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Introduction

Organizations are increasingly using VMware® and Hyper-V Server Virtualization as part of their IT plans in order to increase responsiveness and drive down costs. HP customers need efficient, high-performing, and reliable backup systems that are easily integrated into these virtual environments and deliver the flexibility and cost profile. HP StoreOnce provides a disk-based data protection platform, while addressing data growth by utilizing data deduplication for efficient backup data retention in virtualized and physical environments.

HP StoreOnce Virtual Storage Appliance (VSA) extends the StoreOnce family to enable cost-effective data protection for virtualized environments. By deploying HP StoreOnce in a software-defined form factor customers can increase flexibility and cut storage costs compared to deploying purpose-built appliances. HP StoreOnce VSA is a virtual appliance that delivers fast, efficient, and scalable backup. A virtual appliance increases deployment flexibility and reduces costs through optimized use of storage resources, compute resources, rack space, and power.

Now, HP customers can benefit from HP StoreOnce capabilities by installing HP StoreOnce VSA in HP Data Protector environments. HP Data Protector and HP StoreOnce together provide customers with an integrated backup and recovery solution. HP StoreOnce VSA is built on the same StoreOnce software as the physical HP StoreOnce appliances making it easy for HP Data Protector users to deploy the HP StoreOnce VSA in backup environments and utilize the same advanced data services as physical appliances.

The following are key recommendations for using HP StoreOnce VSA and HP Data Protector:

• Enterprise Remote Office/Branch Office (ROBO): HP StoreOnce VSA is ideal for centrally managed enterprise ROBO with local backup and offsite backup copies. Branch offices can send backup data to a local HP StoreOnce VSA target with data deduplication-optimized copy to a remote HP StoreOnce appliance located at a data center or disaster recovery (DR) site.
• Backup as a service (BaaS): HP StoreOnce VSA fits nicely into a BaaS environment with local backup and off-site as a service. Multiple options are available, such as local backup with offsite replication and backup to a remote target using low-bandwidth Catalyst backup.
• Protect physical server and virtual machine (VM) data: HP Data Protector configured with HP StoreOnce VSA targets can be used to protect physical server data and VM images or data. HP Data Protector integrated with VM environments automatically discovers VMs for backup and recovery. HP Store Once Catalyst can be configured to deduplicate backup data at the backup server, and HP Data Protector copies the data to an HP StoreOnce VSA Catalyst store.
• Media agent in VM: HP StoreOnce VSA Catalyst stores, Common Internet File System (CIFS) shares, and iSCSI virtual tape libraries (VTLs) can be presented directly to VMware or Hyper-V VMs. Installing HP Data Protector in VMs allow VMs to use HP StoreOnce Catalyst software to deduplicate the data prior to sending to a Catalyst store. This method also enables typical backup configuration and the use of HP Data Protector features such as database backup integrations.
• Increased backup speed: Backing up multiple servers or VMs simultaneously to the HP StoreOnce VSA can significantly improve backup speed. There may be a small decrease in deduplication ratios when backing up multiple server VMs simultaneously to the same HP StoreOnce VSA target.
• Increased server resources: A weekly full and daily incremental backup schedule uses less server and HP StoreOnce VSA compute and bandwidth resources during backup than a daily full backup schedule. Backup data requires about the same amount of space on the HP StoreOnce VSA for each backup schedule type.

Building a data protection solution using HP Data Protector and HP StoreOnce VSA appliances enables fast and reliable recovery of data from cost-effective backups. For business environments with remote offices, or a DR site, HP Data Protector and the HP StoreOnce VSA make an effective combination to replicate data to a central data center or remote facility. This document describes the benefits and best practices for using HP StoreOnce VSA and HP Data Protector to protect server and VM data.
Technology overview

HP StoreOnce—key features and benefits

HP StoreOnce deduplication, store more data on disk
HP StoreOnce deduplication reduces the disk space required to store backup data sets without impacting backup performance. Retaining more backup data on disk longer, enables greater data accessibility for rapid restore of lost or corrupt files and reduces downtime.

Deduplication ratios are strongly influenced by two factors—data change rate and backup data retention periods. Low data change rates and data retained for longer periods of time yield higher deduplication ratios.

Deduplication-enabled replication
HP StoreOnce deduplication is the technology enabler for HP StoreOnce deduplication-enabled replication, which allows fully automated replication over low-bandwidth links to a DR site, giving ROBO and small data centers a cost-effective DR solution for the first time.

Rapid restore of data for dependable, worry-free data protection
HP StoreOnce appliances offer immediate access to backups for rapid restores. HP StoreOnce appliances deduplication allows more data to be stored closer to the data center for longer periods of time, which offers immediate access for rapid restores.

Automate, simplify, and improve the backup process
HP StoreOnce automates the backup processes allowing reduced time spent managing data protection. Implementing hands-free, unattended daily backup is especially valuable for environments with limited IT resources, such as ROBOs.

HP StoreOnce VSA systems can back up multiple servers simultaneously via standard Ethernet to a disk-based solution instead of sequentially to a tape drive or autoloader—meaning that substantially reduced backup windows are possible.

HP StoreOnce VSA
HP StoreOnce VSA extends the HP StoreOnce portfolio with the agility and flexibility of HP StoreOnce delivered as a virtual appliance, removing the need to install dedicated hardware, and leveraging the advantages of server virtualization to provide a very cost-effective solution. The flexibility and economics of HP StoreOnce VSA make it especially suitable for ROBO environments and BaaS providers.

Packaged as a VMware or Hyper-V virtual appliance, HP StoreOnce VSA is available with maximum licensed usable capacities of 4 TB or 10 TB. Capacity is configured in 1 TB increments as needed up to the maximum capacity.

HP StoreOnce VSA is currently supported to run on VMware vSphere 5.0, VMware vSphere 5.1, VMware vSphere 5.5, or Windows Server® 2012 R2 Hyper-V virtualized servers. Once installed and powered on, it is used by backup and recovery applications as a backup target, in the same way as physical HP StoreOnce appliances and delivers the following benefits:

- Exceptional value: Install into existing virtualized environments for software-defined deduplication backup storage. HP StoreOnce VSA LTU includes HP StoreOnce Catalyst capability, for seamless data movement across the enterprise, and replication capability to enable it to be a replication target and three years HP support for peace of mind.
- Easy to manage-locally: HP StoreOnce VSA can be managed using a local GUI or HP StoreOnce Enterprise Manager (SEM) application. The local GUI is the same, well-proven, interface used to manage HP StoreOnce Backup appliances and provides a consistent experience for enterprise-wide deployments.
- Easy to manage-across the enterprise: For users with multiple HP StoreOnce appliances and multiple HP StoreOnce VSAs, SEM enables centralized management. Through the centralized SEM up to 400 HP StoreOnce appliances and HP StoreOnce virtual appliances can be managed across multiple sites. Along with advanced monitoring, reporting, forecasting, and trend analysis, SEM can be used to deploy and configure HP StoreOnce VSA appliances.
HP StoreOnce VSA and HP Data Protector

HP StoreOnce VSA offers Catalyst, VTL, and NAS interfaces for backup applications such as HP Data Protector. These offer data deduplication and deduplication-enabled replication that are ideal for data backup and recovery. HP StoreOnce targets are configured as the following HP Data Protector backup devices:

- Catalyst stores are configured as device type **Backup to Disk** with interface type **StoreOnce Backup System**.
- NAS shares are configured as device type **File Library** with the HP StoreOnce VSA NAS share network path as the directory for the library.
- VTL devices can be configured by using the HP Data Protector **Autoconfigure Devices** wizard.

HP StoreOnce VSA and VM backup

- HP StoreOnce deduplication engine can run on a vSphere vStorage APIs for Data Protection (VADP) backup server, a Hyper-V server, a VM media server, a VM client, or an HP StoreOnce VSA, providing flexibility in deduplication strategy.
  - HP StoreOnce VSA target-side deduplication can reduce workload on a VADP backup server, Hyper-V server, or VM.
  - HP Data Protector configured with HP StoreOnce Catalyst using source-side or server-side deduplication, allows deduplication to occur at the VM backup client, VADP backup server, or Hyper-V server. This reduces amount of data packets sent across the network, which reduces network load on the IT infrastructure.
- HP Data Protector backup architecture can be scaled out easily by adding media servers and HP StoreOnce VSA targets.
- HP StoreOnce delivered as a VMware or Hyper-V virtual appliance for backup removes the need to install dedicated hardware. HP StoreOnce VSA is part of the virtual environment.
- Individual HP StoreOnce Catalyst stores can be configured in HP Data Protector as separate storage devices for different purposes such as VM backup, VM backup mirror copies, and application data backup.
- HP StoreOnce common deduplication engine allows VM backups to be copied to remote sites using limited bandwidth without having to be rehydrated.
- With federated data deduplication, HP StoreOnce VSA allows more VM backup data to be retained on disk.
Virtual infrastructure components with HP StoreOnce VSA

Table 1. VM backup architecture

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMware ESXi</td>
<td>Virtual infrastructure software for portioning, consolidating, and managing computing resources.</td>
</tr>
<tr>
<td>Windows® Hyper-V Server</td>
<td>Virtual machine that emulates various servers based on different operating systems. VMs are hosted by ESXi and Hyper-V servers.</td>
</tr>
<tr>
<td>Virtual machine</td>
<td>Virtual infrastructure software for portioning, consolidating, and managing computing resources.</td>
</tr>
<tr>
<td>HP StoreOnce VSA</td>
<td>HP StoreOnce delivered as a virtual appliance for data backup.</td>
</tr>
<tr>
<td>vCenter Server</td>
<td>A Windows service or VM appliance (VMware only) that acts as a central administrator for VM hosts and VMs that are connected on a network.</td>
</tr>
<tr>
<td>Hyper-V Manager or System Center Virtual Machine Manager (SCVMM)</td>
<td>A Windows service or VM appliance (VMware only) that acts as a central administrator for VM hosts and VMs that are connected on a network.</td>
</tr>
<tr>
<td>VADP</td>
<td>Microsoft® Volume Shadow Copy Service (VSS)</td>
</tr>
<tr>
<td>VADP backup server</td>
<td>Enables data protection software to protect system, application, and user data in VMs in a simple and scalable way.</td>
</tr>
<tr>
<td>Windows Hyper-V Server</td>
<td>For complete integration with HP StoreOnce VSA, a backup server uses data protection software such as HP Data Protector VEAgent working with VMware VADP or Hyper-V to backup VMs.</td>
</tr>
<tr>
<td>VM media server</td>
<td>Provides a method for VMs to backup directly to HP StoreOnce VSA targets, and allows for data protection software integrations such as database backup and recovery agents to be used within the VM.</td>
</tr>
</tbody>
</table>

HP StoreOnce VSA and enterprise ROBO

HP StoreOnce VSA is ideal for centrally managed enterprise ROBO with local backup and offsite backup copies. Branch offices can send backup data to a local HP StoreOnce VSA target with data deduplication-optimized copy to a remote HP StoreOnce appliance located at a data center and DR site.

This solution offers the following benefits:

- Reduced backup window: A local HP StoreOnce VSA device in branch offices enables fast backups.
- Backup application flexibility: Users may run a backup application of choice for HP StoreOnce VSA iSCSI VTL and CIFS targets, and backup applications that support HP StoreOnce VSA Catalyst targets.
- Reduced risk of data loss: An offsite copy of branch office backup data further reduces the risk of data loss.
- Off-siting consolidation: Offsite copies of backup data can be consolidated to an HP StoreOnce 6000 or other large appliance.
- Centrally managed: All sites can be managed from a central location using SEM and the backup application.
**Figure 1.** Illustration of how HP StoreOnce VSA can be deployed in an enterprise ROBO solution

**Branch Office 1**

Virtual Environment

- MS SQL
- Exchange
- Oracle
- vSphere

Low-bandwidth replication

**Branch Office 2**

Virtual Environment

- Windows
- Linux
- Web Server
- vSphere (VADP)

**Branch Office 3**

Virtual Environment

- Windows
- Linux
- File Share
- Oracle
- Hyper-V

**HP StoreOnce VSA and BaaS**

HP StoreOnce VSA is ideal in a BaaS environment with local backup and off-siting as a service. The following are some options for customers using HP StoreOnce VSA and BaaS for backup:

- Send backup data to a local HP StoreOnce target and use low-bandwidth replication (LBR) to copy the backup to an offsite service provider, HP StoreOnce VSA.
- Send backup data to a local HP Data Protector software store and use low-bandwidth object copy to replicate the backup to an offsite service provider HP StoreOnce VSA.
- Send backup data directly to an offsite service provider HP StoreOnce VSA using low-bandwidth Catalyst backup.
This solution offers the following benefits:

- **Reduced backup window:** A local HP StoreOnce device in branch offices enables fast backups.
- **Backup application flexibility:** Users may run a backup application of choice for HP StoreOnce VSA iSCSI VTL and CIFS targets, and backup applications that support HP StoreOnce VSA Catalyst targets.
- **Reduced risk of data loss:** An offsite copy of customer backup data by a service provider further reduces the risk of data loss.
- **Reduced capital expenditures (CAPEX):** Moves some costs (DR site) from CAPEX model to partial operating expenditures (OPEX) model.

**Figure 2.** Illustration of how HP StoreOnce VSA can be deployed in a BaaS solution

Note
HP StoreOnce VSA does not deduplicate across backup targets. Each CIFS share, iSCSI VTL, and Catalyst store is an independent deduplication domain. For increased deduplication ratios, it is best to use unique targets for different data types.
Capacity planning

The required backup storage capacity for backups depends on many factors including the following:

- Size and number of backup clients
- Backup retention policy (recovery points needed)
- Type of backups (full, incremental, differential)
- Frequency of backups
- Data rate of change
- The deduplication ratio achieved by the HP StoreOnce VSA

Note

For the purposes of this document, the data rate of change refers to the amount of data that would be contained in an incremental backup as a percentage of a full backup. A 100 GB full backup with a subsequent 5 GB incremental backup before the next full backup would be a 5-percent rate of change.

An administrator may desire two weeks of server backups stored on an HP StoreOnce VSA for quick recovery access. Data deduplication provides more backup space without increasing the physical capacity of the backup device; however, a dynamic environment with changing data affects the backup data deduplication ratio.

Figure 3 shows the data rate of change effect on deduplication ratios when backing up server data to an HP StoreOnce VSA Catalyst store.

In performing these tests, HP used Windows and Linux servers that contained customer representative data sets with realistic structure and content. The server data sets were updated between each backup until the desired rate of change was reached.

Figure 3. Rate of change effect on HP StoreOnce VSA Catalyst store deduplication ratios over time
**Capacity-planning usage models**

As an example, a VM environment with 20 VMs of 30 GB each and a 14-day backup data retention requirement can have several HP StoreOnce VSA usage models. Usage models change based on parameters such as the following:

- **Backup schedule type**
  - Daily VADP full image backups deduplicate well but use more server and HP StoreOnce compute and bandwidth resources during a backup.
  - Weekly full with daily incremental backups do not deduplicate as well but use less compute and bandwidth resources.
  - The end-to-end data compaction for weekly full with daily incremental backup schedules may be better than daily full backups.

- **VM daily rate of change**—Lower change rates result in better deduplication ratios and require less HP StoreOnce VSA storage.

- **Backup block size**—The backup block size set by HP Data Protector application can affect HP StoreOnce deduplication ratios.

- **Sequential or simultaneous VM backups**—Multiple VM backups running simultaneously typically have better backup throughput but may affect HP StoreOnce VSA deduplication ratios.

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**Note**

Data compaction refers to the removal of redundant information from a backup set prior to storing on a backup device. Incremental backups, deduplication, and compression are all methods for removing redundant data from a backup set.

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Figure 4 compares five usage models for VM backups to an HP StoreOnce VSA with the following common characteristics:

- Number of VMs: 20
- VM size: 30 GB per VM
- Backup schedule: daily
- Retention period: 14 days

Each usage model shows the overall size of the VM backup data without deduplication vs. the size of the data on the HP StoreOnce VSA after deduplication.

*Figure 4.* Data compaction comparison of different VM backup usage models
HP Data Protector and HP StoreOnce VSA deduplication options

HP Data Protector offers three different deduplication options for transferring data to HP StoreOnce VSA Catalyst stores (For NAS and iSCSI VTL targets, all deduplication takes place on the HP StoreOnce VSA target):

- **Source-side deduplication:** Deduplication takes place within the backup server. HP StoreOnce deduplication code is embedded within the HP Data Protector media agent. Use source-side deduplication to backup data that is located on the same server.

- **Server-side deduplication:** Deduplication takes place within the backup server as in source-side deduplication. Server-side deduplication can be used for backing up data from other servers with HP Data Protector disk agents as well as data held itself. Data is transferred via network connection to the backup server.

- **Target-side deduplication:** Deduplication takes place within the HP StoreOnce appliance. The deduplication code is embedded within the HP StoreOnce appliance.

The deduplication option chosen may affect data deduplication ratios.

*Figure 5.* HP StoreOnce VSA Catalyst deduplication ratios comparison for server-side vs. target-side deduplication
Other factors that affect backup throughput and data deduplication

There are many possible configuration options when using HP Data Protector with HP StoreOnce VSA, which may affect backup throughput rates and data deduplication ratios. Some options that may have an affect are:

- **Data multiplexing**: When backing up multiple servers or VMs simultaneously, use parallel streams to increase throughput. HP StoreOnce VSA interleaves backup data when writing parallel streams to a single target. Interleaved data may decrease deduplication ratios.
- **Concurrency**: HP Data Protector concurrency accepts multiple backup streams in parallel to a single backup target. Use Concurrency together with data multiplexing to increase HP StoreOnce device throughput and reduce the backup window. Using HP Data Protector Concurrency leads to interleaved data and may decrease deduplication ratios.
- **Block size**: The block size chosen for backup may affect throughput and data deduplication ratios. Generally speaking, larger block sizes result in faster throughput and slightly higher deduplication ratios.
- **Backup method**: Using VMware VADP or Microsoft VSS for Hyper-V versus a DP media agent within a VM may affect throughput. Generally speaking, VM image backup using VADP or VSS results in faster throughput.

Figure 6. The effect on HP StoreOnce VSA backup throughput when using different configuration options

Figure 7. The effect on HP StoreOnce VSA deduplication ratios when using different configuration options
• The figure 6 example with **Concurrency = 4** demonstrates increased throughput rates experienced when backing up multiple clients simultaneously. Figure 7 shows how **Concurrency = 4** results in decreased deduplication ratios compared to **Concurrency = 1**.

• The figure 6 example with **dedup = target side** demonstrates decreased throughput rates compared to server-side deduplication.

• The two figure 7 examples with **data change rate = 5%** demonstrate how a dynamic environment with actively changing data results in decreased data deduplication ratios.

**Disaster recovery with HP StoreOnce VSA**

Most companies recognize the importance of a robust data protection strategy. Enterprise-level customers are likely to invest in a DR site. In addition, many companies, large and small, are protecting VMs in remote offices where untrained IT staff are expected to manage a daily backup process—generally involving the changing of physical tapes, which is a process prone to human error.

LBR, available on HP StoreOnce VSA, offers the solution to both of these problems by allowing local backup data to be replicated between sites in a reliable deduplicated form. This provides the following flexibility in data recovery:

• Data can be recovered at HP StoreOnce source site (original location).

• If a total disaster of the data source site occurs, data can be recovered from the remote data center DR site or the BaaS provider site. The backup data can be replicated or copied back to the source site for complete environment recovery.

• Data can be recovered at HP StoreOnce target site such as a remote data center or DR site.

*Figure 8. HP Data Protector and HP StoreOnce VSA recovery scenarios*
Copy to HP StoreEver Tape for archive

HP StoreOnce products are excellent solutions for regular and daily backup; there is no longer a need to store daily incremental backups on tape. However, HP still recommends periodic copy to tape as the most cost-effective and robust solution for long-term archival of data to meet regulatory requirements of offsite storage for DR where data replication is not an option. Copy to tape is executed using backup and recovery management software such as HP Data Protector.

HP StoreEver is:

- Economical: Efficiently protect and retain rapidly growing data—With support for linear tape–open (LTO), HP StoreEver Tape offers significant cost, energy, and footprint advantages.
- Reliable: Protect and retain data over a long term—With enhanced HP StoreEver Tape reliability and extreme durability, essential but less frequently accessed data can be stored with confidence.
- Secure: Enable a vital “last line of defense”—With hardware-based data encryption and removable storage that are offline to threats, HP StoreEver Tape is a highly reliable safety net and an efficient platform for long-term digital archive.

HP Data Protector object copy enables the ability to copy selected backup objects to a specific media. For instance, a backup object stored on HP StoreOnce could be copied to HP StoreEver Tape media. During the object copy session, HP Data Protector reads the backed up data from the HP StoreOnce source, transfers the data, and writes it to the HP StoreEver target media.

Figure 9. Illustration of how HP StoreEver Tape is used with HP Data Protector object copy to archive data from HP StoreOnce
**Recommendations**

- **Daily full backups vs. weekly full with daily incremental backups**
  - Daily full backups deduplicate at a much higher rate than weekly full with daily incremental backups but require more ESXi server and HP StoreOnce VSA processing resources.
  - HP StoreOnce VSA data storage required is roughly the same for each type of backup schedule over an extended time period.
  - Daily full backups deduplicate better but weekly full with daily incremental backups send much less data for deduplication processing.
  - If daily full backups are not required, HP recommends a backup schedule that includes incremental backups to reduce the resource load required for backup.

- **Increasing backup throughput and deduplication ratios to the HP StoreOnce VSA**
  - HP StoreOnce VSA is able to obtain higher overall throughput with simultaneous backup of multiple servers or VMs and when larger backup block sizes are used.
  - To increase HP StoreOnce VSA deduplication ratios, backup servers, or VMs sequentially.

- **DR**
  - HP StoreOnce remote replication offers an LBR solution to and from remote sites.
  - HP StoreOnce VSA is ideal for centrally managed enterprise ROBO with local backup and offsite backup copies. Branch offices can send backup data to a local HP StoreOnce VSA target with data deduplication-optimized copy to a remote HP StoreOnce appliance located at a data center and DR site.
  - HP StoreOnce VSA is ideal in a BaaS environment with local backup and off-siting as a service.

- **Tape archive**
  - HP StoreEver Tape combined with HP Data Protector Object Copy is an economic, reliable, and secure method for archiving data from HP StoreOnce for long-term data retention.
  - Once backup objects have been archived to HP StoreEver Tape, space can be freed on the HP StoreOnce for new backup objects.
**Conclusion**

Customers demand an efficient, reliable data protection environment while keeping costs under control. HP provides a variety of reliable data protection storage solutions that work with HP Data Protector to address such requirements. HP StoreOnce VSA extends the HP StoreOnce portfolio with the agility and flexibility of HP StoreOnce delivered as a VMware or Hyper-V virtual appliance, removing the need to install dedicated hardware, and providing a very cost-effective solution. Combining HP StoreOnce VSA with HP Data Protector provides a comprehensive data protection solution.

**Useful links**

- HP StoreOnce VSA
- HP StoreOnce Backup manuals
- HP StoreOnce Catalyst Solution Service technical data sheet
- HP StoreOnce Catalyst Solution Service solution brief
- HP StoreEver Tape
- HP Data Protector

Learn more at [hp.com/go/storeonce](http://hp.com/go/storeonce)