



How to use HPE StoreOnce Systems with Veeam Backup and Replication

Considerations when deploying HPE StoreOnce
Systems with Veeam Backup and Replication

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This white paper provides guidance on using [HPE StoreOnce Systems](#) to provide capacity for Veeam Backup and Replication backup repositories. It is written for HPE StoreOnce Catalyst (not NAS or VTL) connection between Veeam and HPE StoreOnce.

Veeam backup repository storage choice

Veeam writes backup data, copy data, and associated metadata to storage locations called backup repositories. Multiple storage types are supported for a Veeam backup repository:

- Microsoft Windows or Linux® servers
- CIFS (SMB) shares
- Detachable hard drives
- HPE StoreOnce and other vendors' deduplication appliances

When choosing the storage for a Veeam backup repository, the performance and cost requirements need to be defined and a storage is chosen that will deliver those requirements. As with all infrastructure choices, the storage choice is a trade-off between the various requirements. The requirements include:

- **Backup job time:** This is determined by the write throughput speed. As the protected data volume grows, additional speed is needed to complete the backup jobs in the available backup window. The backup speed is determined by the data sources, the links, and finally the storage destination.

HPE StoreOnce Systems can increase throughput speed in multiple ways—they support multiple concurrent data sources or Veeam servers and, by deduplicating the backup data at the source, they also greatly reduce the required network bandwidth. This has an additional benefit where the network bandwidth between the Veeam server and the backup repository is particularly limited as it is across WAN connection.

- **Protection from ransomware and other malware:** Taking and keeping backup data is an important defense against malware attacks. For full protection, the backup repository should not be vulnerable to attack. When the backup repository is built on Windows/Linux servers, or CIFS shares, it is vulnerable because all backup files are in an accessible local disk, or they are accessible using known protocols via the Veeam backup proxy. A backup repository created on an HPE StoreOnce System is invulnerable because it communicates with the Veeam backup proxy using the HPE Catalyst API, which is not known by malware and is effectively an air gap.
- **Backup repository availability:** For Veeam backup, copy, and restore jobs to complete the backup repository must be available. A Veeam scale-out backup repository can, to some degree, improve availability. However, the main determinant of backup repository availability is the storage type used. If Windows or Linux servers are used, availability depends on host platform's availability.

Other processes running on the host that could lead to restarts, contention for resources, and related events could make the backup repository unavailable. Similarly, if a CIFS share is used for the backup repository, the availability of the CIFS server can be impacted by other processes running on the host. Detachable hard drives offer low cost and some flexibility for backup repository storage but are not a solution for a reliably available backup repository. Using an HPE StoreOnce System means the backup repository has high availability as it is a redundant, dedicated backup appliance that is not accessible by other workloads than Veeam.

- **Virtual synthetic full backup processing:** Veeam virtual synthetic backups create full backups from incremental backups. When using an HPE StoreOnce based backup repository, the creation of the full backup is executed at the workload cost of the incremental backup, which offloads the synthesis of the full backup to the StoreOnce System. It is very effective at this process as it leverages its deduplication capabilities to use pointers to existing data segments rather than moving large amounts of data. The same processing on Windows/Linux servers or NAS servers requires more resources.
- **Restore job times:** There are different restore options, the most common is a full VM restore. This requires high sequential read throughput to complete the restore process fast for which the HPE StoreOnce Systems are well suited. Granular and Instant VM Recovery (IVMR) are other widely used Veeam recovery option.

- **Random I/O:** Some Veeam features such as IVMR and DataLabs, generate significant random I/O workload. The IOPS performance is primarily determined by a factor of the number and speed of the installed hard disks, the RAID configuration, and any contention for these resources from other workloads for I/O. Solid state disks (SSDs) can be used to improve IOPS performance. For HPE StoreOnce, as a purpose-built appliance, the IOPS performance depends on the model deployed. For HPE StoreOnce Virtual Storage Appliance (VSA), the IOPS performance depends upon the resources allocated to the VSA.
- **Storage cost:** The more restore points that are needed, the more storage capacity that is required for the backup and copy data. New regulations and protection against slow progressing ransomware attacks require backup data to be retained for multiple months and consequently many restore points. This is where the more efficient deduplication of HPE StoreOnce based backup repositories, compared to Veeam deduplication with general purpose storage-based backup repositories, can significantly reduce storage costs, including data center space and power/cooling.
- **Network bandwidth utilization:** This is important for local backups over a LAN and even more important for backup and replication from remote sites over a WAN. Veeam WAN Accelerators can be used, in some situations, to reduce bandwidth requirements for backup copies and VM replication. A more efficient process to reduce network bandwidth requirements is to use source-side deduplication when writing for HPE StoreOnce based backup repositories. Using a local Veeam gateway server writing to a remote HPE StoreOnce System dramatically reduces the network bandwidth requirements for backups and copies over a WAN.
- **Ease of management:** The selected backup repository storage needs easy-to-manage capacity and troubleshoots events. HPE StoreOnce has an easy GUI optimized for storage management, which has advanced performance monitoring features to easily measure the workload of every important component. It also has alerting features designed to warn approaching capacity thresholds and any other major issues. Using general-purpose server products for backup repositories will not provide such storage-specific management and reporting.

HPE StoreOnce Systems for Veeam backup repositories

Thousands of HPE StoreOnce Systems are currently deployed to provide storage for Veeam backup repositories. They are high performance, high-efficiency, and ransomware-proof storage for Veeam backup repositories. With robust data storage, HPE StoreOnce Systems use deduplication and compression to reduce the amount of backup data stored. Experience shows this is typically up to 95% compared to undeduplicated full backups but depends on multiple factors.¹ Tests run at HPE in 2018, simulating a 5-week retention with a daily 3% change rate, showed space saving from the HPE StoreOnce deduplication and compression to be 8x the space saving from using Veeam deduplication and compression.

HPE StoreOnce Systems are available as dedicated appliances and flexible virtual appliances. They also offer capacities from 4 TB to 1.7 PB. Veeam can not only connect to HPE StoreOnce using HPE Catalyst over LAN or FC but also NAS protocols SMB and NFS are supported. HPE Catalyst is the preferred connection method and this document is based on the Catalyst connectivity between Veeam and HPE StoreOnce.

As Veeam, extends its software with advanced backup, restore, and other features to leverage the backup data, there are more random read and write operations requested from the backup repository. These workloads require different performance characteristics to the traditional sequential backup and restore workloads, in particular, high random I/O performance over an extended period. When planning to use HPE StoreOnce based backup repositories in conjunction with the following Veeam features, the performance should be evaluated before deployment.

– Instant VM Recovery

IVMR is supported for use with HPE StoreOnce based backup repositories. For a small number of VMs with typical performance characteristics, the response times when running the VM from the backup file on HPE StoreOnce should be acceptable for most users. If many VMs are restored using IVMR at the same time, or the VMs generate high IOPS rates for starting internal application services, then a backup target should be considered. This target should support more IOPS than HPE StoreOnce, they can be HPE Nimble Storage or HPE Apollo.

¹ [HPE StoreOnce Systems QuickSpecs](#)

Often restore and IVMR operations are executed from fresh restore points and, in this situation, hardware snapshot are the preferred source because they are fresh, frequent, and as fast as production storage. Veeam offers advanced snapshot orchestration features with HPE Nimble Storage and HPE 3PAR, and it is possible to design protection policies combining traditional daily backup to HPE StoreOnce with hourly snapshot-only Veeam jobs for a very granular protection.

– **DataLabs** (SureBackup, U-AIR, On Demand Labs, and new 9.5 U4 features)

This Veeam feature based on IVMR allows the automation of tasks such as DevOps, analytics, upgrade validation, and security testing starting from the backup data instead of using additional copies of the production data. As long as these tasks are based on IVMR, the same limitations and considerations apply.

– **File-level recovery**

The process of restoring files from Veeam backup files mounts the image from the backup repository and makes the contents visible on the Veeam console. The backup file remains on the repository in a read-only state. Browsing the backup file may require significant IOPS. The likely IOPS requirements for file-level recovery should be evaluated before deploying HPE StoreOnce Systems. As a general guideline, restoring few files, even large ones, does not create too many random I/O but restoring entire directories containing 100,000 files may create a lot of random I/O and run slower than usual.

– **Veeam Backup Explorers for granular restore**

Veeam Backup Explorers enable granular restore of items from Veeam backup or replica files. The process reads the contents of the backup or replica file on the repository so the entire VM does not need to be restored. Browsing the application data from the backup file may require significant IOPS. If granular application restore is likely to be used often or on regular basis, then performance requirements should be evaluated before directing those VMs backup to HPE StoreOnce Systems. As described in the IVMR section, Veeam orchestrated hardware snapshot may be an excellent data source.

– **Backup to tape jobs**

Veeam backups files can be copied to tape. This requires reading the backup file from its backup repository and then writing them to the tape target. To avoid doubling the workload on HPE StoreOnce, we suggest to run backup to tape jobs off the normal backup windows. The Veeam backup to tape job generates a single-stream read and a single-stream write for each tape device. To scale up in performance, it is possible to start multiple concurrent operations to multiple tape devices. This operation generates multiple concurrent read streams from HPE StoreOnce and increases the aggregated throughput.

– **Backup copy jobs**

Veeam Backup Copy Job (BCJ) is a process for replicating restore points from the primary backup repository to a second one generally located in a remote site. In other words, a BCJ reads from the source backup repository and writes to the remote one. As long as a BCJ makes predominantly sequential read/write operations, HPE StoreOnce can be used as a source and target storage. This use case reminds the system administrator that the source HPE StoreOnce has to be sized to support the backup write workload, as well as the read workload generated by the BCJ. To avoid resource contention, we suggest to run the BCJ out of the backup window, otherwise, it is necessary to deploy an HPE StoreOnce System with adequate read-and-write performance. Needless to say that this consideration is valid for each kind of storage and not only for HPE StoreOnce.

– **Full VM restore and replication jobs when performed from backup as source**

For better efficiency, VM remote replication can be executed from a backup file. The VM replica uses the backup chain, stored on the repository as its source. This reduces the load on the production storage but increases the load on the backup repository. If there's a plan to create VM replicas from the backup files, the backup repository storage should be capable of delivering the required performance.

Attention should also be paid to the restore performance requirements of large multi-disk VMs. Due to Veeam interleaving the backup of each virtual disk into single file, the restore can require significant I/O to separate the restore data for each virtual disk. The restore operation is single stream and, therefore, limited to the maximum single stream performance of HPE StoreOnce.

– **New Veeam 9.5 U4 features**

New features such as anti-virus quarantine have not yet been fully reviewed by Hewlett Packard Enterprise for use with HPE StoreOnce. This document will be updated when they have been reviewed.

– **Backup jobs that transform backup files—Synthetic full, forever forward incremental, reverse incremental, compact processing**

These backup policies are not supported on HPE StoreOnce. For each operation, there is an alternative supported process that offers higher performance and seamless management. If you modify an existing backup job to have HPE StoreOnce as new backup repository, then modify the other job parameters as described in the [Veeam and HPE StoreOnce Catalyst configuration guide](#).

– **Backup jobs configured with health check**

Health check verifies the latest restore point in a backup chain. It is primarily designed for storage devices without built-in data integrity feature. HPE StoreOnce Systems have robust backup data integrity making this feature less relevant for HPE StoreOnce compared to more basic storage devices. If a Veeam health check is run against backup files stored on HPE StoreOnce, it will generate a significant IOPS load and hence should be used with caution so it does not interfere with production operations.

– Particular care should be used for BCJs writing to remote HPE StoreOnce based repository using Catalyst over WAN connections. This is a common configuration because Catalyst source-side deduplication is very effective to reduce the data transferred over the WAN. For this use case, we suggest to avoid configuring Veeam health check because this operation generates massive read over the WAN and read operations are not deduped.

Deployment options

The most efficient deployment option is to configure a backup repository based on an HPE StoreOnce System presenting an HPE Catalyst store to Veeam. Where this will not provide the required IOPS for restore, IVMR, and other operations listed earlier. HPE StoreOnce can be supplemented with array-based snapshots and/or with the use of high IOPS performance storage, typically using SSDs. This additional storage layer is used for a backup repository to land and retain backups for a short period before copying them to HPE StoreOnce System for longer-term retention.

Three deployment options are summarized here. These can be used together and the design should be based on the availability required for each VM or class of VMs. For many organizations, VMs require the fast restore enabled by IVMR, or the other random I/O-intensive Veeam features. Therefore, the different options here could be used for different classes of VMs to deliver the most efficient protection based on the availability requirements of the VMs.

1. All backups to an HPE StoreOnce based backup repository

Sending backups directly to a HPE StoreOnce Catalyst based backup repository should be the default configuration for HPE StoreOnce with Veeam. For many Veeam users, an HPE StoreOnce System or HPE StoreOnce VSA provides suitable storage for a Veeam backup repository. Additional protection is enabled by using a Veeam BCJ to write a backup copy to remote HPE StoreOnce System for off-site protection. The backup jobs can be configured with source-side deduplication for low bandwidth backup over a LAN, FC SAN, or WAN.

If this configuration does not provide the IOPS performance needed to run the workloads such as IVMR or DataLabs one of the following configurations should be used.

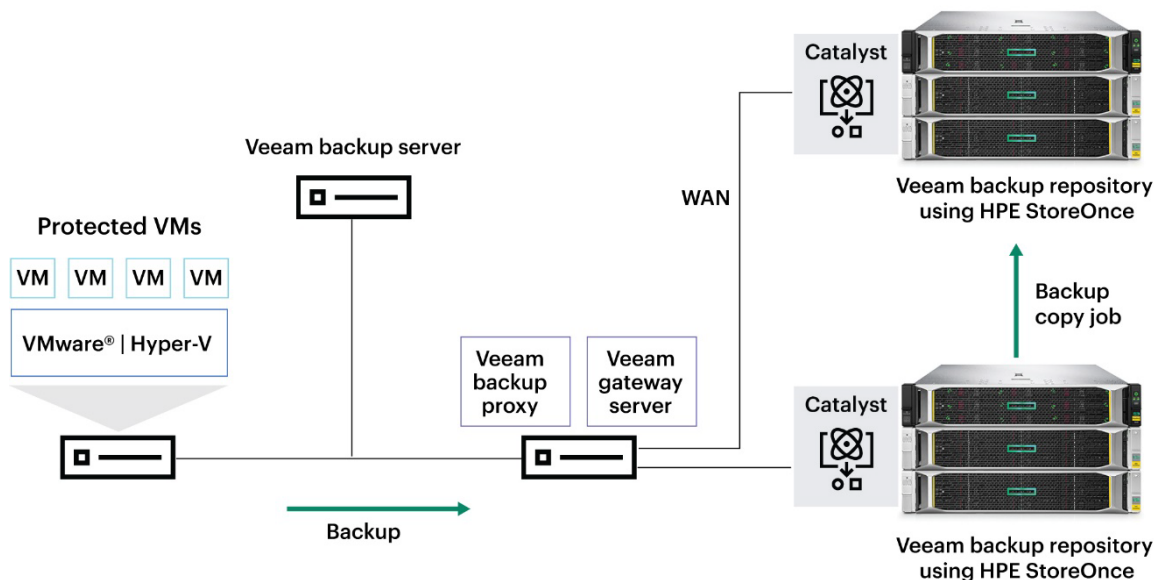


Figure 1. Veeam backup to an HPE StoreOnce based backup repository with an off-site copy to a remote HPE StoreOnce backup repository

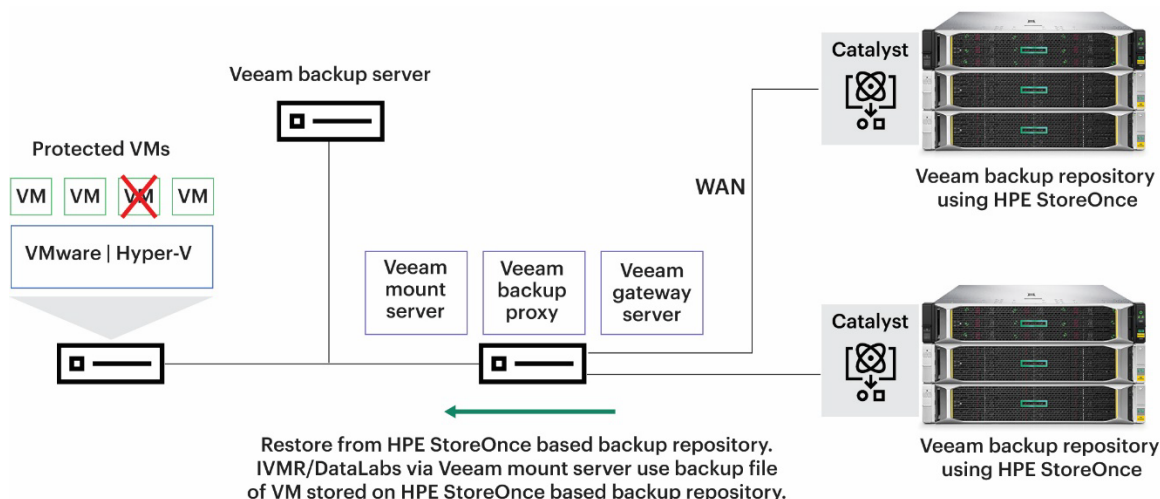


Figure 2. Veeam restore from an HPE StoreOnce based backup and/or support of advanced Veeam features from the HPE StoreOnce backup repository

2. Storage system snapshots with backup to an HPE StoreOnce based backup repository

Extended use of features such as IVMR or DataLabs will require high random IOPS performance. A larger HPE StoreOnce model could be deployed, with more disk spindles, but this may be uneconomical if the additional capacity this provides is not required. These workloads can be serviced from the primary array, such as HPE Nimble Storage or HPE 3PAR, by making use of their efficient array-based snapshots.

Running VMs from array-based snapshots will have similar performance to the primary VM. Executing IVMR from array snapshots does not use the Veeam vPower NFS layer; it uses a direct read-write connection to a storage virtual volume for high performance. The frequency of snapshot execution and which snapshots are backed up to the HPE StoreOnce backup repository depends on the number of restore points needed for IVMR and regular restore operations. Additional protection is enabled by using a Veeam BCJ to write a backup copy to remote HPE StoreOnce System for off-site protection. Snapshots consume resources on the primary array so the number retained should be the minimum needed based on the estimated need for fast restore from a snapshot or other uses of the snapshots.

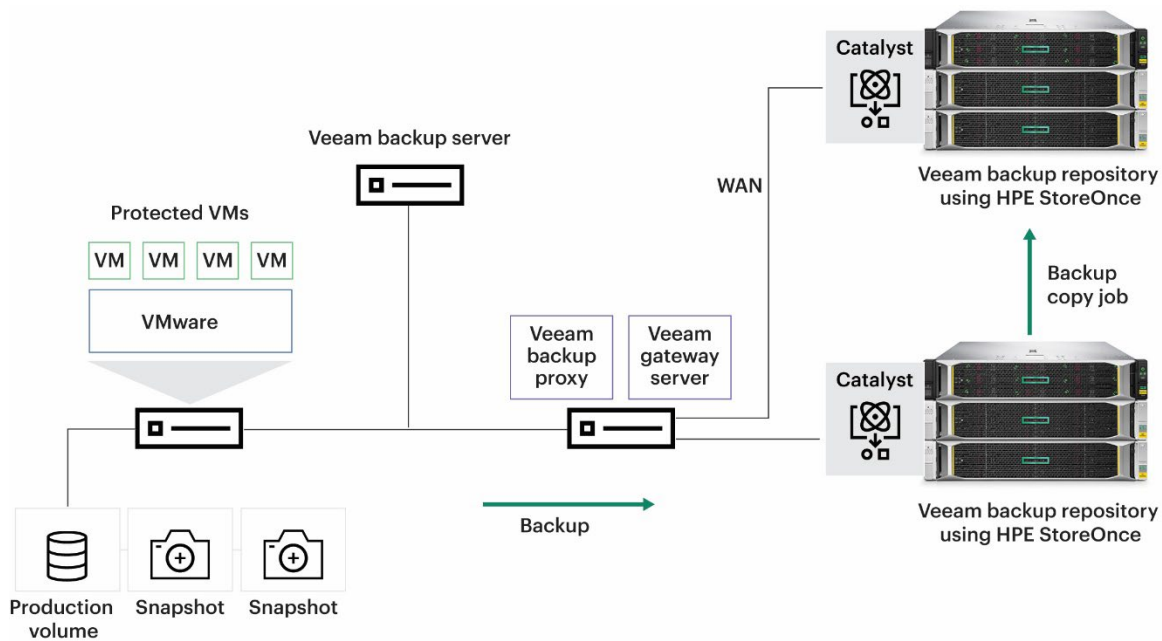


Figure 3. Leveraging storage system snapshots for high performance access to backup data with longer-term backup data retention on HPE StoreOnce

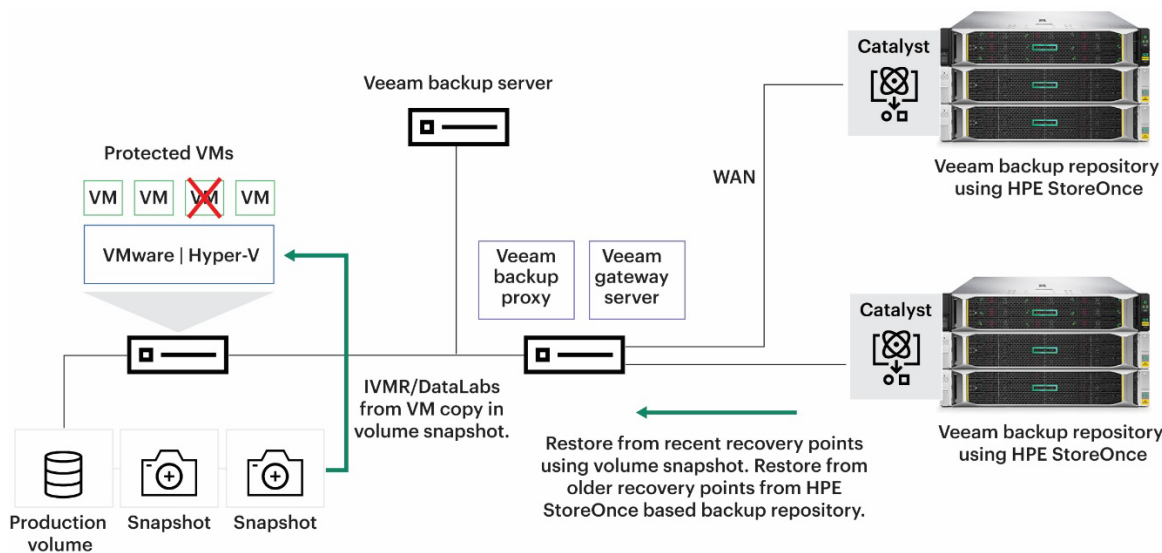


Figure 4. Restore from storage system snapshots and/or backups from snapshots on HPE StoreOnce backup repositories

3. Two-tier backup using a high performance disk-based backup repository and an HPE StoreOnce based repository

Where more IOPS performance is needed than can be delivered by an HPE StoreOnce System to support IVMR and other non-backup and copy operations, a two-tier deployment can be used. The first tier is an alternative to using array snapshots. The first tier is used for a high IOPS performance backup repository to land VM backups that require the high IOPS performance for IVMR and other non-backup and copy operations. These backups are retained on the tier one storage for a short time. As with the snapshots, the retention time on tier one storage, depends upon the user’s needs and will be determined by the likelihood and frequency of IVMR and other operations. A Veeam BCJ copies/moves the VM backups to HPE StoreOnce for longer retention and protection against malware attacks.

When sizing the storage for the tier one backup repository, it must be sized with enough IOPS and capacity to support the backup, the BCJ, and IVMR and other non-backup and copy operations. There are multiple options with different capacity and performance characteristics.

- a. HPE ProLiant server with internal HDD or/and SSD for low capacity requirement
- b. HPE Apollo server with HDD or/and SSD for high capacity requirement
- c. HPE ProLiant with HPE Nimble Storage with HDD or/and SSD for highest capacity and performance

This server is not used only for its storage capacity, its compute resources can be used for running all the Veeam services as well.

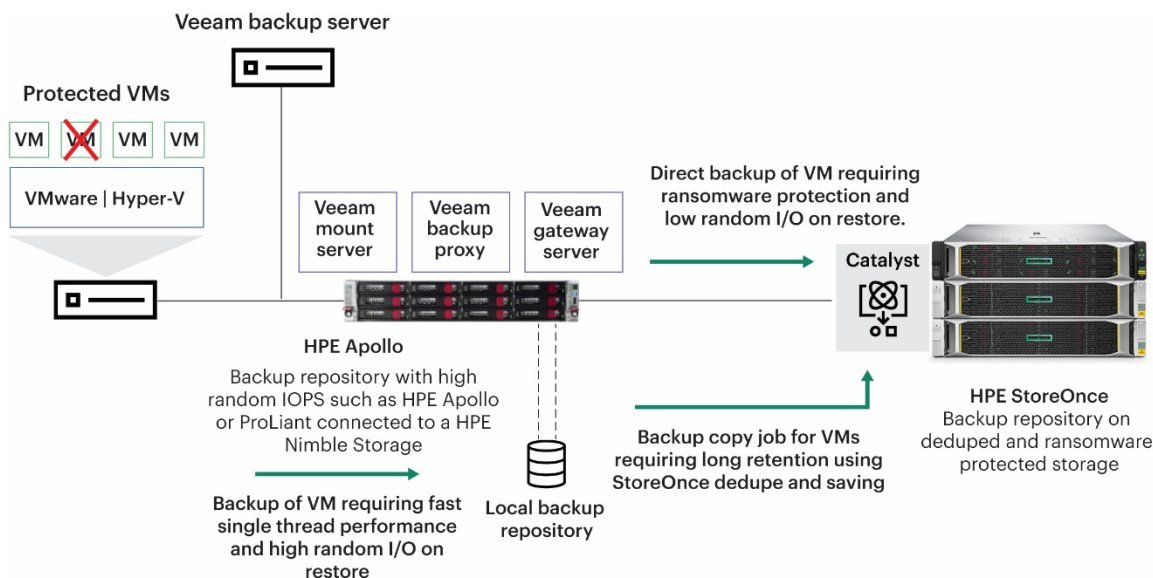


Figure 5. High performance storage, such as HPE Apollo, for a high IOPS performance backup repository with backups copied to HPE StoreOnce for older restore points

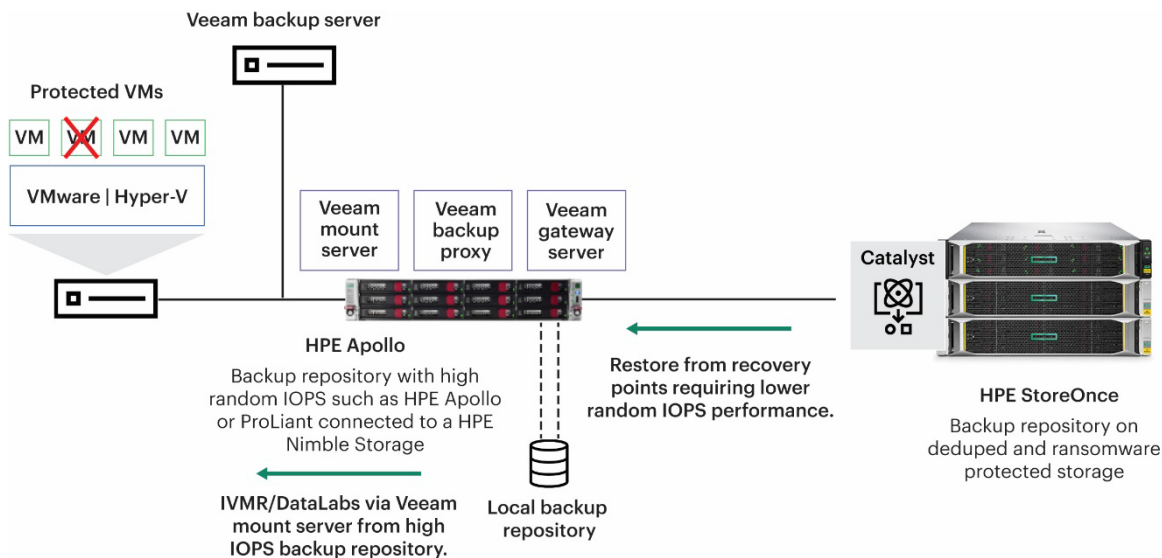


Figure 6. IVMR, DataLabs, and other high IOPS performance requirements workloads running off high performance backup repository

References

Veeam Backup and Replication version 9.x with HPE StoreOnce Catalyst Configuration Guide on [HPE.com](https://www.hpe.com).

Veeam Software available at [Veeam Software QuickSpecs](https://www.veeam.com).

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