Hewlett Packard Enterprise

HPE Reference Architecture for tiered backup solution for Hybrid IT with Veeam

Contents

Executive summary

Today's modern enterprise faces multiple IT challenges. The most critical challenges include not only managing and mining the data produced and used, but also ensuring the digital experience is always-on for its customers. To address and solve these challenges, business leaders need a deep understanding of how enterprise data is changing and how new technologies and approaches can unleash its full value.

With more industries now adopting virtualization through the use of technologies such as VMware®, the problems of system sprawl and hardware utilization are being greatly minimized. However, one area that virtualization does not address is backup and recovery. Virtualized workloads need to be protected by quick and efficient backups, and have a restore solution that will address disasters resulting in data loss. Also, as a result of virtual machine (VM) sprawl, many IT organizations find that the amount of storage needed to retain backups increases quickly.

The need of the hour is to ensure that data is secure, protected, compliant, and meets the requirements of the growing hyper-critical business. One of the biggest challenges for an enterprise is managing the cost related to the rapid growth, of the sheer amount of data and its changes, as data is being generated from a variety of sources more quickly than ever before. Managing and mining this data is an increasing challenge. To meet this new reality, where enterprise data is scattered across many different clouds and systems, it's not enough for data to be backed up, secure, and available. Data must also move to a new state of intelligence, be automatically able to anticipate need and meet demand, securely, across multi-cloud infrastructures and meet the expectations of the mobile, always-on world.

It therefore becomes necessary to back up all workloads and ensure they are always recoverable in the event of outages, attack, loss, or theft. When data is sent to a centralized site for protection, problems may arise with data transfer efficiency which needs to be addressed by reliable backup solutions that are fast, seamless, and efficient. A data protection plan where enterprise data centers are well connected to the secondary or disaster recovery sites for data backup and restore of the critical workloads, helps address the data protection problems to larger extent.

This paper describes the data protection between data centers located at different geographical locations, with primary and secondary data centers running on HPE Synergy 480 Gen10 servers, HPE Nimble storage, and Veeam Backup & Replication 9.5. For long term archival, HPE StoreOnce is configured on the secondary data center.

Target audience: This paper is intended for data center administrators, enterprise architects and deployment/implementation engineers. The target audience must have a basic knowledge of VMware vCenter™, Veeam, HPE StoreOnce, Windows® Operating System and Microsoft® SQL database.

Document purpose: The purpose of this document is to describe the data protection solution for HPE Hybrid IT wherein the data backup and restore methodologies includes a snapshot backup on primary storage (HPE Nimble), warm backup to secondary storage (HPE Nimble), and cold backup (HPE StoreOnce), using Veeam Integrated HPE storage software. This solution uses MSSQL servers to demonstrate the backup and restore use cases from a primary data center to a secondary data center.

This Reference Architecture describes solution testing performed in November 2018.

Solution overview

Tiered data storage is often neglected in data backup and recovery plans, but tiering your data is crucial to reduce risks and costs. For many businesses, backup and recovery is a series of tradeoffs. The priority data should be stored in high-performance data storage systems. As the data value in that storage system declines or depreciates over time, it should be moved to or migrated to lower performance and lower cost storage. Migrating the data will better align its value with the cost of storing it. The use of tiered data storage is often ignored or forgotten when data backup and recovery plans are implemented into an enterprise data storage environment. In most cases, the value of an application and its data can also be applied to backup and recovery procedures. Reducing the downtime for small, medium and larger enterprises is a key factor to help meet increased business requirements for application availability.

This solution has the following configured on its primary and secondary data centers, wherein the identified use cases are validated.

- Data centers: The primary and secondary data centers built on HPE Synergy composable infrastructure, HPE Synergy 480 Gen10 servers, which are secure industry standard servers widely used to deploy virtualized workloads, and an HPE OneView unified API to manage the entire infrastructure. These Gen10 servers with their silicon root of trust feature are capable of protecting sensitive data while ensuring the highest levels of security.
- Primary storage: The storage comprises of HPE Nimble hybrid flash array which acts as the primary storage and backup repository for the primary and secondary data centers respectively. HPE Nimble is fast and is integrated with most widely used hypervisors and operating

systems to help consolidation and cost reduction. It ensure business continuity in the event of site-wide or natural disasters with multi-site asynchronous replication with automatic failover - keeping the applications online all the time.

- Tertiary storage: HPE StoreOnce is configured on the secondary data center for long term data retention. This reduces and optimizes the space required for data storage, with its deduplication technology and catalyst protocol.
- Backup and replication: This solution utilizes Veeam® Backup & Replication™ software to help backup, restore, and replicate data - all deployed at the centralized primary data center.

This Reference Architecture presents a comprehensive approach to implement business continuity for tiered Hybrid IT infrastructure with Veeam Backup & Replication™ as the backup software. In this solution, a primary and the secondary data centers running MSSQL servers on a VMWare ESXi platform was built on HPE Synergy 480 Gen10 servers. HPE Nimble storage was deployed on each of the data centers to protect the data locally (snapshots backup). The secondary data center which was acting as the disaster recovery site with HPE Nimble configured for warm backup (tier 2), and HPE StoreOnce configured at the secondary site for cold backup (i.e. for long time archival).

HPE Synergy is a composable infrastructure platform that reduces operational complexity for traditional and other conventional workloads and increases operational velocity for the new breed of applications and services. Through a single user interface, HPE Synergy composes compute, storage, and fabric pools into a configuration optimized for any application. In this solution, VMware clusters running on HPE Synergy compute nodes were deployed on both primary and secondary sites for hosting MSSQL databases. Backup and disaster recovery scenarios are illustrated with these MSSQL workloads.

HPE Nimble hybrid storage array helps deploy both mixed and primary workloads and it also serves as a secondary flash array for backup and disaster recovery. HPE Nimble is the affordable storage suitable for medium and enterprise businesses. HPE Nimble Storage delivers industry-leading effective capacity efficiency as well as a future-proofed architecture. In this solution, Nimble HF20H was deployed at both of the data centers and was connected to HPE Synergy via iSCSI network. This Nimble storage provides the shared storage for MSSQL workloads running on HPE Synergy. All the network connectivity is established through top of rack switch.

Hewlett Packard Enterprise and Veeam-based solutions offer comprehensive and efficient data protection, particularly with the HPE StoreOnce as a tertiary backup target. When we combine HPE StoreOnce technology with Veeam as the backup solution, we have a complete backup recovery and disaster recovery (DR) solution that leverages the replication capabilities of Veeam.

HPE StoreOnce Backup is a family of appliances that provides disk-based backup for IT environments, from the smallest remote sites to the largest enterprises. HPE StoreOnce with its Catalyst feature helps control unpredictable data growth and reduce costs by decreasing the amount of storage resources required for backup archival through the use of integrated deduplication technology. In this solution, HPE StoreOnce 5100 was deployed at the secondary data center to hold the primary data center backups offsite. It dramatically improves the value proposition of disk-based data protection since it eliminates the redundancy typically seen in secondary storage processes. HPE StoreOnce also provides the ransomware protection both locally and offsite with its Catalyst store's ability to completely isolate data from being tampered unintentionally.

Note

The SQL workload validated in this solution is a sample workload. The functionality in the paper is applicable for similar workloads with adequate changes to suit various customer scenarios and workloads.

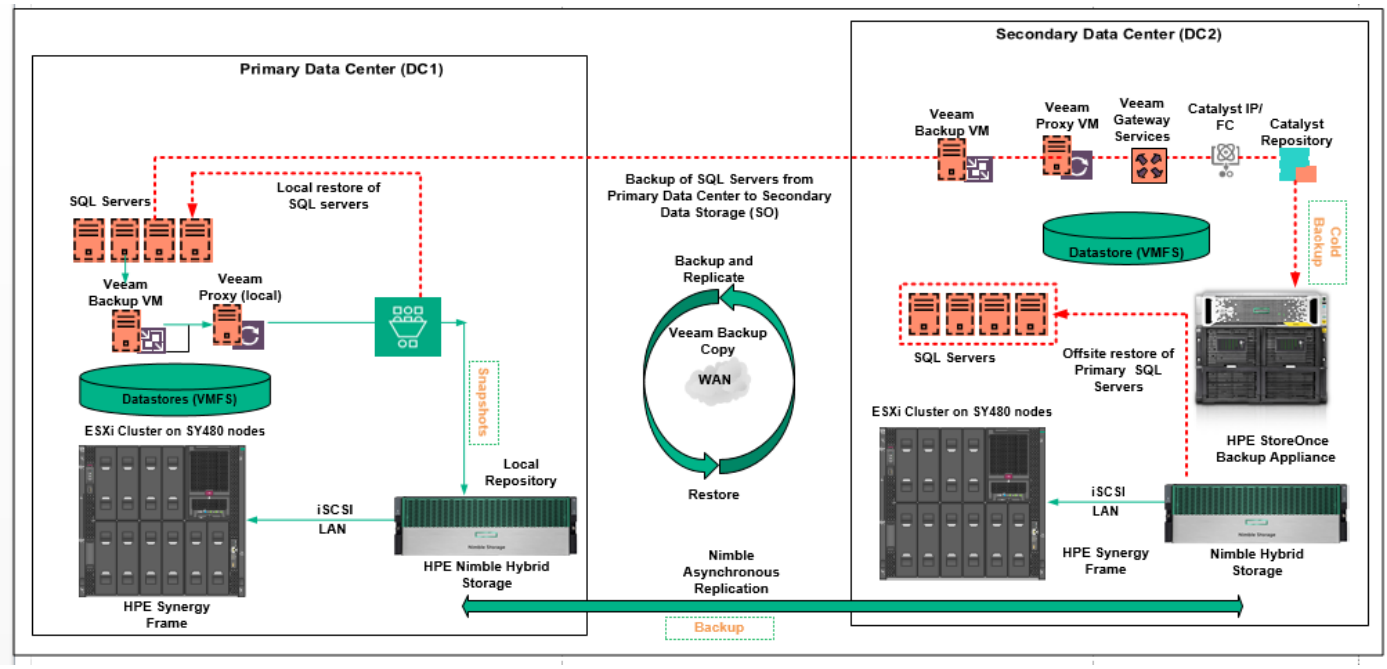

Figure 1. Solution diagram showcasing data backup and recovery from the primary data center to secondary data center

As shown in figure 1, the solution presented in this white paper consists of VMWare ESXi clusters on HPE Synergy 480 Gen10 servers and HPE Nimble storage running on primary data center (DC1) and secondary data center (DC2). HPE StoreOnce is configured on the secondary data center for processing cold backups i.e. long time archival. Virtual machines running MSSQL were deployed at the primary data center.

Here are the list of use cases that are validated as part of this solution.

- Snapshot level data backup to HPE Nimble primary storage from the primary data center (snapshots), leveraging Veeam Management UI
- Veeam and HPE Nimble Storage Integration towards data replication from HPE Nimble primary storage to HPE Nimble secondary storage (backup)
- Restoring the workloads to the primary data center from the secondary storage (i.e. leveraging the snapshots replicated at secondary site)
- Data backup from HPE Nimble Secondary to HPE StoreOnce (cold backup)

The HPE Nimble array in the primary data center is the primary storage and copies of its snapshots are being used as restore points by Veeam. The Veeam Backup & Replication server deployed as a virtual machine on the VMWare cluster at the data centers, performs both local and offsite backups of MSSQL servers to HPE Nimble storage. In the event of any failure at the primary site, the replicated snapshots from the secondary HPE Nimble storage array are leveraged using Veeam Backup & Replication to recover/restore the MSSQL servers at the primary data center.

Solution components

Hardware

For this evaluation, HPE Synergy composable infrastructure (HPE Synergy 480 Gen10 servers), with HPE Nimble storage for data storage (secondary data storage and primary storage), were deployed at both the primary and secondary data centers. In addition, an HPE StoreOnce unit was configured in the secondary data center, to move the data from HPE Nimble secondary storage, for data retention and long term archival.

Table 1. List of hardware configured on the primary and secondary primary data center

Hardware at primary data center	Hardware at secondary data center	General purpose
HPE Synergy	HPE Synergy	Hosts ESXI VMware clusters
HPE Nimble	HPE Nimble	Primary and secondary data storage
	HPE StoreOnce	Offsite backups for primary data center workloads

HPE Synergy

HPE Synergy is the first platform architected from the ground up as a composable infrastructure. As an extensible platform, it easily enables a broad range of applications and operational models such as virtualization, hybrid cloud, and DevOps. Composable infrastructure has three main capabilities:

- Software defined intelligence: software-defined intelligence simplifies operational activities for IT admins by allowing for more automation and template driven workloads.
- A fluid pool of resources: Fluid resource pools enable the infrastructure to meet each application's changing needs effortlessly by allowing for the composition and recomposition of single blocks of disaggregated compute, storage and fabric infrastructure.
- A unified API: unified API provides a single management interface to integrate operational silos and eliminate complexity.

With fluid resource pools, a unified API, and software defined intelligence, HPE Synergy provides infrastructure for traditional and cloud native apps at cloud like speeds.

HPE Synergy is used to build the primary and the secondary data center in this solution. Along with running its own set of heterogeneous workloads, HPE Synergy also hosts replicas of data centers' workloads and provide resources to support disaster recovery of primary data center. The data center is built using a single HPE Synergy frame with a composers, an Image Streamer, four HPE Synergy 480 compute blades and virtual interconnects to support network connectivity. For more on HPE Synergy, visit HPE Synergy.

Figure 2. Front view and rear view of HPE Synergy showcasing composable infrastructure appliances

HPE Synergy integrates the three key elements that define a composable infrastructure: fluid resource pools, software-defined intelligence, and a unified API called HPE OneView. HPE Synergy enables IT to deliver a new experience by maximizing the speed, agility, and efficiency of operations. By precisely adjusting fluid pools of resources, the cost of over provisioning is reduced with a single infrastructure that runs any application. Operations teams can easily automate and accelerate internal processes. Developers can now take advantage of the open unified API and software defined intelligence to quickly access infrastructure resources to accelerate the application development process.

HPE Nimble

HPE Nimble hybrid flash array was used at both the primary and secondary data centers as a shared storage connected to the HPE Synergy via iSCSI LAN. The HPE Nimble Storage Adaptive Flash array is designed for both primary and secondary flash workloads. It is a hybrid flash array for mixed, primary workloads where cost-efficient flash performance is important. It can also serve as a secondary flash array for backup and disaster recovery while allowing you to put your backup data to work. The flash-enhanced architecture is combined with HPE InfoSight predictive analytics for fast, reliable access to data and availability.

HPE Nimble storage replication systems deliver an accelerated performance for higher throughput/IOPS and sub-millisecond latencies, a reduction of up to 75 percent in storage footprint, non-disruptive scaling to fit changing application needs through increased performance/capacity, maximized data and storage availability with an already integrated data protection and disaster recovery system, and above all else, reduced operational overhead. HPE Nimble storage replication will store and protect critical applications utilized by your business such as Microsoft Exchange, Microsoft SQL server, server virtualization, database, and virtual desktops (VDI).

To find out more about HPE Nimble Storage, visit HPE Nimble.

Figure 3. HPE Nimble HF20H hybrid flash array

HPE StoreOnce

HPE StoreOnce uses next-generation deduplication technology, which allows you to store more backup data and reduce the storage footprint. Multiple backup copies definitely enhance data availability and help adhere to backup best practices. Since deduplication identifies and eliminates redundant data, it optimizes storage capacity—effectively reducing the cost of disk by allowing more backup data to be stored on the same footprint. It dramatically improves the value proposition of disk-based data protection since it eliminates the redundancy typically seen in secondary storage processes.

The HPE StoreOnce Backup family with HPE StoreOnce deduplication provides consolidated, automated backup and DR operations that span the enterprise data centers, regional, and remote or branch offices. With HPE StoreOnce Backup, you can:

- Meet shrinking backup windows and optimize dedupe performance with HPE StoreOnce and Catalyst feature to enable storage deduplication and LAN/WAN bandwidth reduction across the HPE StoreOnce backup range.
- Simplify data protection for even the most complex environments. With a single HPE StoreOnce deduplication technology, you can easily manage the movement of data between remote offices and enterprise data centers.
- Enhance the manageability of DR and remote office backup operations.
- Protect data from unauthorized access through data-at-rest encryption and secure erase functionality for disks that are lost, stolen, or discarded.
- Integrate with existing backup applications seamlessly, as well as flexible integration into SAN, virtualized, and other environments.

In this solution, HPE StoreOnce 5100 was deployed at the secondary data center and is used as a target to hold the offsite backups for primary data center workloads. For more information on HPE StoreOnce Backup Systems, see HPE StoreOnce Data Protection.

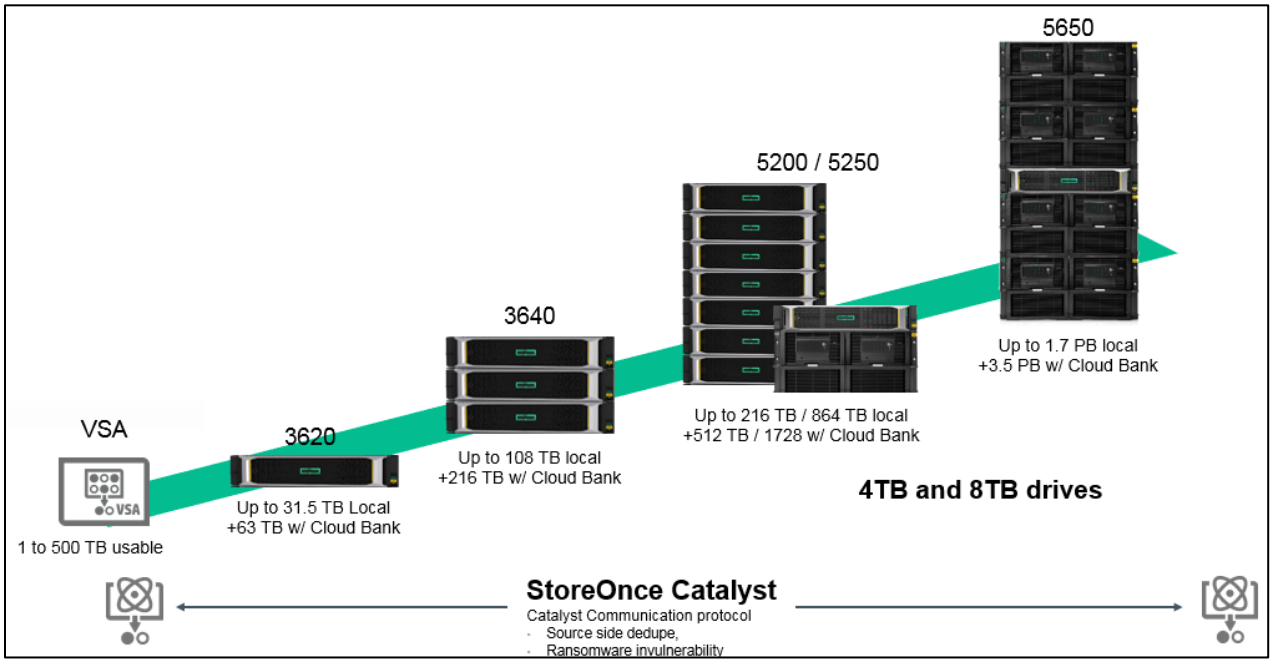

Figure 4. HPE StoreOnce capacity configurations available for small, medium, and enterprise business solutions

The figure below depicts the integration components between Veeam and StoreOnce.

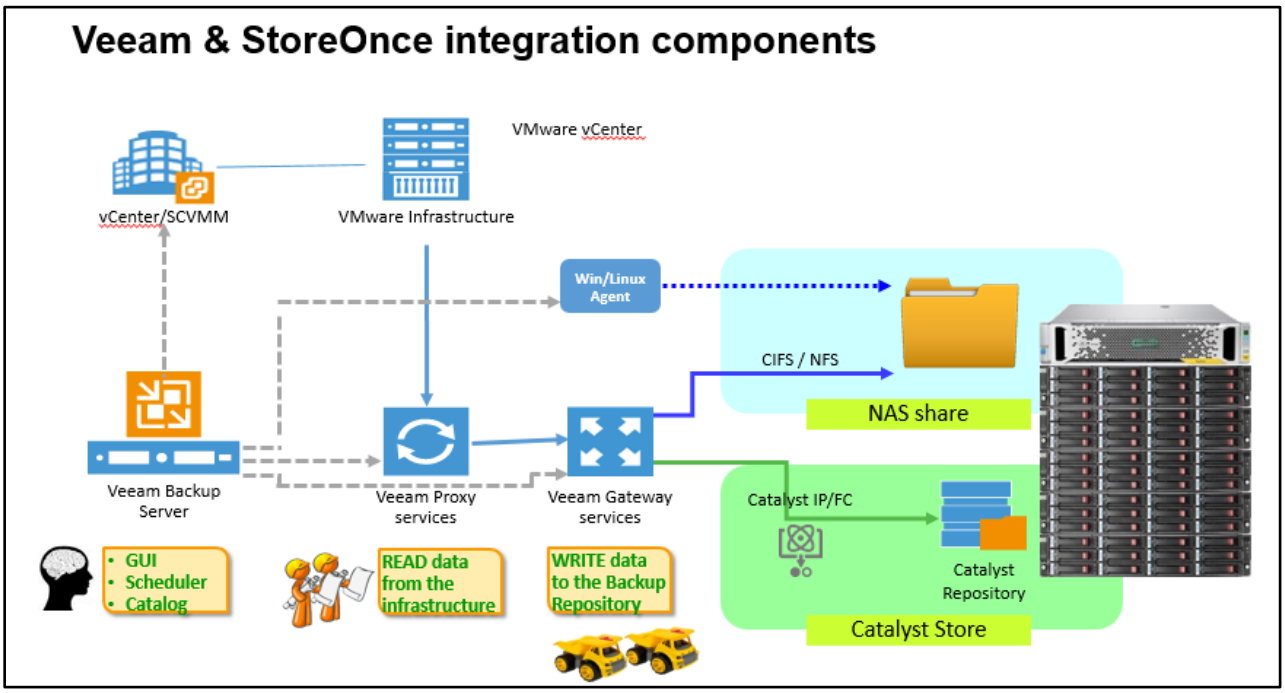

Figure 5. Integration between HPE StoreOnce and Veeam

Software

Veeam Backup & Replication Software

Veeam Backup & Replication offers a data protection solution for backup and replication together in a single software solution. Veeam Backup & Replication provides backup, replication and recovery of VMware VMs, physical servers and cloud-based workloads. The components of Veeam Backup & Replication consist of a backup server, backup proxy servers, and a disk-based backup repository. These resources can be physical or virtual depending on the requirements and topologies.

In this solution, Veeam Backup Server was deployed at the primary data center and Veeam proxy servers were deployed both at the primary and the secondary data centers. Veeam Proxy Server performs the backup of the workloads running on the primary data center to the local HPE Nimble storage and the secondary data center's HPE StoreOnce. The backup repository does backup copy from the primary data center to the secondary data storage.

Veeam Backup server and proxy server are run in a virtual machine running Windows Server 2016 Standard. HPE StoreOnce 5100 was deployed at the secondary data center and the catalyst store created on it was added as a backup repository on the Veeam Backup Server. Veeam uses Catalyst for source-side deduplication over a WAN for direct backup or backup copy to create a secondary copy of local backup data. In the backup repository wizard the created Catalyst store is specified, where the backup data will be archived for long term retention. Figure 6 shows the Veeam backup architecture.

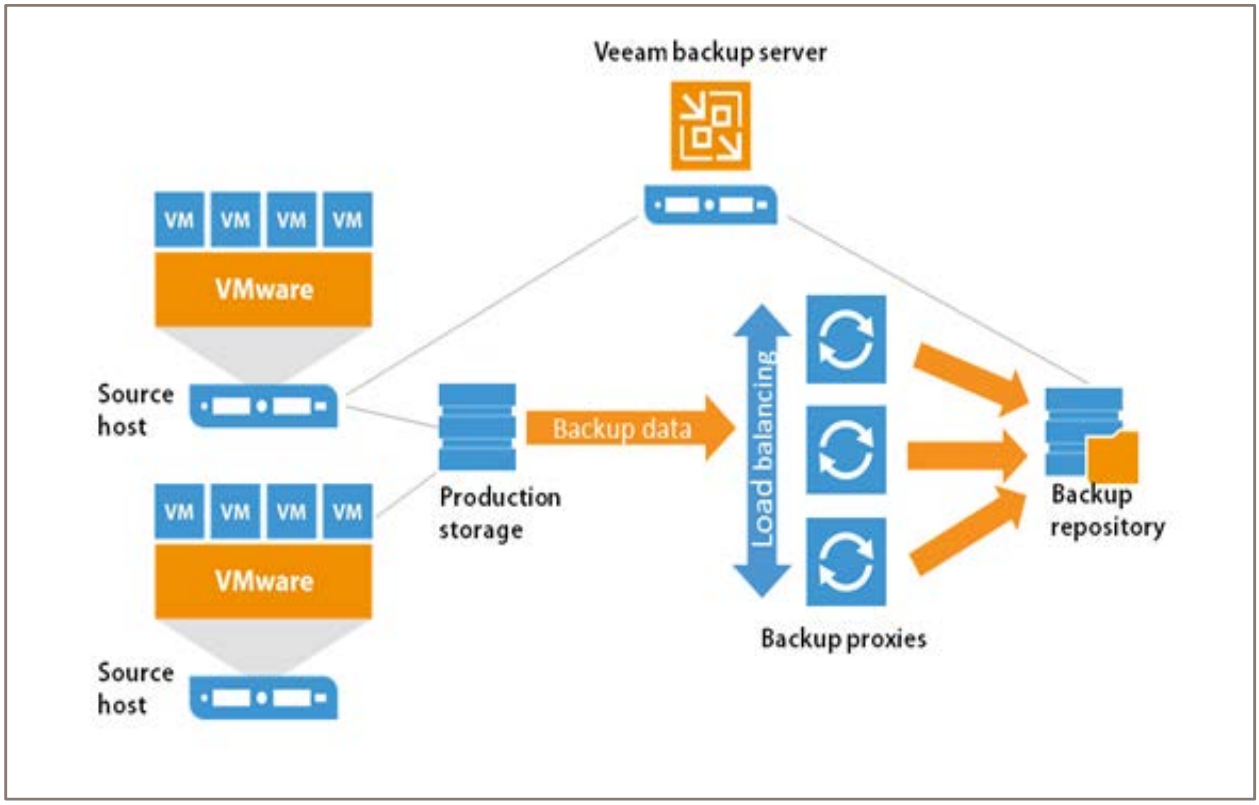

Figure 6. Veeam backup architecture (Courtesy: Veeam)

Protecting data in any client's environment is paramount to the success of the business. Due to the increasing amount of data in the environment, shrinking backup windows and demand for constant access to data 24x7x365 — this can become a challenge. To satisfy the Recovery Point Objectives (RPO) of the business, IT and Storage Professionals have the benefit of leveraging storage array-based snapshotting mechanisms. This provides nearly zero impact to the production Virtual Machines (VMs) running on the array allowing IT to protect the datastores in which their VMs reside on much more frequent than was possible with hypervisor snapshots alone. Unfortunately, the manual snapshot mount process is cumbersome and prone to user error.

Veeam's advanced integration with Nimble Storage provides additional protection and recovery options that are not available without direct integration and joint development efforts that provide the ability to:

- Schedule the creation of Nimble storage snapshots containing application-consistent VM images, and storage snapshot replication orchestration.
- Restore from Nimble storage snapshots or their Replicated Copies (entire VM, guest files and application items).
- Backup from Nimble storage snapshots or their Replicated Copies.

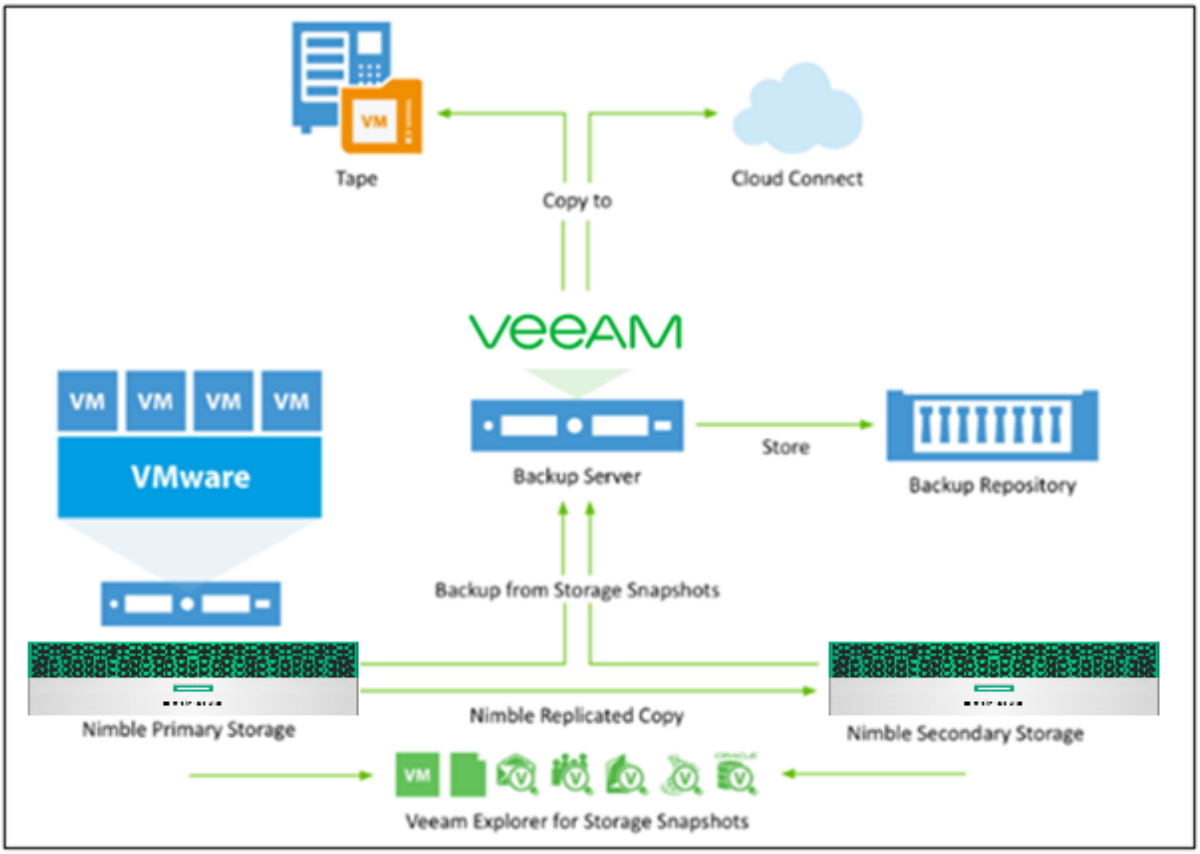

Figure 7. Veeam integration with HPE Nimble storage

Best practices and configuration guidance for the solution

The lab test configuration comprised the primary and secondary data centers set up on VMWare cluster deployed on four HPE Synergy 480 Gen10 servers. HPE Synergy on the primary data center was running various other bare metal and virtualized workloads. HPE Nimble hybrid storage was deployed at both the data centers and was connected to HPE Synergy via iSCSI. This hybrid HPE Nimble provides the shared storage necessary to run various workloads on HPE Synergy. HPE Nimble storage replication will store and protect critical applications utilized by the business such as Microsoft SQL server, server virtualization, database. In this whitepaper, MSSQL workloads running on the data centers are used to validate the use cases. HPE Nimble storage replication systems deliver an accelerated performance, maximized data and storage availability with an already integrated data protection and disaster recovery system, and above all else, reduced operational overhead.

For this solution, Veeam backup and replication software was deployed on the primary data center as a virtual machine on HPE Synergy. Veeam proxy services were deployed on Microsoft Windows 2016 Standard virtual machines at both the primary data center and the secondary data

center. These Veeam backup proxy processes backup jobs and delivers the backup traffic, while the Veeam backup server administers backup tasks.

HPE StoreOnce appliance was deployed on the secondary data center and catalyst store was created on it to hold the backups from the HPE Nimble secondary storage. HPE StoreOnce Backup is connected to HPE Synergy via LAN and catalyst stores were created on it which acts as the backup repository for storing the data backups. HPE StoreOnce in the secondary data center uses 10Gb network connection.

StoreOnce Backup guidance

- With HPE StoreOnce Catalyst source-side deduplication, deduplication happens at source (here Veeam gateway server at Secondary data center) before the data is transferred over the network to the HPE StoreOnce backup. This helps in efficient backup data transfer and less network utilization.
- When creating Catalyst stores on HPE StoreOnce, the low bandwidth settings of both the primary and secondary transfer policy enables HPE StoreOnce Catalyst source-side deduplication, which is preferred when the workload to be backed up to the Catalyst store is high and when the backup or backup copy job is configured over a WAN. It reduces the physical data transferred over the network during the backup process.
- When creating Catalyst stores on HPE StoreOnce, the high bandwidth settings of both primary and secondary transfer policy disables HPE StoreOnce Catalyst source-side deduplication and compression, which is preferred when the network bandwidth utilization is low and deduplication could be done more efficiently on the target StoreOnce appliance.

In our test environment, both the primary and secondary transfer policies were set to low bandwidth, enabling source-side deduplication. See the HPE StoreOnce Catalyst configuration guide for configuring Veeam with HPE StoreOnce Catalyst.

Figure 8 shows the Catalyst store created on HPE StoreOnce with both primary and secondary transfer policy set to low bandwidth.

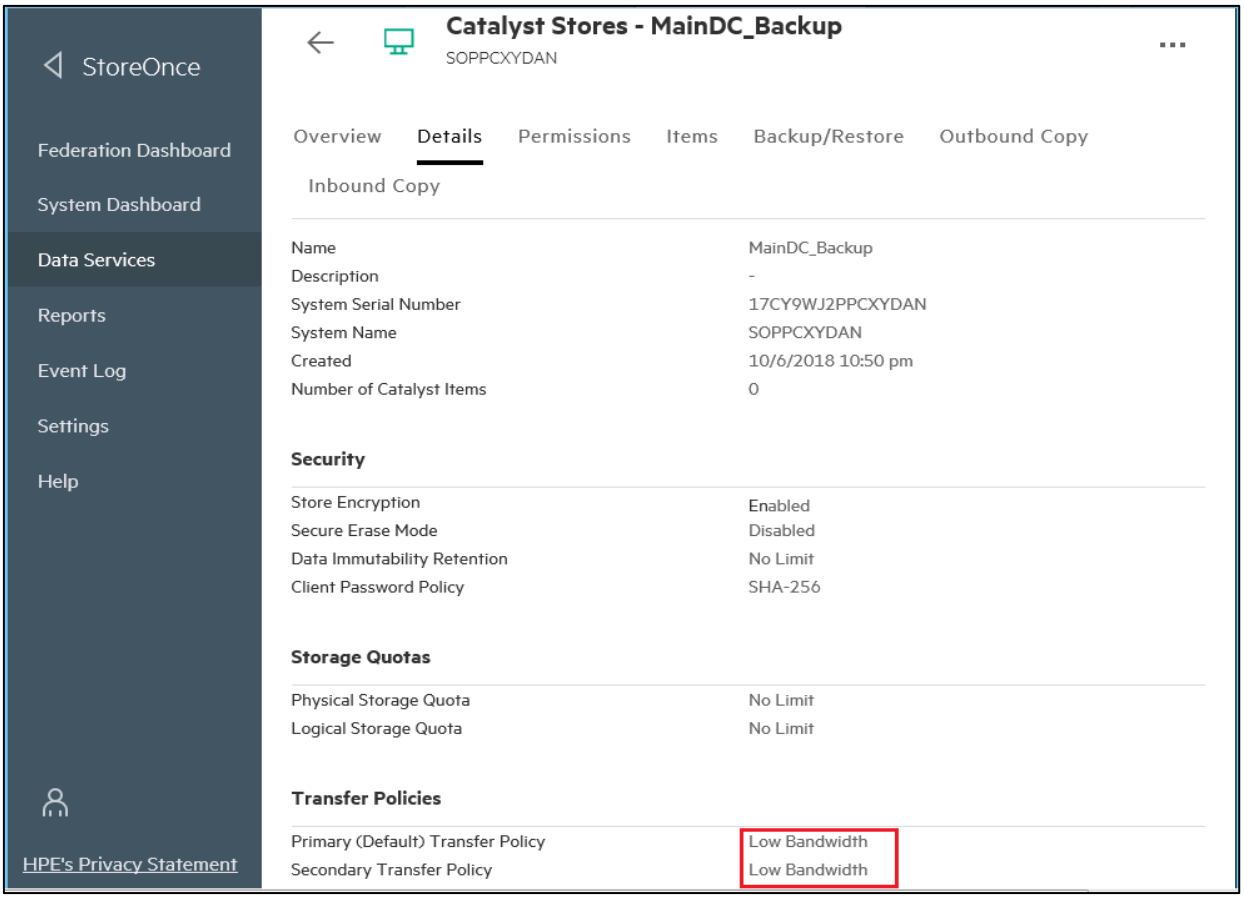

Figure 8. HPE StoreOnce Catalyst store with source side deduplication enabled for low bandwidth transfer

Note

Backing up data directly to dedupe appliances may have performance implications when using Instant VM Recovery and SureBackup features which require lot of random I/O. If there are requirements to use features that require random I/O, then you can optionally choose standard storage such as HPE Nimble or HPE Apollo as the primary backup target. StoreOnce Catalyst helps in bandwidth reduction irrespective of its placement either as a primary backup target or as a secondary backup target.

Veeam Backup & Replication and HPE StoreOnce Catalyst solution benefits include the following:

- Source-side or client-side deduplication capabilities
- Virtual synthetic full backups and support for Instant VM Recovery
- More efficient backup data transfer over LAN and WAN
- Reduced storage space and faster performance compared to traditional NAS protocol (CIFS and NFS) connectivity
- Available on-site and off-site backup copies using HPE StoreOnce Replication

Network guidance

For maximum backup performance, Hewlett Packard Enterprise recommends connecting HPE StoreOnce to the data center network using 10GbE links. Table 2 shows the firewall ports configured between primary data center the secondary data Center for this solution. You can refer to the comprehensive list of Veeam firewall ports here based on your solution customization requirement, https://helpcenter.veeam.com/docs/backup/vsphere/used_ports.html?ver=95.

Table 2. Firewall ports configured between the primary data center and the secondary data center

From (Primary data center)	To (Secondary data center)	Port	Description
Veeam Backup Server and Veeam Backup Proxy	VMWare vCenter Server	HTTPS TCP 443	Default port used for connecting vCenter Server
Veeam Backup Server	VMWare vCenter Server	HTTPS TCP 10443	Port used for communication with vCenter Server
Veeam Backup Server and Veeam Backup Proxy	ESXi Server	TCP 902	Port used for data transfer to ESXi host
Veeam Backup Server and Veeam Backup Proxy	Veeam Backup Proxy	TCP UDP 135, 137-139, 445	Ports to deploy Veeam Backup and Replication components
Veeam Backup Server and Veeam Backup Proxy	Veeam Backup Proxy	TCP 6160	Default port used by Veeam Installer Service
Veeam Backup Server and Veeam Backup Proxy	Veeam Backup Proxy	TCP 6161	Default port used by the Veeam vPower NFS Service
Veeam Backup Server and Veeam Backup Proxy	Veeam Backup Proxy	TCP 6162	Default port used by Veeam Data Mover Service
Veeam Backup Server and Veeam Backup Proxy	Veeam Backup Proxy	TCP 2500 5000	Default port range used as data transmission channels and for collecting logs
Veeam Backup Server	HPE StoreOnce	TCP 9387	Default command port used for communication with HPE StoreOnce
Veeam Backup Server	HPE StoreOnce	TCP 9388	Default data port used for communication with HPE StoreOnce
HPE Nimble Primary Storage	HPE Nimble Secondary Storage	TCP 4213, 4214	Ports enabled from one HPE Nimble array to talk to another for the purpose of replication tasks
From (Primary data center)	**To (Nimble)**	**Port**	**Description**
Veeam Backup Server	Nimble storage system	HTTPS TCP 5392	Default command port used for communication with Nimble storage (used for Nimble OS 2.3 and later).
Veeam Backup Server and Veeam Backup Proxy	Nimble storage system	HTTPS TCP 3260	Default iSCSI target port.

Veeam Backup Server guidance

In this solution, both Veeam Backup Server and Veeam proxy servers were installed on a Windows Server 2016 Standard VM and was configured with eight vCPUs and 16 GB memory.

To make the Veeam Backup job MSSQL database-aware, enable "application aware image processing" in the "Guest Processing" options of the Veeam backup job. This uses Volume Shadow Copy service within the VM to make the MSSQL server complete any I/O operations in preparation for backup.

When the backup repository target is an HPE StoreOnce, is it advisable to always use Veeam recommend settings which will be flagged in the Veeam UI when creating the backup repository and backup job. This includes keeping the default compression level, turning Veeam dedupe off, and when creating the StoreOnce backup repository, keep the defaults which includes decompressing the data before it is stored on StoreOnce as shown in Figure 9.

Enabling the Virtual Synthetic Full feature, which is part of the Veeam and HPE StoreOnce catalyst integration, provides faster concurrent full backups. To enable this option, choose "Create synthetic full backups periodically" in advanced job settings as shown in Figure 9.

Veeam Explorer Explorer for Microsoft SQL helps perform object-level restore and transaction-level restore of backed up MSSQL databases. This requires a staging server which presents the transaction records and object-level changes made in the database to the user. It is possible to configure both local and remote staging servers by using the Options dialog (in the main menu) in Veeam Explorer. To create transactionally consistent backups or replicas of VMs 'application aware processing' is enabled for the job. Veeam Explorer for Microsoft SQL to restore databases from any successfully created backup or replica of a virtualized Microsoft SQL Server. The backup or replica must be created with application-aware processing enabled and the corresponding options turned on.

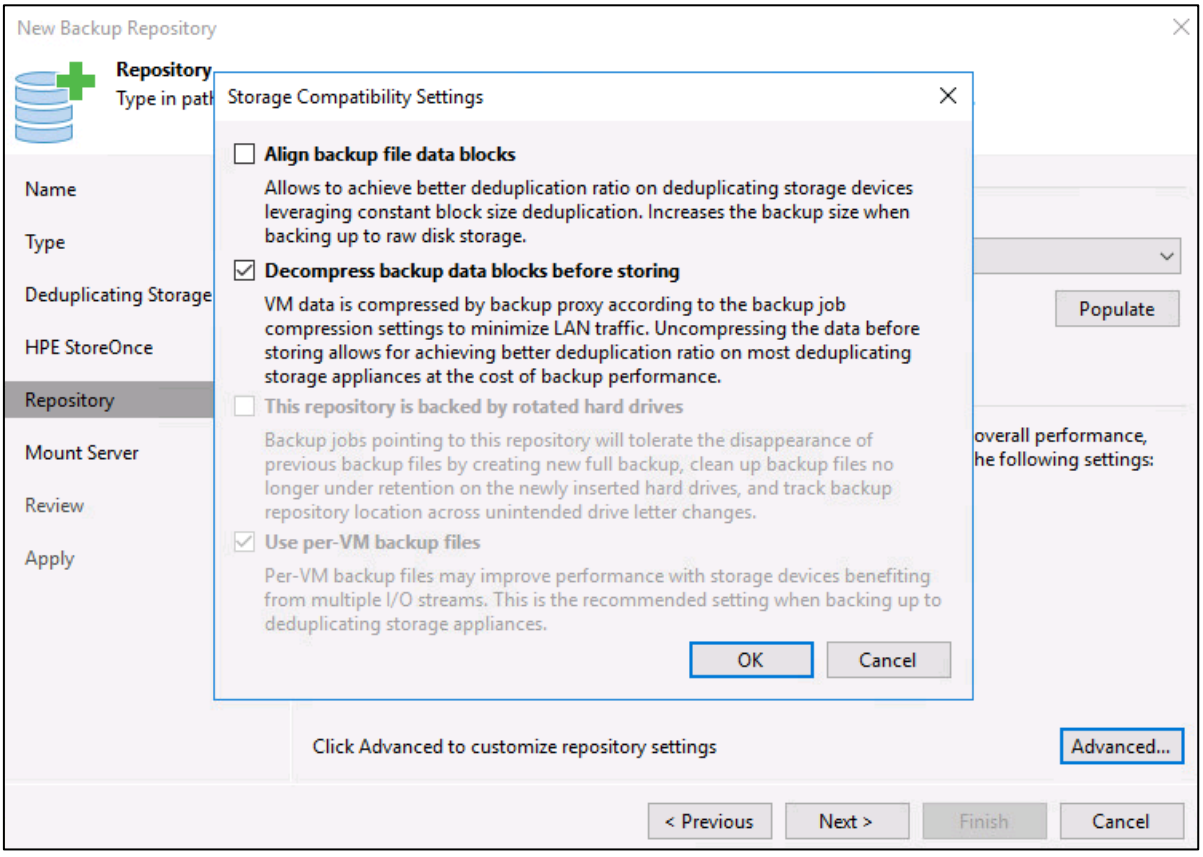

Figure 9. Advanced settings for HPE StoreOnce storage repository creation and backup job creation

Veeam and HPE Nimble Storage Integration replication

For daily data recovery tasks, such as recovering an accidentally deleted or corrupted file, you can take snapshots that serve as a backup. In the event of a power failure or a site disaster, replication technology can be a quick and effective way to recover data at an offsite location.

Replication maintains a copy or replica of a volume or set of volumes on another HPE Nimble array that is configured as part of a pair of replication partners.

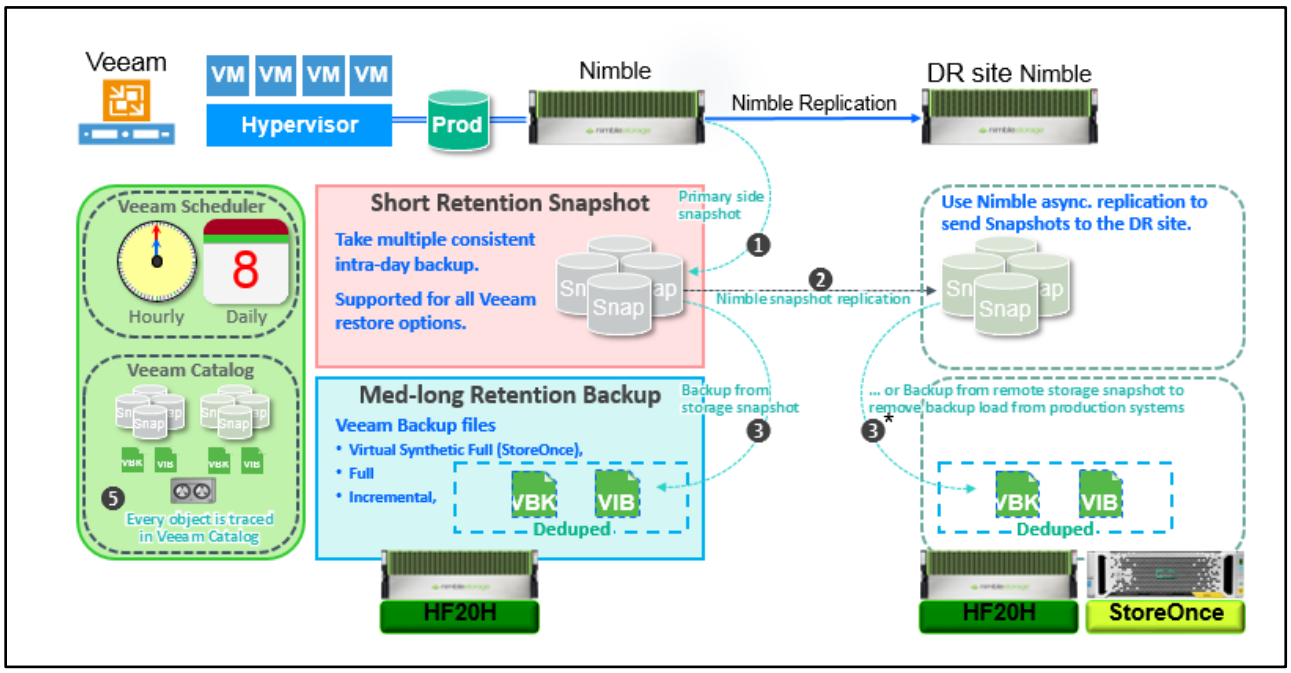

Figure 10. Detailed depiction of data transfer and backup from primary data center to secondary data center (DR site)

Workload description

The primary data center with HPE Synergy 480 Gen10 servers running VMWare cluster was deployed. MSSQL Servers (small and large) were also deployed at the primary data center. These MSSQL servers were running Microsoft SQL 2016 developer edition on Windows server 2016 standard. The MSSQL servers were created with Datastore consisting the configuration files, SQL data and SQL logs within.

Smaller MSSQL servers had 4 CPU cores, 8GB memory, and 200GB disk storage. Larger MSSQL servers had 8 CPU cores, 16GB memory, and 400GB disk storage.

HammerDB version 3.0, an open source benchmarking tool was used to create a database called TPCC on each of the MSSQL servers. TPCC database on smaller MSSQL servers was loaded with 10GB of data and TPCC database on larger MSSQL servers was loaded with 100 GB of data. These databases loaded with transactions were created to perform table and object level restore of MSSQL database.

Use Cases

This solution is validated for the below listed use cases. All use cases have a centralized Veeam Backup Server at the primary data center deployed on HPE Synergy platform running VMWare cluster. HPE Nimble storage was configured as the primary and secondary backup repositories at both the data centers. HPE StoreOnce was deployed on the secondary data center as Secondary storage device for long time archival.

Backup and Recovery of VMs from primary Nimble storage

In this use case, Backup jobs are run from the Veeam management UI to keep snapshots of the datastores containing MSSQL servers (VMs) on the HPE Nimble Storage primary array. Veeam proxy servers deployed at the primary data center helps process backup jobs and also delivers the backup traffic. The VMs & SQL server databases were recovered leveraging the recovery features (i.e. Instant VM Recovery, file-level restore or application item restore options supported by the Veeam Backup & Replication.)

The following were validated as part of this use case:

- Scheduling the Nimble Storage snapshots with application-consistent VM image
- Recovery of VM from the backup at HPE Nimble primary storage

In order to validate the restore and recovery options, we manually deleted MSSQL servers running at the primary data center and using the Veeam Backup Server, restored these two MSSQL servers from HPE Nimble primary storage array snapshots, to their original location. Refer to figure 11 for details.

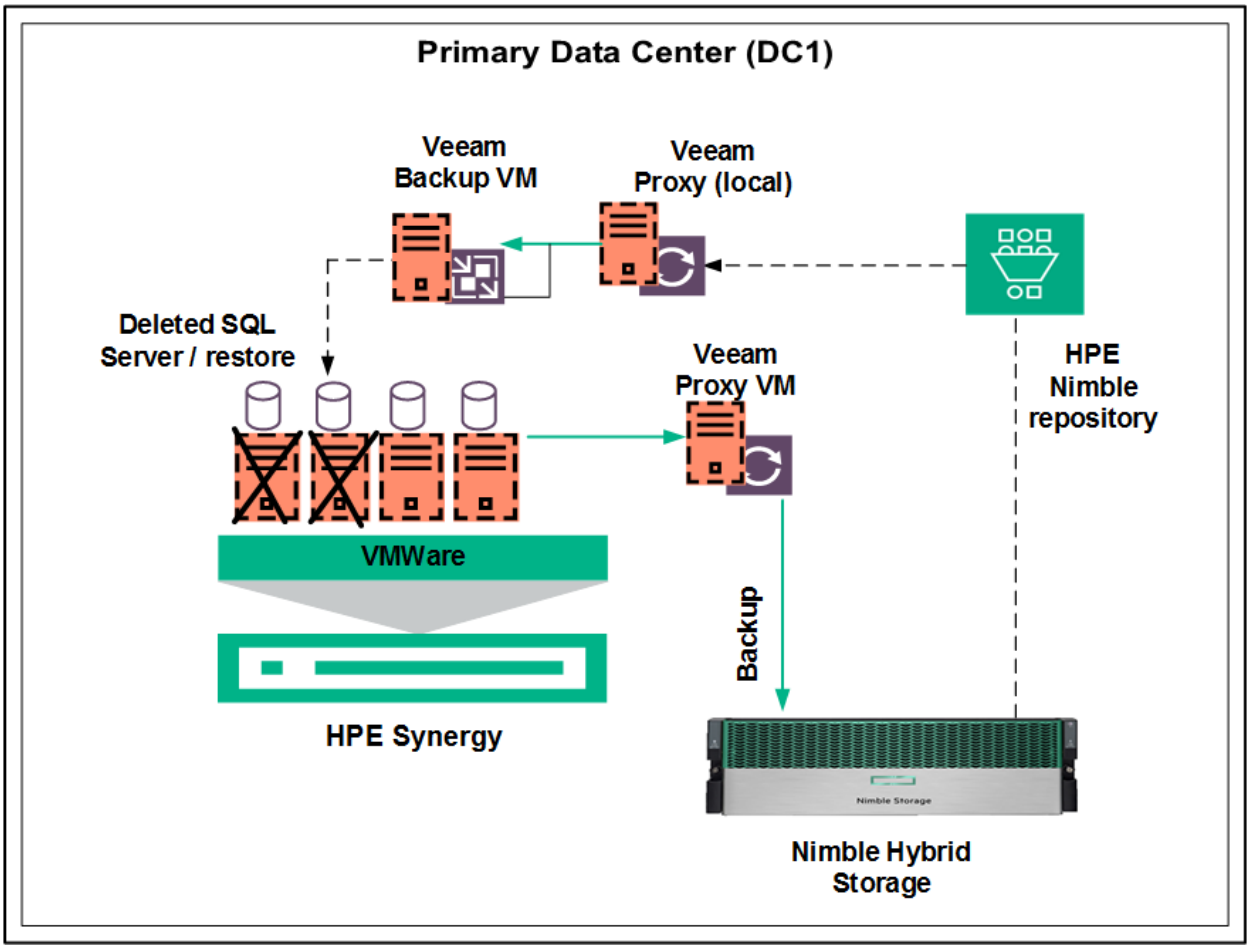

Figure 11. Backup and Restore of SQL workloads to local HPE Nimble snapshots at the primary data center

Table 3 lists the test scenarios validated for recovery and restoration of VMs, applications, databases from primary storage.

Table 3. Backup and recovery of primary data center VMs on local HPE Nimble storage test cases validation

Test Case	Name	Description	From	To	Validation	Outcome
3.1	Backup MSSQL servers	Backup virtual machines running MSSQL server to HPE Nimble backup repository	Primary data center (Synergy)	HPE Nimble storage repository	On the Veeam Backup Server user interface, under 'Disk' tab - 'Backups' section shows all the Backed up MSSQL Servers	Success
3.2	Backup MSSQL servers (snapshot)	Scheduling the Nimble Storage snapshots with application-consistent VM image	Primary data center (Synergy)	HPE Nimble storage repository	Create a new backup job in the Veeam Backup console; Choose backup repository on Storage; On completion of the job – snapshots can be seen under the storage Infrastructure console	Success
3.3	MSSQL server recovery	Recover the deleted virtual machine (SQL server) using snapshots from Nimble	HPE Nimble primary storage repository	Primary data center (Synergy)	Leveraging the Instant VM recovery option on Veeam, the desired VM is recovered/restored	Success

For Nimble storage snapshot orchestration, on the backup job wizard - **Nimble snapshot (Primary storage snapshot only)** option for the Backup repository is chosen on the Storage tab as seen in figure 12.

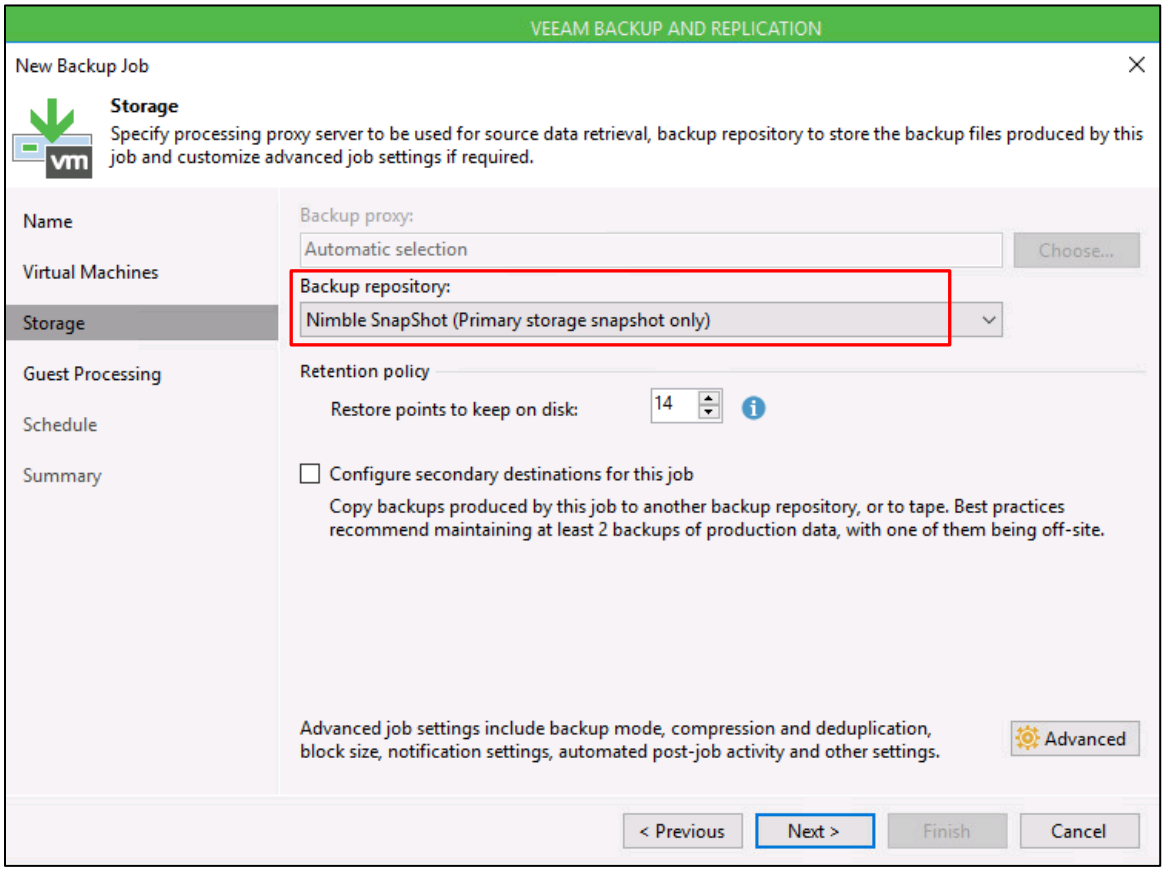

Figure 12. Backup job with backup repository selection on storage tab – as seen on Veeam Storage Infrastructure

Successfully completed snapshots are seen on the Veeam console as seen in figure 13.

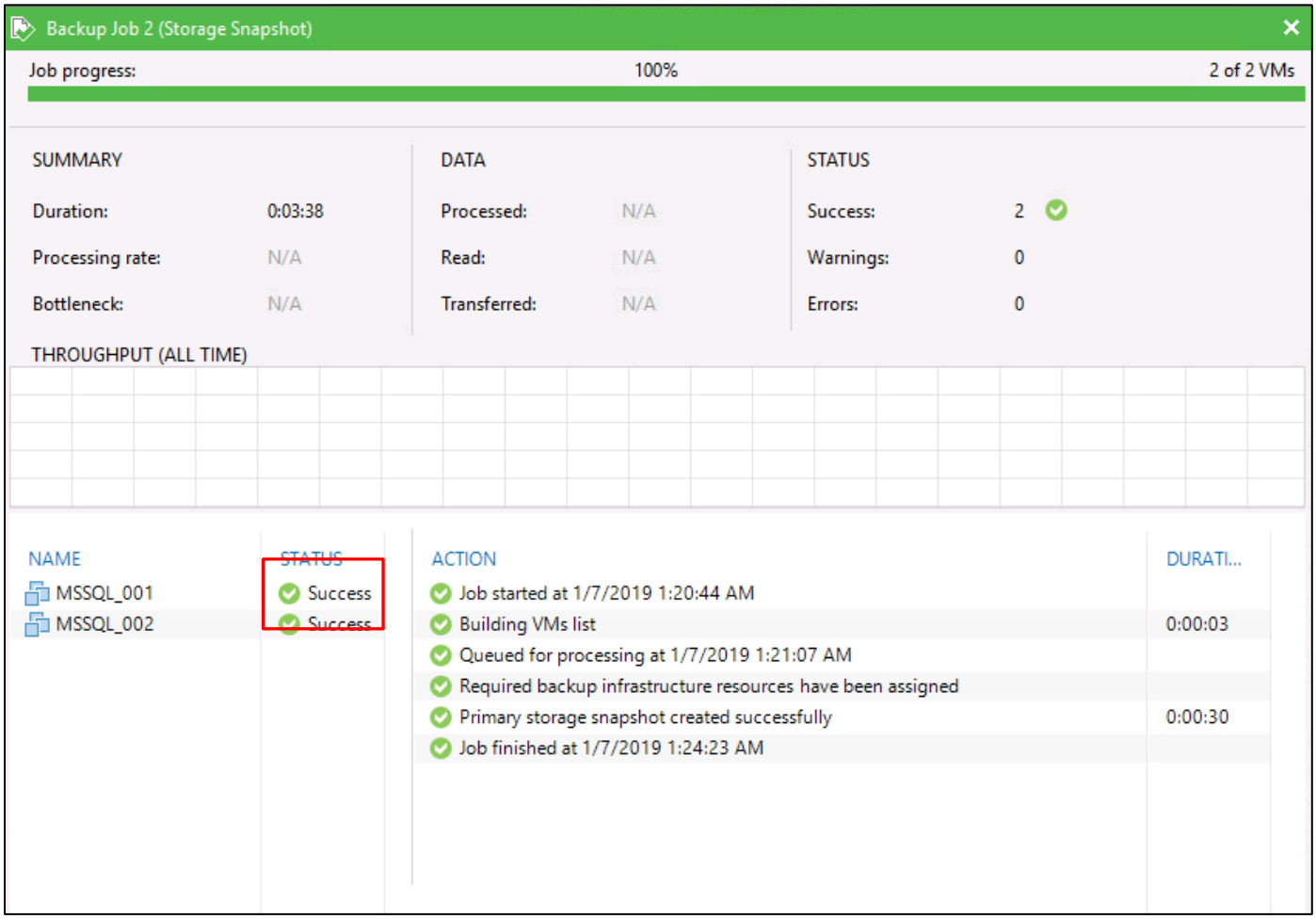

Figure 13. Successful completion of the backup job run– as seen on Veeam Storage Infrastructure

Completed backup jobs on Veeam can also be seen under the storage infrastructure section for primary data center, as highlighted in figure 14.

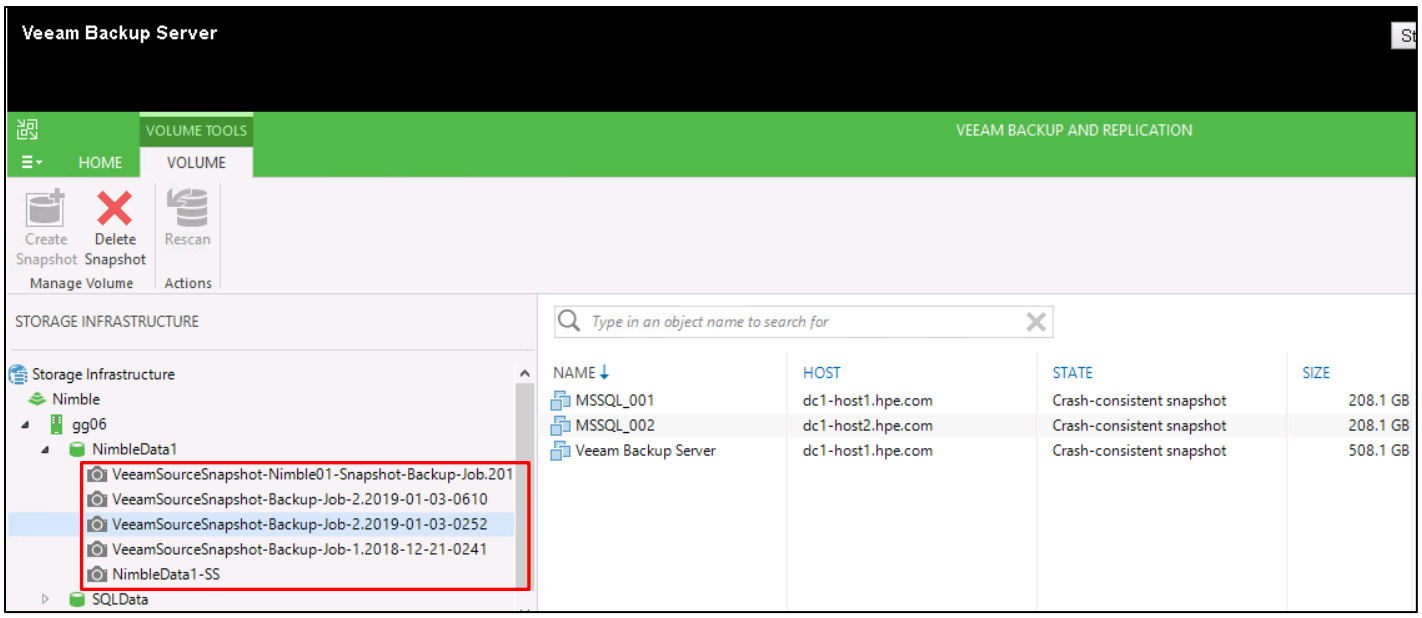

Figure 14. Backup job with MSSQL snapshots successfully stored on HPE Nimble primary storage – as seen on Veeam Storage Infrastructure

Figure 15 depicts the snapshots stored on the volume created on HPE Nimble storage which was orchestrated through Veeam.

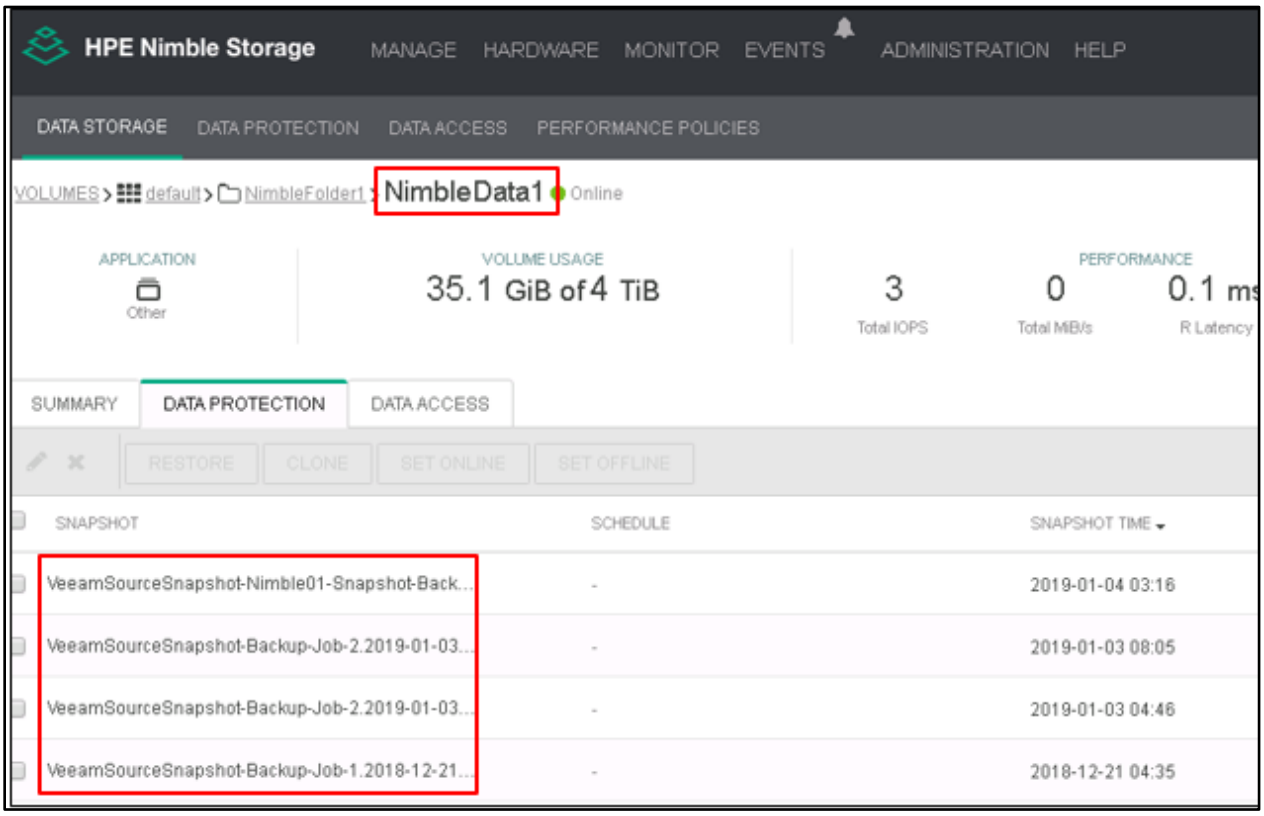

Figure 15. MSSQL snapshots successfully stored on HPE Nimble primary storage

With instant VM recovery, we can immediately restore a VM into the production environment by running it directly from the snapshot.

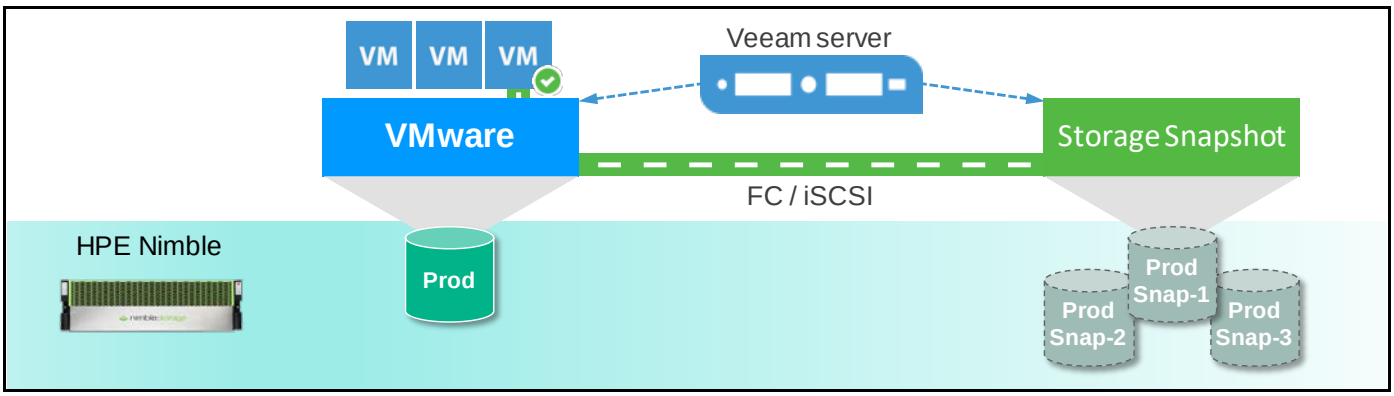

Figure 16. Instant VM recovery form HPE Nimble Storage snapshot (iSCSI)

Benefits of Instant VM Recovery (IVMR):

- Veeam interacts with HPE-Storage and VMware to boot VMs from HW Snapshots
- The VM is up and running in a matter of seconds and it is as fast as your production

The following image describes the Instant VM recovery scenario wherein the SQL server from the replicated snapshot on the primary Nimble storage is restored to Datacenter1.

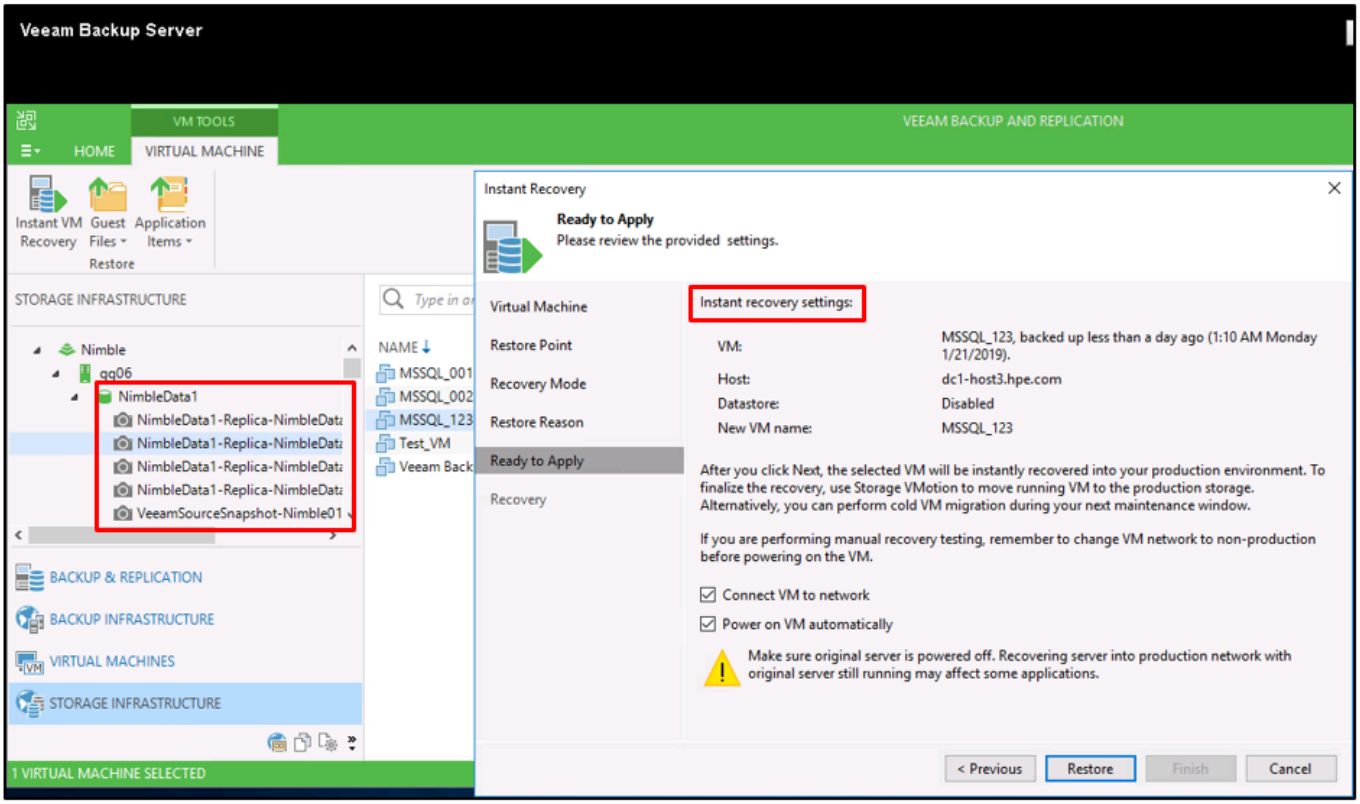

Figure 17. Instant VM recovery form secondary HPE Nimble Storage snapshot to Datacenter1

Figure 18 shows a successfully restored SQL server on Datacenter2.

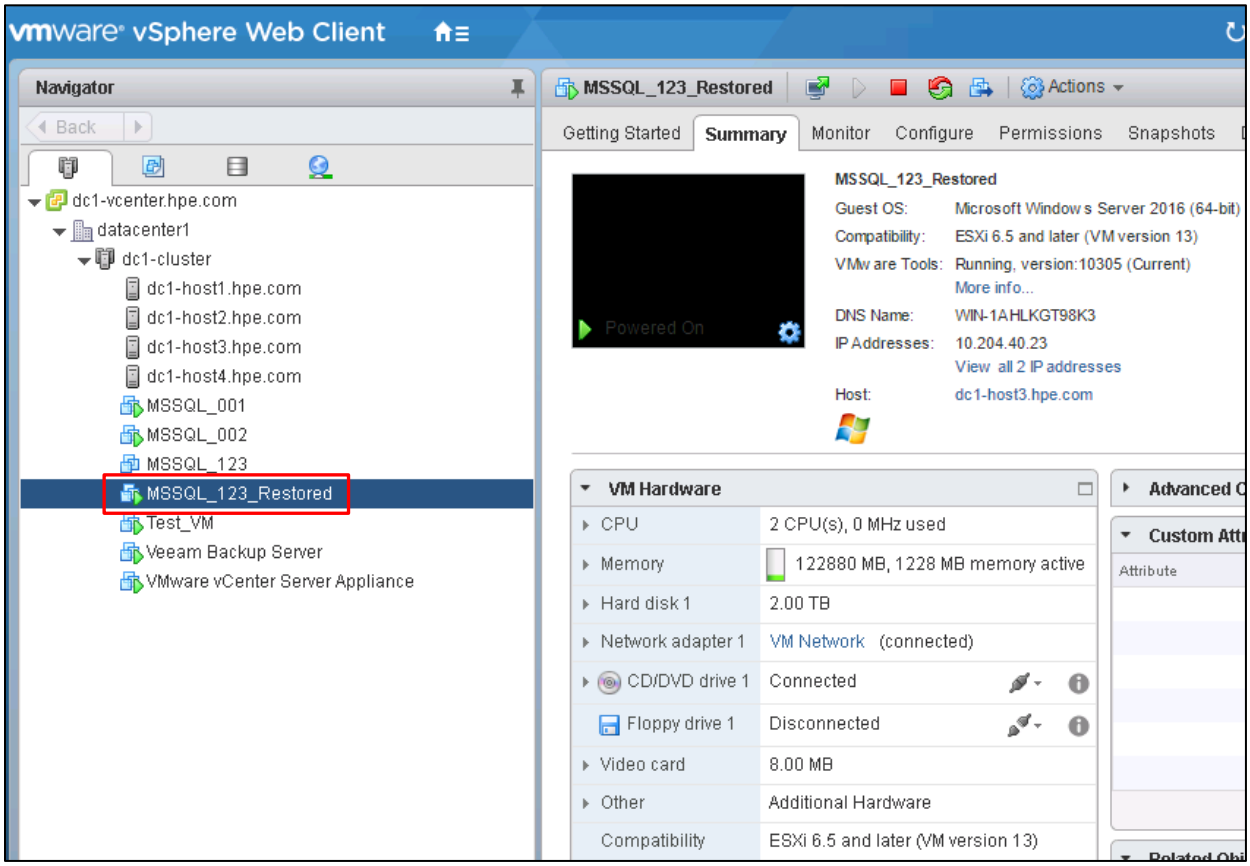

Figure 18. Successfully restored SQL server on Datacenter2, leveraging Instant VM Recovery feature

Replication: Primary HPE Nimble Storage to Secondary HPE Nimble storage (warm backup –restore points)

For daily data recovery tasks, such as recovering an accidentally deleted or corrupted file, you can take snapshots that serve as a backup. In the event of a power failure or a site disaster, replication technology can be a quick and effective way to recover data at an offsite location.

Replication maintains a copy or replica of a volume or set of volumes on another HPE Nimble array that is configured as part of a pair of replication partners.

In this use case, short retention snapshots of the MSSQL servers on the primary data centers were triggered, which were saved on the primary HPE Nimble storage. These snapshots are then sent to HPE Nimble secondary storage using HPE Nimble replication mechanism. Later the backup files (snapshot) are sent to secondary storage systems such as StoreOnce, to remove backup load from production systems.

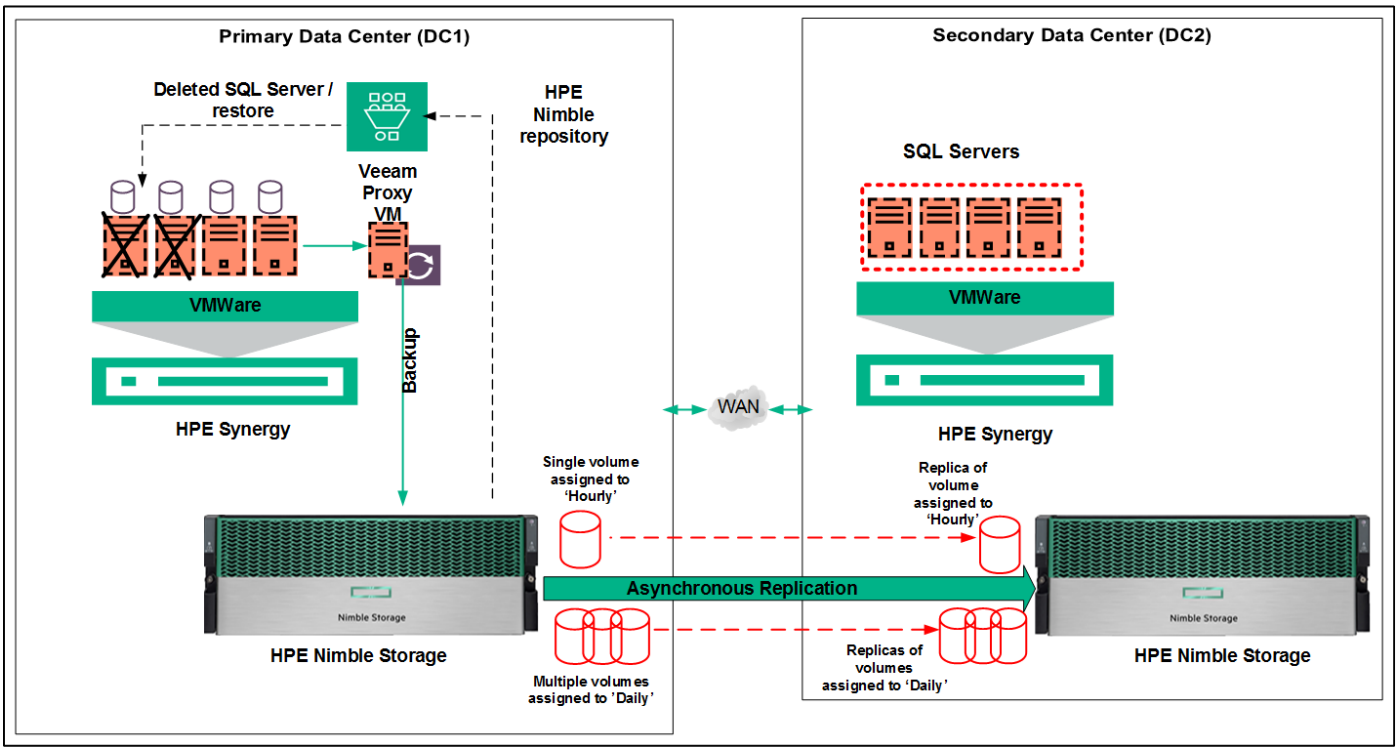

Figure 19. Backup and restore of workloads at Primary data center to HPE StoreOnce repository

Table 4 lists the retention points and the duration at primary and secondary Nimble storage.

Table 4. HPE Nimble primary storage to HPE Nimble secondary storage volume names with retention duration

Sl #	Volume Name	Snapshot retention duration	No of snapshots retained
4.1	Primary Nimble: NimbleData1	2 weeks	24
4.2	Secondary Nimble: Cluster2-NimbleVolume	2 weeks	48

Table 5 lists the test case validations from the primary data center to the secondary data center.

Table 5. HPE Nimble primary storage to HPE Nimble secondary storage asynchronous replication test cases validation

Test Case	Name	Description	From	To	Validation	Outcome
5.1	Primary side snapshot	Creation of short retention snapshots at the primary storage	Primary data center (Synergy)	HPE Nimble storage	Take multiple consistent, Intra-day backup. Supported for all Veeam restore options	Success
5.2	HPE Nimble snapshot replication	Data replication from HPE Nimble storage primary to secondary	HPE Nimble storage primary site	HPE Nimble storage secondary site	HPE Nimble asynchronous replication to send snapshots to secondary site	Success

Figure 20 describes the snapshots replicated from the primary HPE Nimble storage to the secondary HPE Nimble storage. The same can be seen under the 'replicated' column with snapshots checked.

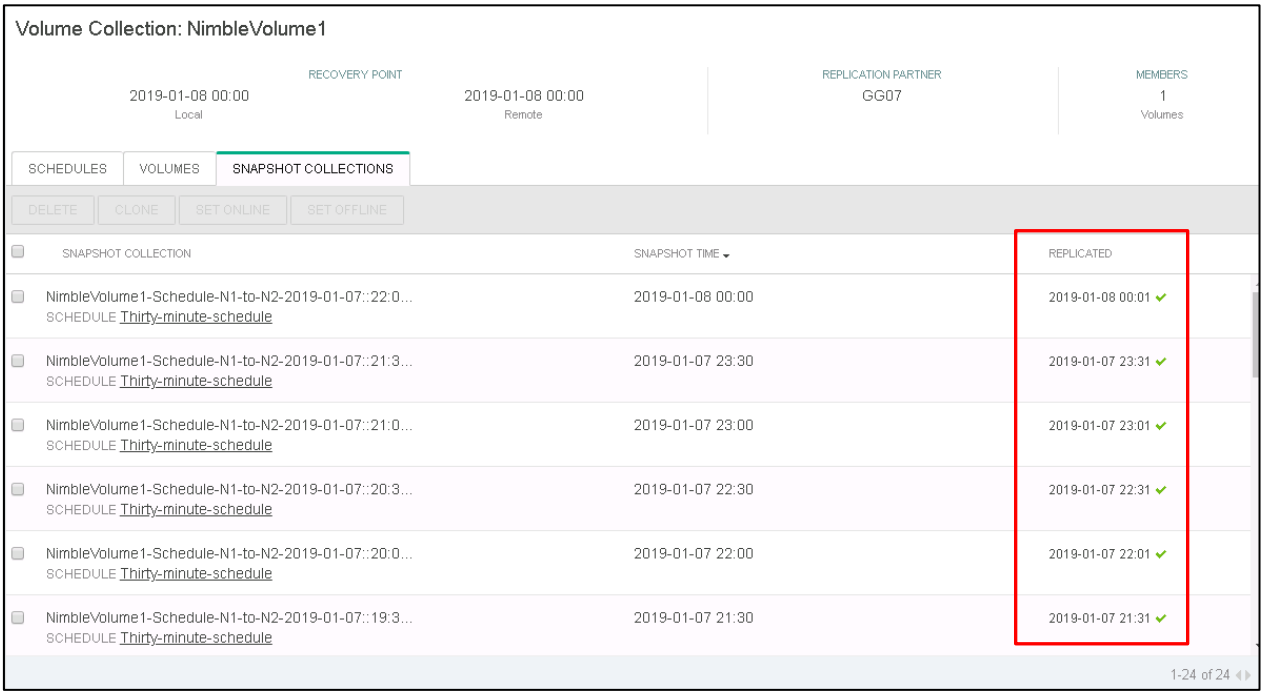

Figure 20. Snapshots replicated from HPE Nimble primary storage

Successful data replication on HPE Nimble – data volume on secondary data center, after initiating the HPE Nimble replication at primary HPE Nimble storage can be seen in figure 21.

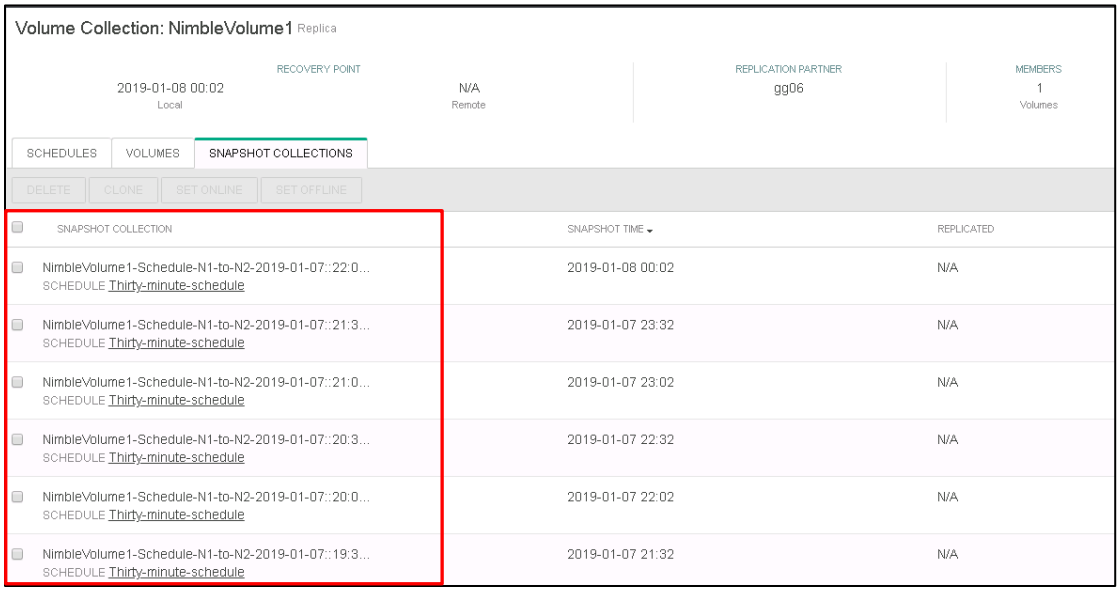

Figure 21. Successful replication of snapshots from the primary storage to HPE Nimble secondary storage

Restore VMs/MSSQL servers from HPE Nimble Secondary to Primary data center (restore/recovery)

This use case leverages the Recovery option supported by Veeam, to bring up the primary site by restoring the VM's or MSSQL workloads from the replicated data at the HPE Nimble secondary storage. Nimble snapshots provides with a set of recovery options enabled by Veeam, such as Instant VM Recovery, application-item recovery etc.

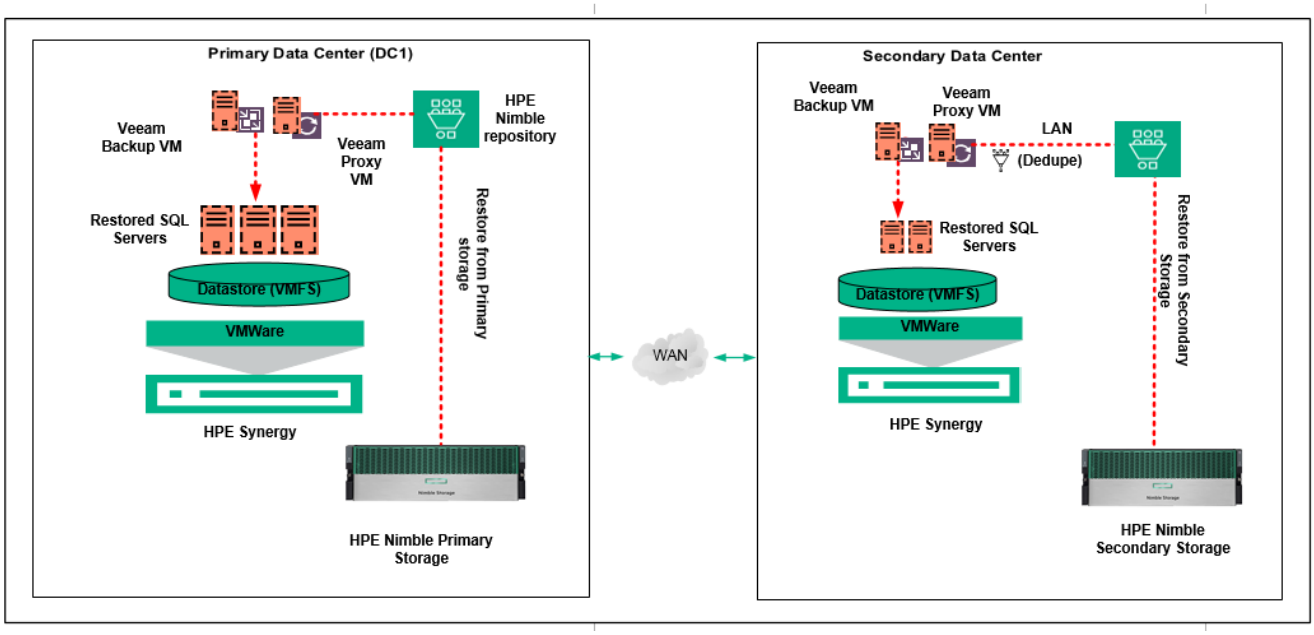

Figure 22. Recovery and restoration of VMs from HPE Nimble storage snapshots across primary and secondary data centers

Validation of the test case from restoring the secondarty data storage, to the primary data center, as seen in table 6.

Table 6. Restoration from secondary data storage to primary data center test cases validation

Test Case	Name	Description	From	To	Validation	Outcome
6.1	Restore from secondary storage systems	Recovering the VMs on secondary site, from backup snapshots at secondary Nimble storage	HPE Nimble secondary storage	Secondary data center	Right click the snapshot, select VM and choose restore application/ database/ Instant VM recovery. Upon completion, VMs/ database/files are restored on secondary data center	Success

To validate scenario 1 from table 6, the snapshots of SQL servers on the primary HPE Nimble storage were leveraged. SQL servers from the snapshots were restored from the source (hostA) to another destination host (hostB).

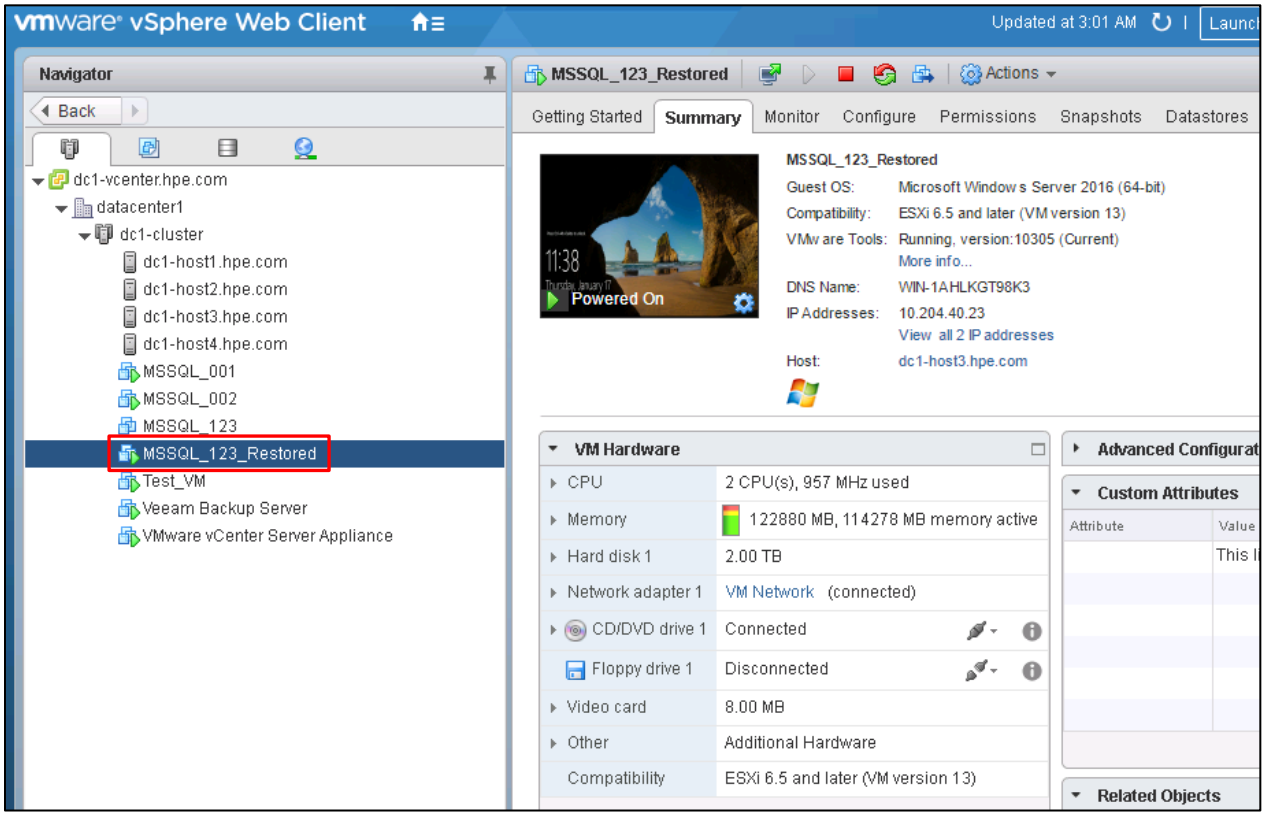

Figure 23. SQL server restored from the snapshots backed up on the primary Nimble storage to Datacenter1

Figures 24 and 25 describes the database restoration and files restoration respectively, from the Veeam orchestrated HPE Nimble storage snapshots.

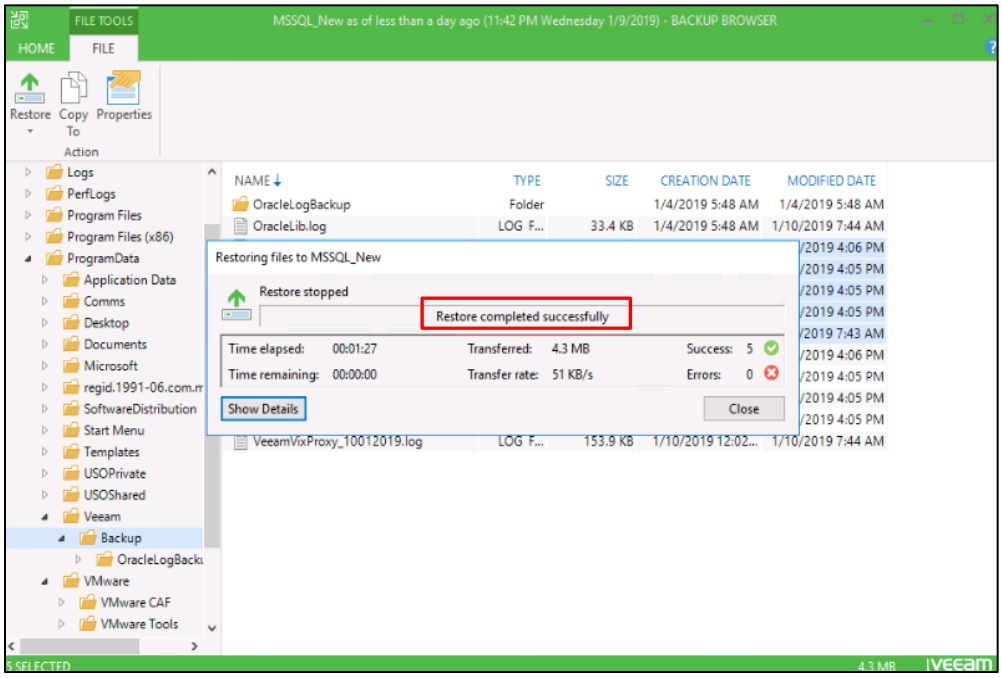

Figure 24. Successfully restored files from HPE Nimble storage snapshots – as seen on Veeam UI

The replicated snapshots from the HPE primary storage volume to secondary storage volume were restored on Datacenter2, leveraging the Restore features supported by Veeam for SQL applications. The screenshot below depicts the SQL server restored on Datacenter2, from the replicated data on HPE Nimble storage volume on DC2.

To validate the scenario from table 6, the snapshots of the SQL servers from the primary data center's Nimble storage were replicated to secondary Nimble storage on Datacenter2.

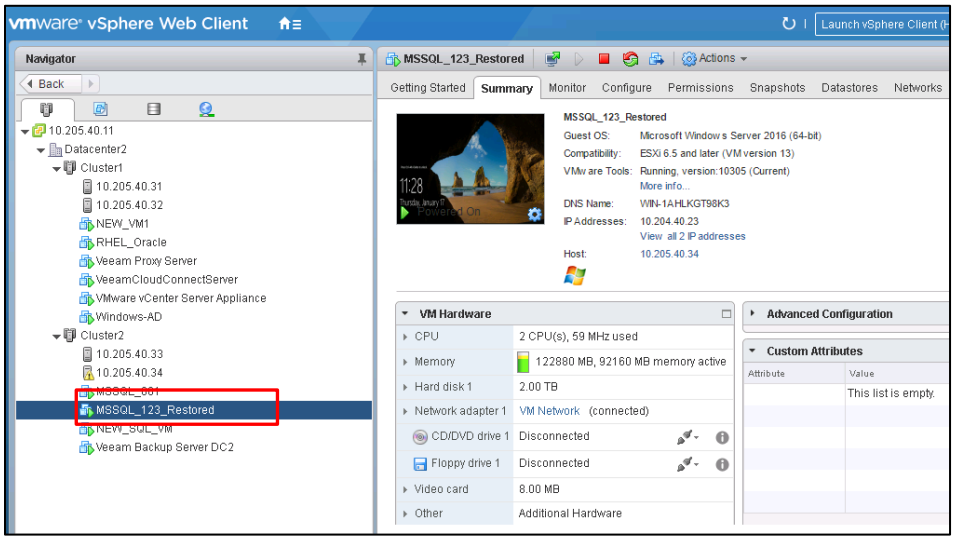

Figure 25. MSSQL server (DC1) is successfully restored though the secondary HPE Nimble storage snapshots on DC2

Figure 26 depicts the successful restoration of a database from replicated snapshot.

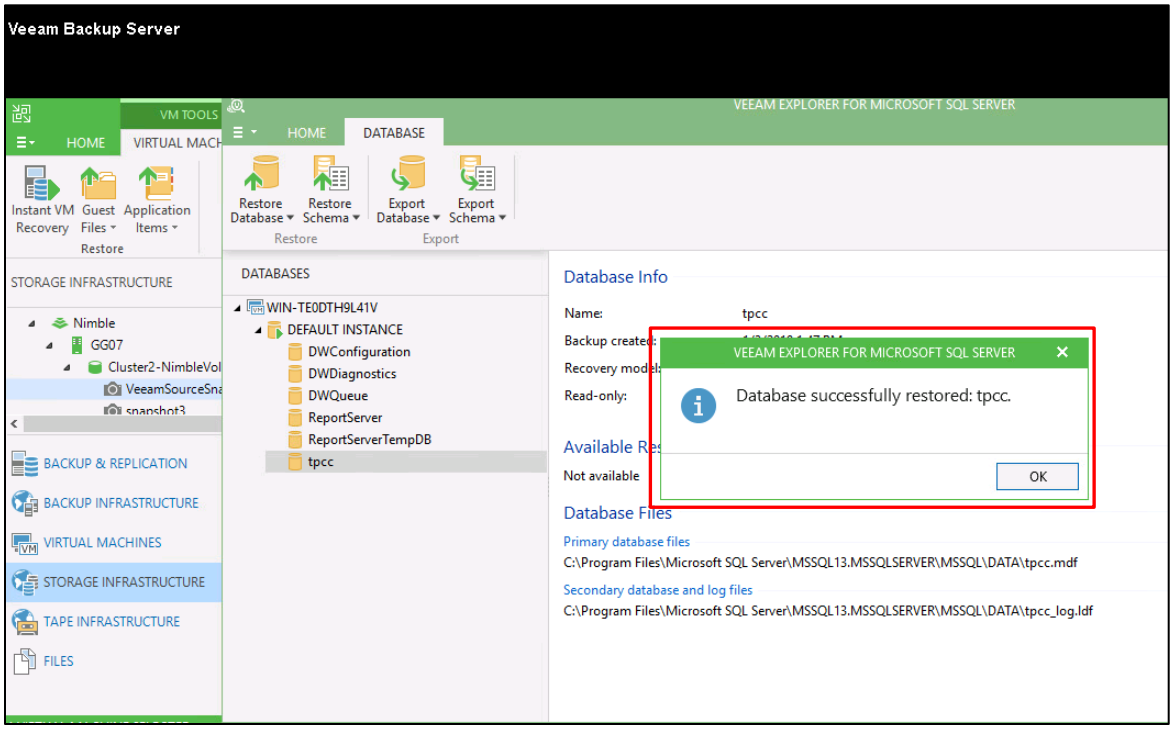

Figure 26. Successful restoration of a database from the replicated snapshot on secondary Nimble storage on Datacenter2

HPE Nimble primary to HPE StoreOnce (cold backup)

To address site level failures where the primary data center is running critical applications goes down, it is necessary to have the workloads replica or back up all workloads in an offsite location and ensure they are always recoverable in the event of outages, attack, loss, or theft to run the business operations without disruptions. Veeam Backup Copy helps copy the existing backup from one location to another location, typically offsite. The backup copy should be generally scheduled to take place during low activity periods. The need to ensure that data is secure, protected and in compliance for business outcomes.

Backup copy allows you to create several instances of the same backup in different locations, including on-site and off-site, making it easy to maintain multiple copies of your data. A Backup Copy Job can be configured from the infrastructure, from other backups, or from other jobs. In this use case, Veeam Backup Server at the primary data center performs the backup copy of the MSSQL servers from the backup jobs at the primary storage repository, to the HPE StoreOnce catalyst repository. The Backup Copy to HPE StoreOnce Backup repository was performed by the Veeam Backup Server deployed at the primary data center. Veeam proxy server deployed at the primary data center helps process the backup copy jobs and also delivers the backup traffic.

The Veeam Backup Copy job was initiated from the Veeam backup server for the completed backup jobs. The destination repository, i.e. the catalyst store created on the HPE StoreOnce, was provided as the target repository for the backup copy job. This data stored on the secondary storage can eventually be moved to tape media for archival purposes.

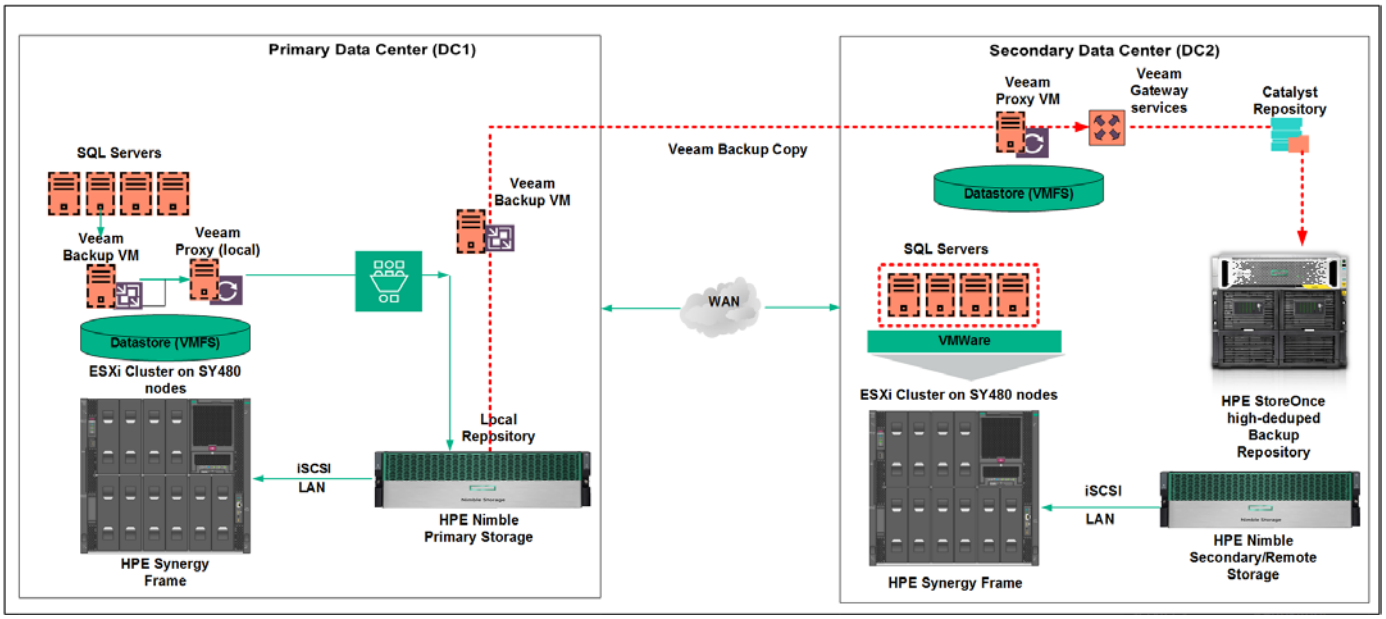

Figure 27. Cold backup – Primary data to HPE StoreOnce

Table 7 lists the test scenarios validated as part of this use case.

Table 7. Cold backup of primary data to HPE StoreOnce at secondary data center test cases validation

Test Case	Name	Description	From	To	Validation	Outcome
7.1	Create backup copy	Backup copy of MSSQL servers from the primary data center to HPE Nimble Primary storage/backup repository	Primary data center	HPE Nimble storage (Primary)	On the Veeam Backup Server user interface, under 'Disk(Copy)' tab - 'Backups' section shows all the backup copy of the MSSQL Servers	Success
7.2	Backup copy job from Primary Data center	Long term retention backup	HPE Nimble storage repository at the primary data center	HPE StoreOnce Catalyst repository at the secondary data center	Backup from storage snapshots to StoreOnce for long time archival. Catalyst store on HPE StoreOnce displays the increase in new storage volume	Success

Prerequisite

A backup job with the required MSSQL servers is run successfully and stored on HPE Nimble primary storage repository. The Catalyst store on HPE StoreOnce is created and configured.

A Backup Copy job is initiated from the Veeam backup server in the primary data center, the appropriate backup job is selected, and other relevant details are entered in the Backup Copy Job wizard.

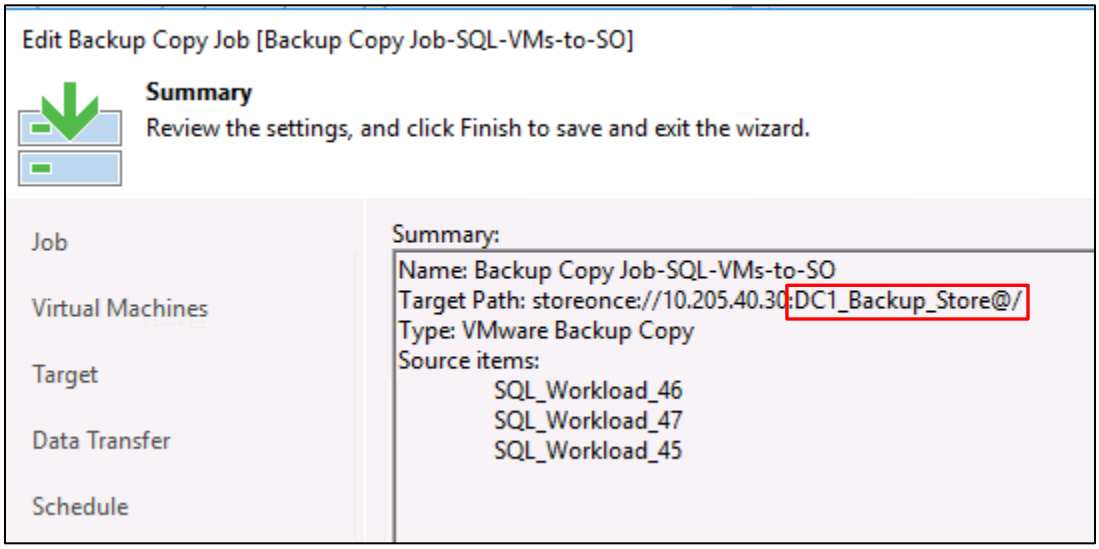

Figure 28. Backup Copy Job initiated from Veeam backup server at primary data center

A Catalyst store is created on HPE StoreOnce along with Disk size post the successful Backup Copy Job is seen in the image below.

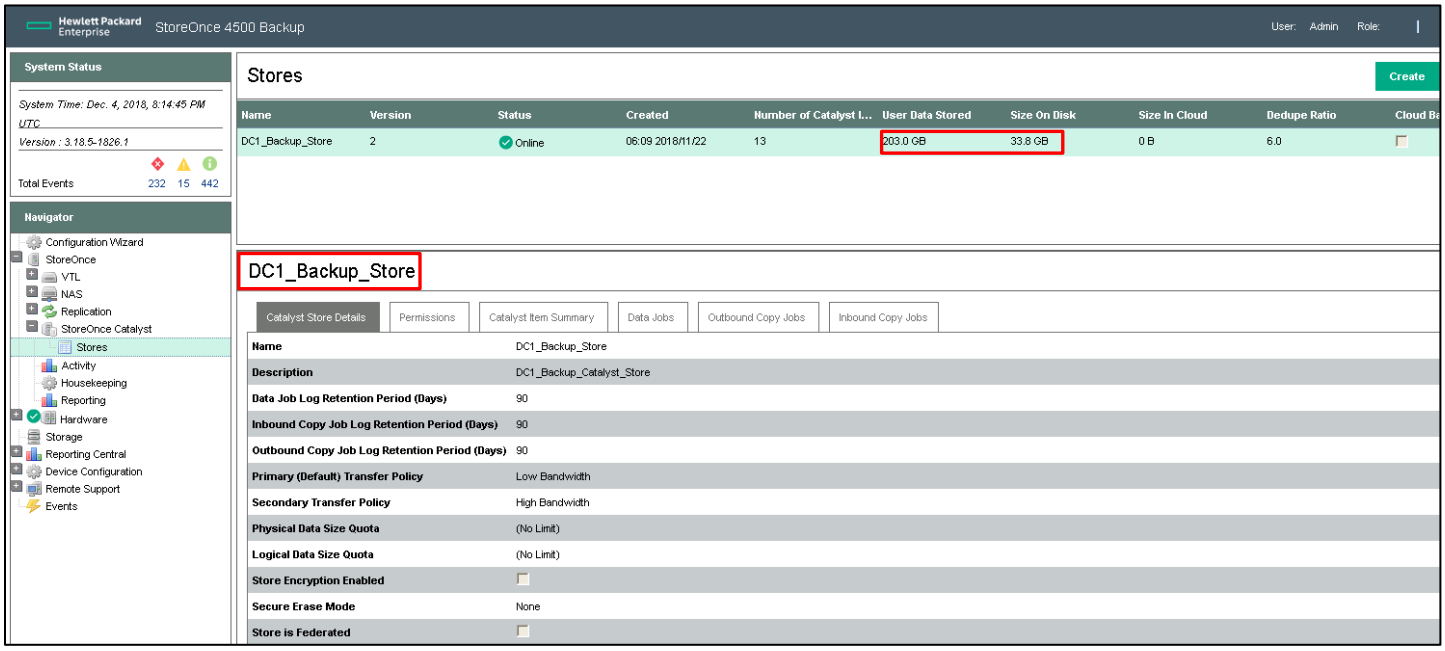

Figure 29. Catalyst store created on HPE StoreOnce which stores the data from HPE Nimble secondary storage

Summary

Organizations invest in composable infrastructures to reap the benefits of a pre-tested and validated solution platform that can help reduce risk, increase operational efficiencies, and deploy workloads upon a predictable infrastructure set. A correct data protection plan is a must-have for any business running critical applications. With more and more organizations relying on virtualization, protecting data deployed on virtualized infrastructure has gained importance. HPE Synergy composable infrastructure offers a secure, high-performing, and highly affordable platform to run the most demanding visualized workloads and HPE Synergy platform to run heterogeneous visualized workloads as per the requirements of an organization.

To all the SMBs and enterprises running MSSQL workloads on HPE Synergy virtualized platform, Veeam Backup & Replication is a natural complement to perform the backup and restore of data. Veeam offers a new kind of solution that delivers high-speed recovery, data loss avoidance, verified protection, leveraged data and complete visibility. Veeam Availability Suite, which includes Veeam Backup & Replication, leverages virtualization, storage, and cloud technologies that enable the modern data center to help organizations save time, mitigate risks, and dramatically reduce capital and operational costs. Veeam Backup & Replication provides a solid software package for virtual machine backup, replication, and recovery; however, without effective storage infrastructure, meeting the demands of the business can be difficult.

This solution addresses the tiered backup mechanisms for enterprise data centers, wherein the data loss is ensured to have minimal impact on the business, since backup is factored at almost all relevant stages. Snapshot (hot) backup to address any VM/database level failure at primary site; warm backup to take care of data replication from primary site to secondary site; cold backup to move the data from the secondary site to backup-storage repository for long time archival.

- HPE Nimble storage replication systems allows a flash-optimized hybrid storage system that is engineered to achieve maximum efficiency.
- HPE Nimble storage replication systems deliver an accelerated performance for higher throughput/IOPS and sub-millisecond latencies, a reduction of up to 75 percent in storage footprint, non-disruptive scaling to fit changing application needs through increased performance/capacity, maximized data and storage availability with an already integrated data protection and disaster recovery system, and above all else, reduced operational overhead.
- High speed recovery - Instant VM Recovery is the ability to take any virtualized application on VMware vSphere directly from a backup.

With automated backup and disaster recovery operation, together with secure data retention and built-in data encryption for data at rest, HPE StoreOnce is a powerful and reliable data protection tool. HPE StoreOnce Catalyst backup solution, together with Veeam Backup & Replication software provides significant backup storage space reduction with inbuilt deduplication technology, offers an end-to-end data protection solution to recover virtual appliances rapidly, effectively, and with minimal disruption to business. This integration greatly simplifies virtualized workload backup and restoration and provides reliable and efficient solution for data protection.

Note

This document is the continuation of the Backup solutions on Hybrid IT using Veeam Phase1 of the multi-tier solution was published earlier (486 - HPE RA for ROBO Backup Recovery solution with Veeam and Synergy), executed earlier. The published Reference Architecture could be accessed at http:// h20195.www2.hpe.com/V2/GetDocument.aspx?docname=a00058031enw

Appendix A: Bill of materials

Note

Part numbers are at time of publication/testing and subject to change. The bill of materials does not include complete support options or other rack and power requirements. If you have questions regarding ordering, please consult with your HPE Reseller or HPE Sales Representative for more details. hpe.com/us/en/services/consulting.html

Table A-1. Bill of materials

Qty	Part number	Description
		Rack and Network Infrastructure
2	797740-B21	HPE Synergy 12000 CTO Frame
2	804943-B21	HPE Synergy Frame 4x Lift Handles
8	777430-B21	HPE Synergy 3820C 10/20Gb Converged Network Adapter
2	804353-B21	HPE Synergy Composer
2	804937-B21	HPE Synergy Image Streamer
2	804942-B21	HPE Synergy Frame Link Module
2	804938-B21	HPE Synergy Frame Rack Rail Kit
4	755985-B21	HPE Synergy 12Gb SAS Connection Module with 12 Internal Ports
2	H6J85	HPE Rack Hardware Kit
2	455883-B21	HPE BladeSystem c-Class 10Gb SFP+ SR Transceiver
2	804942-B21	HPE Synergy Frame Link Module CAT6A 1.2m Cable
		Virtualization Hosts
8	871940-B21	HPE Synergy 480 Gen10 Configure-to-order Compute Module
8	873378-L21	HPE Synergy 480/660 Gen10 Intel® Xeon®-Gold 6136 (3.0GHz/12-core/150W) Processor Kit
8	873378-L21	HPE Synergy 480/660 Gen10 Intel Xeon-Gold 6136 (3.0GHz/12-core/150W) FIO Processor Kit
4	794502-B23	HPE Virtual Connect SE 40Gb F8 Module for Synergy
8	804424-B21	HPE Smart Array P204i-c SR Gen10 (4 Internal Lanes/1GB Cache) 12G SAS Modular Controller
8	804428-B21	HPE Smart Array P416ie-m SR Gen10 (8 Int 8 Ext Lanes/2GB Cache) 12G SAS Mezzanine Controller
8	872392-B21	HPE 1.92TB SAS 12G Read Intensive SFF (2.5in) SC 3yr Wty Digitally Signed Firmware SSD
4	P01367-B21	HPE 96W Smart Storage Battery (up to 20 Devices) with 260mm Cable Kit
128	835955-B21	HPE 16GB 2Rx8 PC4-2666 V-R Smart Kit
40	870757-B21	HPE 600GB SAS 15K SFF SC DS HDD
		Storage
2	835386-B21	HPE Synergy D3940 CTO Storage Module
2	Q8H71A	HPE Nimble Storage HF20H Adaptive Dual Controller 10GBASE-T 2-port Configure-to-order Base Array
2	Q8B67B	HPE Nimble Storage HF20H Adaptive Array 11TB (11x1TB) FIO HDD Bundle
2	Q8B77B	HPE Nimble Storage HF20H Adaptive Array 480GB (2x240GB) FIO Cache Bundle
2	Q8B86B	HPE Nimble Storage 2x10GBASE-T 2-port FIO Adapter Kit
2	Q8G27B	HPE Nimble Storage NOS Default FIO Software

Qty	Part number	Description
4	Q8J22A	HPE Nimble Storage JIS8303 6-15 to C13 250V 15Amp 1.8m JP FIO Power Cord
1	BB915A	HPE StoreOnce 5100 with 48TB of raw disk storage
2	J9281B	HPE X242 10G SFP+ to SFP+ 1 m direct attach copper cable
1	BB926A	HPE StoreOnce 10 GbE network card
2	BB887A	HPE StoreOnce Catalyst (LTU)
1	BC002A	HPE StoreOnce 4 TB Base
		Others
2	798096-B21	HPE 6x 2650W Performance Hot Plug Titanium Plus FIO Power Supply Kit
4	720199-B21	HPE BladeSystem c-Class 40G QSFP+ to QSFP+ 3m Direct Attach Copper Cable
4	455883-B21	HPE BLC 10G SFP+ SR Transceiver
2	720199-B21	HPE BladeSystem c-Class 40G QSFP+ to QSFP+ 3m Direct Attach Copper Cable
4	AJ718A	HPE 8Gb Short Wave Fibre Channel SFP+ 1 Pack
2	P9K10A	HPE 42U 600mmx1200mm G2 Kitted Advanced Shock Rack with Side Panels and Baying
4	P9Q56A	HPE G2 Basic 10kVA/ C13 C19/ NA/JP PDU
1	JH179A	FlexFabric 5930-4Slot

Resources and additional links

HPE Reference Architectures, hpe.com/info/ra

HPE Servers, hpe.com/servers

HPE Storage, hpe.com/storage

HPE Networking, hpe.com/networking

HPE Composable Infrastructure, hpe.com/info/composable

HPE ConvergedSystem, hpe.com/info/convergedsystem

HPE OneView, hpe.com/info/hpeov

HPE Synergy, hpe.com/synergy

HPE ProLiant servers, hpe.com/servers/proliant

HPE StoreOnce Data Protection, hpe.com/storage/storeonce

HPE Infosite, https://infosight.hpe.com

HPE Technology Consulting Services, hpe.com/us/en/services/consulting.html

To help us improve our documents, please provide feedback at hpe.com/contact/feedback

a00066817enw, February 2019