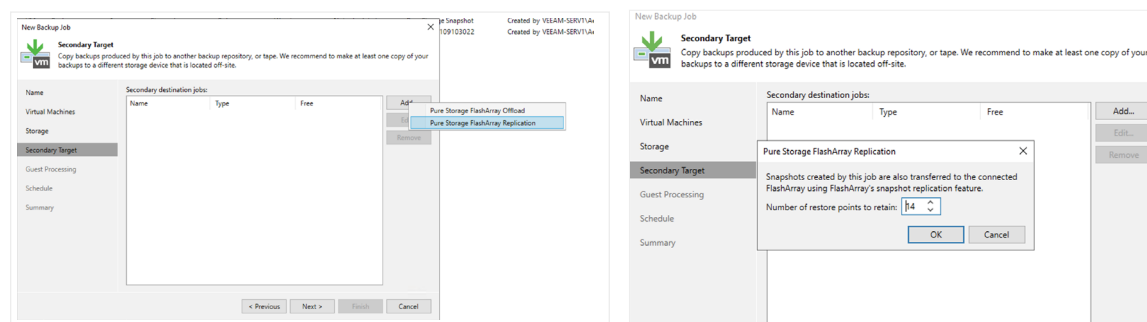
The key settings for the snapshot-only job and replicating the snapshots are:

- When creating a Veeam job policy for snapshot only, a primary storage system is selected at the storage step of the wizard as a repository. You can then select the retention restore points on primary storage.
- To replicate to a secondary FlashArray, at the Storage step of the wizard, select the Configure secondary destinations for this job option as shown in the figure below.

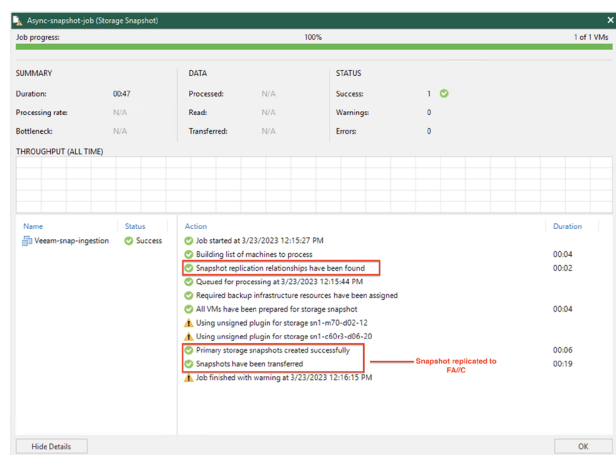


- At the Secondary Target step of the wizard, add the replication feature of a secondary storage array and the Number of snapshot copies to the retain field.



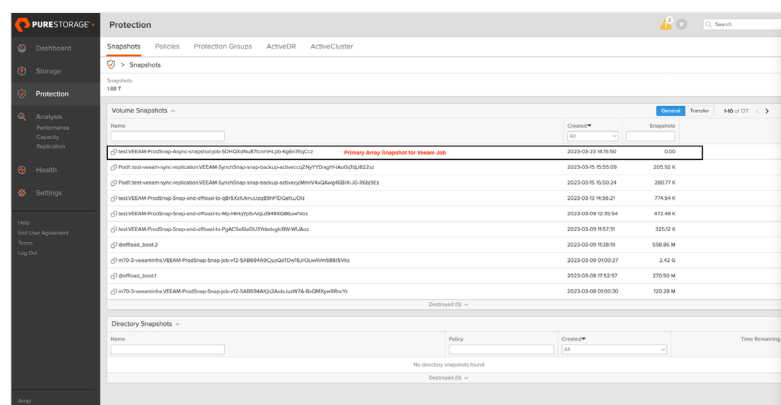


To create application-consistent, long-term storage snapshots, you can enable VMware Tools quiescence or application-aware processing. If you do not enable either of these options, Veeam Backup & Replication will produce a crash-consistent, long-term storage snapshot. Once the job is configured and submitted for the run, you will see the following message on the job run.

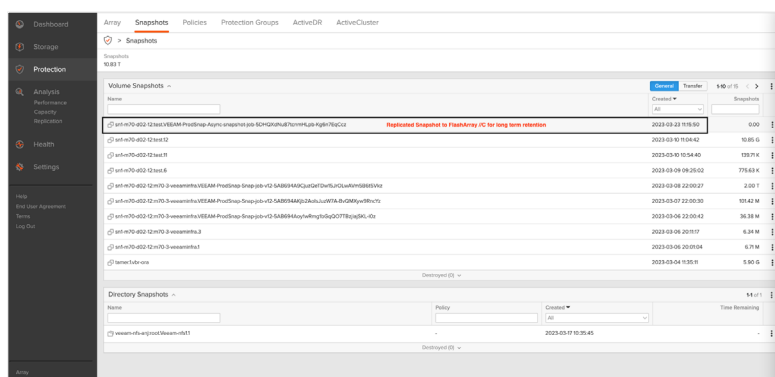


**FIGURE 3** Snapshot replication

Once the job is completed there will be a corresponding Veeam job snapshot on the primary array and the Veeam job will also perform the replication to the secondary array for long term retention. In this example, the snapshots are replicated to FlashArray //C as shown in the below screenshot.



**FIGURE 4** Primary Array Veeam Job created volume snapshot



**FIGURE 5** Replicated snapshot to another FlashArray (In this example the snapshot is replicated to FlashArray//C)

## Restore Snapshot

The following are restore paths that can be performed:

- Primary storage snapshots recovery in-place on the primary production FlashArray.
- VBR recovery of the virtual machine from primary storage snapshots, via exploring the volume of the primary storage infrastructure on the Veeam server.
- VBR recovery of the virtual machine from the replicated storage snapshot.

## Use Case 2: Performing Backup from the Snapshot Replicated to the Secondary Storage (Asynchronous Replication)

### Description

This is the extension of the Veeam snapshot replication job to secondary array, where the backups will be executed from the snapshots on the secondary storage. This requires the Veeam backup job to be configured on the VBR server, and requires selecting a secondary storage target as the data source to perform the backup from the replicated storage snapshot.

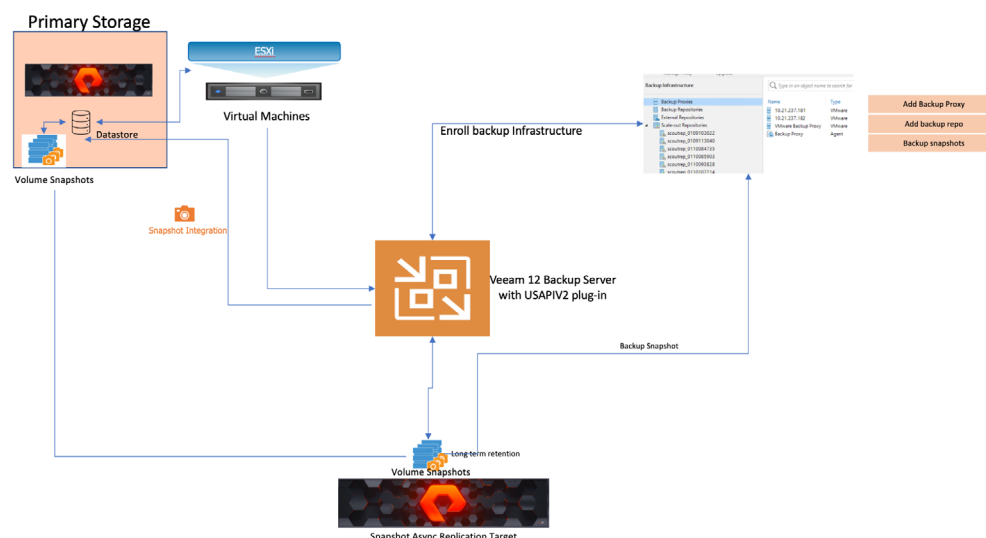
## Value Proposition

The following are the business implications from Veeam replication to secondary storage:

- Limit the IO and network bandwidth on the primary storage by performing backup from replicated snapshots on secondary array
- Restore to primary storage from backup copies
- Long-term retention on backup target for instant/Full and File level recovery

## Reference Architecture

The following reference architecture illustrates the workflow of performing a backup job from the secondary storage snapshot.



**FIGURE 6** Workflow of performing a backup from the secondary storage snapshot.

The snapshot-only jobs create a chain of storage snapshots on the primary storage array with the option to perform replication to the secondary Pure storage array for longer retention and for disaster recovery purposes. The Veeam backup from secondary job will instead create a backup copy from the snapshots replicated to the target array, retain the snapshots on both the replicated and primary sites, and the snapshots will expire based on the corresponding retention timeline. There is a provision to run both snapshot replication jobs and backup from snapshot that can be configured on Veeam backup job policy. Backing up from the secondary storage snapshot adds an extra layer to the data protection strategy and provides the ability to perform Full VM recovery, granular recovery, or for archival purposes. It can also be the path for recovery in case of man made or natural disasters.

## Underlying Backup Mechanism

Backup from snapshots on secondary storage arrays is similar to Backup from Storage Snapshots on the primary storage array. Veeam Backup & Replication analyzes which VMs in the job host their disks on the storage system and checks the backup infrastructure to detect if there is a backup proxy that has a direct connection to the storage system.

Veeam Backup & Replication detects whether the storage system uses snapshot transfer, and whether backup from a secondary storage array is possible. Veeam Backup & Replication triggers a VMware vSphere snapshot for a VM whose disks are hosted on the primary storage array. It instructs the storage system to create an application-consistent temporary storage snapshot, and it will transfer the snapshot to the secondary storage array. The temporary snapshot(s) capture the VMware vSphere VM snapshot, and the VMware snapshot is thus deleted as soon as the array snapshot has been created.

The temporary storage snapshot for a backup job is transferred from the primary storage array to the secondary storage array. The transferred temporary storage snapshot is mounted to the detected backup proxy. The backup job retrieves VM data from the mounted temporary storage snapshot. When the job finishes processing the VM, Veeam Backup & Replication instructs the storage system to delete the temporary snapshot on the primary storage array (except for one snapshot which is baseline snapshot for replication). The transported snapshot on the secondary storage becomes a long-term snapshot and remains in the snapshot chain until it is removed by the retention policy.

## Setting Up the Configuration

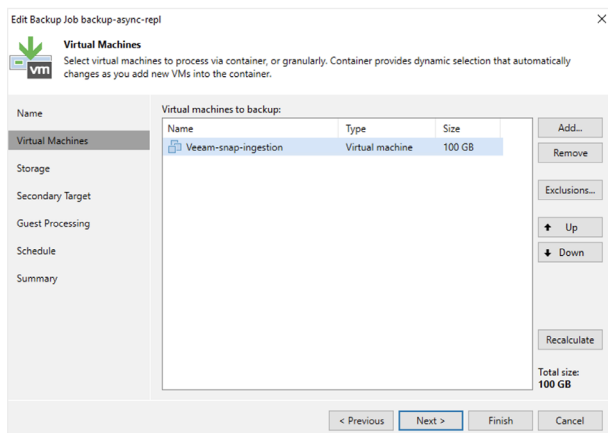
There are two main configuration steps for setup: Step 1 is setting up and configuring asynchronous replication (see link). Step 2 is configuring Veeam backup jobs, which is explained in the next section.

## Setting Up Veeam Backup Jobs

You can configure a backup job to create regular backup files in the backup repository, and additionally maintain a snapshot chain on the storage system. Veeam Backup & Replication lets you create long-term storage snapshots in the following destinations:

- Secondary storage arrays (retain for long term retention)
- Backup from the secondary storage (with policy retention)

Depending on the backup job settings, the storage snapshots can be application-consistent or crash-consistent. The following screenshots show the creation of a Veeam backup to repository job, with secondary storage snapshot replication and use of the replicated snapshot for backup data ingest.



Creating a Veeam backup

At the “Storage” step of the wizard, check the box for **Configure secondary destinations for this job**. In the Advanced settings, check the box for **Enable backup from storage snapshots**. By default, this option is enabled. At the Secondary Target step of the wizard, add Pure Storage FlashArray Replication and enable the **Use as the data source** check box.

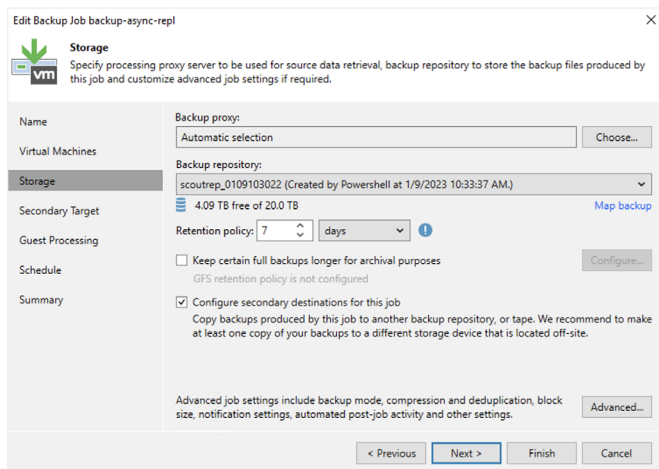


FIGURE 8 Storage wizard



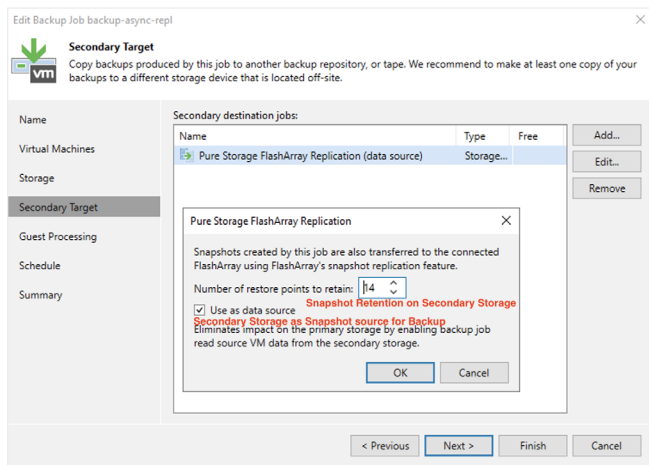


FIGURE 9 Setting restore points.

## Backup Job Execution Workflow

Below are the steps to execute a backup job.

1. Veeam Backup & Replication triggers the vCenter Server to create a VMware vSphere snapshot for a VM.
2. Veeam Backup & Replication instructs the storage system to create the snapshots of a volume or LUN capturing VM disks. A temporary snapshot is created for backup and replication operations. This snapshot is removed after backup or replication is complete.
3. Veeam Backup & Replication removes the VMware vSphere VM snapshot.
4. Veeam Backup & Replication uses the storage snapshot as a data source for backup and replication.
5. Veeam Backup & Replication performs cleanup operations and removes the temporary snapshot on the storage array if applicable.
6. Veeam Backup & Replication checks the number of long-term storage snapshots in the snapshot chain on the secondary storage. If the number exceeds the value defined in retention policy settings, Veeam Backup & Replication instructs the storage system to remove the earliest snapshot from the snapshot chain. For more information on Veeam settings please refer to this [link](#).

Following is the screenshot from VBR server showing the backup job from the replication target; in this example we have used FlashArray//C as a replicated target for both snapshots and performing backup from snapshots.



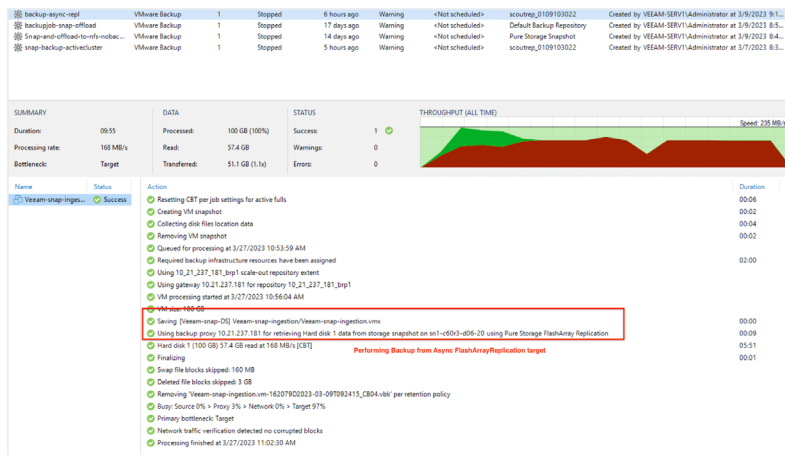


FIGURE 10 Screenshot from VBR server showing the backup job from the replication target

## Use Case 3: Veeam Backup from Secondary Storage with Asynchronous Replication on FlashArray

### Description

Backing up from snapshots on secondary storage arrays is similar to backing up from storage snapshots on the primary storage array. The algorithm differs slightly for snapshot transfer and synchronous replication. Veeam Backup & Replication analyzes which VMs in the job host their disks on the storage system and checks the backup infrastructure to detect if there is a backup proxy that has a direct connection to the storage system. In this use case you can use the secondary storage array as a data source for backup. Backup from snapshots on secondary storage arrays reduces the impact on the production storage. During backup, operations on VM data reading are performed on the side of the secondary storage array, and the primary storage array is not affected.

### Value Proposition

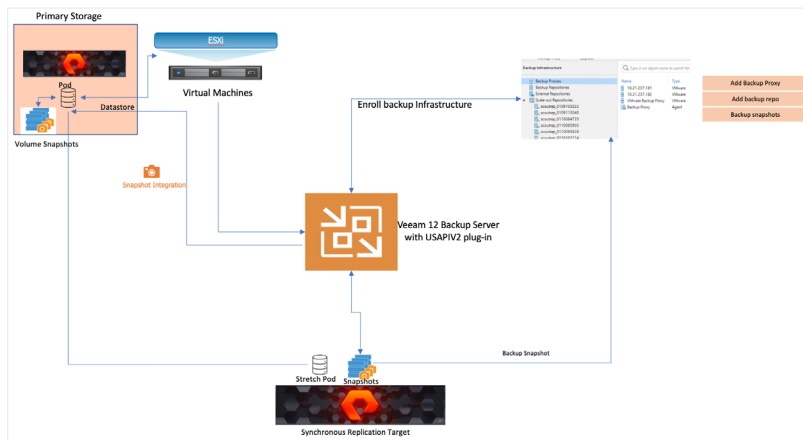
The following are the business implications from Veeam backup from secondary storage:

- Limit the IO and network bandwidth on the Primary storage by performing backup from replicated snapshots on secondary array.

### Reference Architecture

The following diagram illustrates the architecture of synchronous replication and Veeam backup and snapshot job.





**FIGURE 11** Synchronous replication and Veeam backup and snapshot job replication

Veeam Backup & Replication analyzes which VMs in the job host their disks on the storage system and checks the backup infrastructure to detect if there is a backup proxy that has a direct connection to the storage system. VBR detects whether the storage system uses synchronous replication, and whether backup from a secondary storage array is possible. VBR triggers a VMware vSphere snapshot for a VM whose disks are hosted on the primary storage array, and creates an application-consistent temporary storage snapshot. The created temporary storage snapshot is mounted to the detected backup proxy. When the job finishes processing the VM, Veeam Backup & Replication instructs the storage system to delete the temporary snapshot on the secondary storage array.

## Underlying Backup Mechanism

For the synchronous replication feature—in this case Pure Storage Array ActiveCluster™ Replication—the “Use as the data source” option is enabled by default and cannot be changed. Veeam Backup & Replication will create backups from temporary snapshots created on the secondary storage array, snapshots created on the primary storage array will not be used for backup.

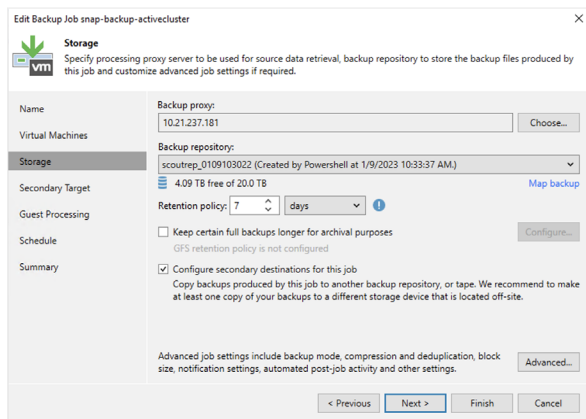
## Setting Up the Configuration

There are two main configuration steps for setup: Step 1—setting up and configuring [synchronous replication](#) and Step 2—configuring Veeam backup jobs, which is explained in the next section.

### Set Up Backup from Secondary Storage Snapshots

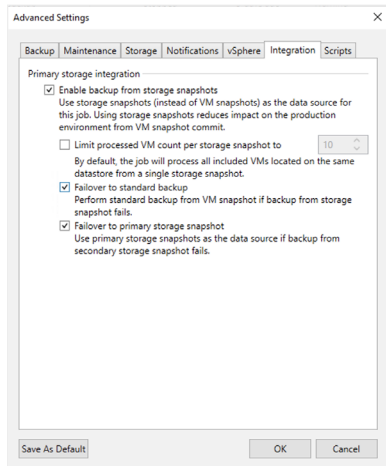
At the storage step of the configuration wizard, select backup proxy. In the retention policy section, specify the number of backup restore points that you want to keep. Select the “Configure secondary destinations for this job” checkbox, as shown in the below screenshot.





**FIGURE 12** Storage step of the configuration wizard

Make sure that the “Enable backup from storage snapshots” checkbox is selected in the advanced settings. If Veeam Backup & Replication fails to create a temporary storage snapshot, VMs whose disks are located on the storage system will not be processed by the job. To fail over to the regular data processing mode and back up such VMs, select the “Failover to standard backup” checkbox. If Veeam Backup & Replication cannot create a temporary storage snapshot on the secondary storage array, the job will not back up VMs whose disks are located to the storage system. To fail over to backup from storage snapshots on the primary storage system, select the “Failover to primary storage snapshot” checkbox.



**FIGURE 13** Configuration wizard advanced settings

At the Secondary Target step of the wizard, click Add and select a replication feature that Veeam Backup & Replication will use to create backups.



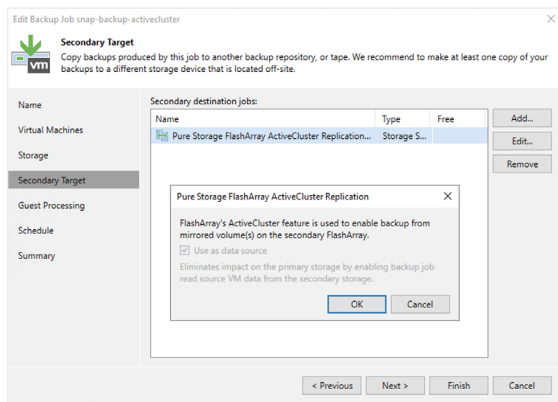


FIGURE 14 Secondary target wizard

For the synchronous replication feature, if you do not select an option to create snapshots on the primary storage array at the Secondary Target step and select only the synchronous replication feature, then the VBR will create only temporary snapshots for backup purposes. The snapshot chain (long-term snapshots) will not be created on either the primary storage array nor on the secondary storage array. To create a snapshot chain, you would also need to add the option to create snapshots on the primary storage array and specify the number of snapshot copies to retain as shown below screenshot. In this case, long-term snapshots will be created simultaneously on the primary and secondary storage arrays; that is, coordinated snapshots will be created. Veeam Backup & Replication will retain the same number of snapshots on both storage arrays.

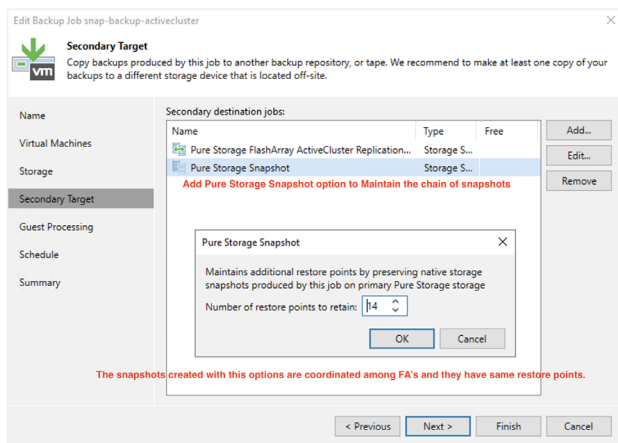


FIGURE 15 Secondary target wizard

The following are the screenshots of the Veeam Backup Job and the primary and secondary FlashArrays from where the snapshot and backup were executed respectively.



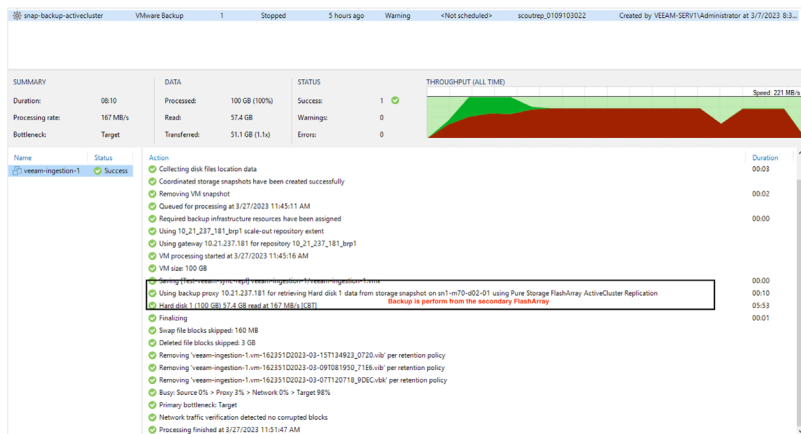


FIGURE 16 Veeam Backup Job from secondary storage with synchronous replication

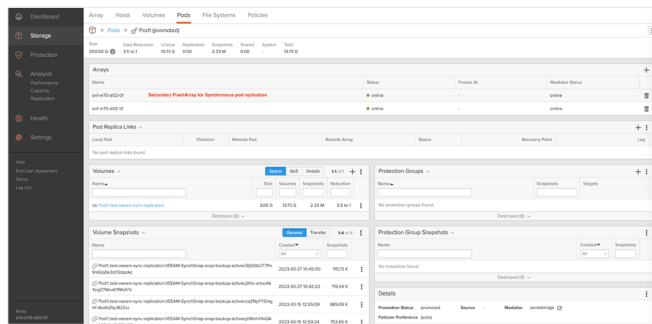


FIGURE 17 Primary and Secondary FlashArray Synchronous replication

## Restore

- To restore an instant virtual machine from the Veeam interface, browse to the storage infrastructure of the secondary FlashArray on the VBR.

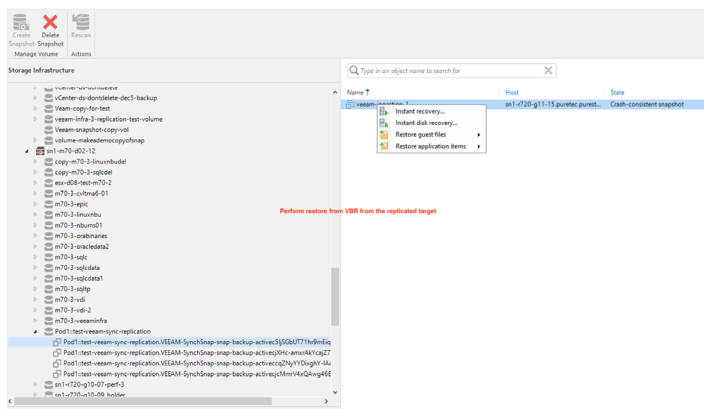


FIGURE 18 Browsing to the storage infrastructure of the secondary FlashArray on the VBR

- Perform the entire volume restore from replicated Snapshot to the original volume in case of any human error deletion or disaster to the primary array or volume.

## Use Case 4: Performing Snapshot Offload to FlashBlade NFS

### Description

FlashArray snapshots are used for data protection, test/dev, cloning, and replication workflows. Offloading snapshots to NFS extends the functionality by adding the ability to move snapshots off the FlashArray on NFS storage target. Encapsulation of metadata along with the data blocks makes these snapshots truly portable, so they can be offloaded from Pure FlashArray to any heterogeneous NFS storage target, and are recoverable to any Pure FlashArray appliance.

Some examples of NFS storage target that can be used with snapshot offload to NFS are:

- The Pure Storage FlashBlade® appliance
- Third party NFS storage appliances
- Generic Linux servers

### Value Proposition

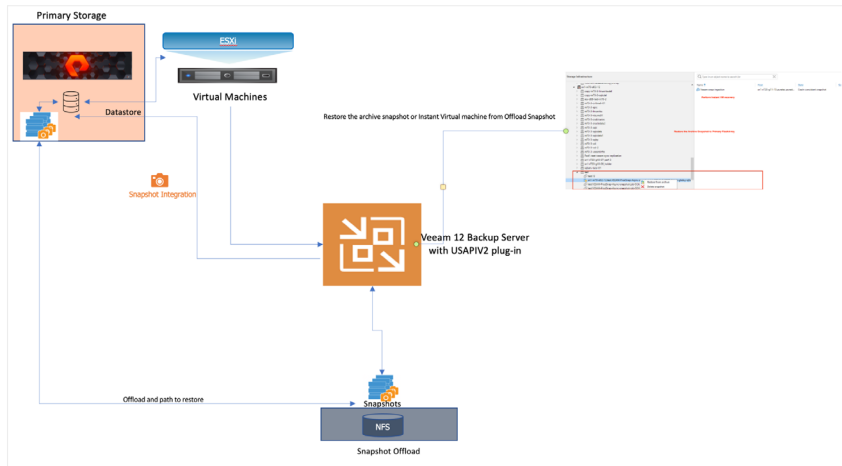
Since Snap to NFS was built from scratch for the FlashArray system, it is deeply integrated with the Purity Operating Environment, resulting in highly efficient operation. A few examples of the efficiency of Snap to NFS are as follows:

- Snap to NFS is a self-backup technology built into FlashArray. No additional software licenses or media servers are required. There is no need to install or run a Pure software agent on the NFS target either.
- Snap to NFS preserves data compression in transit and on the NFS target, saving network bandwidth and further increasing the efficiency of inexpensive NFS storage appliances, even the ones without built-in compression
- Snap to NFS preserves data reduction across snapshots of a volume. After offloading the initial baseline snapshot of a volume, it only sends delta changes for subsequent snaps of the same volume. The snapshot differencing engine runs within the Purity Operating Environment in the FlashArray, and uses a local copy of the previous snapshot to compute the delta changes. Therefore, there is no back and forth network traffic between the FlashArray and the offload target to compute deltas between snapshots, further reducing network congestion. As a result:
  - Less space is consumed on the NFS target.
  - Network utilization is minimized.
  - Backup windows are much smaller.
- Snap to NFS knows which data blocks already exist on the FlashArray, so during restores, it only pulls back the missing data blocks to rebuild the complete snapshot on the FlashArray. In addition, Snap to NFS uses dedupe-preserving restores, so when data is restored from the offload target to the FlashArray, it is deduped to save precious space on the FlashArray

### Reference Architecture



The following diagram illustrates the Veeam snapshot offload to FlashBlade NFS target for longer retention and rapid recovery.



**FIGURE 19** Veeam snapshot offloading to FlashBlade NFS target for longer retention and rapid recovery

The Veeam snapshot offload feature is supported on Purity 6.3 and above. The Veeam snapshot offload job can be configured on the virtual machine with the corresponding volume on the FlashArray. The Veeam snapshot job will create a corresponding volume snapshot with Veeam defined retention and the same job is configured to offload to a secondary target with its own retention timeline. The offload snapshot feature can serve as a long-term archiving for years and it can serve to restore the entire snapshot to original FlashArray and later can be restored to the original volume. The recovery of archive snapshots can be performed from the Veeam backup and recovery storage infrastructure via browsing to the volume of the primary storage and selecting the archived snapshot to restore.

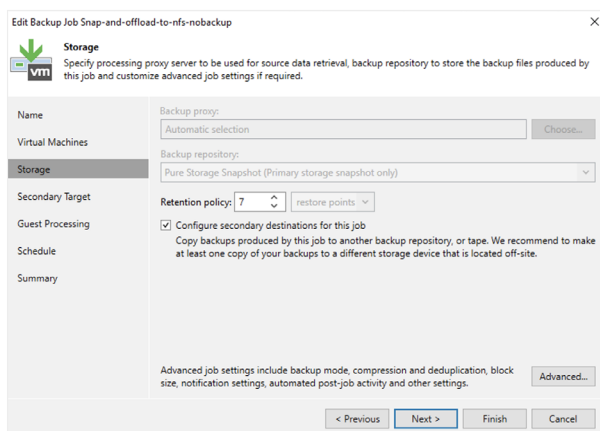
## Setting Up the Configuration

There are two main configuration steps for setup: Step 1—set up and configure [Snap to NFS offload](#), followed by Step 2—configuring Veeam Snapshot Offload, which is explained in the next section.

### Setup Veeam Snapshot Offload

The key settings for the snapshot-only job and snapshot offloading to NFS are:

- When creating a Veeam job policy for snapshot only, at the Storage step of the wizard, a primary storage system is selected as a repository as shown in below figure, and select the retention restore points on primary storage.



**FIGURE 20** Selecting a primary storage system for a repository



## Snapshot Offload Policy Configuration

- To perform the snapshot offload to NFS target at the Storage step of the wizard, select the “Configure secondary destinations for this job” option and select Pure Storage FlashArray Offload from the list.

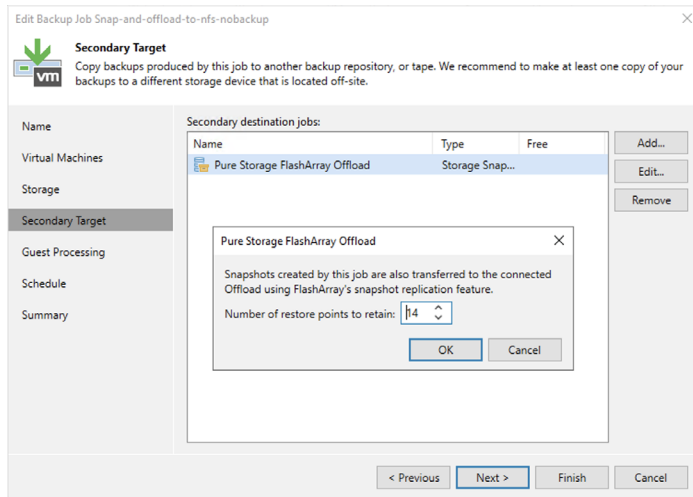


FIGURE 21 Pure Storage FlashArray snapshot offload and setting the retention

Once the job is successfully configured and executed, the VBR will detect the offload relationship of the volume on the FlashArray protection group, and it will perform the snapshot on the primary array and later will offload it to the configured NFS target on FlashArray, below is the screenshot of the job run on the Veeam server.

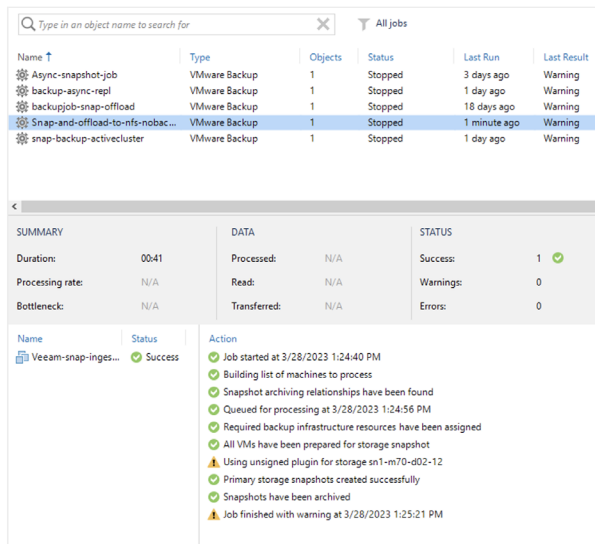


FIGURE 22 Running a job on the Veeam server



## Restore from NFS Offload Target

- You can perform the Veeam snapshot restore from the Veeam backup and recovery server via the Storage infrastructure tab and navigating to the primary FlashArray storage volume. The snapshots can be restored by expanding the volume as shown in the screenshot below.

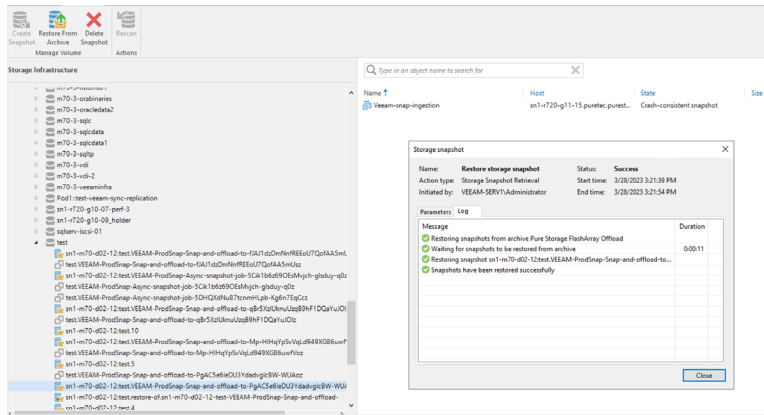


FIGURE 23 Expanding the volume

- The restore also supports performing an instant recovery of the virtual machine after the snapshot is unarchived to the original Flasharray.
- The archived snapshot can also be recovered directly on the original FlashArray or new FlashArray (provided the same offload target is configured) and this has to be executed using API or CLI; there is no option in the FlashArray UI to perform the restore on volume snapshots from the offload target. Use the following command to perform the volume snapshot restore directly to the FlashArray.

```
purevol get [snapName] --on [offload_name]
```

```
pureeng@sn1-m70-d02-12-ct0:~$ purevol get sn1-m70-d02-12:test.VEEAM-ProdSnap-Snap-and-offload-to-qBr5XzIUknuUzqB9hF1DQaYuJOIz --on FB
Name                               Size Source Created          Serial
sn1-m70-d02-12:test.restore-of.sn1-m70-d02-12-test-VEEAM-ProdSnap-Snap-and-of-18507 200G test 2023-03-13 15:56:21 EDT 5AB694A6739142470001484B
pureeng@sn1-m70-d02-12-ct0:~$
```

## Use Case 5: Ransomware Protection with SafeMode

Just performing snapshots or snapshot replication can help safeguard critical data against common scenarios such as recovering from natural or human-made disasters, data corruption, or accidental deletions. However, ransomware attacks can stress your existing data protection infrastructure more than expected, especially if it's built on legacy architectures such as disk and tape. If you're already struggling to meet recovery service level agreements (SLAs), a ransomware attack can intensify the situation with additional, unplanned downtime. An attack can compromise your primary data, snapshots and data, which could require you to reinstall and reconfigure your backup solution before even contemplating data recovery, and if due to some human error or rouge if snapshots are deleted there is no path to recovery without SafeMode™ Snapshots feature enabled for enhanced protection.

FlashArray with SafeMode Snapshots works well as the underlying storage for Veeam Backup & Replication (VBR) Backup Repositories due to the fact that VBR backup files are "portable." This means that they do not rely on any external metadata—





such as a central database or a catalog—to perform a recovery operation. A customer with access to a FlashArray snapshot containing the backup files from VBR Backup Repository can recover the protected workloads even if all other components of the Veeam environment have been lost. SafeMode extends the core immutability of all FlashArray snapshots to protect against administrative error or credential compromise by a malicious actor with a focus on having a snapshot before the point of encryption.

SafeMode offers an additional protection level with a new approach to mitigating these attacks when using Pure FlashArray systems. SafeMode snapshots, a built-in feature of the Purity operating environment, enable you to create immutable, read-only snapshots of primary data with retention period of snapshots set to minimum 14 days, and it overwrites the Veeam generated snapshot retention timeline. In case of ransomware attacks or accidental deletes on the Veeam generated snapshots of the volume get impacted or deleted, the snapshots will not be eradicated from the system completely and in case of disaster the snapshots can be recovered back to the original filesystems, helping guard against attacks by ransomware and even rogue administrators. Deploying Pure's all-flash solutions with Veeam provides:

- **Complete protection:** SafeMode snapshots not only protect your Veeam Backup repository but also protect FlashArray snapshots created locally or replicated from another FlashArray.
- **Enhanced ransomware protection:** Ransomware can't eradicate (delete), modify, or encrypt SafeMode snapshots. Only an authorized designee from your organization working directly with Pure Technical Support can configure, modify policies, or manually eradicate snapshots.
- **Fast restore:** FlashArray's all-flash architecture scales with data to speed backups and recovery.

Pure leverages the tightly coupled integration between FlashArray snapshots and Veeam through the jointly developed Universal API. Veeam orchestrates and manages FlashArray-created snapshots and presents them through the Veeam management UI. And with FlashArray SafeMode snapshots, you can mitigate the risks associated with ransomware attacks or admin mistakes.

### SafeMode Enablement

SafeMode is easy to configure: Call Pure Support to request SafeMode be enabled and provide additional (up to five) contacts that are authorized to request SafeMode changes. Support will issue a six-digit PIN for each authorized user to be used for any future changes. While SafeMode itself is either on or off, the eradication timer is configurable. Most of our customers settle on 14 days but the timer can be extended up to 30 days.

SafeMode is an easy, no-extra-cost feature that prevents permanent loss of data due to admin mistakes or malicious ransomware attacks. It works by simply preventing the eradication of snapshots for a configured time frame. In the event of an attack, instead of suffering painful and very public downtime only to wind up paying a ransom, you simply remove the attacker's encrypted data and instantly restore your data from a prior point in time. To enable it, all you need to do is call support, establish your contacts, and set the timer length. Those three steps will give you a simple, pro-active victory before potential disaster strikes.



## Estimate Capacity Requirements

To estimate the capacity required for SafeMode snapshots, you need the baseline size, daily change rate, and expected data reduction rate.

With the captured data:

- Apply the reduction rate to the daily change rate and multiply it by the number of days you will retain the SafeMode snapshots.
- Add the baseline size to calculate the total expected capacity required for SafeMode snapshot implementation. Here's an example:
- In an environment with 300TiB of data, the baseline size after initial data reduction is 180TiB.
- If the daily change rate is 10TiB and data reduction is 2:1, the overall backup change rate is 5TiB per day.
- Across a seven-day retention period, there would be 35TiB of data change, plus another 35TiB kept in snapshots. The total additional capacity would be 250TiB.

For further sizing considerations please work with your Pure Storage account team.

## Conclusion

Veeam Backup & Replication provides complete orchestration and management of snapshots and replicas on FlashArray systems from the data center to remote sites. This integration allows performing snapshots of the volumes associated with Virtual machines and ability to be replicated to another FlashArray//X or FlashArray//C. With this integration our customers can also perform backup of the snapshots from secondary storage target (replicated site) for both synchronous and asynchronous replicated target. FlashArray snapshots are space-efficient, fast to recover from, and provide deep integration with Veeam. The Pure Storage Plugin is available for free and may be downloaded from the Veeam website.

Pure Storage integration with Veeam provides:

- Agentless, application-consistent array-based snapshot backups.
- Veeam management and orchestration of FlashArray snapshots, backups, and replicas from the data center to a remote site.
- Snapshot offload from primary storage snapshots for long term archival purposes
- Auto-on SafeMode—source snapshot, replicated snapshot, and Veeam backup repository





## About the Author

Mandeep Arora is the Pure Storage Data Protection Solutions Architect responsible for defining data protection solutions partnered with various backup applications. He is responsible for defining solutions and reference architecture for primary workloads such as Oracle, SQL, and VMware based on the company's products, and performance benchmarks. He also led the FlashRecover™ solutions from concept to fully integrated modernized data protection. Mandeep has spent over 16 years of his career with the data protection industry, he has the flavor working with various data protection products

meant for small and medium businesses as well as large enterprises. He started his career with IBM Tivoli Storage Manager in the core software development and test team, followed by Isilon Systems, where he was responsible for delivering the NAS backup solution to enterprise class customers. He was also a part of the Veritas storage solutions team and was responsible for technical relationships and advising partners on data protection for VMware.

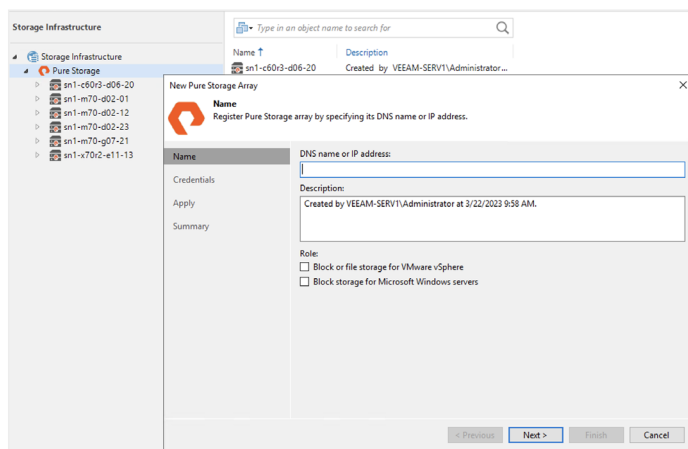
## Appendix

### Veeam Pure Storage Infrastructure and Backup Infrastructure

Veeam Backup & Replication lets you leverage Pure Storage snapshots as a part of a comprehensive backup and recovery strategy where Pure Storage snapshots and image-level backups complement each other. With Veeam Backup & Replication, you can perform:

- Application consistent snapshots on primary storage FlashArray
- Application consistent snapshots and asynchronous replication to secondary FlashArray for long term retention
- Application consistent snapshots with synchronous replication to another FlashArray
- Application consistent snapshots and offload it to S3 or any NFS target for long term retention

Adding the storage infrastructure to Veeam is straightforward, open the Veeam console and maneuver to storage infrastructure and add primary storage and replication storage array into VBR server as shown in the below screenshot.



**FIGURE 24** Adding FlashArray Storage to Veeam Backup and Recovery Server.

**NOTE:** For this release the plugin only supports a single replication target.

### Adding Backup Infrastructure



Before executing the Veeam backup jobs for Pure Storage snapshots in Veeam Backup & Replication, the backup infrastructure must be properly configured, such as setting up the Veeam backup server's proxy component which will be used for scanning VMFS on Pure Storage volumes and will be used for performing snapshots on the volume on Pure Storage. The backup proxy must be configured with iSCSI or Fibre Channel protocol access to the FlashArray, including best practices as provided through the Pure Storage support portal. The proxy server initiator also needs to be registered on FlashArray and configured for the Volume to be snapshotted. For more details on the configuration refer to the [Veeam pure deployment guide](#).

## Use Case: Performing Snapshot-only Jobs and Replicating Them to Secondary Storage (Async Replication)

### Asynchronous Replication

Asynchronous replication leverages Purity snapshots. A snapshot is created on the source, and that snapshot is replicated to the target array. The first transfer, known as the baseline, is a complete transfer of the entire contents of the volume. After the baseline copy is performed, the replication process performs incremental transfers by differencing the previously replicated snapshot and a newly created snapshot to determine which data to send to the target array.

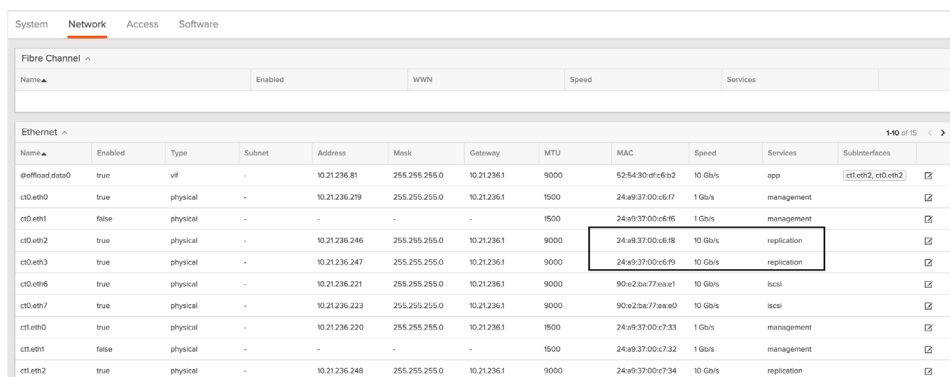
Asynchronous replication can be configured using the Purity web GUI, CLI, or by REST API. Configuring replication using the GUI is very straightforward. Configuring replication consists of the following high-level actions:

1. Review the requirements for replication
2. Connect the source and target array
3. Create a protection group and add secondary FlashArray
4. Add volumes for the corresponding virtual machines to the protection group

### Requirements for Replication

Asynchronous replication requires the following configuration items before proceeding with replication:

1. The source and target arrays must be connected to Ethernet switches. Direct connecting two storage arrays for replication is not supported.
2. Each FlashArray must have four physical replication interfaces with two per controller or a replbond interface configured with the replication service assigned. The replication interfaces can be managed in the Settings > Network tab as shown below.



System <b>Network</b> Access Software											
Fibre Channel											
Name	Enabled	WWN	Speed	Services							
Ethernet											
Name	Enabled	Type	Subnet	Address	Mask	Gateway	MTU	MAC	Speed	Services	Subinterfaces
@offload.data0	true	vif	-	10.21.236.81	255.255.255.0	10.21.236.1	9000	52:54:00:a9:c6:b2	10 Gb/s	app	ct0.eth2, ct0.eth3
ct0.eth0	true	physical	-	10.21.236.219	255.255.255.0	10.21.236.1	1500	24:a9:37:00:c6:f7	1 Gb/s	management	
ct0.eth1	false	physical	-	-	-	-	1500	24:a9:37:00:c6:f6	1 Gb/s	management	
ct0.eth2	true	physical	-	10.21.236.246	255.255.255.0	10.21.236.1	9000	24:a9:37:00:c6:f8	10 Gb/s	replication	
ct0.eth3	true	physical	-	10.21.236.247	255.255.255.0	10.21.236.1	9000	24:a9:37:00:c6:f9	10 Gb/s	replication	
ct0.eth6	true	physical	-	10.21.236.221	255.255.255.0	10.21.236.1	9000	90:c2:b6:77:ee:e1	10 Gb/s	iscsi	
ct0.eth7	true	physical	-	10.21.236.223	255.255.255.0	10.21.236.1	9000	90:c2:b6:77:ee:e0	10 Gb/s	iscsi	
ct1.eth0	true	physical	-	10.21.236.220	255.255.255.0	10.21.236.1	1500	24:a9:37:00:c7:33	1 Gb/s	management	
ct1.eth1	false	physical	-	-	-	-	1500	24:a9:37:00:c7:32	1 Gb/s	management	
ct1.eth2	true	physical	-	10.21.236.248	255.255.255.0	10.21.236.1	9000	24:a9:37:00:c7:34	10 Gb/s	replication	

FIGURE 25 Managing replication interfaces

**NOTE:** If Replbond is used, a mix of 1GbE, 10GbE, and 25GbE ports are not supported in the same replication replbond interface.

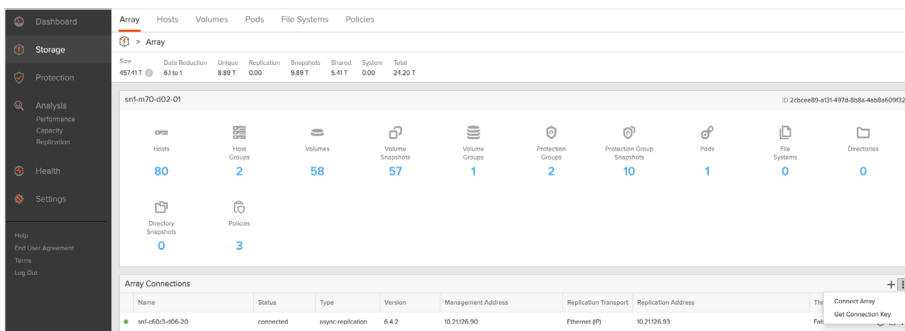


## Connect Arrays

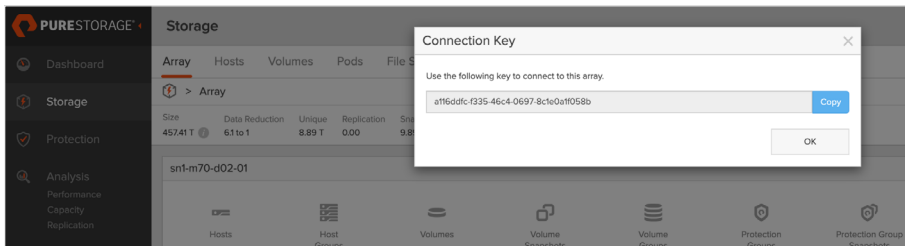
To configure asynchronous replication, you will first need to connect the source and target arrays. Connecting arrays is a one-time process for each pair of peer arrays. For more information on multiple array connections please refer to pure asynchronous replication knowledge base at this [link](#).

Arrays can be connected from either the source or target. Regardless of which array you use to create the connection you must make a note of the other array's management IP or fully qualified domain name and get a connection key from the array you are connecting to.

In this example, we will be performing the connection from a source FlashArray sn1-m70-d02-12 to a target FlashArray sn1-m70-d02-01. This means we will need to provide the management IP address and obtain a connection key from the target FlashArray sn1-m70-d02-01 array. On the target FlashArray, click Storage then select the Array tab. Click the configuration button at the right corner of the Connected Arrays window and select Get Connection Key as shown in below screenshots.

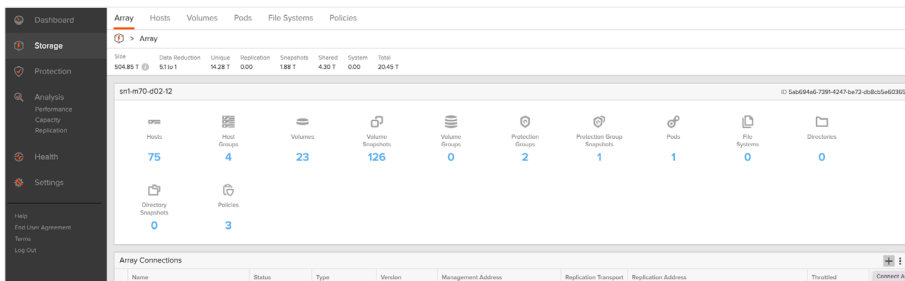


**FIGURE 26** Get the connection key from the target FlashArray to build the replication relationship.



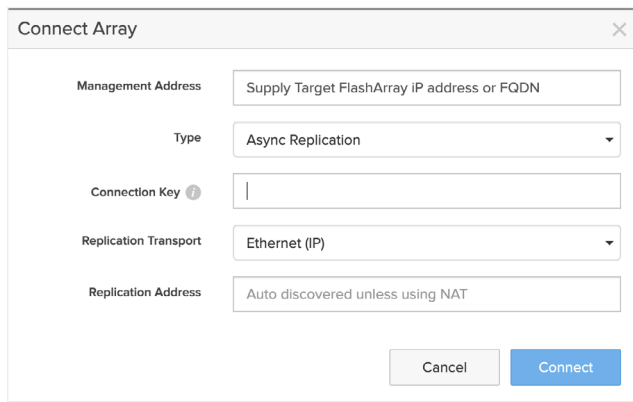
**FIGURE 27** Connection key from target FlashArray

On the source FlashArray, click Storage then select the Array tab. Click the + button in the right corner of the Connected Arrays panel. A Connect Array dialog window will open as shown below screenshots.



**FIGURE 28** Connect array





The 'Connect Array' dialog box contains the following fields and options:

- Management Address:** A text input field with the placeholder text 'Supply Target FlashArray IP address or FQDN'.
- Type:** A dropdown menu currently set to 'Async Replication'.
- Connection Key:** A text input field with a help icon (i) to its left.
- Replication Transport:** A dropdown menu currently set to 'Ethernet (IP)'.
- Replication Address:** A text input field with the placeholder text 'Auto discovered unless using NAT'.
- Buttons:** 'Cancel' and 'Connect' buttons at the bottom right.

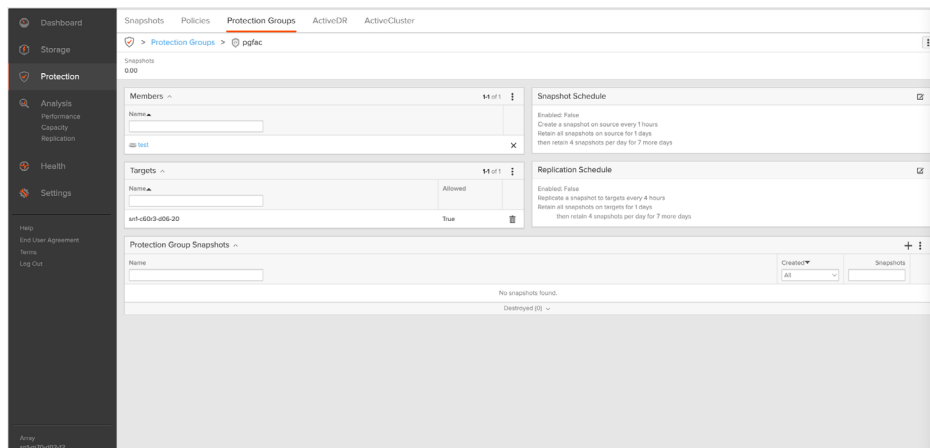
FIGURE 29 Connect array dialog

Enter the management IP address or FQDN of the target FlashArray into the Management Address field and paste the connection key from the target FlashArray into the connection key field, and click Connect. This will set up the asynchronous replication relationship between the arrays.

Once the replication connection is set up successfully, for Veeam to perform the replication for the Veeam snapshot jobs it is mandatory to create a protection group and you would need to enroll the appropriate storage volumes (which are associated to the virtual machines in the Veeam job) into the protection group with the replication target configured.

## Protection Group

A protection group, a.k.a. pgroup, defines a set of volumes, hosts, or host groups which will be replicated together with point-in-time consistency across the member volumes. Replication in Purity is snapshot-based, so each time a Veeam job replication occurs a snapshot is created. Each pgroup snapshot consists of one snapshot per volume for each of the volumes contained within that pgroup. For the Veeam integration, all the volumes in the pgroup will have a snapshot created that is point-in-time consistent with all of the member volumes in that pgroup and it will be controlled by Veeam for replicating to the target array. A protection group must be created on the source array as shown in the below screenshot.



The screenshot shows the 'Protection Groups' tab in the Veeam Purity interface. The main area displays a table for protection groups, with one group named 'pgfac' selected. The table has columns for Name, Members, Targets, and Snapshots. Below the table, there are sections for 'Snapshot Schedule' and 'Replication Schedule' for the selected group. The 'Snapshot Schedule' section shows 'Enabled: False' and a description: 'Create a snapshot on source every 1 hours. Retain all snapshots on source for 1 days. Then retain 4 snapshots per day for 7 more days.' The 'Replication Schedule' section also shows 'Enabled: False' and a description: 'Replicate a snapshot to targets every 4 hours. Retain all snapshots on targets for 1 days. Then retain 4 snapshots per day for 7 more days.' At the bottom, there is a 'Protection Group Snapshots' section with a table showing no snapshots found.

FIGURE 30 Protection group



## Use Case: Veeam Backup from Secondary Storage with Synchronous Replication on FlashArray

### Synchronous Replication (ActiveCluster)

ActiveCluster—symmetric active/active synchronous replication with transparent failover—enables clustered applications to rapidly recover or, in some cases, continue operating without disruption (RTO = 0). These types of environments consist of a stretched cluster product sitting on top of the stretched storage layer of ActiveCluster. Write IO to stretched volumes on one FlashArray are synchronously written to the second, peer FlashArray. There is no notion of typical disruptive storage “failover.” Should one array fail, the other array is still online and will continue to service IO to stretched pod volumes provided it has mediator access.

- **Synchronous replication:** Writes are synchronized between arrays and protected in non-volatile RAM (NVRAM) on both of the arrays before being acknowledged to the host.
- **Symmetric active-active:** Read and write to the same volumes at either side of the mirror, with optional host-to-array site awareness.
- **Transparent failover with preferences:** Automatic non-disruptive failover between synchronously replicating arrays and sites according to user selected preference with automatic resynchronization and recovery.

### Core Components

Purity ActiveCluster is composed of three core components: The Pure1 Mediator, active/active clustered array pairs, and stretched storage containers.

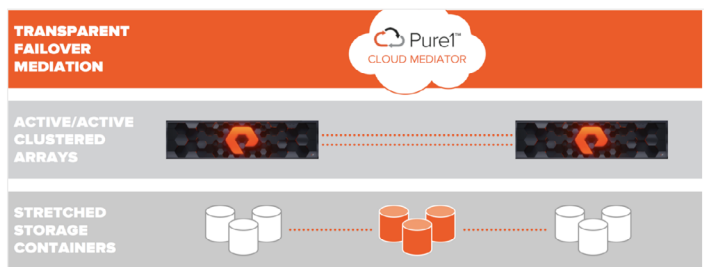


FIGURE 31 Purity ActiveCluster

An ActiveCluster pod is a stretched storage container that defines a set of objects that are synchronously replicated together, and which arrays they are replicated between. An array can support multiple Pods. Pods can exist on just one array or on two arrays simultaneously with synchronous replication. Pods that are synchronously replicated between two arrays are said to be stretched between arrays as shown in below figure.

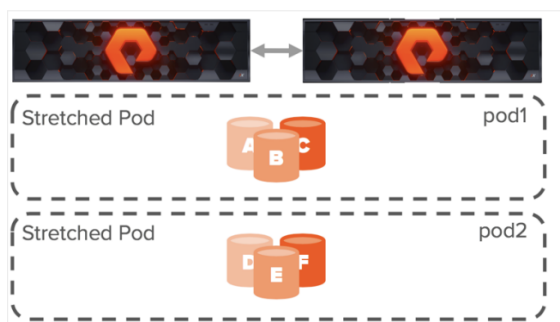


FIGURE 32 Pods for synchronous replication



ActiveCluster storage volumes can be accessed by hosts using either a uniform or a non-uniform SAN connectivity topology. In a uniform storage access configuration, each host has connectivity to both ActiveCluster FlashArrays. In a non-uniform storage configuration, each host connects to just one ActiveCluster FlashArray. There is no need to configure ActiveCluster for one way or the other; it is determined simply by the way hosts are connected to the ActiveCluster. For more information on active cluster and synchronous replication please refer to this [link](#).

## Use Case: FlashArray Snapshot Offload to NFS

### FlashArray Snapshot Offload

FlashArray snapshots are used for data protection, test/dev, cloning, and replication workflows. Offloading snapshots to NFS extends the functionality by adding the ability to move snapshots off the FlashArray on NFS storage target. Encapsulation of metadata along with the data blocks makes these snapshots truly portable, so they can be offloaded from Pure FlashArray to any heterogeneous NFS storage target, and are recoverable to any Pure FlashArray appliance.

Some examples of NFS storage target that can be used with snapshot offload to NFS are:

- The Pure Storage FlashBlade® appliance
- Third party NFS storage appliances
- Generic Linux servers

The ability to use a generic NFS storage target as the offload target means that for customers who want an inexpensive storage solution for long-term retention, a low-cost NFS storage solution from any vendor can be used as the NFS target. Customers who require extremely fast backups and rapid restores can use a FlashBlade system as the NFS target.

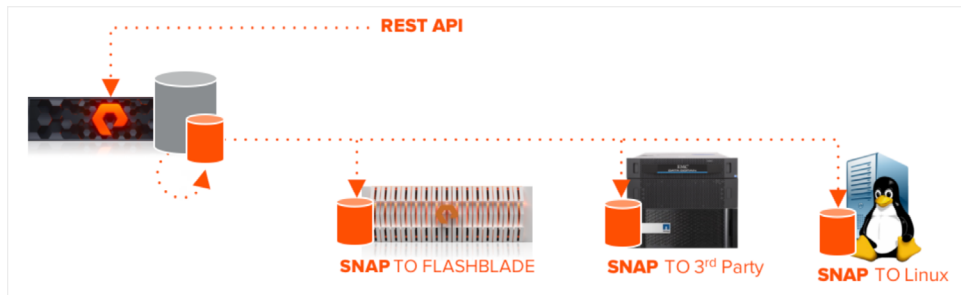


FIGURE 33 Using any NFS storage target

### Setting Up the FlashArray for Offload operation

The initial configuration must be done by Pure Storage Support. To do this, simply create a ticket to configure the snapshot offload setup. The IP address is needed by the support for setting up the offload. After enabling the Remote Assist/RA, the support staff can now perform the configuration. The prepared IP address is placed as a virtual interface over a replication interface of both controllers (ct0-eth2, ct1-eth2), this has no influence on the operation of functionalities like ActiveCluster.





## Installing the Offload Application

The NFS offload application is available on every FlashArray (above purity 5.1) but the recommendation for Veeam is to have at least Purity 6.3, or else the Veeam generated snapshots can't be browsed on the FlashArray. To install the NFS offload application go to the FlashArray Settings→ Software as shown in below screenshot. Pure Storage support team can help installing the offload application.

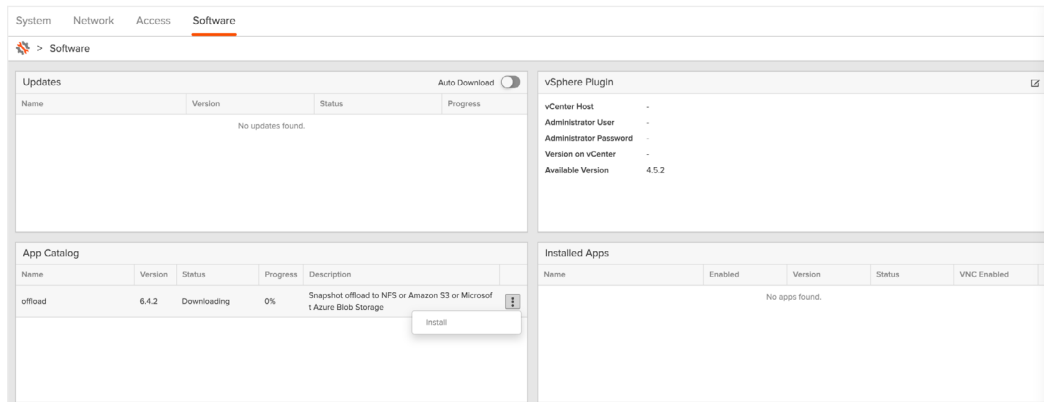


FIGURE 34 FlashArray settings

Once the application is downloaded to the array, it will automatically perform the installation and will create a virtual network for offloading it to NFS target, and configure the IP address for the offload network vif. If no replication bond is present you can also create a vif via command line using the following command.

SystemNetworkAccessSoftware

Fibre Channel14 of 14

Name	Enabled	WWN	Speed	Services	
CT0.FC0	true	52-AA:93:7A:72-4A:38:00	16 Gb/s	scsi-rc	
CT0.FC1	true	52-AA:93:7A:72-4A:38:01	16 Gb/s	scsi-rc	
CT1.FC0	true	52-AA:93:7A:72-4A:38:10	16 Gb/s	scsi-rc	
CT1.FC1	true	52-AA:93:7A:72-4A:38:11	16 Gb/s	scsi-rc	

Ethernet110 of 22

Name	Enabled	Type	Subnet	Address	Mask	Gateway	MTU	MAC	Speed	Services	Subinterfaces
@offload.data0	true	vif	-	10.21126.100	255.255.255.0	10.21126.1	9000	52:54:30:e5:54:a1	25 Gb/s	app	repibond
ct0.eth0	true	physical	-	10.21126.91	255.255.255.0	10.21126.1	1500	24:a9:37:40:a7bc	1 Gb/s	management	
ct0.eth1	false	physical	-	-	-	-	1500	24:a9:37:40:a7bd	1 Gb/s	management	
ct0.eth4	true	physical	-	10.21126.94	255.255.255.0	10.21126.1	9000	24:a9:37:40:a7c1	25 Gb/s	iscsi	
ct0.eth5	true	physical	-	10.21126.95	255.255.255.0	10.21126.1	9000	24:a9:37:40:a7c0	25 Gb/s	iscsi	
ct0.eth6	false	physical	-	-	-	-	1500	24:a9:37:41:f3b3	50 Gb/s		
ct0.eth7	false	physical	-	-	-	-	1500	24:a9:37:41:f3b2	50 Gb/s		
ct0.eth8	false	physical	-	-	-	-	1500	24:a9:37:41:f3b5	50 Gb/s		
ct0.eth9	false	physical	-	-	-	-	1500	24:a9:37:41:f3b4	50 Gb/s		
ct1.eth0	true	physical	-	10.21126.92	255.255.255.0	10.21126.1	1500	24:a9:37:40:a7d4	1 Gb/s	management	

Subnets

Name	Enabled	Prefix	VLAN	Gateway	MTU	Services	Interfaces
------	---------	--------	------	---------	-----	----------	------------

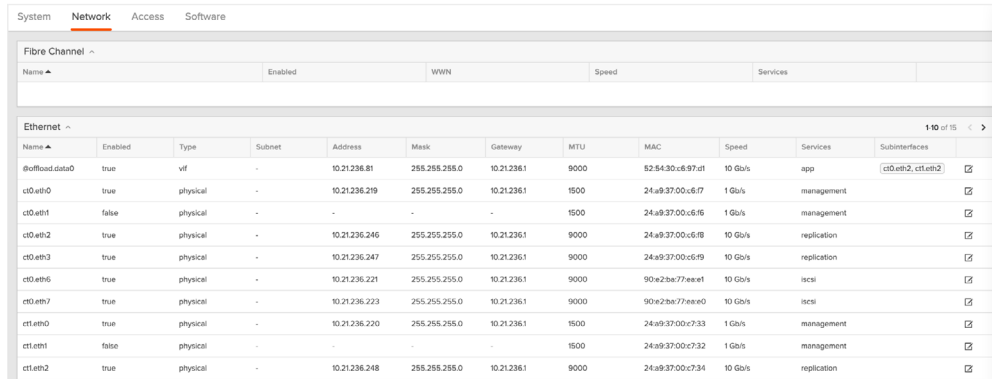
FIGURE 35 Vif command

In case FlashArray is set up for synchronous replication you can setup the offload vif pointing to the replication network via running cli command on FlashArray. For example:

```
purenetwork eth create vif --subinterfacelist ct0.eth2,ct1.eth1 @offload.data0, where ct0.eth2 and ct1.eth2 are the network settings for managing the replication traffic.
```



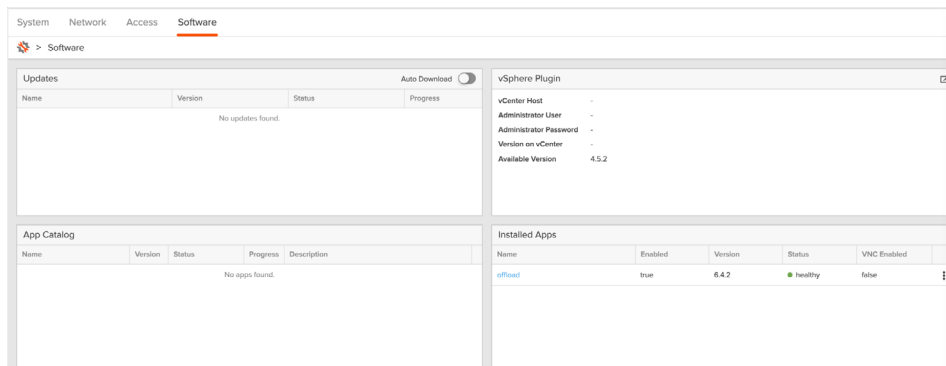
This will create the @offload.data0 vif configuration on physical replication interfaces.



Name	Enabled	Type	Subnet	Address	Mask	Gateway	MTU	MAC	Speed	Services	Subinterfaces
@offload.data0	true	vif	-	10.21.236.81	255.255.255.0	10.21.236.1	9000	82:54:30:c6:97:a1	10 Gb/s	app	(ct0.eth2, ct1.eth2)
ct0.eth0	true	physical	-	10.21.236.219	255.255.255.0	10.21.236.1	1500	24:a9:37:00:c6:f7	1 Gb/s	management	
ct0.eth1	false	physical	-	-	-	-	1500	24:a9:37:00:c6:f6	1 Gb/s	management	
ct0.eth2	true	physical	-	10.21.236.246	255.255.255.0	10.21.236.1	9000	24:a9:37:00:c6:f8	10 Gb/s	replication	
ct0.eth3	true	physical	-	10.21.236.247	255.255.255.0	10.21.236.1	9000	24:a9:37:00:c6:f9	10 Gb/s	replication	
ct0.eth6	true	physical	-	10.21.236.221	255.255.255.0	10.21.236.1	9000	90:e2:ba:77:ee:a1	10 Gb/s	iscsi	
ct0.eth7	true	physical	-	10.21.236.223	255.255.255.0	10.21.236.1	9000	90:e2:ba:77:ee:a0	10 Gb/s	iscsi	
ct1.eth0	true	physical	-	10.21.236.230	255.255.255.0	10.21.236.1	1500	24:a9:37:00:c7:33	1 Gb/s	management	
ct1.eth1	false	physical	-	-	-	-	1500	24:a9:37:00:c7:32	1 Gb/s	management	
ct1.eth2	true	physical	-	10.21.236.248	255.255.255.0	10.21.236.1	9000	24:a9:37:00:c7:34	10 Gb/s	replication	

FIGURE 36 Vif configuration

Once the installation and network IP address for the offload virtual network is configured, the status on the offload software installation will turn green.



Name	Version	Status	Progress
No updates found.			

Name	Version	Status	Progress	Description
No apps found.				

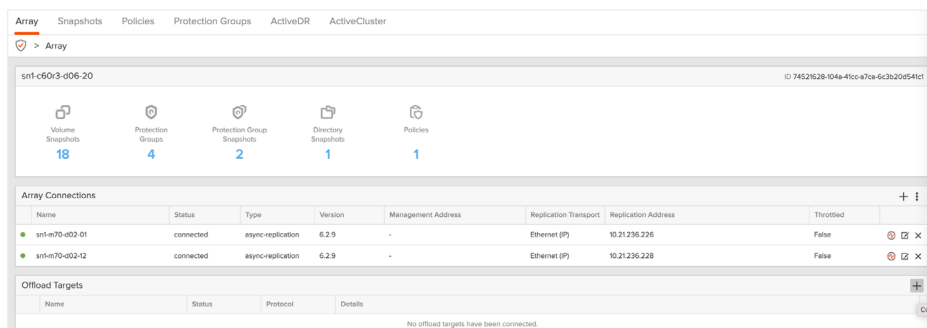
  

Name	Enabled	Version	Status	VNC Enabled
offload	true	6.4.2	healthy	false

FIGURE 37 Offload software status

## Configuring NFS Target and FlashBlade

Setting up the NFS target on FlashArray to FlashBlade is straightforward: you just need the data ViP address from FlashBlade network settings, and create an NFS filesystem to be configured on FlashArray for snapshot offloading. In this example, a filesystem share is created on FlashBlade with no restrictions, but you can set up the export rules accordingly. Go to the array tab and in the offload targets, click the plus button to add the offload target.



Name	Status	Type	Version	Management Address	Replication Transport	Replication Address	Throttled
sn1-m70-d02-01	connected	async-replication	6.2.9	-	Ethernet (IP)	10.21.236.226	False
sn1-m70-d02-12	connected	async-replication	6.2.9	-	Ethernet (IP)	10.21.236.228	False

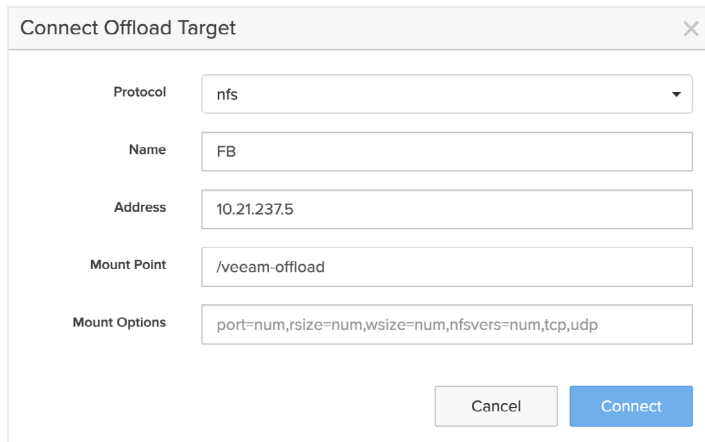
  

Name	Status	Protocol	Details
No offload targets have been connected.			

FIGURE 38 Adding an offload target



The add(+) button will pop up a window to supply the nfs target for offload as shown in the below screenshot.



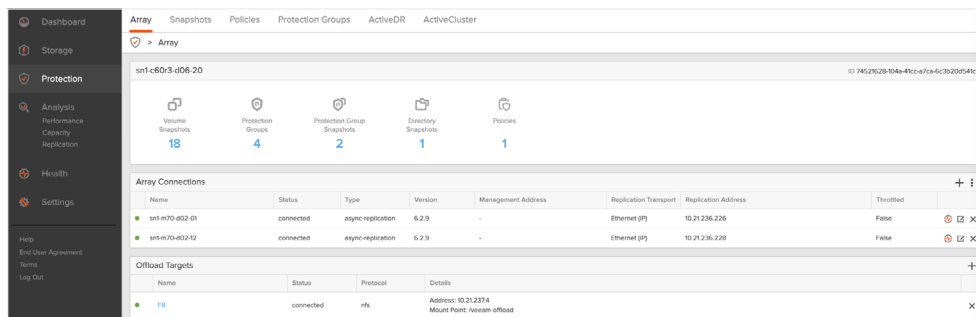
The screenshot shows a 'Connect Offload Target' dialog box with the following fields:

- Protocol:** nfs
- Name:** FB
- Address:** 10.21.237.5
- Mount Point:** /veeam-offload
- Mount Options:** port=num,rsize=num,wsiz=num,nfsvers=num,tcp,udp

At the bottom, there are 'Cancel' and 'Connect' buttons.

**FIGURE 39** Connect offload target screen

Once the connection is successful, the offload targets will have FlashBlade NFS mount as a connected session for the FlashArray snapshots.



The screenshot shows the 'Array' section of the Pure Storage interface. It displays a summary of the array's status and a table of 'Array Connections'.

Name	Status	Type	Version	Management Address	Replication Transport	Replication Address	Throttled
sr1-c603-d06-20	connected	async replication	6.2.9	-	Ethernet (IP)	10.21.236.226	False
sr1-c603-d06-20	connected	async replication	6.2.9	-	Ethernet (IP)	10.21.236.228	False

Below the table, there is an 'Offload Targets' section with a table showing the 'FB' target as connected via NFS at address 10.21.237.4 with mount point /veeam-offload.

**FIGURE 40** Flashblade connected session

You can browse all the existing FlashArray snapshots on the offload target. Once the protection group for the volume snapshot to offload is configured, the snapshots offload can be executed with Veeam Job snapshot offload configuration. And in case of any disaster or human accidental deletes to any primary FlashArray snapshots, there is a path to recover the snapshots from offloading a target.

## Protection Group

A protection group a.k.a. pgroup defines a set of volumes, host, or host group together with point-in-time consistency across the member volumes. The offload snapshots in Purity are snapshot-based, so each time offload occurs a Veeam job snapshot is created. Each Veeam snapshot job consists of one snapshot per volume for each of the volumes contained within that pgroup. For the Veeam integration, all the volumes in the pgroup will have a snapshot created that is point-in-time consistent with all of the member volumes in that pgroup and it will be controlled by Veeam for replicating to the target array.