**Technical white paper**

# HP ConvergedSystem 700 and 700x with CommVault Simpana and HP StoreOnce

## Reference architecture and best practices for backup and recovery

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# Executive summary

Applications that are core to the success of your business are often classified as *mission critical* or business critical. Their requirement for zero-downtime operations results in stringent service-level agreements (SLAs) to achieve and maintain high levels of performance, availability, reliability, and serviceability. Normally, addressing these requirements requires the application to be deployed upon bare-metal operating environments, but advancements in hypervisor technologies now let you deploy these applications as virtualized workloads, for added scalability and rapid deployment.

Many organizations rely on virtualization to improve security and meet compliance requirements, increase data center flexibility, simplify deployment and management, improve operational efficiencies, and lower the total cost of ownership (TCO). To fully embrace and reap these benefits, adopting an integrated end-to-end solution can deliver the agility needed to accommodate the current needs and future growth requirements that mission-critical applications demand. Equally important, an integrated technology stack can enable you to expand, contract, scale up, scale down, scale out, or scale in to address infrastructure allocation requirements as workloads change. To meet these needs, HP has created a converged infrastructure solution that combines HP networking, computing, and storage. The solution is proven, tested, and improvised to help you meet long-term data center needs for a variety of mixed application workloads—mission-critical or not.

HP ConvergedSystem 700 (CS700) and 700x (CS700x) are members of HP's integrated data center rack configurations, which include both hardware and software and provide:

- Integrated and validated technologies from an industry leader in computing, storage, networking, and server virtualization
- A single, converged platform capable of scaling to meeting data center requirements, based on a common architecture with shared technologies to non-disruptively address future demands
- Centralized management built on the integrated features of the physical components resulting in workload services based on a shared infrastructure pool
- Extensions that enable the seamless integration of additional HP hardware and software to extend the shared infrastructure to additional areas of IT—such as backup and recovery
- The capability to address workload demands of mission-critical, business-critical, and mixed-priority workloads

When it comes to mission-critical transactional and analytical workloads, Oracle databases are chief among the applications driving these workloads. More importantly, many major applications rely on Oracle Database architectures within the application stack. Deploying a solid database architecture, virtually or physically, is a key success indicator that can mean the difference between leading and following your competition.

A solid database architecture can make the difference between competitive differentiation and simple comparative parity. Competitive organizations establish aggressive recovery-point objectives (RPOs) and recovery-time objectives (RTOs) to minimize data loss and ensure application recovery and restartability. They choose primary infrastructure and data protection strategies that must deliver application-consistent backups, application-restartable recoveries, user-defined service levels, single-point-of-failure eliminations, along with the ability to maximize resource utilization. Finding these requirements in a non-integrated solution is possible, but the long-term application lifecycle costs are often much greater in the end.

In this paper, we will examine both a mission critical application-streaming backup and recovery as well as a virtual machine (VM)–based backup and recovery leveraging the CommVault Simpana Virtual Server Agent.

# Solution overview

A well-designed data management strategy does not use a one-size-fits-all approach to data protection. A combination of tactics tailored to the target application provides the best protection and SLA adherence. Following that principle, the environment described below takes different approaches for critical and generalized workloads. Critical applications, such as Oracle Database needing deep integration with the data management system are protected using the CommVault Simpana iDataAgent specific to the application. For generalized workload, the CommVault Simpana Virtual Server Agent for VMware provides a unified protection and recovery vehicle for all virtual machines.

# Technology overview

## HP CS700/CS700x solution overview

HP ConvergedSystem 700/700x for Virtualization has been designed to address one of today's top priorities for IT organizations—reducing data center complexity. Preconfigured to meet a range of business needs, HP ConvergedSystem 700/700x for Virtualization offerings can be easily and rapidly deployed to support a variety of virtualized application environments. HP does all the work, using balanced building blocks of servers, storage, and networking, along with integrated management software and bundled support.

HP ConvergedSystem 700/700x for Virtualization delivers proven virtualized infrastructure, with integrated software, hardware, services, and support—all delivered as a single, proven solution that can support multiple hypervisors and is enabled for cloud management.

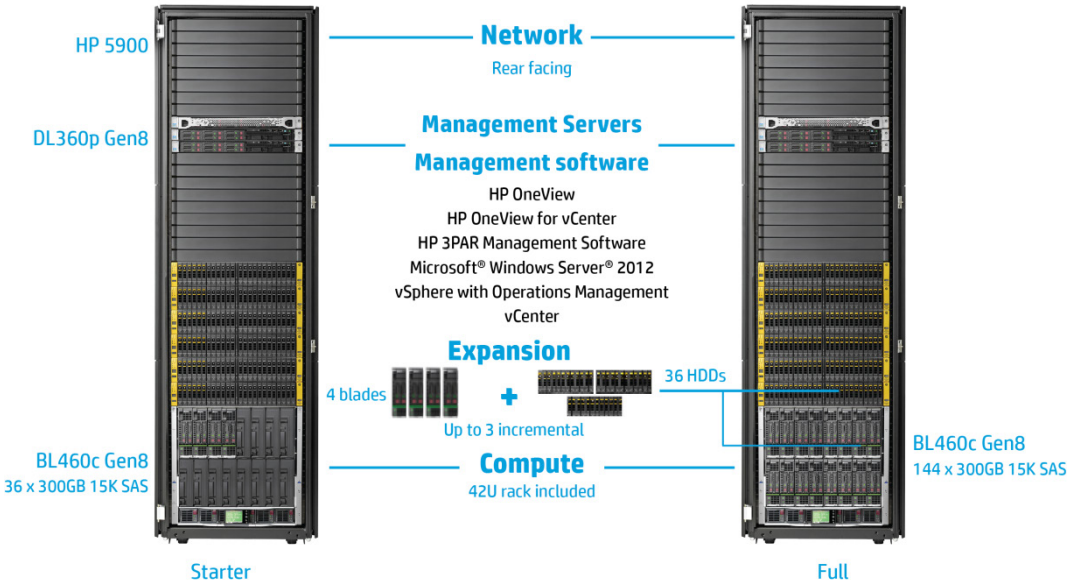
Much of the hardware and software contained in the solution stack is partner-integrated. Close engineering links between HP and VMware® have resulted in application programming interfaces (APIs) and other cross-intellectual property (IP) offerings designed to help minimize complexity and simplify management and interaction.

HP ConvergedSystem 700 and CS700x for Virtualization deliver a broad range of benefits, including the followings:

- Purpose built: HP ConvergedSystem 700 for Virtualization is powered by purpose-built building blocks designed for speed and efficiency. HP has done all the pre-engineering and validation to help optimize these systems in order to provide reliable and predictable performance while reducing risk.
- Automated: HP ConvergedSystem 700 for Virtualization features automated converged management that radically simplifies everyday tasks to reduce operating expenditures (OPEX) and improve operational agility. It features templates that obviate many manual operations and device-focused processes.
- ROI redefined: Return on investment (ROI) is redefined so you can efficiently reduce operational costs, reduce downtime, and proactively avoid errors. HP ConvergedSystem 700 for Virtualization delivers faster time-to-value to reduce risks as you transition to hybrid cloud.

**HP ConvergedSystem 700 for Virtualization**

**Figure 1.** HP ConvergedSystem 700 for Virtualization




The HP ConvergedSystem 700 for Virtualization starts with an HP ConvergedSystem 700 for Virtualization Starter Kit and may have up to three HP ConvergedSystem 700 for Virtualization Expansion Kits as explained below in Table 1

- HP ConvergedSystem 700 for Virtualization Starter Kit: This kit is the required starting point for an HP ConvergedSystem 700 for Virtualization solution, and consists of rack, power, switches, management servers, as well as four compute server blades for virtualization, and an HP 3PAR StoreServ 7200 Storage array with 36 drives.

- HP ConvergedSystem 700 for Virtualization Expansion Kit (Expansion Kit): This kit is used to extend the resources of the Starter Kit, whether for an existing solution or for a new solution that needs more resources than those provided with the Starter Kit. The Expansion Kit includes four additional compute blades and 36 more drives for the HP 3PAR StoreServ 7200 Storage array.

The Starter and Expansion Kits are each sized to handle a generic workload with the following assumptions:

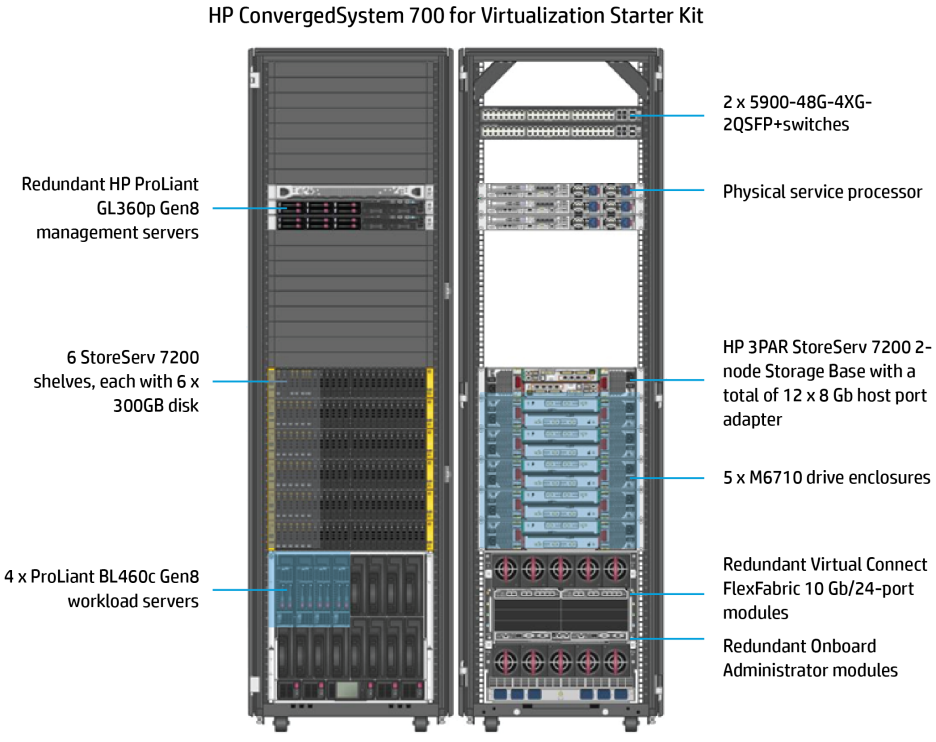
- One to two VMs per physical CPU core

  An average storage load of 30—50 host IOPS per VM[1]

**Table 1.** The table shows a resource summary for each possible configuration of HP ConvergedSystem 700 for Virtualization

| Virtualization blades | Total physical cores | Total memory | Configuration option | Storage disks | Raw storage capacity |
|---|---|---|---|---|---|
| 4 | 64 | 1 TB | Starter Kit | 36 x 300 GB | 10.8 TB |
| 8 | 128 | 2 TB | Starter Kit + 1 Expansion Kit | 72 x 300 GB | 21.6 TB |
| 12 | 192 | 3 TB | Starter Kit + 2 Expansion Kits | 108 x 300 GB | 32.4 TB |
| 16 | 256 | 4 TB | Starter Kit + 3 Expansion Kits | 144 x 300 GB | 43.2 TB |

**Figure 2.** Front and rear views of an HP ConvergedSystem 700 for Virtualization Starter Kit




For more information on HP ConvergedSystem 700, please check:
h20195.www2.hp.com/V2/GetDocument.aspx?docname=4AA5-0006ENW&cc=us&lc=en

[1] Based on random, small-block I/Os with 60% reads/40% writes and 20 millisecond (ms) response time

## HP ConvergedSystem 700x for Virtualization

HP ConvergedSystem 700x is extremely flexible, with a broad range of configurations available—from single-rack solutions with as few as four workload servers to a five-rack solution with 64 workload servers. With single-rack solutions, everything is in one rack—compute, storage, or network—while resources are more evenly spread in multi-rack solutions, allowing these resources to be scaled individually. Thus, HP ConvergedSystem 700x can satisfy the footprint, and compute resource and storage resource requirements of your particular environment.

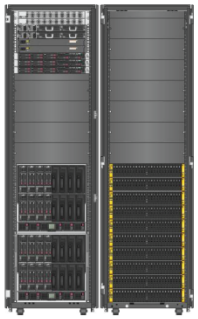
**Figure 3.** HP Converged 700x for virtualization

### HP ConvergedSystem 700x Configuration Options

**Single Rack 7200/ 7400/7450**

- **Configuration/Growth options**
- Scale from 4-16 blades
- Scales across HP 3PAR 7000 series storage options w/ mix of SSD/SAS as needed
- 20U of rack available for storage controller and drive enclosures
- FlexFabric
- Flat SAN option

**Multi-Rack 7400/7450**



- **Configuration/Growth options**
- Scale from 4-64 blades across 2 compute racks
- Scale across HP 3PAR 7400/7450 series storage options w/ mix of SSD/SAS in storage rack
- FlexFabric

**Multi-Rack 10400/10800**

- **Configuration/Growth options**
- Scale from 4-64 blades across 2 compute racks
- Scale across HP 3PAR 10000 series storage options w/ mix of SSD/NL/SAS in storage rack
- FlexFabric

HP ConvergedSystem 700x is available as the following offerings:

- HP ConvergedSystem 700x for VMware—Workload servers featuring VMware vSphere 5.5 virtualization
- HP ConvergedSystem 700x for Microsoft—Workload servers featuring Microsoft® Windows® Server 2012 R2 with Hyper V virtualization
- HP ConvergedSystem 700x Foundation—Hardware solution designed to implement a custom cloud solution or an application-specific reference architecture

HP ConvergedSystem 700x is configured by the customer based on the planned workload. Your key choices include:

- Workload servers: Depending on the number of processor cores you need, you can configure 4–64 server blades to function as workload servers. Six processor options allow each blade to provide 6–16 physical cores. In addition, you can configure each blade with 64–512 GB of memory.[2]

  Blades are housed in up to four HP BladeSystem c7000 Platinum enclosures, with a maximum of two enclosures per compute rack.
- Storage: HP ConvergedSystem 700x scales across HP 3PAR StoreServ Storage and can be configured to meet your particular needs for storage capacity and IOPS. Your choices include:
  - HP 3PAR StoreServ 7200 Storage
  - HP 3PAR StoreServ 7400 Storage 2N or 4N (where N refers to the number of storage controller nodes)
  - HP 3PAR StoreServ 7450 Storage 2N or 4N
  - HP 3PAR StoreServ 10400 Storage 2N or 4N
  - HP 3PAR StoreServ 10800 Storage 6N

[2] Depending on the particular HP ConvergedSystem 700x solution and the processor selected.

Solution configuration options include:

- Single-rack—Includes HP 3PAR StoreServ 7200/7400/7450 Storage with a single c7000 enclosure
- Multi-rack—Includes HP 3PAR StoreServ 7400/7450/10400/10800 Storage with up to four c7000 enclosures

To help you size an appropriate HP ConvergedSystem 700x solution, HP recommends a range of configurations (outlined in table 2) based on the following design objectives:

- Provide an optimal number of processor cores
- Provide appropriate memory for VMs
- Sustain an average storage load of 30–50 host IOPS[3] per VM. In the case of the HP 3PAR 7450 StoreServ All Flash array, the number of IOPS drastically exceeds 50 host IOPS per VM with a response time of less than 1 ms.

**Table 2.** Recommended configurations for HP ConvergedSystem 700x

| Storage | | Solution racks | Workload servers | Physical cores[4] | SAN type/ports[5] |
|---|---|---|---|---|---|
| **HP 3PAR StoreServ Array** | **Raw capacity** | | | | |
| 7200 | 32.4 TB | Single | 12 | 192 | Flat SAN[6] |
| | | | 12 | 192 | 2 x 24 |
| 7400 2N | 43.2 TB | Single | 16 | 256 | Flat SAN |
| | | | 16 | 256 | 2 x 24 |
| | 41.8 TB | Multiple | 16 | 256 | 2 x 48 |
| 7400 4N | 48.0 TB | Single | 16 | 256 | Flat SAN |
| | | | 16 | 256 | 2 x 24 |
| | 83.5 TB | Multiple | 32 | 512 | 2 x 48 |
| | | | 48 | 768 | 2 x 48 |
| 7450 2N | 46.0 TB | Single | 16 | 256 | 2 x 24 |
| | | Multiple | 16 | 256 | 2 x 48 |
| 7450 4N | 92.0 TB | Single | 32 | 512 | 2 x 24 |
| | | Multiple | 32 | 512 | 2 x 48 |
| 10400 2N | 87.7 TB | Multiple | 16 | 256 | 2 x 48 |
| 10400 4N | 175.4 TB | Multiple | 32 | 512 | 2 x 48 |
| | | | 48 | 768 | 2 x 48 |
| 10800 6N | 291.8 TB | Multiple | 48 | 768 | 2 x 48 |
| | | | 64 | 1,024 | 2 x 48 |

[3] Assuming eight-core processors are used.
[4] Based on random, small-block I/Os with 60 percent reads and 40 percent writes—varies based on the storage model.
[5] Available ports on HP StoreFabric SAN switches; not all ports are consumed in each configuration.
[6] Direct-attached.

To provide further assistance with sizing, the HP Sizer for Server Virtualization can be used to access the HP ConvergedSystem Sizer. The sizer should be used to propose an optimized HP ConvergedSystem 700x solution based on workload characteristics specified by you.

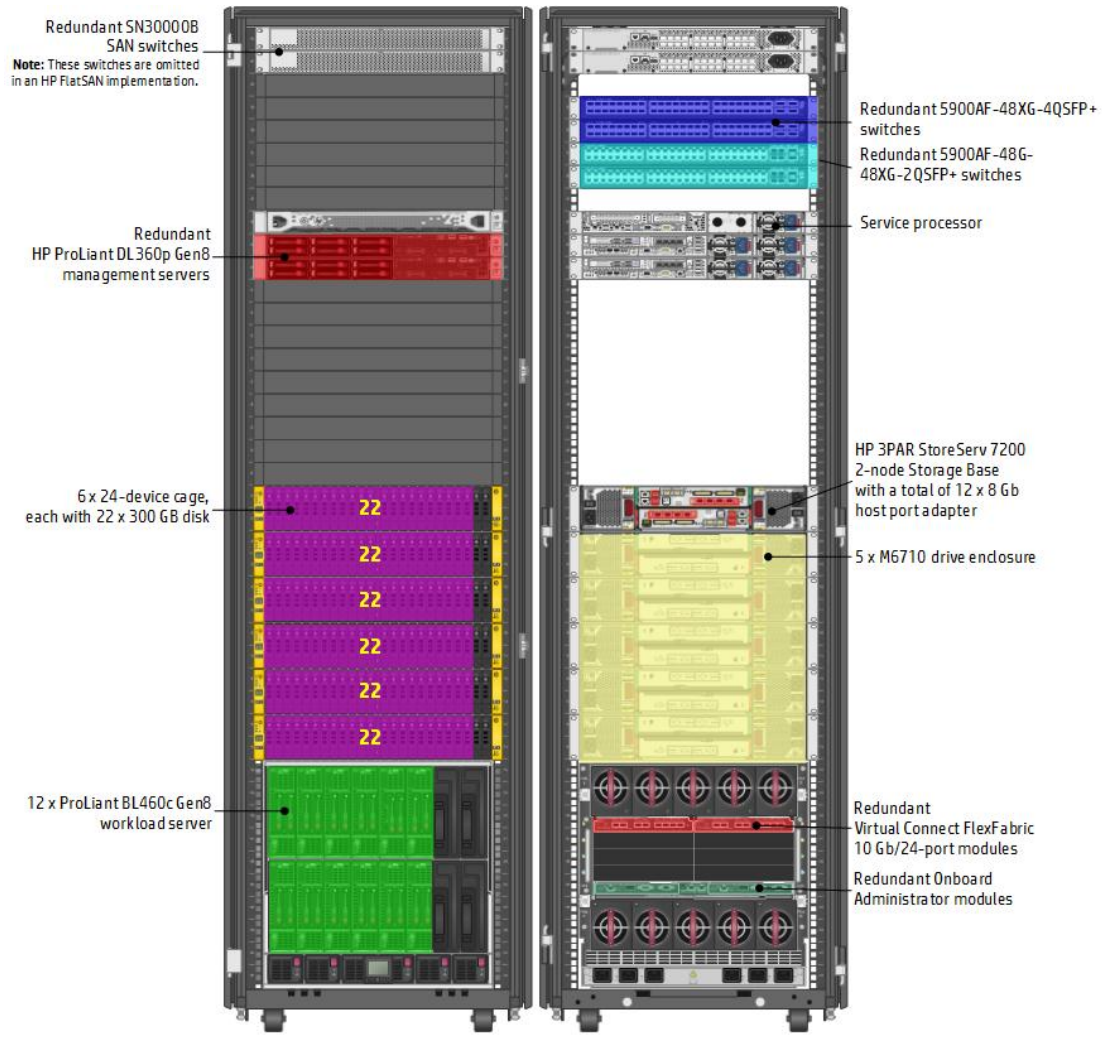
Storage media in these HP-defined configurations include the following (other disk options can be selected as desired per array:

- HP 3PAR StoreServ 7200 Storage: enterprise SAS HDDs
- HP 3PAR StoreServ 7400 2N or 4N Storage: enterprise SSDs and enterprise SAS HDDs
- HP 3PAR StoreServ 7450 2N or 4N Storage: enterprise SSDs
- HP 3PAR StoreServ 10400 2N or 4N or 10800 6N Storage: enterprise SSDs and Fibre Channel (FC) drives, along with nearline drives to provide a high capacity storage tier for less performance-intensive applications

Each solution also includes redundant management servers designed to provide holistic management of both physical and virtual environments.[7] Management has been consolidated to a single-pane-of-glass, with high levels of flexibility and scalability.

Key features of HP ConvergedSystem 700x for Virtualization are highlighted in figure 4.

**Figure 4.** Key features of HP ConvergedSystem 700x for Virtualization




For more information on HP ConvergedSystem 700x, please check:
h20195.www2.hp.com/V2/GetDocument.aspx?docname=4AA5-0007ENW&cc=us&lc=en

[7] Please note Management servers are optional with HP ConvergedSystem 700x Foundation.

## HP 3PAR StoreServ 7400—key features and benefits

HP 3PAR StoreServ Storage offers the performance and flexibility that you need to accelerate new application deployments and support server virtualization, cloud, IT as a service (ITaaS), and your future technology initiatives. It's a storage platform that allows you to spend less time on management, gives you technically advanced features for less money, and obviates tradeoffs that require you to sacrifice critical capabilities such as performance and scalability. With HP 3PAR StoreServ Storage, you can serve unpredictable and mixed workloads, support unstructured and structured data growth, and meet both file and block storage needs.

The modular HP 3PAR StoreServ Architecture can be scaled from 1.2 TB to 1.2 PB, making the system deployable as a small, or very large centralized system. Until now, enterprise customers were often required to purchase and manage at least two distinct architectures to span their range of cost and scalability requirements. HP 3PAR StoreServ Storage is the ideal platform for virtualization and cloud computing environments. The high performance and scalability of the HP 3PAR StoreServ Architecture is well suited for large or high-growth projects and consolidation of mission-critical information, demanding performance-based applications and data lifecycle management.

## HP StoreOnce—key features and benefits

#### Industry-leading, scale-out architecture to meet enterprise requirements

The scale-out architecture allows you to grow as your business needs dictate and not be limited by technology or vendor constraints. Choose capacity points available through virtual backup solutions or dedicated appliances that start small and allow you to add in virtual capacity, shelves, or nodes as needed.

With a range of capacity points, HP StoreOnce Backup suits all requirements from small remote offices to enterprise data centers with centralized monitoring through HP StoreOnce Enterprise Manager.

For enterprise data centers, the HP StoreOnce 6500 scales from 120 TB raw (72 TB usable) to 2,240 TB raw (1,728 TB usable).

For midsize data centers or regional offices, choose from HP StoreOnce 4500 or 4700 and scale from 24 TB raw (16 TB usable) to 192 TB raw (160 TB usable), or the high density HP StoreOnce 4900 to scale from 60 TB raw (36 TB usable) to 560 TB raw (432 TB usable) in a small footprint.

For small and remote offices, choose the HP StoreOnce VSA virtual appliance, now with support for Hyper-V, which scales from either 1 TB to 4 TB or 1 TB to 10 TB in 1 TB increments depending on the model—or the entry-level HP StoreOnce 2700 appliance for 8 TB raw (5.5 TB usable).

#### HP StoreOnce Deduplication

Deduplication works by examining the data stream as it arrives at the storage appliance, checking for small blocks[8] of data that are identical and removing redundant copies. If duplicate data is found, a pointer is established to the original set of data as opposed to actually storing the duplicate blocks, removing, or "deduplicating" the redundant data. The key here is that the data deduplication is being done at the block[10] level to remove far more redundant data than deduplication done at the file level where only duplicate files are removed. HP StoreOnce uses data compression prior to storing data. Data compression works at a byte level mitigating repetitive sequences of data up to around 2 KB.

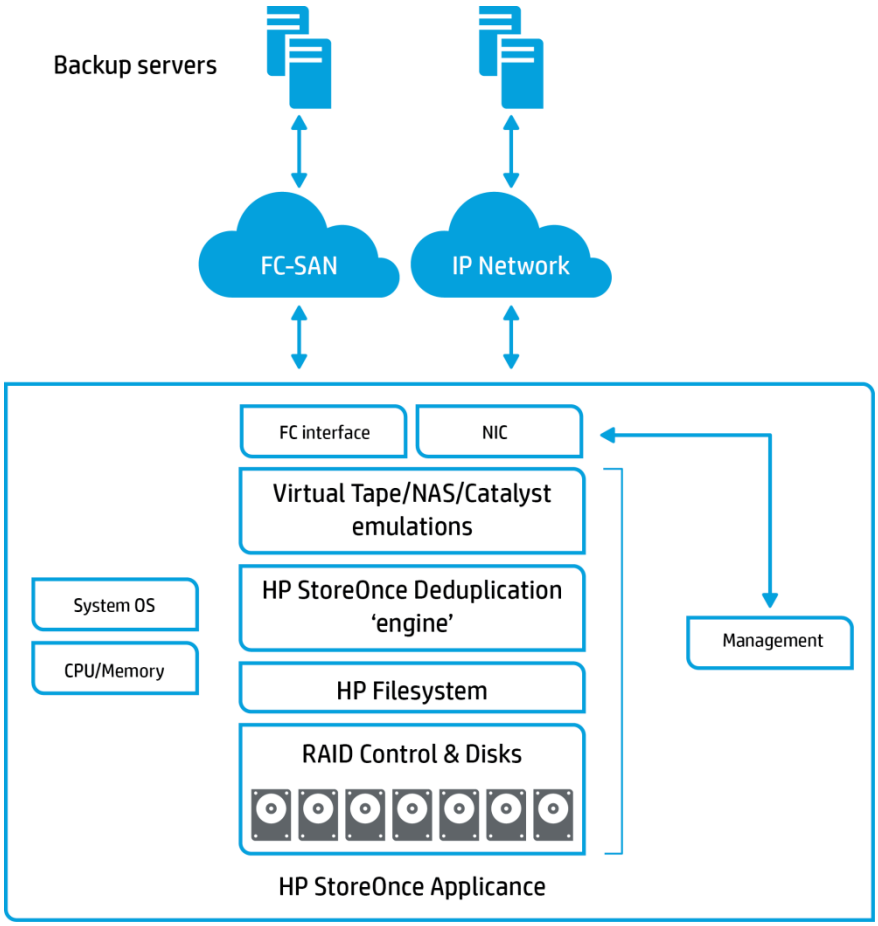
Data deduplication is especially powerful when it is applied to back up, since most backup data sets have a great deal of redundancy. The amount of redundancy will depend on the type of data being backed up, the backup methodology, and the length of time the data is retained.

HP StoreOnce provides virtual tape (VT), NAS, or StoreOnce Catalyst (non-applicable to CommVault Simpana) target devices for data protection applications. Interfaces can be via a network connection or FC. Figure 9 shows the basic components of the StoreOnce appliance. The actual storage medium is hard disk and these are arranged in a RAID 6 configuration with an enterprise-class HP-designed RAID controller. Data is written across all disks in the RAID. RAID 6 prevents data loss in case of two hard disk failures. RAID disks in current StoreOnce appliances are either 2 TB or 4 TB serial-attached SCSI (SAS) disk drives.

[8] "Block" is sometimes referred to as "segment" in other deduplication technology

HP StoreOnce deduplication is also used to move backups to other HP StoreOnce appliances in a bandwidth-efficient manner. This enables customers to move backups to another physical location often using a WAN connection with no human intervention. In the event of a total site loss, the data is still safe at the disaster recovery site and systems can be quickly restored.

**Figure 5.** StoreOnce Architecture overview




**Note**

HP StoreOnce Backup Systems with Catalyst is not supported with CommVault Simpana.

## HP StoreOnce 4700

HP StoreOnce has been designed to cater to the needs of all types of customers from entry level to large scale enterprises. HP StoreOnce Backup systems deliver scale-out capacity and performance to keep pace with shrinking backup windows, reliable disaster recovery, simplified protection of remote offices and rapid file restore to meet today's SLAs. The models vary by capacity and connectivity protocol and customers can start out by purchasing a single HP StoreOnce base unit/couplet, and then expand with additional couplets and expansion shelves. The HP StoreOnce 4700 used in this reference architecture is the perfect choice for the CS700 and CS700x single rack configuration. HP StoreOnce 4700 delivers cost-effective, scalable disk-based backup with deduplication for long-term, onsite data retention for the CS700 and CS700x single rack configuration. It also provides a replication target device for up to 50 remote or branch offices. StoreOnce 4700 delivers a scalable 4U to 18U solution from 20 TB to 160 TB of usable capacity (24 TB to 192 TB RAW) and speeds of up to 7.6 TB/hr* without HP StoreOnce Catalyst.

Please note for the CS700x multi-rack configuration targeted to enterprise data centers, HP recommends the HP StoreOnce 6500.

**Note**

* - In all cases, actual performance is dependent upon configuration, data set type, compression levels, number of datastreams, number of devices emulated and number of concurrent tasks, such as housekeeping or replication.

**Table 3.** StoreOnce configuration—options and features

| **HP StoreOnce 4700 specification** | |
|---|---|
| **Form factor** | 4U scalable rack |
| **Total capacity (RAW)** | Up to 192 TB[9] |
| **Total capacity (usable)** | Up to 160 TB[9] |
| **Data retention with deduplication (20:1)** | 3.2 PB[9] |
| **Maximum number of source appliances per target appliance (fan in)** | 50 |
| **Write performance (aggregated VTL)** | 7.6 TB/hr[9] |
| **Read performance (aggregated VTL)** | 9.0 TB/hr[9] |
| **Catalyst performance (aggregate - non applicable to CommVault Simpana)** | 22 TB/hr[9] |
| **Targets for backup applications** | HP StoreOnce Catalyst (non-applicable to CommVault Simpana), Virtual Tape Library (VTL), and NAS |
| **Device interfaces** | 4x 8GB Fibre Channel, 2x 10Gb Ethernet, 4x 1Gb Ethernet |
| **Disk drives** | 2TB, SAS 7200rpm, 3.5-inch |
| **Number of disk drives** | 12 (min.), 12 x 8 (max.), hardware RAID 6 |
| **Maximum number of StoreOnce Catalyst (non-applicable to CommVault Simpana), VTLs and NAS backup targets (combined)** | 50 |
| **Maximum number of cartridges emulated** | 204,800 |
| **Replication** | Supports data replication—Replication is automatic and appliances may function as both replication targets and sources simultaneously with licensing only being required for appliances acting as a target. Replication of data can occur between VTL and NAS devices created on StoreOnce appliances and StoreOnce VSAs. |

## CommVault Simpana v10—key features and benefits

Simpana v10 includes the following main product categories:

### Server

You can use **Simpana** software from CommVault Systems, Inc. company, to analyze, back up and recover, replicate, archive, and search data and information across your enterprise and across any storage devices—from data centers to desktops to

[9] Assumes VTL target for backup and use of maximum upgrade kits to achieve improved performance. Actual performance is dependent upon configuration, data set type, compression levels, number of data streams, number of devices emulated, and number of concurrent tasks, such as housekeeping or replication.

laptops and in the cloud. The software enables policy-based automation, while integrated role-based access ensures secure management. The built-in alerting and reporting provide operational oversight across data management operations.

The software is built from the ground up on a single platform and unified code base for integrated data and information management. You can modernize your data protection and management operations without the complexity of multiple products and silos to facilitate singular information management.

**Modern Data Protection**
Modern Data Protection offers seamless and efficient backup and restore of data and information in your enterprise from any operating system, database, and application.

**Archiving and long-term retention copy using OnePass**
Archiving agents move data from primary to secondary storage to help optimize storage space, and retain and find relevant data on any disk, tape, or cloud storage.

This comprehensive solution incorporates the traditional backup and archiving processes in a single operation. It moves data to a secondary storage and uses the data to function as both backup and archive copy. Stubs are retained on the primary storage that points to the data moved as part of backup. The archived data is available for quick and easy retrieval.

You can retain, store, classify, and access information according to its business, compliance, or evidentiary value with one method of access and preservation across all electronically stored information (ESI).

**Deduplication**
Deduplication identifies and eliminates duplicate blocks of data during backups. All data types from Windows®, Linux®, and UNIX® operating systems can be deduplicated before moving the data to a secondary storage thereby reducing the space required for storage. The recommendation though is to turn OFF CommVault Simpana deduplication feature when HP StoreOnce is used as a target device. The HP StoreOnce deduplication feature must be turned ON.

**Virtualization**
Virtualization protects all of your virtual machines in a short period and unifies the data protection of physical and virtual environments. In addition, you can help optimize recovery and retention of files, VMs, and virtualized applications.

**Snapshot Management**
Snapshot Management uses **IntelliSnap technology** to automate the creation of application-aware hardware snapshot copies across a multi-vendor storage environment. The snapshot data is catalogued, which simplifies the recovery of individual files without the need for a collection of scripts and disparate snapshot, backup, and recovery tools.

**Edge Data Protection and mobile access**
Edge Data Protection protects, recovers, discovers, and accesses valuable information that is created and stored on laptops and desktops across your enterprise. You can provide self-service access to your mobile workforce so that you can protect and access data efficiently and securely.

**Reports**
You can manage and report operations centrally across multiple instances and across geographically distributed environment, reclaim unused capacity, and make informed choices about archiving rules and storage policies using the integrated reporting and analytics methodology of the software.

**Simpana** provides a robust set of reports with built-in analytics so that you can deliver ITaaS and analyze infrastructure cost planning. Reports provide an insight into operations and simplified compliance audits, and eliminate the need for third-party reporting tools.

**Operation management**
**Operations Manager** ensures efficient use of resources in your enterprise.

**VM Life Cycle Management** to manage all of your VMs/resources.

**External Data Connector** to collect and provide centralized reports on all of the backup products that you use in your enterprise.

**Global Repository Cell (GRC)** to centralize and consolidate data from remote offices to a central office and then generate reports from the consolidated data.

**CommCell Migration** to perform cross-server restores, or move and consolidate clients from one CommCell to another.

### Cloud and managed backups

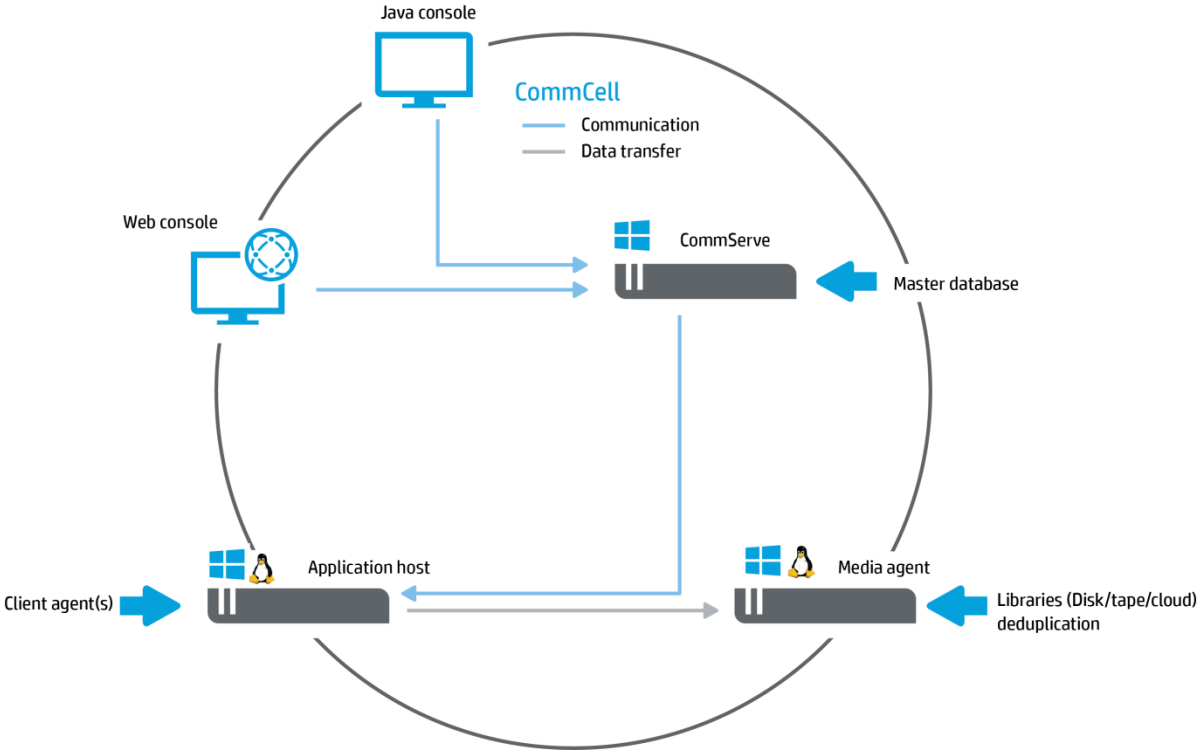
Whether you deploy an internal private cloud, leverage services from a public cloud provider, or look to offer cloud-based services of your own, **Simpana** software is optimized for cloud-based service delivery, incorporating industry-leading capabilities.

## Simpana anatomy

### CommCell

Figure 6 shows the overall architecture of CommVault's Simpana software. Required components are a CommServe, which must be a Windows Server, at least one Media Agent and one client, which are both available for various Windows and Linux platforms.

**Figure 6.** Simpana CommCell overview




The CommServe runs a Microsoft SQL database (included) and orchestrates all Clients and Media Agents within the CommCell.

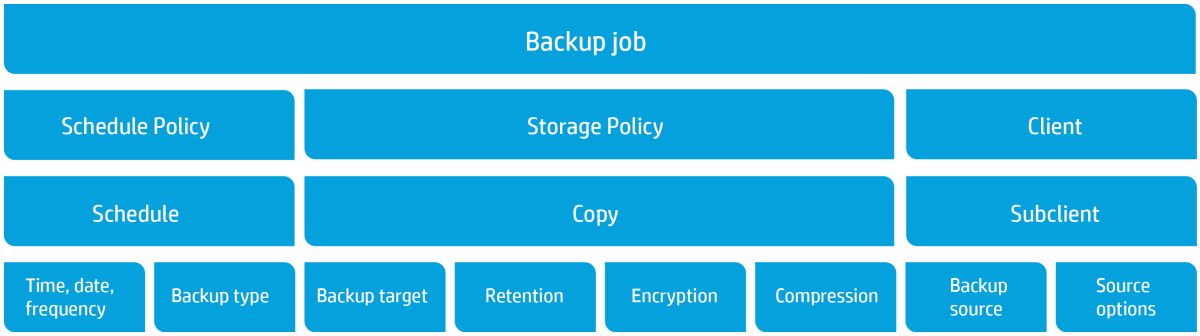
The Clients are servers that run the customer applications. A small software component called an iDataAgent communicates with the CommCell and streams backup data to the Media Agent.

The Media Agent is a server that connects to target devices. For this document the only target device considered is HP StoreOnce, but HP StoreEver or HP StoreAll could both be used as part of an offload or archive solution.

# Backup definition

Various components make up the Simpana backup operation, each of which controls a specific part of the backup job. These are available to all backup jobs in any combination, allowing administrators to build on existing policies and processes.

**Figure 7.** Simpana backup definition




A Schedule Policy contains the time, date, and frequency of a job, and the backup type. A common policy might include an incremental backup on weekday evenings, with a full backup executing over the weekend.

A Storage Policy contains one or more copies, each of these is a destination for the data backed up, and includes retention, compression, and encryption details. Specifying multiple copies allows the backup administrator to define tiered data protection.

The client and subclient components define the source of the backup data. A client is the host on which the data resides, and the subclient is a selection of data with common properties. You might, for example, have one subclient for the live files on a server, and a separate subclient for the test/development copy.

## Data pipeline

The data flows from source to target using varying transport methods. It is read using the iDataAgent on the application server consuming local system resources for each configured reader. Network threads are then used to transfer this data to the Media Agent. Finally, data is written to the StoreOnce device, using a pre-defined number of writers. Further detail is available in the CommVault documentation here: documentation.commvault.com/commvault/v10/article?p=features/streams/streams.htm. Further detail on sizing CommVault components is available here: documentation.commvault.com/commvault/v10/article?p=system_requirements/common/requirements_overview.htm.

## Benefits of deploying HP StoreOnce with CommVault Simpana v10

- It is easier setup to protect, manage, and access data.
- CommVault Simpana auto-discovery technique provides a list of available StoreOnce Backup System devices. This can be automatically made available for storage policy setup.
- StoreOnce Backup is optimized for CommVault backup streams. In other words, StoreOnce performs Simpana-aware deduplication yielding better deduplication efficiencies and considerable reduction in backup footprint.
- It improves functionality, performance, and TCO, while migrating data protection environments from disparate small systems to scalable StoreOnce Backup systems.
- It is easier to migrate traditional physical tape devices to StoreOnce Backup systems and perform workload balancing using CommVault Simpana migrate disk library capability.
- StoreOnce Backup systems with CommVault Simpana can be scaled out easily by adding MediaAgents and NAS backup devices.

StoreOnce NAS shares are recommended because optimized for CommVault Simpana backups.

# Installation and configuration of CommVault Simpana v10

## CommVault Simpana backup infrastructure components

**Table 4.** CommVault Simpana components

| Component | Description |
|---|---|
| CommServe server | It communicates with all Clients and MediaAgents and co-ordinates all operations such as backup, restore, copy, media management, and so on within a CommCell. |
| CommCell | A CommCell consists of CommServe server, MediaAgents, and Clients. |
| CommCell GUI | It is a GUI that allows you to control and manage the operation of CommCell. |
| MediaAgent | It manages the transmission of data between client and backup media. |
| Client | A Client computer is any computer whose data must be backed up. The CommServe server and MediaAgent are also Clients. |

To protect and manage the data in your environment, the Simpana software must be distributed across the computers that you want to protect, such as servers, desktops, and laptops. The group of protected computers is referred to as your CommCell environment, while each protected computer is referred to as a client. A client is a uniquely addressable (TCP/IP) device.

**Simpana components in a CommCell environment**
The main operations in a CommCell environment are handled by the following components:

**CommServe**
This component creates an SQL database that communicates with all clients and coordinates all operations within the CommCell environment, such as backups, restores, copies, and media management operations. Install the CommServe component on a Windows Server computer.

Along with the CommServe software, the following components are automatically installed:

**CommCell Console**
The console is a GUI that allows you to control and manage CommCell operations.

**File System**
The File System component enables the backup and restore of files and folders residing on the CommServe computer.

**Web Server and Web Console**
If the Internet Information Services (IIS) is enabled on the computer, the Web Server component is installed along with the Web Console component. The Web Console is a Web-based application that allows end users manage their data.

**Workflow**
It is a tool that allows you to automate business processes by putting together a set of tasks in a specific order.

**MediaAgent**
This component manages the transmission of data between clients and backup media. Install the MediaAgent component on a Windows or UNIX computer that is configured with the backup media. The backup media is a storage device where you want to store your backed up data.

### iDataAgent

The Simpana software provides a range of installable components that support the type of data that you want to protect. These components are referred to as iDataAgents, or just agents.

Agents allow you to protect file systems, applications, and databases on a client computer. For example, to back up and restore data from an Oracle database, you need to install the **Oracle Database** component.

### Installation methods

You can use one of the following methods to install Simpana components:

- Remote installation
- Interactive installation

For additional information on installation methods, please visit:
documentation.commvault.com/commvault/v10/article?p=deployment/common_install/install_overview.htm.

## Configuring CommVault Simpana v10 with HP StoreOnce 4700

### Simpana compression and deduplication

HP StoreOnce contains enhancements that improve StoreOnce deduplication and throughput when used in conjunction with Simpana. To take advantage of the enhancements, the StoreOnce should be configured using NAS shares. For a better deduplication, disable data compression in Simpana. Deduplication is not enabled by default in Simpana and should not be used for data written to StoreOnce.

**Compression is disabled on a per-subclient basis.**

**Figure 8.** CommVault Simpana compression option

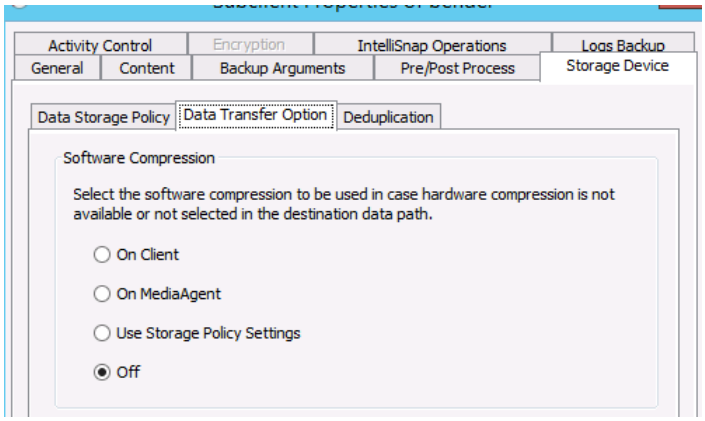


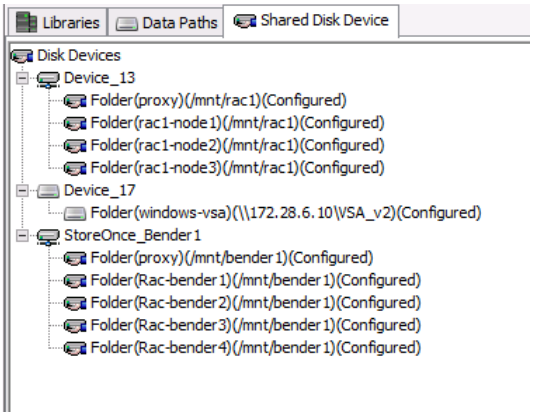

**Figure 9.** CommVault Simpana compression option (storage policy)


It must also be disabled in the storage policy copy on clients.

### Disk library configuration

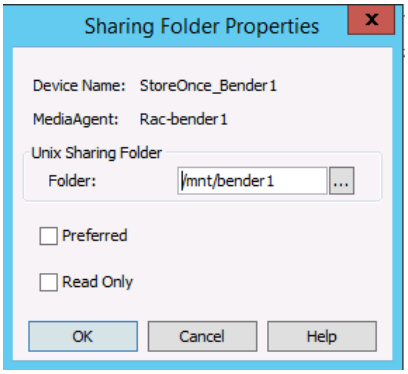
StoreOnce NAS shares are configured in Simpana as shared disk devices, so Simpana recognizes and relates all the available paths to each shares.

**Figure 10.** StoreOnce NAS shares




On a Linux MediaAgent, the StoreOnce NFS export must be mounted to the file system. The mount path is then configured in the shared disk device.

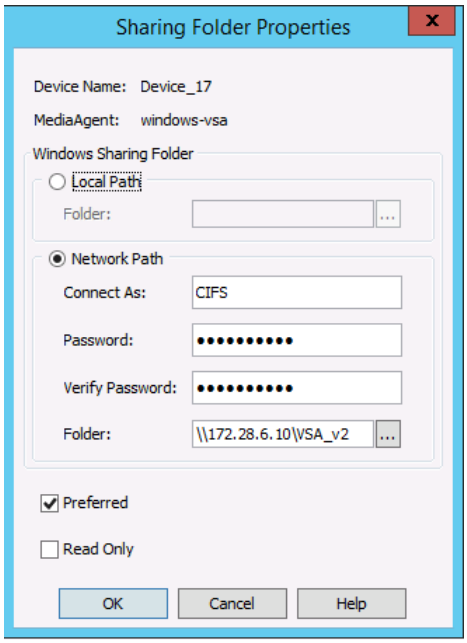
**Figure 11.** StoreOnce NFS export




```
172.28.6.10:/nas/Bender_v2 on /mnt/bender1 type nfs (rw,sync,nfsvers=3,addr=172.
28.6.10)
```

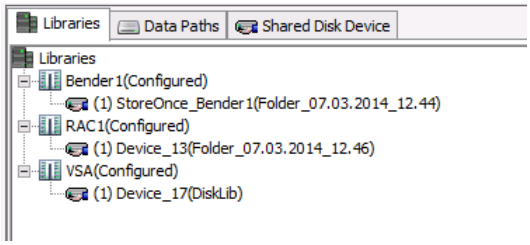
On a Windows MediaAgent, the StoreOnce Common Internet File System (CIFS) share is added directly, along with credentials that can access the share.

**Figure 12.** StoreOnce CIFS share




The shared disk devices are added to disk libraries that can be associated to storage policies.

**Figure 13.** StoreOnce shared disk devices



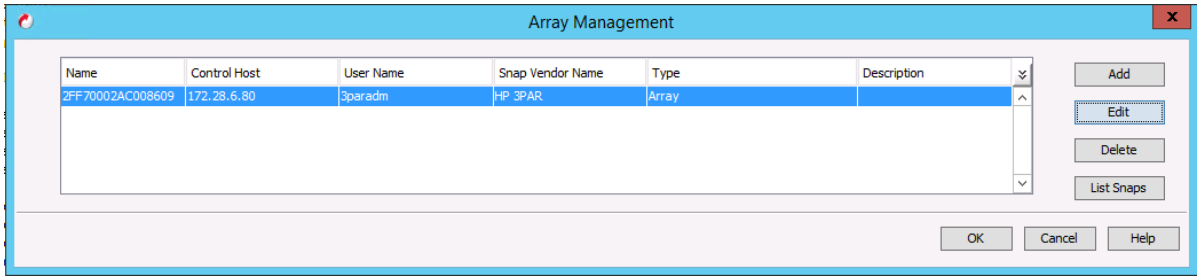

## Configuring CommVault Simpana v10 with HP 3PAR StoreServ 7400

HP 3PAR StoreServ 7400 integrates with Simpana IntelliSnap to enable robust, simple snapshot management, providing short RPO and rapid RTO. In a HP ConvergedSystem virtualized environment, IntelliSnap can be used with the Simpana Virtual Server Agent for generalized workloads. On the CS700x, with agent-based data management within virtual machines, IntelliSnap can offload backup processing for ultra-critical applications that cannot tolerate the additional overhead of backup to a proxy server.

For streaming protection only, no additional configuration is required in Simpana.

To enable IntelliSnap integration, Simpana needs to be made aware of the StoreServ array. This is performed in Simpana's Array Management interface.

**Figure 14.** Configuring CommVault Simpana with HP 3PAR StoreServ



For detailed information on configuring CommVault IntelliSnap with HP 3PAR StoreServ, please visit:
documentation.commvault.com/commvault/v10/article?p=features/snap_backup/3par/overview.htm

For detailed information on configuring HP 3PAR StoreServ, please visit:
hp.com/us/en/products/data-storage/3parstoreserv.html

For detailed information on configuring VMware, please visit:
documentation.commvault.com/commvault/v10/article?p=virtualization.html

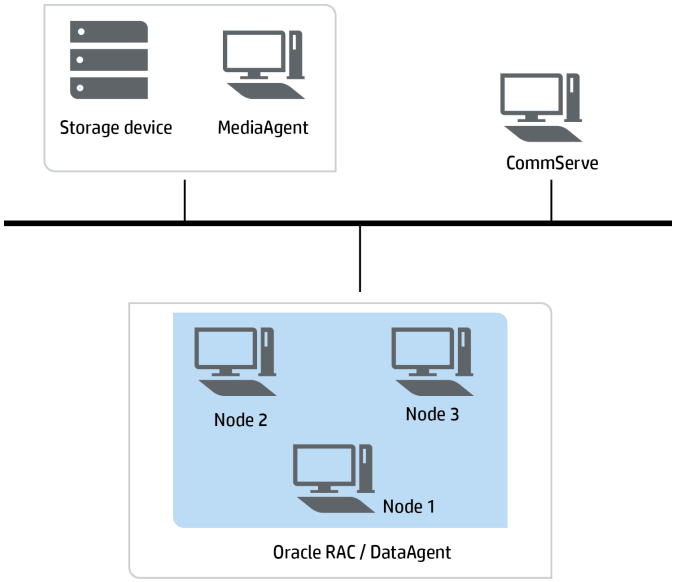
For detailed information on configuring Oracle Real Application Clusters (RAC) 12c, please visit:
documentation.commvault.com/commvault/v10/article?p=system_requirements/oracle_rac.htm

## Simpana Oracle RAC 12c integration

The Oracle RAC iDataAgent provides a simplified end-to-end backup and recovery solution for Oracle databases in your enterprise without using multiple subclients and storage policies. It also allows you to load-balance Oracle backups and restores across multiple database nodes. The product can be used to perform both full system rebuilds and granular recovery of data and logs. The CommVault Simpana integration with Oracle RAC 12c offers a full range of backup and recovery options. The Oracle RAC iDataAgent provides a single management point for backups and recoveries across all the nodes in an RAC cluster. The RAC client provides the flexibility to back up and recover the Oracle Database across one or more of the nodes, while providing control of the number of Oracle streams allocated to each node. You can perform a full or incremental backup of the entire database or individual datafiles/tablespaces, and archive logs at any point in time.

In configurations where there is no Oracle Recovery Manager (RMAN) catalog, the Oracle control file can be used as an alternative.

**Figure 15.** CommVault Simpana and Oracle RAC Architecture overview




The following section describes the backups that can be performed in different environments.

### Offline backup

When the database is shut down and not available for use, perform a full backup of the database without the logs. Use the offline backup when the data is consistent and there are no transactions in the database.

### Online backup

When you cannot bring down the database to perform an offline backup, use the online backup method. Perform full or incremental backups when the database is online and in ARCHIVELOG mode. Use online backups when you want to perform a point-in-time restore of the database.

You can also backup the archive logs only when the database is online. These logs can be applied to an online backup to recover the database to the current point in time. Archive log management is also configurable during backup. Archive logs can be retained on disk or deleted after backup, as desired, freeing up disk space in the archive log area.

You can also protect the non-database files and profiles using the appropriate File System iDataAgent.

### Selective online full backup

You can backup and store copies of valid data from a source copy of a specific storage policy to all or one active secondary copy within a storage policy to provide a better tape rotation. An online full backup job is copied to a selective copy if the full backup job cycle completes successfully. This allows you to select, store, and protect your valuable data on a secondary copy for future restores.

## Backup and recovery considerations when virtualizing Oracle RAC 12c

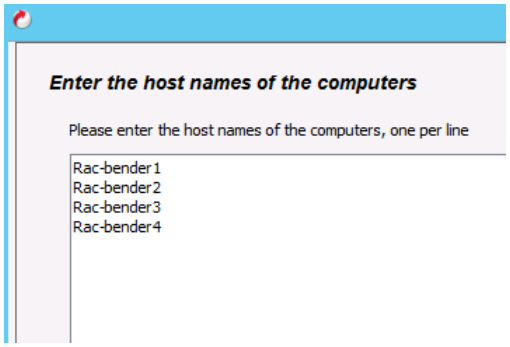
In a virtualized environment, Oracle can be protected using the Simpana Virtual Server Agent (VSA) or the Oracle iDataAgent. For the greatest backup and recovery flexibility, install the Oracle iDataAgent into the virtual machines and leverage the Simpana integration with Oracle protection and recovery.

### Configuring CommVault Simpana v10 with Oracle RAC 12c

The Oracle iDataAgent can be installed manually from each Oracle node, or it can be pushed remotely from the Simpana GUI. For a remote push, consider the following recommendations:

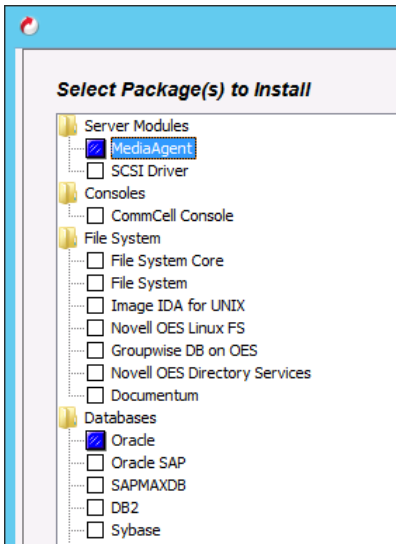
Deploy to all nodes in parallel by entering all of the hostnames as targets.

**Figure 16.** Deploying iDataAgent



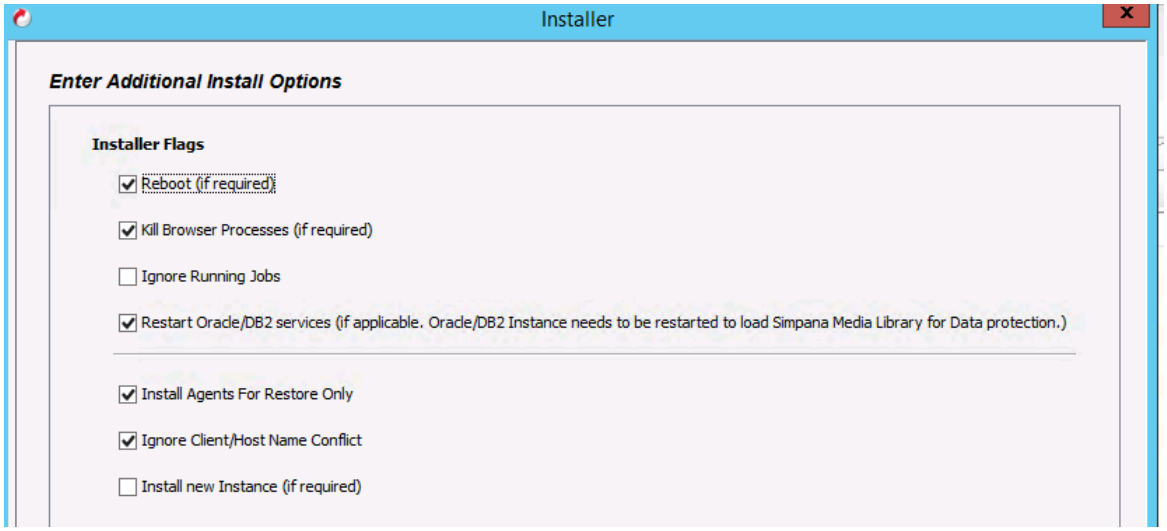

Install the MediaAgent and Oracle agents to allow the nodes to write directly to StoreOnce.

**Figure 17.** Deploying MediaAgent



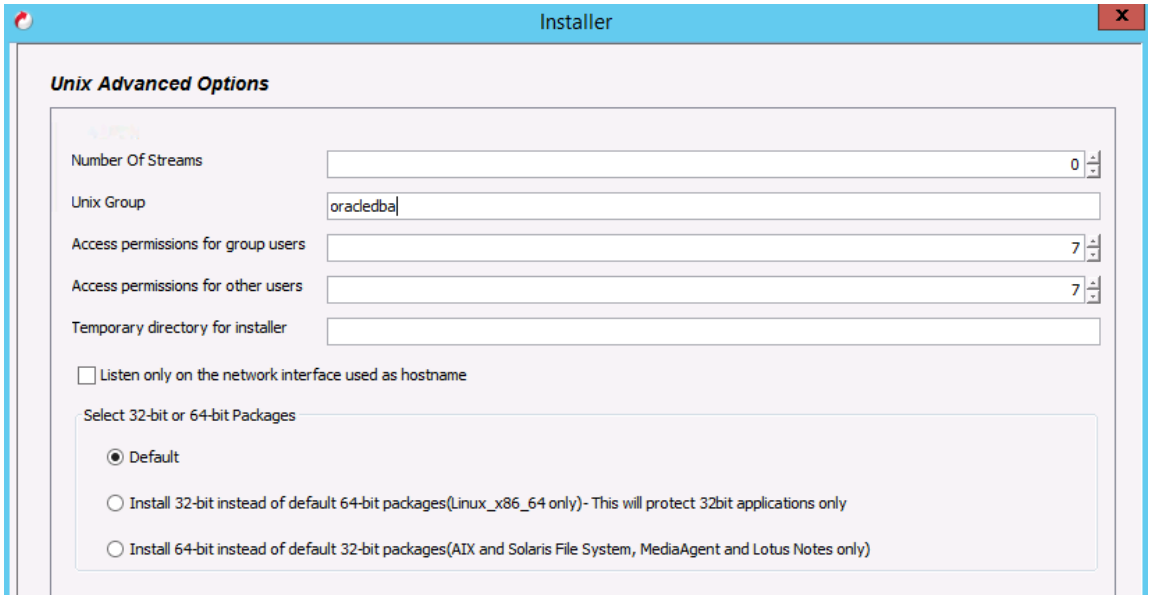
Select the options to reboot if required and restart Oracle services.

**Figure 18.** Additional installer options




Specify a UNIX group to limit the permissions on the Simpana installation paths. Database administrators (DBAs) who need permission to run Simpana commands must belong to this group.

**Figure 19.** Advanced installer options




For additional information on installing the Simpana Oracle RAC iDataAgent, please visit:
documentation.commvault.com/commvault/v10/article?p=products/oracle_rac/deployment_unix.htm

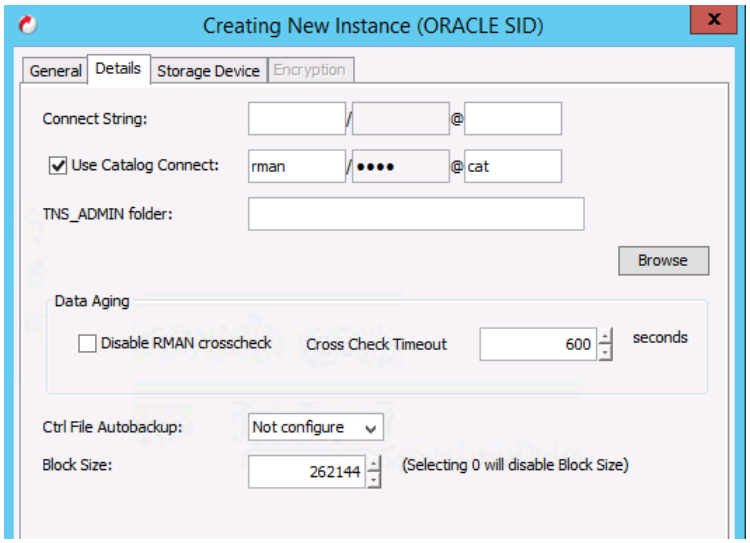
## Configuring Oracle iDataAgent on RAC nodes

Database instances participating in the RAC cluster must be discovered on the individual nodes. If Oracle Automated Storage Management (ASM) is in use, it must also be discovered. The instance SIDs on each node must be unique across the cluster.

When configuring instance manually, provide ORACLE_SID, ORACLE_USER, ORACLE_HOME details:

Optionally, you can enter the RMAN catalog connect string details and RMAN parameters:

**Figure 20.** Creating the new Oracle instance




If the environment uses ASM, the ASM instance on each node must be manually configured under the client for that node, not in the RAC client.

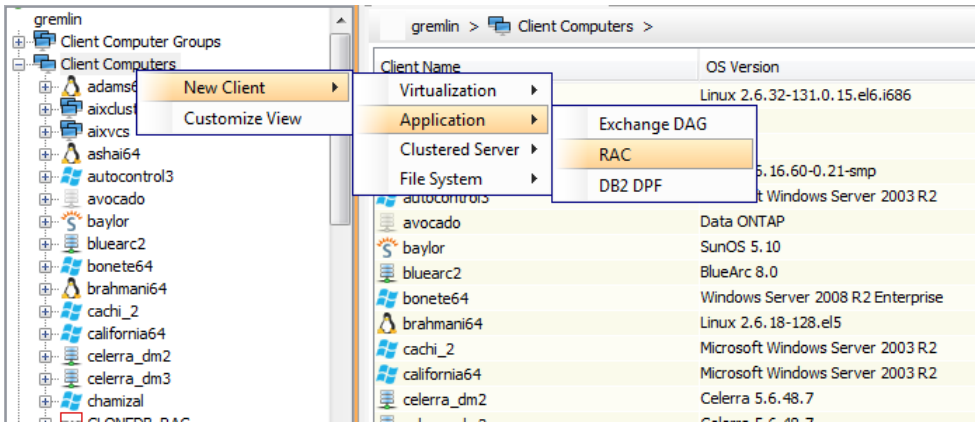
For more details on configuring Oracle instances, please visit:
documentation.commvault.com/commvault/v10/article?p=products/oracle/c_ora_config_oracle_instances.htm

### Creating an RAC client

Once the Oracle iDataAgent is installed on all the RAC database nodes, create a new Oracle RAC pseudo client. An RAC pseudo-client is a logical grouping of Oracle instances within an RAC instance.

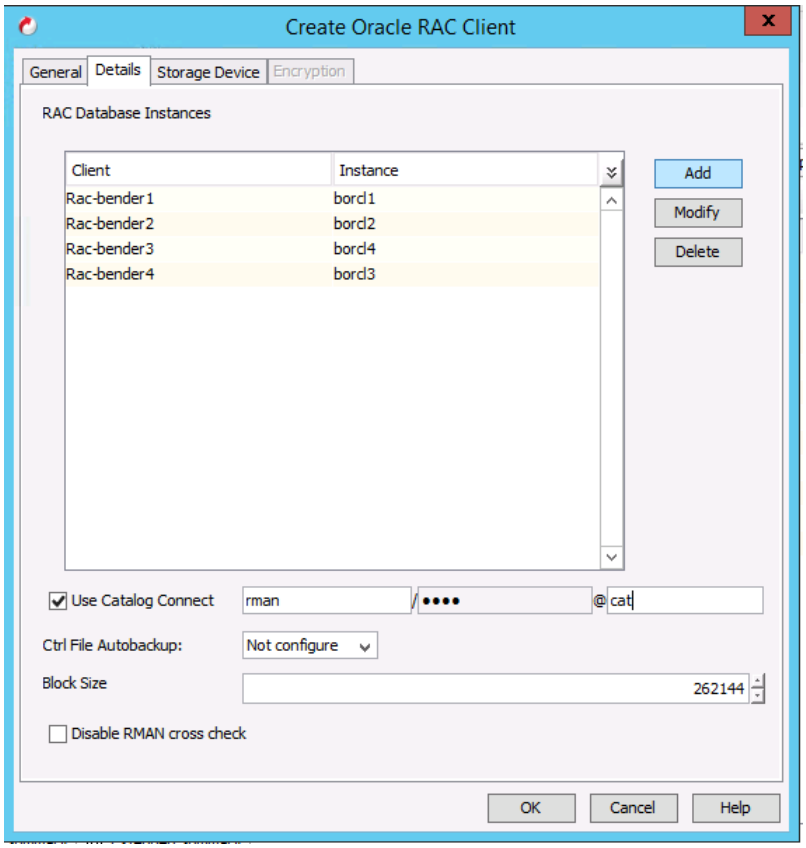
1. On the CommCell Console, right-click **Client Computers**, navigate to **New Client**, **Application**, and then click **RAC**.

**Figure 21.** Creating RAC clients




Each node instance is added to the RAC client, along with credential and ORACLE_HOME details, to give Simpana the knowledge of the RAC topology.

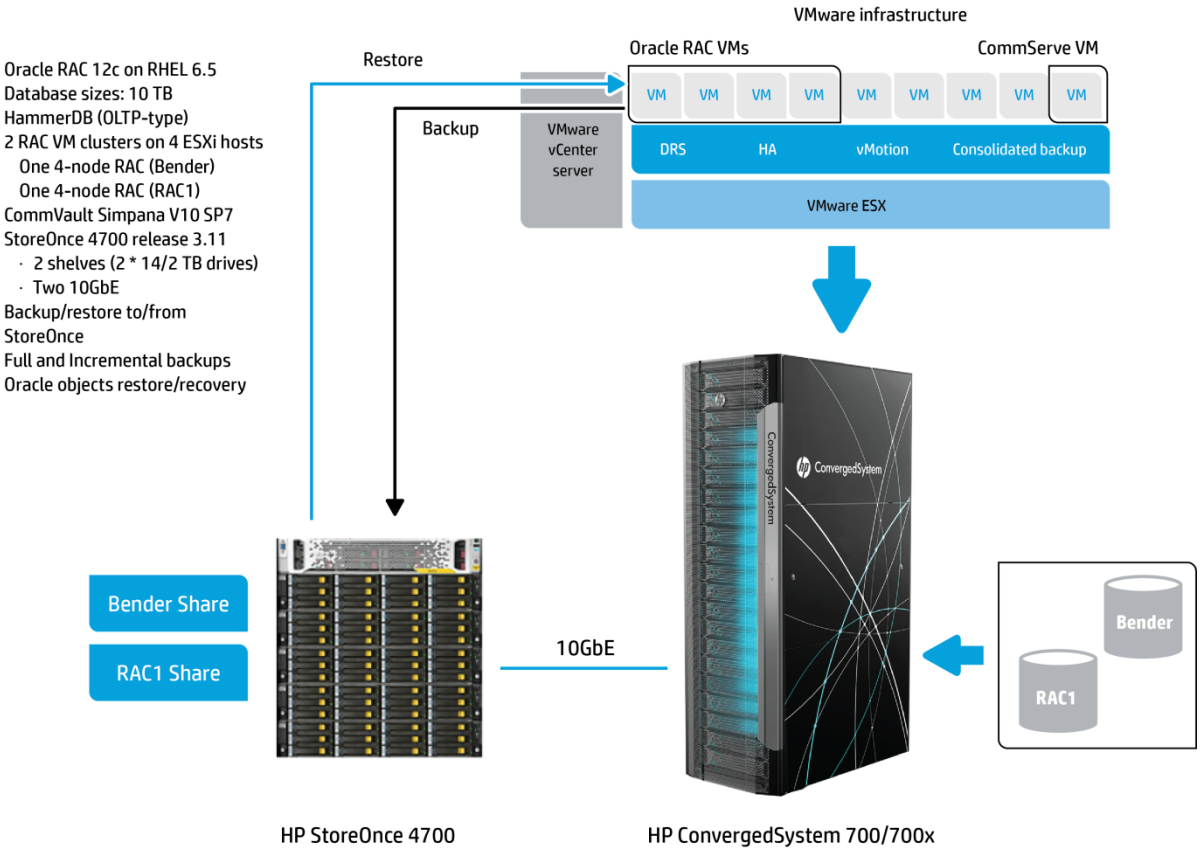
**Figure 22.** Listing the existing Oracle RAC clients




For complete installation, instructions, and advanced options, please visit:
documentation.commvault.com/commvault/v10/article?p=products/oracle_rac/config_basic.htm

# Test Bed architecture overview

**Figure 23.** HP CS700x, Oracle RAC, and CommVault Simpana Test Bed architecture overview



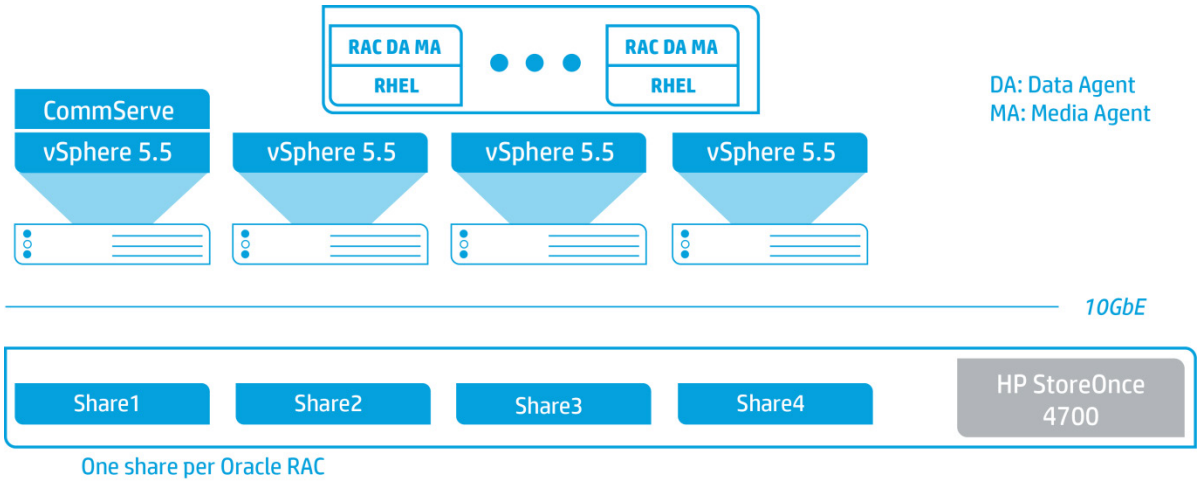

The test bed consisted of one HP ConvergedSystem 700x and StoreOnce 4700 connected via a 10GbE network. Two 10GbE links were bonded to provide redundancy and a large pipe. Nine virtual machines were created on four of the CS700x blades. Eight virtual machines were dedicated to the two Oracle clusters: a set of two 4-virtual machine Oracle RAC across the 4 ESXi hosts on the CS700x. Each Oracle VM has 16 virtual CPU (vCPU) and 64 GB of memory. One virtual machine is used for CommServe server. The two Oracle databases and VMware DataStore reside on the HP 3PAR StoreServ 7400.

## CommVault Simpana architecture overview with StoreOnce

Each RAC node has Simpana Oracle iDataAgent and MediaAgent software installed. This enables the nodes to send data directly to the StoreOnce to increase throughput and distribute resource utilization across the ESXi hosts.

A StoreOnce share is provisioned for each RAC instance, and all nodes for that instance write and read from the same share. This configuration enhances deduplication while allowing high, parallel stream counts for high throughput. The shares are configured as V2, a new option in StoreOnce 3.11.3 optimized for CommVault Simpana.

**Figure 24.** CommVault architecture overview with StoreOnce




## Solution components

This solution includes the following key components:

### HP ConvergedSystem 700x tested configuration

**Table 5.** HP CS700x hardware for the Test Bed

| Component | Purpose |
|---|---|
| One HP BladeSystem c7000 Enclosure | Enclosure to host blades and Virtual Connect modules |
| Two HP Virtual Connect FlexFabric 10Gb/24-Port Modules | Virtual Connect module for Ethernet and SAN connectivity |
| Six HP ProLiant BL460c Gen8 E5-v2 Server Blades | Server blade to host two Oracle RAC 12c 4-node clusters , Simpana application, and HammerDB application running as VMs |
| One HP 3PAR StoreServ 7400 | Storage for Oracle Database and data stores for VM |
| Two HP StoreFabric SN600B 24-port SAN switches | Fibre Channel switches for SAN connectivity between servers and HP 3PAR |
| HP StoreOnce 4700 | Target for Oracle Database backup |
| Two HP 5920AF-24XG switches<br>Two HP 5120-24G El switches | 10GbE top-of-rack switches<br>Ethernet switches |

### Software configuration

- Oracle RAC 12c configured on virtual machine running Red Hat Enterprise Linux 6.5.
- Oracle Automated Storage Management (ASM)
- Oracle Recovery Manager (RMAN)
- Simpana v10 SP7 configured on Windows 2012 R2.
- HammerDB 2.16 configured on virtual machine running Red Hat Enterprise Linux 6.5.
- HP 3PAR OS version must be 3.1.3.
- CommVault Simpana v10 SP7.
- StoreOnce 4700 release 3.11.3.

### Storage configuration

The HP 3PAR StoreServ 7400 hosted the two Oracle databases of 10 TB each. To accomplish this layout, the HP 3PAR StoreServ primary storage array, of the HP ConvergedSystem 700x, is used to allocate and present storage pools as described table 6 Once allocated, the storage objects are presented to the VMware vSphere environment. The storage is allocated and provisioned using a thick format to enhance I/O performance during the workload-testing phase of this solution.

**Table 6.** Storage configuration for the Test Bed

| Contents | Size | Provisioning | Disk type | Notes |
|---|---|---|---|---|
| Oracle Data Files | 10 TB | Thick | 15kSAS | RAID 5 |
| Oracle Temp Files | 500 GB | Thick | 15kSAS | RAID 5 |
| Oracle Redo logs | 500 GB | Thick | 15kSAS | RAID 5 |
| Oracle Control Files | 500 GB | Thick | 15kSAS | RAID 5 |
| Virtual Machine OS, Binaries specifications | 150 GB | Thin | 15kSAS | RHEL 6.5, Oracle 12c (16 core and 96 GB memory) |
| CommServe server, Simpana specifications | 200 GB | Thin | 15kSAS | Win2012 R2, Simpana v10 SP7 (8 core and 32 GB memory) |
| HammerDB | 50 GB | Thin | 15kSAS | RHEL 6.5, HammerDB 2.16 |

### HP StoreOnce 4700 configuration

The StoreOnce 4700 for this evaluation was configured with two disk shelves. Each disk shelf has fourteen 2 TB disk drives. The maximum throughput of a fully configured StoreOnce 4700 without Catalyst is 7.6 TB/hr. The unit we tested had a maximum throughput of 1.5 TB/hr due to the limited number of disk drives (28). Performance is affected by parallel stream count; more streams gives higher performance. The StoreOnce unit included the followings:

- 2x 10GbE bonded—NFS backup target
- 4x 1GbE—management
- 2x 8 Gb FC—unused
- StoreOnce software version 3.11.3

### Workload

HammerDB is an open source database load testing and benchmarking tool for Oracle and other databases.

HammerDB is used to load the data into the two Oracle databases. Transactions were run against the databases during backup to simulate a customer production environment. The load on the system would be qualified as medium and would consume 45 percent of the CPU. The daily data change rate is estimated between 1.8 percent and 2 percent.

**Figure 25.** Database data load using HammerDB

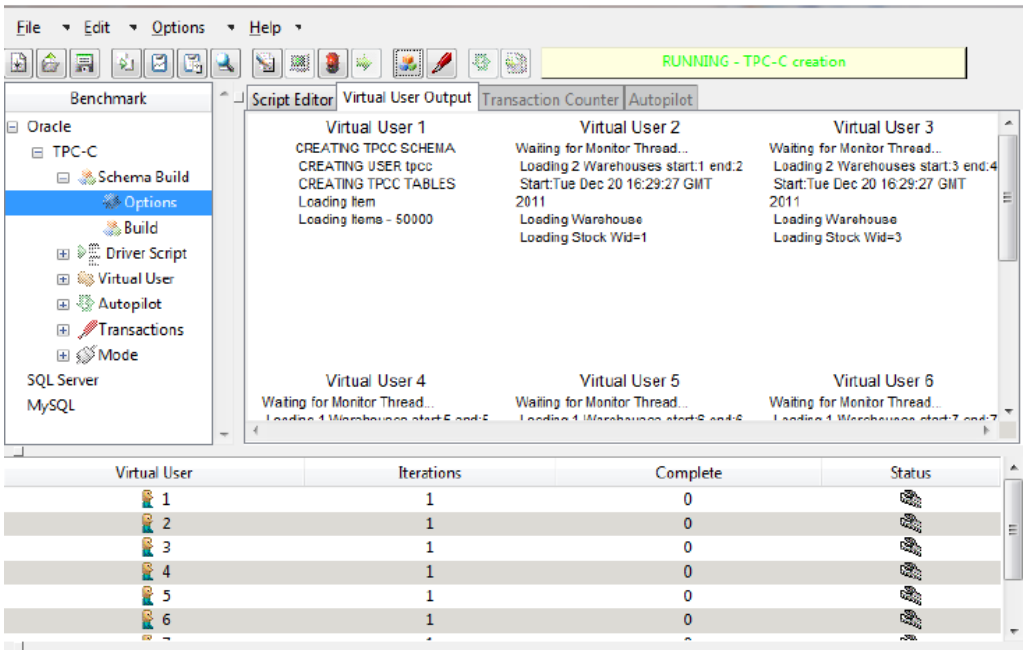
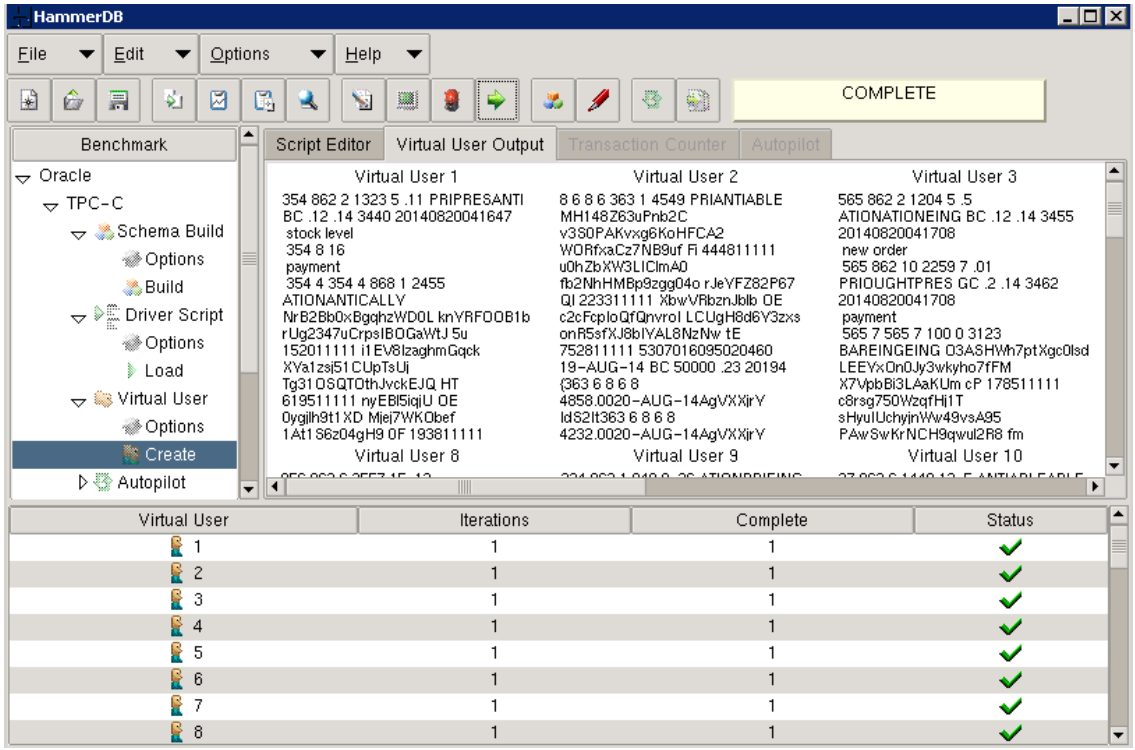



**Figure 26.** HammerDB transaction running against the Oracle Database



# Optimizing backup and recovery for Oracle RAC 12c on CS700x with CommVault Simpana

## StoreOnce tuning guidelines

- Make use of the HP StoreOnce Sizing tool to size your StoreOnce solution. It is available at: h30144.www3.hp.com/SWDSizerWeb/default.htm.
- Always ensure that the appliance software in your HP StoreOnce Backup System is fully up-to-date. Software upgrades also contain all the necessary component firmware upgrades.
- Where possible, group backups of like data types to the same destination device (Share/VTL/Store)—this can help optimize deduplication ratios.
- Use separate StoreOnce shares and Simpana storage policies for different data types, e.g., separate file system and database backups from each other.
- Run multiple backups in parallel to improve aggregate throughput for a StoreOnce appliance. Appendix A shows the maximum number of simultaneous streams per configured device.
- Use blackout windows and replication windows to ensure that the appliance is not concurrently performing backup, replication, housekeeping, and offload to tape operations. This can keep system performance consistent throughout the backup period.
- Configure multiple Ethernet ports in a network bond to achieve increased available network throughput.
- Identify and resolve other performance bottlenecks in your backup environment such as slow clients and media agents.

### StoreOnce—maximum supported streams and devices[10]

**Table 7.** Maximum supported streams and devices

| StoreOnce | Devices | Streams | Non-catalyst maximum[11] throughput |
|---|---|---|---|
| VSA | 4 | 16 | 300 GB/hr |
| 2700 | 8 | 48 | 1.3 TB/hr |
| 4500 | 32 | 128 | 5.4 TB/hr |
| 4700 | 50 | 192 | 7.6 TB/hr |
| 4900 | 50 | 320 | 8.5 TB/hr |
| 6500 | 50 | 320/node | 63.2 TB/hr |

### Networking

"The recommendation is to configure the StoreOnce with bonded 10GbE connections where possible to allow increased throughput. Multiple Clients and Media Agents can write to the StoreOnce simultaneously reducing the total backup window required."

- Adhere to the suggested maximum number of concurrent operations per share/appliance, as shown in table 7. Be aware that there is a limit of 48 concurrent writes to NAS shares on HP StoreOnce; if more streams are required, use multiple shares.
- For NFS shares, use the correct mount options to help ensure in-order delivery and improve deduplication ratios. See the "HP StoreOnce Linux and UNIX Configuration Guide" for specific details at: hp.com/go/storage/docs.

[10] These figures are correct at the time of publication, but are subject to change with differing software versions.
[11] These figures are headline performance figures, generated with extremely high performance clients to show raw StoreOnce performance.

### Replication

- When using StoreOnce NAS with replication, you can configure Simpana with a replica disk library. This makes Simpana aware that an appliance level replication is used and Simpana can subsequently restore from this location should the local device fail.
- More information on StoreOnce replication and its configuration is available at: hp.com/go/storage/docs.
- Simpana replica disk-library configuration is detailed at: documentation.commvault.com/commvault/v10/article?p=features/disk_library/replicated_library.htm

## Simpana tuning guidelines

### Number of clients

- A larger number of clients allows for a greater aggregate throughput to StoreOnce, shrinking the backup window required. Please see table 7 for supported streams and total throughput on each StoreOnce platform; this should be considered during the sizing exercise.

### Media Agent sizing

- The Media Agent is involved in all data operations between the clients and StoreOnce; it needs to be capable of supporting sufficient concurrent operations. Use the CommVault system requirements table to help ensure you meet the requirements for the Media Agent, including scope for future growth. It is available at: documentation.commvault.com/commvault/v10/article?p=system_requirements/ma.htm

### Backup types

- Simpana can run various backup types to protect data: Full, Incremental, and Synthetic Full. When using StoreOnce, Synthetic Full backups are discouraged; there is a serious impact on the deduplication ratio and performance. Regular Full backups can deduplicate very efficiently and allow immediate restores. However, they place a significant load on the client as it streams the entire dataset for each backup. A Schedule Policy containing regular incremental backups and less frequent full backups can often result in excellent balance of performance, StoreOnce disk use, and client load. The downside to such a policy is that restoring may require the restore of a full backup and subsequently several incremental restores in sequence.

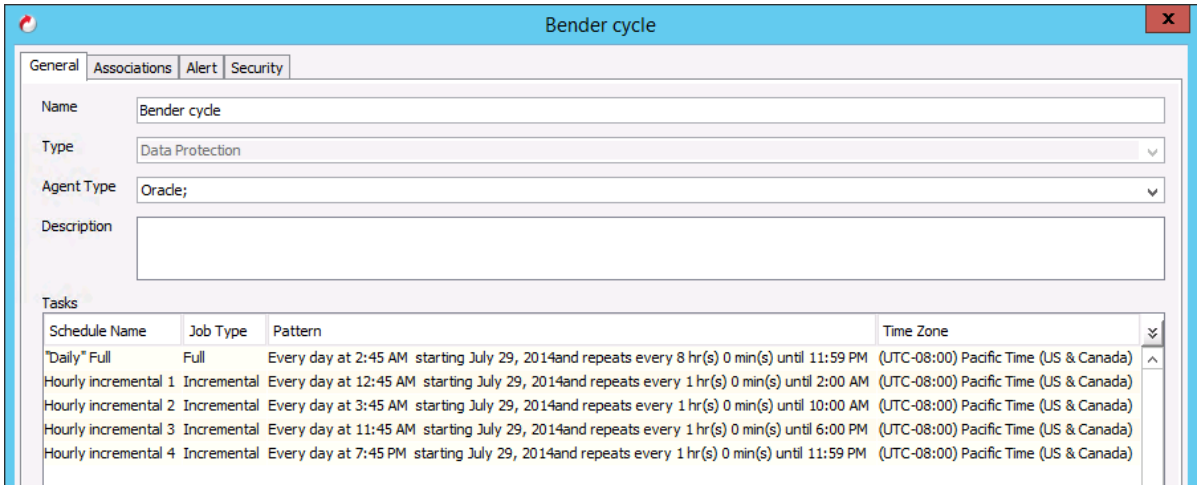
### IntelliSnap

IntelliSnap is a Simpana feature that allows the management of snapshots on primary storage arrays, such as HP 3PAR StoreServ. These snapshots can be mounted directly to the Media Agent and backed up whilst the production server continues to service clients as normal. Additionally, restores can be done almost instantaneously by reverting the snapshot as long as the array is fully functional; this is ideal for recovering from data corruption or user error scenarios. For more information on IntelliSnap requirements, please visit: documentation.commvault.com/commvault/v10/article?p=features/snap_backup/support_snapbackup.htm

# Backup configuration

For the test configuration, a cycle of full and incremental backups was scheduled to run three times daily. Each cycle represents a day of transactions and growth in the Oracle Database. Full backups were scheduled to run every eight hours. Hourly incremental backups were scheduled to run in between the full backups. Streaming log backups were configured to run automatically with the snapshot backups.

**Figure 27.** Backup scheduler




## Backup use cases

Three Oracle backup use cases were investigated. An online streaming full backup was taken utilizing a single node of the RAC with 24 RMAN channels allocated for the backup. The average throughput for this case was 1.3 TB/hr. Spreading the workload over all four nodes of the RAC, increased the average throughput to 1.4 TB/hr, while also spreading the CPU demands of the backup across all four RAC nodes. Finally, two parallel database backups were run to the StoreOnce, with 12 RMAN channels allocated for each database. The average throughput for each database was 1.3 TB/hr. Table 9 shows the performance results for the streaming backup.

Please note that the StoreOnce configuration used for the testing was only capable of 1.5 TB/hr due to the limited number of disk drives (14). The number of streams may vary based on your configuration. In our testing, we evaluated different number of streams and 24 was the optimum value for both backup and restore.

**Table 8.** Database backup results

| RMAN streaming backup performance use cases | | | | |
|---|---|---|---|---|
| Use case | Streams | Average throughput | Size of data | Total job time |
| Single node backup | 24 | 1.3 TB/hr | 7.3 TB | 5.5 hr |
| Multi-node backup | 24 | 1.4 TB/hr | 8.1 TB | 6 hr |
| Multi-node parallel backup (2 databases) | 24 (12 per database) | 1.3 TB/hr | 14.6 TB | 11.25 hr |

### Backup from snapshot

For ultra-critical workloads that cannot take the additional load from backups, hardware snapshots can be created, and then streaming backups can be taken from the snapshot using a physical proxy server. During testing, snapshot creation completed in three minutes or less, regardless of backup type. This represents the complete execution time and includes processes to place Oracle in hot backup mode and release it, as well as storing Simpana's index information.

The streaming backup of the snapshot to StoreOnce via the proxy system averaged between 1,100 and 1,200 GB per hour with 24 streams. Peak speed was observed at upwards of 1,400 GB per hour. Maximizing throughput with StoreOnce

depends on high bandwidth and high parallelism. For off-host IntelliSnap backup copy, 24 streams provided excellent balance of throughput and proxy system utilization.

## Backup best practices for virtualized Oracle RAC 12c

- An application agent for Oracle Database provides excellent level of protection and recovery. Simpana provides RAC awareness to simplify protection and recovery processes.
- To leverage hardware snapshots in a virtual Oracle environment, you must present database logical unit numbers (LUNs) directly to the Oracle guests. Environments using FC connectivity must use physical mode RDMs. Environments with iSCSI may present LUNs directly to the virtual guests using the initiator within the guest.
- When using snapshots, several factors affect the retention strategy. RPOs and RTOs must be balanced against the cost of maintaining snapshots. For many databases, the value of the recovery copies diminishes rapidly with time. Superior strategy retains enough frequent snapshot copies to meet recovery time and recovery point objectives, with less frequent streaming copies for disaster recovery, testing and reporting refresh, and other uses.
- For environments not leveraging snapshots, best practice is to dedicate a virtual RAC node to backups to reduce the impact on the other nodes in the cluster.
- For outstanding performance, streaming backups to StoreOnce should use as many streams as the Oracle instance can support. This applies to both direct streaming and IntelliSnap backup copy operations.
- Streaming log backups should be performed on a regular schedule, at a frequency based on RPOs and RTOs.
- Virtual machines performing data movement, whether RAC nodes or IntelliSnap proxies, should have dedicated CPU and memory resources allocated. Backup traffic should be segregated where possible using separate VLANs and adapters.

For additional configuration options with VMware, please visit:
documentation.commvault.com/commvault/v10/article?p=virtualization.html

## Recovery

Simpana provides the ability to recover to a specific point in time using the archived redo logs.

All recoveries are initiated through the same browse and recover interface. Simply select the time range to search, and then select the database content to restore. The recovery options selected will determine what database and archive log backups will be used for restore and recovery.

**Figure 28.** Restore options

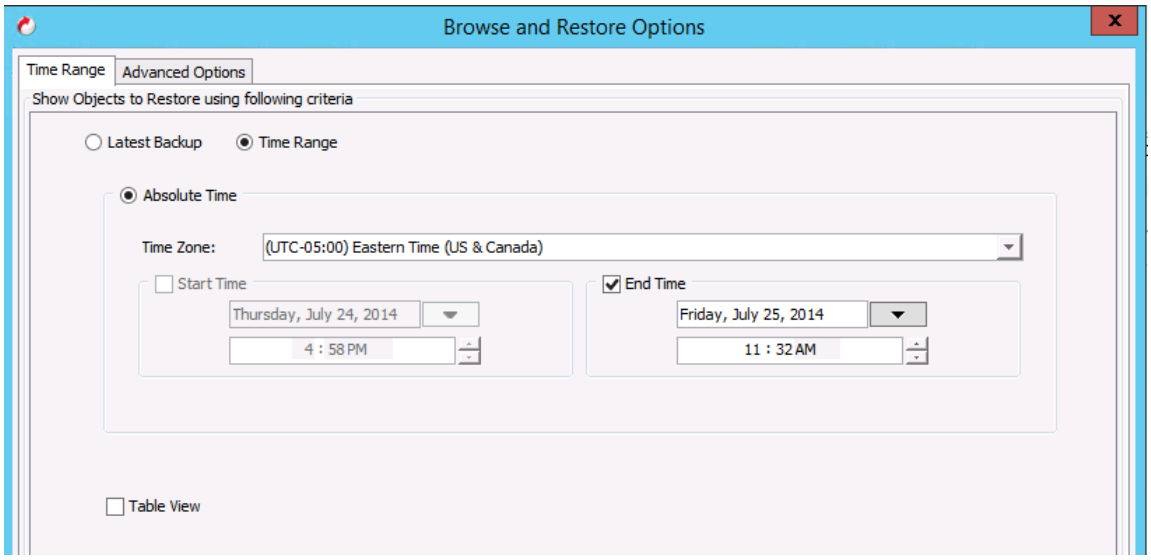
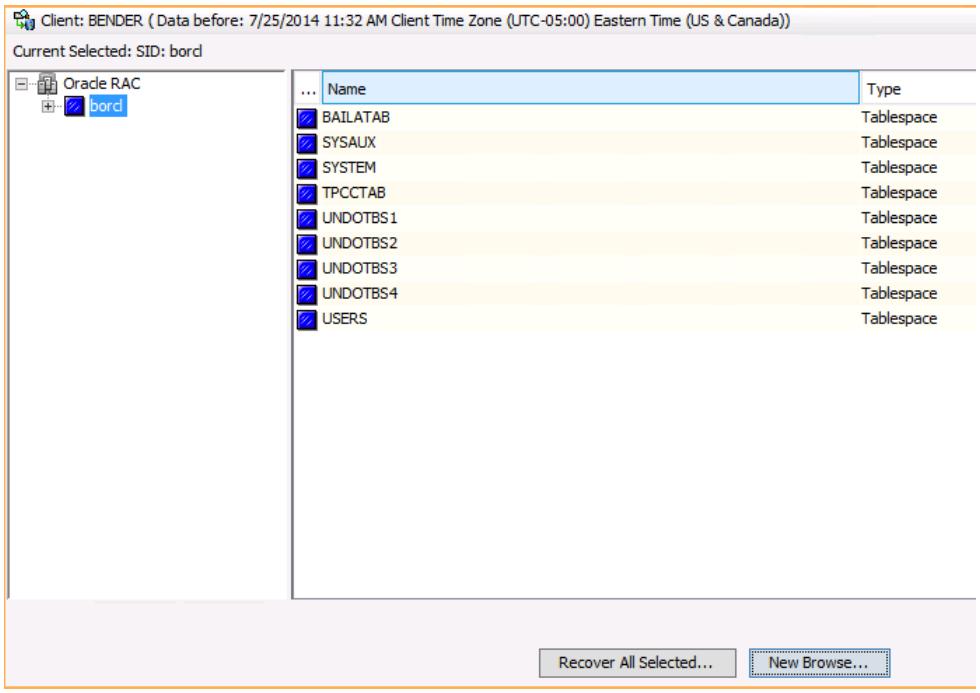
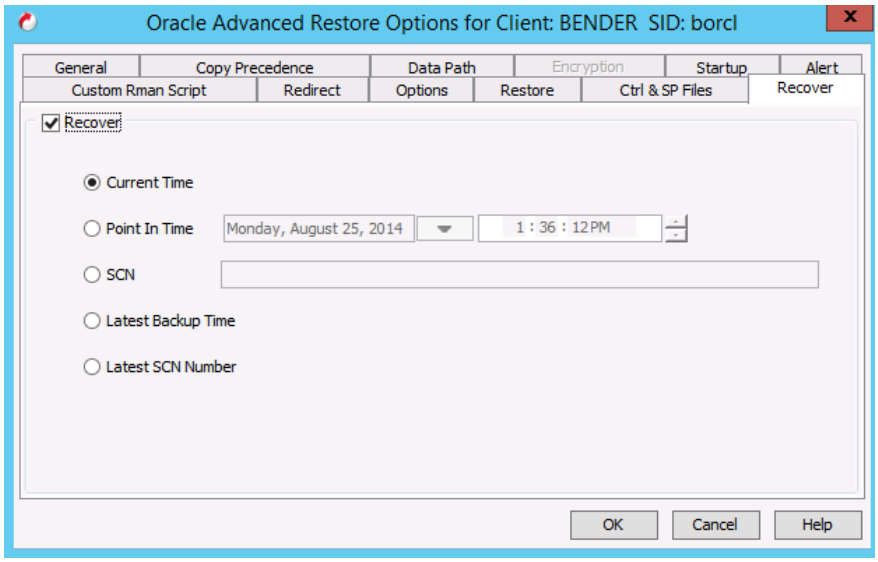


**Figure 29.** Restore options through the CommVault Simpana interface




The Simpana interface allows the user to select from different recovery options such as recover to current time, a specific point in time, or a System Change Number (SCN) as shown from the selection dialog box:

**Figure 30.** CommVault Simpana advanced restore options



## Restore from StoreOnce Backup

Simpana integration with StoreOnce provides streaming recovery from deduplicated storage. Performance scales with the number of streams used—applications such as Oracle Database that can perform multi-streamed restores see the biggest benefit from the appliance.

Simpana will automatically use a local recovery path, if available. Setting up access from the Oracle RAC nodes directly to StoreOnce NAS shares can yield outstanding performance during restore operations. This requires CommVault MediaAgent software to be installed on the RAC nodes.

## Recovery use cases

In each database restore scenario, archive logs were applied to bring the database back to the current time. The first scenario was a restore from a full backup only with archive logs applied after the restore to bring the database current. The average throughput was 1.5 TB/hr. Next, a full backup was restored, followed by the application of four sets of incremental backups, and again followed by archive logs to roll the database forward to the current time once again. The aggregate throughput in this case dropped to an average of 1.1 TB/hr. Finally, two databases were restored and recovered in parallel from the StoreOnce. Both databases restore full backups, followed by incremental and archive logs. The average throughput for both databases was 1.1 TB/hr. Table 10 shows the performance results for database restore and recovery.

**Table 9.** Database restore and recovery results

| RMAN recovery performance use cases | | | | |
|---|---|---|---|---|
| Use case | Streams | Average throughput | Size of data | Total job time |
| Entire database restore from Full | 24 | 1.5 TB/hr | 8.08 TB | 5.5 hr |
| Entire DB recovery from Full + 4 Incremental + logs | 24 | 1.1 TB/hr | 8.4 TB | 7.75 hr |
| Parallel DB recovery from Full + 4 Incremental + logs | 24 (12 per database) | 1.1 TB/hr | 15.2 TB | 13.8 hr |

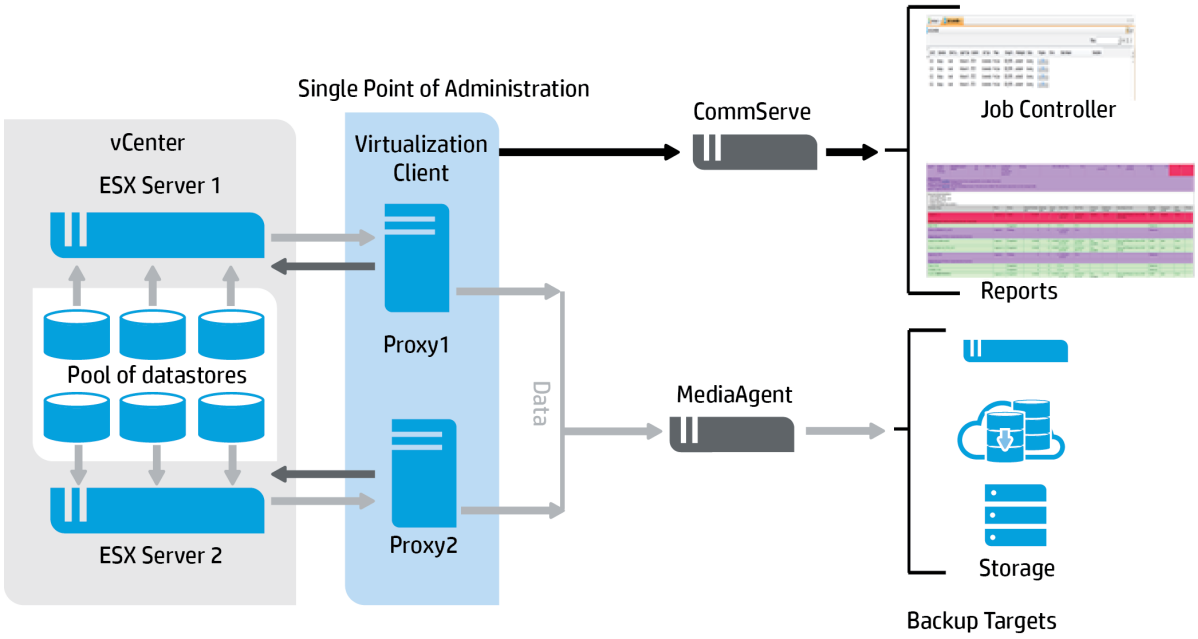
## Recovery best practices for virtualized Oracle RAC 12c

For outstanding performance, recovery should be configured to use streams on all RAC nodes. In our testing, 24 was the optimum number of streams. Please note this may vary based on your configuration.

## Simpana VMware integration: protecting your virtual machine

The CommVault Simpana Virtual Server Agent for VMware provides a unified protection and recovery vehicle for all virtual machine data in your vCenter. In addition to complete protection of entire virtual machines for disaster recovery, the CommVault Simpana Virtual Server Agent provides more granular backup and recovery options. Options such as customized automatic discovery, deduplication, and reporting help ensure all your virtual machine data is easily traceable and retrievable whenever the need arises.

**Figure 31.** CommVault Simpana Virtual Server Agent for VMware architecture overview




### Key features

**Single administration point**

The virtualization client serves a single point of administration for all proxies. The proxy computer can be any computer where the CommVault Simpana Virtual Server Agent is installed. All administration activities such as backups, restores, schedules, and reports can be performed from the virtualization client.

The virtualization client also enables proxy teaming. The proxy teaming ensures the fault tolerant backup. It can be useful when you want to perform the backup for a large number of virtual machines in a limited backup window.

**Automatic protection for all virtual machines in a vCenter**

Once you configure the CommVault Simpana Virtual Server Agent for a vCenter, all the virtual machines in the vCenter are automatically selected for backup. This behavior is designed to help ensure all virtual machines are backed up.

**Customized discovery**

If you want to backup only specific virtual machines in a vCenter, you can set criteria to search the virtual machines and automatically select them for backup. This is useful in environments where virtual machines are frequently added, or removed. You can easily browse and select vCenter objects such as hosts, datastores, resource pool, etc. to set criteria for automatic discovery.

**Customized filters**

You can exclude specific virtual machines or disks on the virtual machines from the backup. You can add filters for the virtual machines or disks.

**Detailed reporting for each virtual machine backup**
You can view a detailed report about each backed up virtual machine. It contains information such as name of the proxy, which performed the backup of the virtual machine, size of the backup data, type of backup, etc. You can view all this information from the CommCell Console when the backup job is running. It appears on the Client status tab of the view job details dialog box.

**vCloud backup and restore**
You can protect the vCloud-specific attributes of a virtual machine and restore it back to a vCloud.

**Point-in-time snapshots of virtual machines**
IntelliSnap backup enables you to create a point-in-time snapshot of a virtual machine by temporarily quiescing the data, taking a snapshot, and resuming live operations. IntelliSnap backups work in conjunction with hardware snapshot engines.

**Changed block tracking**
Changed block tracking (CBT) is a VMware feature that can be used to help optimize backups of virtual machines by reading only the allocated and modified portions of a virtual disk. CBT is automatically enabled for virtual machines running on hardware version 7 or higher.

## Backup best practices for VMware-generalized workloads

Simpana provides a default subclient that automatically discovers new VM guests and adds them to protection operations. Scheduling backup jobs with this subclient ensures all VMs are protected.

Changed block tracking significantly improves performance of incremental backups.

Subclients should generally align to ESX clusters. Simpana will attempt to load balance backups across datastores within the subclient.

Guest applications that do not support Volume Shadow Copy Service (VSS) should have freeze or thaw scripts configured to ensure application consistency at the time of backup.

Configure separate virtual clients for vCenter and vCloud Director to ensure vCloud metadata is collected properly.

IntelliSnap should only be used for large- or high-I/O VMs. Generally, streaming backups are faster overall for smaller, less busy VMs. VMs protected with IntelliSnap should be placed in separate datastores from streaming VMs. IntelliSnap subclients should align to datastores to avoid creating excessive hardware snapshots.

For more detail on Simpana best practices with VMware, please visit:
documentation.commvault.com/commvault/v10/article?p=products/vs_vmware/best_practices.htm

## VMware tuning guidelines

- Ensure sufficient resources are allocated to the CommServe, CommVault Simpana Virtual Server Agent, and MediaAgents. Resource contention will result in performance degradation.
- Segregate StoreOnce traffic from other networks to help ensure throughput is not affected by traffic fluctuations.
- Test the impact of compression on the backup. Compression will add to the CommVault Simpana Virtual Server Agent CPU load, but depending on the data, the increase may be more than offset by a reduction in backup time. In the test environment, compression added 30 percent CPU load but negligible difference in backup performance.[12]

[12] HP and CommVault Internal test, 2014

# Configuring CommVault Simpana v10 with VMware

### Installing the Virtual Server Agent

The Virtual Server Agent must be installed on a Windows Server 2008 R2 or later system. The CommVault Simpana Virtual Server Agent system can be physical or virtual, but for more efficient performance, it must have access to the datastores hosting the virtual machines that are protected. The Virtual Server Agent can be installed manually on the CommVault Simpana Virtual Server Agent system, or it can be pushed remotely using the Simpana GUI.

For details on installing the Virtual Server Agent, please visit:
documentation.commvault.com/commvault/v10/article?p=products/vs_vmware/deployment.htm

### Configure virtualization client

A virtualization client allows Simpana to interface with VMware vCenter and vCloud Director to identify and manage vSphere host and datastore resources. Configuring a virtualization client simply requires the name or address of the vCenter or vCloud Director instance and credentials with appropriate access privileges.

As mentioned previously, the default subclient by default will detect and protect all virtual machines managed by vCenter or vCloud Director. Additional subclients can be created to meet different protection needs for targeted sets of VMs, such as longer retention or IntelliSnap. Content for subclients can be explicit or rule-based and targeted at hosts, clusters, VMs, and datastores.

**Figure 32.** CommVault Simpana Virtual Server Agent explicit content selection

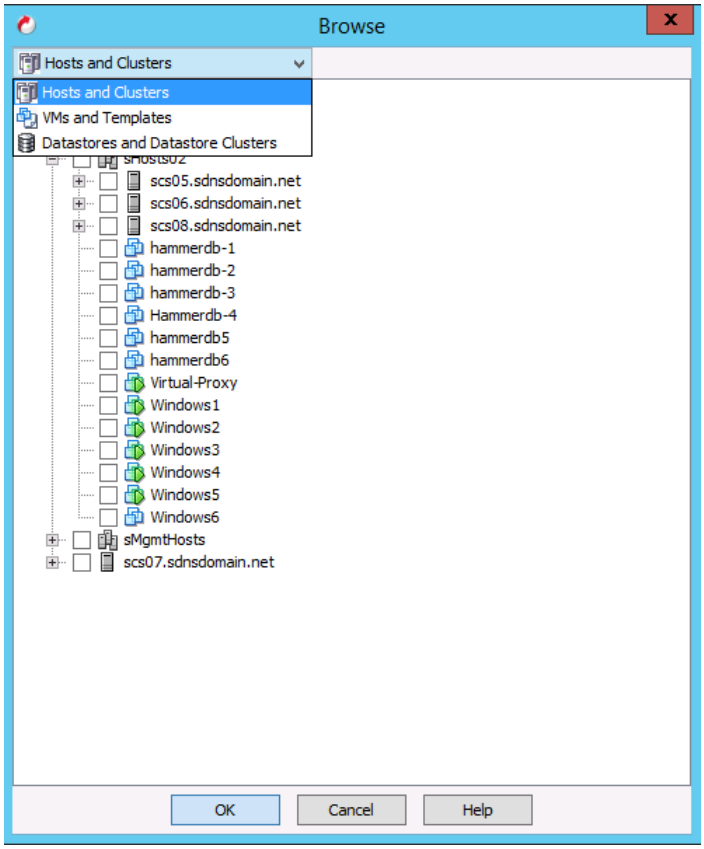


**Figure 33.** CommVault Simpana Virtual Server Agent rule-based content selection


For more detail on configuring VMware protection with the Virtual Server Agent, please visit: documentation.commvault.com/commvault/v10/article?p=products/vs_vmware/config_basic.htm

## Backup configuration

For the test configuration, five virtual machines running Windows Server 2012 were configured as the content for a CommVault Simpana Server Agent subclient. A sequence of backups and data changes was run to simulate daily file changes and protection operations. The sequence consisted of six incremental backups and one full backup, with a roughly one percent change rate between jobs.

### Backup use cases

Five backup use cases were investigated with VMware. Full VM backups were performed with and without metadata collection enabled. Incremental VM backups were performed with metadata collection enabled. In addition, IntelliSnap full and incremental backups of the VMs were performed, with out-of-band streaming backup copy and metadata collection enabled. Table 10 shows the performance results for VMware backup. Incremental results are averaged across five jobs.

**Table 10.** CommVault Simpana Virtual Server Agent backup results

| Virtual Server Agent streaming backup performance use cases | | | |
|---|---|---|---|
| Use case | Average throughput | Size of data | Total job time |
| Full with metadata | 290 GB/hr | 39.37 GB | 9.75 min |
| Incremental with metadata | 11.2 GB/hr (average) | 888 MB (average) | 5.5 min (average) |
| Full without metadata | 283 GB/hr | 40.37 GB | 9.5 min |
| IntelliSnap full | 295 GB/hr (backup copy) | 40.27 GB | 2.1 min (snapshot)<br>11.1 min (backup copy) |
| IntelliSnap incremental | 13.6 GB/hr (average) | 906.47 MB (average) | 2.4 min (snapshot average)<br>6.5 min (backup copy average) |

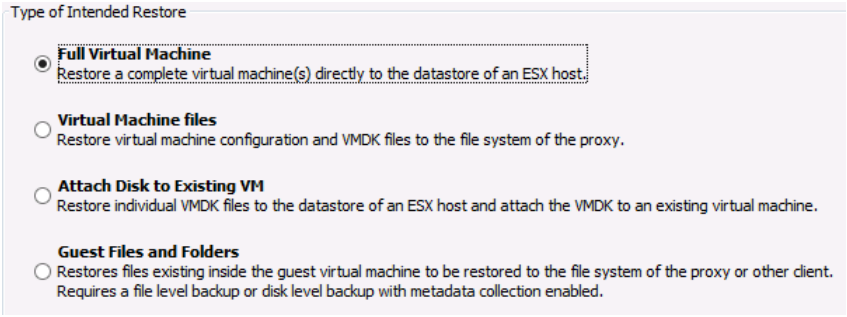
Notes on performance:

- Job time is not limited to data transfer duration.
- Throughput incorporates metadata collection in addition to data transfer.
- StoreOnce performance scales with stream count and disk shelves. More parallel jobs from additional CommVault Simpana Virtual Server Agents can result in higher throughput.

## Recovery

Simpana provides a number of recovery options for VMware. Full VMs can be restored either in place or out of place. Virtual machine files such as configuration and Virtual Machine Disk (VMDK) files can be restored to the CommVault Simpana Virtual Server Agent system. VMDK files can be restored to a datastore and attached to an existing VM to allow manual browsing. And granular files from within the VMDKs can be recovered to any Simpana client or even to a VM without a Simpana agent installed.

**Figure 34.** CommVault Simpana Virtual Server Agent restore options



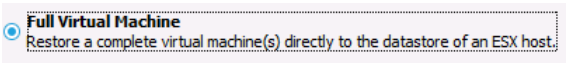

## Recovery best practices for VMware

### Recovery use cases

Three recovery use cases were investigated. Out-of-place full VM recovery simulates a disaster recovery operation. Granular guest file recovery illustrates restoration of individual files from within a VM guest, with no agent required in the guest. Live browse and recovery from snapshot showcases Simpana's ability to recovery VM content, including individual files, without indexing the VM content beforehand.

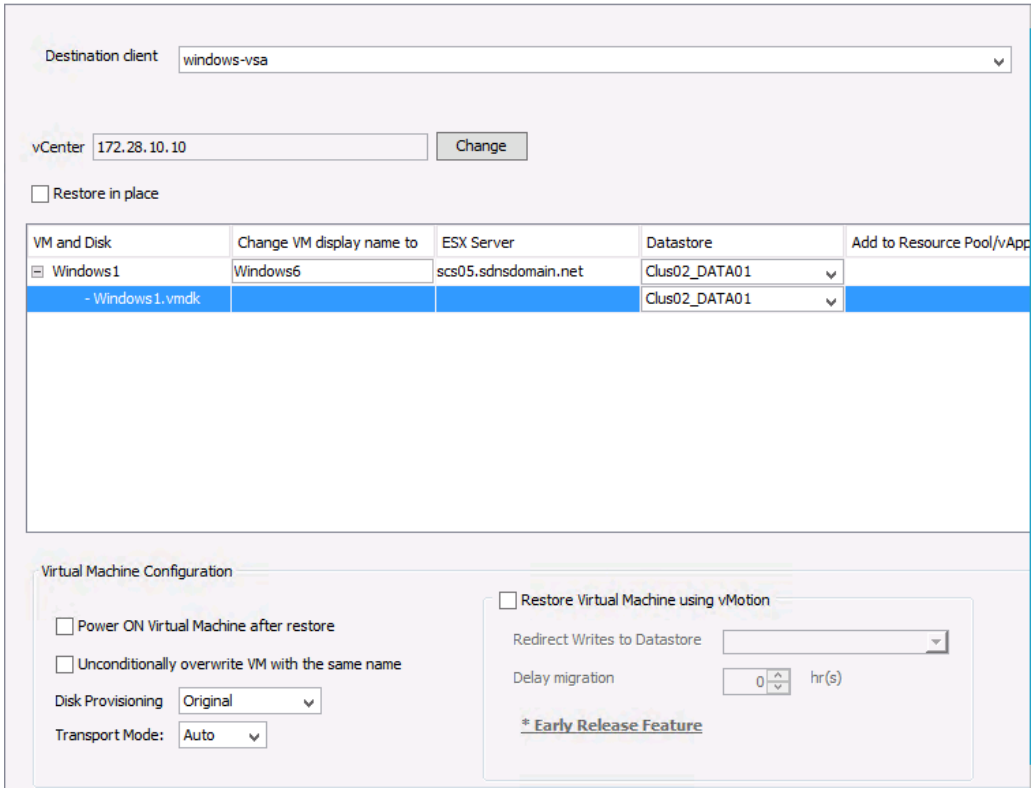
Out-of-place full VM recovery

**Figure 35.** CommVault Simpana Virtual Server Agent out-of-place full VM restore



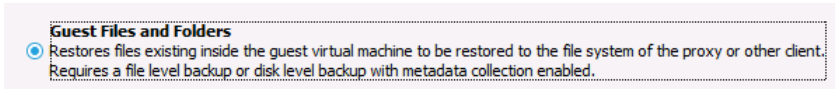

The virtual machine was recovered to a different VM name on a different datastore. Simpana includes a wide variety of options to customize the restore, including changing hosts, datastores, powering on the VMs, and changing disk provisioning, among others.

**Figure 36.** CommVault Simpana Virtual Server Agent VM restoration in a different ESXi host



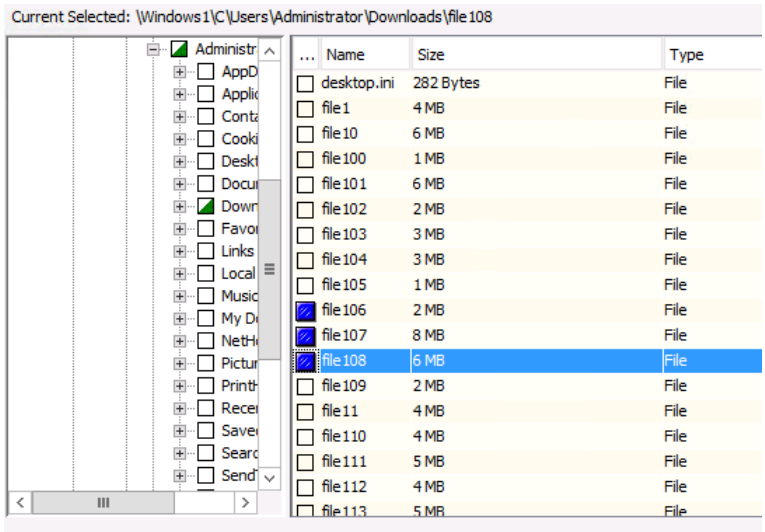

## Granular, agentless guest file recovery to VM

**Figure 37.** CommVault Simpana Virtual Server Agent granular restore



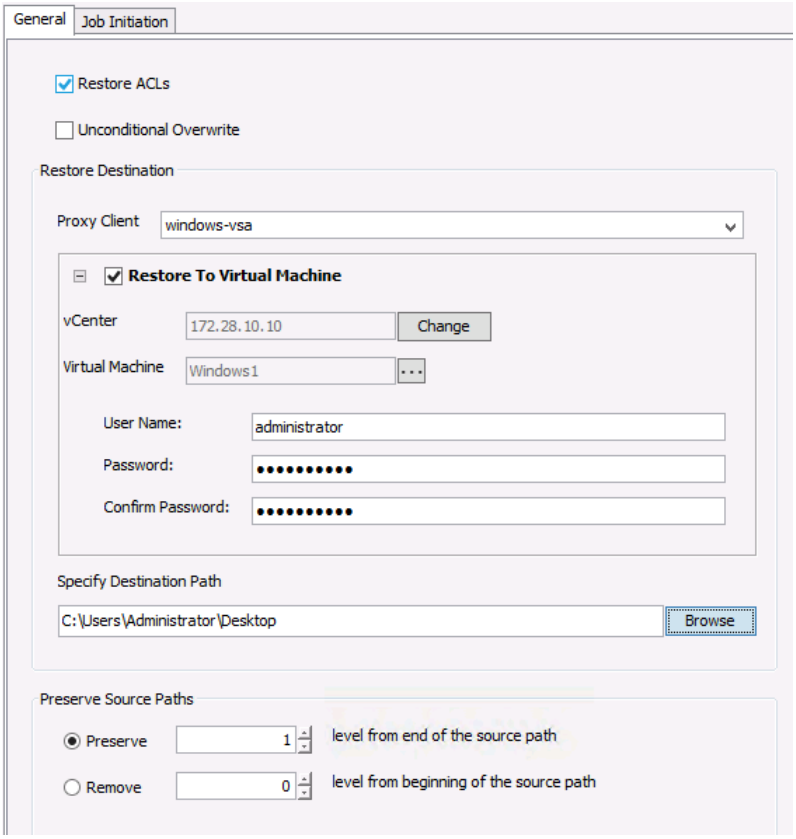

Browsing from the CommVault Simpana Virtual Server Agent allows drilling down into the file system of the protected VMs. Individual files and folders can be selected.

**Figure 38.** CommVault Simpana Virtual Server Agent content for granular restoration



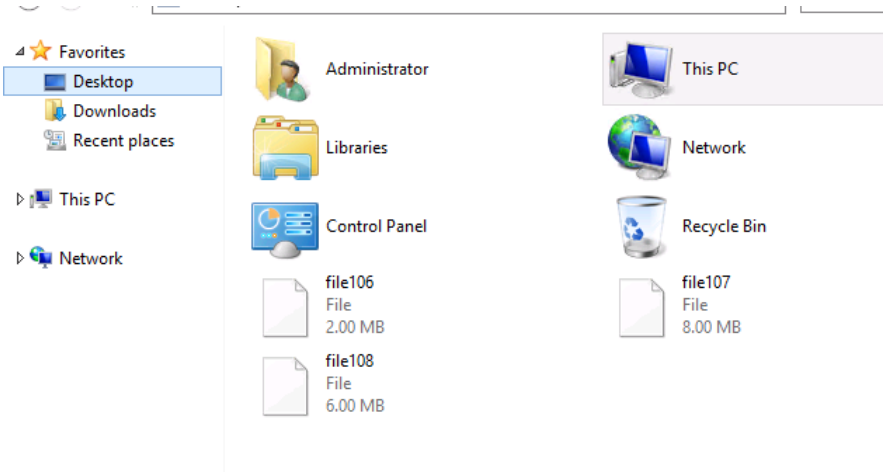
Content can be recovered to any file system agent or to a virtual machine.

**Figure 39.** CommVault Simpana Virtual Server Agent granular restoration to virtual machine




After recovery the files are available in the target location.

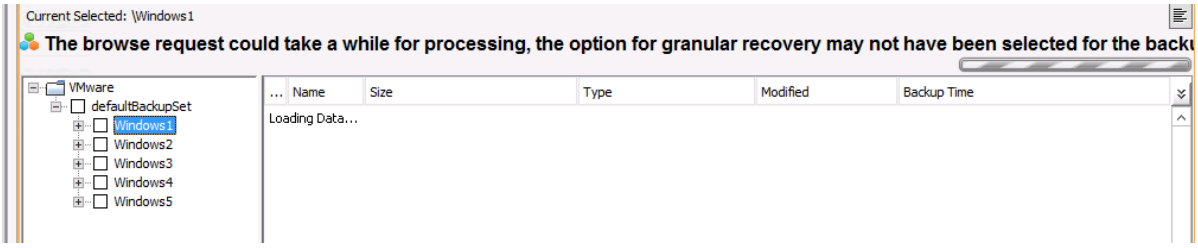
**Figure 40.** Files available after restoration



### Live browse and granular restore from snapshot

Browsing for granular file content from an unindexed snapshot starts a live browse, which is a real-time indexing operation. This is most efficient when using a hardware snapshot as a recovery source. The process starts automatically when a snapshot is the most appropriate recovery source.

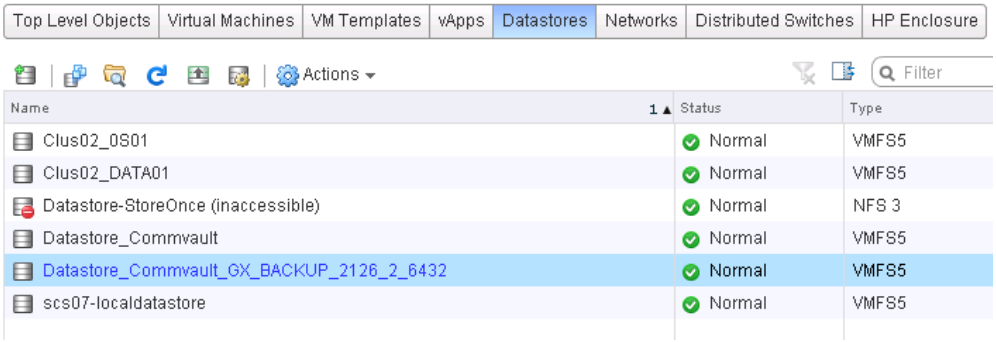
**Figure 41.** CommVault Simpana Virtual Server Agent browse request




The live browse returns identical content to an indexed browse. Restore options are identical to an indexed browse.

During the live browse, the hardware snapshot is mounted to an ESX proxy host as a datastore to present the VMs for indexing.

**Figure 42.** CommVault Simpana Virtual Server Agent snapshots listing




For detailed information on VM recovery options, visit:
documentation.commvault.com/commvault/v10/article?p=products/vs_vmware/restore_adv.htm

**Table 11.** VMware recovery performance results

| VMware recovery performance | | | |
|---|---|---|---|
| Use case | Average throughput | Size of data | Total job time |
| Out-of-place full VM recovery | 224 GB/hr | 16.01 GB | 4.25 min |
| Granular, agentless guest file recovery to VM | 1.11 GB/hr | 16 MB | 0.9 min |
| Live browse and granular restore from snapshot | 0.41 GB/hr | 10 MB | 1.5 min |

## Summary

Organizations invest in converged technology stacks to reap the benefits of a single pre-tested and validated solution platform that can help reduce risk, increase operational efficiencies, and deploy workloads upon a predictable infrastructure set. With a converged approach, you get a modular solution design that can scale with the demands and growth of your workloads. This provides you with a simplified and consistent approach to key processes for Oracle databases: data protection, recovery, disaster recovery, provisioning, cloning, replication, migration, etc. The HP solution built upon the HP ConvergedSystem 700 and 700x, HP StoreOnce, and CommVault Simpana removes the burdens of a build-it-yourself model. In conclusion, the key takeaways from this joint HP and CommVault project could be defined as follow:

- HP ConvergedSystem 700 and 700x are improvised architectures for backup and recovery of virtualized mission-critical applications.
- CommVault Simpana combined with HP StoreOnce deduplication capability provide the good RPOs/RTOs for virtualized mission-critical applications as well as backup storage efficiencies.
- CommVault Simpana provides a comprehensive data protection solution for ConvergedSystem that accelerates time to deployment, and reduces risk and costs while maintaining overall application service-level objectives.

## Bill of materials

**Table 12.** CS700x Bill of materials

| Item No | Quantity | Model # | Description |
|---|---|---|---|
| | 0 | | HP ConvergedSystem 700x v1.1 VMware Kit (J0H72A)(CS700x) [#1] |
| 100 | 1 | BW904A | HP 642 1075mm Shock Intelligent Rack |
| | 1 | BW904A 001 | HP Factory Express Base Racking Service |
| 101 | 1 | HA454A1-000 | HP Fctry Express Solution Package 4 SVC |
| 102 | 1 | HA862A1 | HP Fcty Exp Control Environment Srvr SVC |
| 103 | 3 | HA854A1 | HP Fctry Exp Virtualization Enable SVC |
| 104 | 1 | J0H72A | HP ConvSys 700x v1.1 for VMware Soln Kit |
| 105 | 6 | 735151-B21 | HP BL460c Gen8 E5-v2 10/20Gb CTO Blade |
| | 6 | 735151-B21 0D1 | Factory integrated |
| 106 | 6 | 718056-L21 | HP BL460c Gen8 E5-2680v2 FIO Kit |
| 107 | 6 | 718056-B21 | HP BL460c Gen8 E5-2680v2 Kit |
| | 6 | 718056-B21 0D1 | Factory integrated |
| 108 | 96 | 708641-B21 | HP 16GB 2Rx4 PC3-14900R-13 Kit |
| | 96 | 708641-B21 0D1 | Factory integrated |
| 109 | 12 | 652611-B21 | HP 300GB 6G SAS 15K 2.5in SC ENT HDD |
| | 12 | 652611-B21 0D1 | Factory integrated |
| 110 | 6 | 684212-B21 | HP FlexFabric 10Gb 2P 554FLB FIO Adptr |
| 111 | 6 | 690164-B21 | HP Smart Array P220i Controller FIO Kit |

**Table 12.** CS700x Bill of materials (Continued)

| Item No | Quantity | Model # | Description |
|---|---|---|---|
| 112 | 1 | 677595-B21 | HP BLc 1PH Intelligent Power Mod FIO Opt |
| 113 | 1 | 517521-B22 | HP 6X 2400W Plat Ht Plg FIO Pwr Sply Kit |
| 114 | 1 | 517520-B21 | HP BLc 6X Active Cool 200 FIO Fan Opt |
| 115 | 1 | 456204-B21 | HP BLc7000 DDR2 Encl Mgmt Option |
| | 1 | 456204-B21 0D1 | Factory integrated |
| 116 | 2 | 571956-B21 | HP BLc VC FlexFabric 10Gb/24-port Opt |
| | 2 | 571956-B21 0D1 | Factory integrated |
| 117 | 1 | E5Y41A | HP OV 3yr 24x7 Encl FIO Phys 16 Svr Lic |
| 200 | 2 | TK739A | HP 2.0m 250V 16A C19-C20 3PC IPD Jpr Crd |
| | 2 | TK739A 0D1 | Factory integrated |
| 300 | 2 | QK753B | HP SN6000B 16Gb 48/24 FC Switch |
| | 2 | QK753B 0D1 | Factory integrated |
| 301 | 2 | HA454A1-021 | HP Fctry Exp Strg and Ntwking Pkg 4 SVC |
| 302 | 72 | AJ716B | HP 8Gb Short Wave B-Series SFP+ 1 Pack |
| | 72 | AJ716B 0D1 | Factory integrated |
| 400 | 1 | H1K92A3 | HP 3Y 4 hr 24x7 Proactive Care SVC |
| | 2 | H1K92A3 QAM | HP SN6000B 16Gb 48/24 FC Switch JW Supp |
| 500 | 2 | JG510A | HP 5900AF-48G-4XG-2QSFP+ Switch |
| | 2 | JG510A 0D1 | Factory integrated |
| 501 | 2 | HA454A1-021 | HP Fctry Exp Strg and Ntwking Pkg 4 SVC |
| 502 | 4 | JC682A | HP 58x0AF Bck(pwr)-Frt(ports) Fan Tray |
| | 4 | JC682A 0D1 | Factory integrated |
| 503 | 4 | JC680A | HP A58x0AF 650W AC Power Supply |
| | 4 | JC680A 0D1 | Factory integrated |
| | 4 | JC680A ABA | U.S. - English localization |
| 504 | 2 | JG326A | HP X240 40G QSFP+ QSFP+ 1m DAC Cable |
| | 2 | JG326A B01 | Include with complete system |
| 505 | 2 | JD096C | HP X240 10G SFP+ SFP+ 1.2m DAC Cable |
| | 2 | JD096C B01 | Include with complete system |

**Table 12.** CS700x Bill of materials (Continued)

| Item No | Quantity | Model # | Description |
|---|---|---|---|
| 506 | 4 | SG510A | HP C13-C14 6ft Sgl Data Special |
| | 4 | SG510A 0D1 | Factory integrated |
| 600 | 1 | H1K92A3 | HP 3Y 4 hr 24x7 Proactive Care SVC |
| | 2 | H1K92A3 R4W | HP 5900AF-48 2QSFP Switch JW Supp |
| 700 | 2 | JC772A | HP 5900AF-48XG-4QSFP+ Switch |
| | 2 | JC772A 0D1 | Factory integrated |
| 701 | 2 | HA454A1-021 | HP Fctry Exp Strg and Ntwking Pkg 4 SVC |
| 702 | 4 | JC682A | HP 58x0AF Bck(pwr)-Frt(ports) Fan Tray |
| | 4 | JC682A 0D1 | Factory integrated |
| 703 | 4 | JC680A | HP A58x0AF 650W AC Power Supply |
| | 4 | JC680A 0D1 | Factory integrated |
| | 4 | JC680A ABA | U.S. - English localization |
| 704 | 2 | JG326A | HP X240 40G QSFP+ QSFP+ 1m DAC Cable |
| | 2 | JG326A B01 | Include with complete system |
| 705 | 4 | SG510A | HP C13-C14 6ft Sgl Data Special |
| | 4 | SG510A 0D1 | Factory integrated |
| 706 | 2 | JD096C | HP X240 10G SFP+ SFP+ 1.2m DAC Cable |
| | 2 | JD096C B01 | Include with complete system |
| 707 | 2 | JG330A | HP X240 QSFP+ 4x10G SFP+ 3m DAC Cable |
| | 2 | JG330A B01 | Include with complete system |
| 800 | 1 | H1K92A3 | HP 3Y 4 hr 24x7 Proactive Care SVC |
| | 2 | H1K92A3 R4R | HP Networks 5900-48 Switch JW Support |
| 900 | 7 | C7536A | HP Ethernet 14ft CAT5e RJ45 M/M Cable |
| | 7 | C7536A 0D1 | Factory integrated |
| 1000 | 6 | C7535A | HP Ethernet 7ft CAT5e RJ45 M/M Cable |
| | 6 | C7535A 0D1 | Factory integrated |
| 1100 | 4 | C7533A | HP Ethernet 4ft CAT5e RJ45 M/M Cable |
| | 4 | C7533A 0D1 | Factory integrated |
| 1200 | 1 | BW946A | HP 42U Location Discovery Kit |
| | 1 | BW946A 0D1 | Factory integrated |

**Table 12.** CS700x Bill of materials (Continued)

| Item No | Quantity | Model # | Description |
|---|---|---|---|
| 1300 | 1 | BW935A | HP Custom Rack Door Branding Kit |
| | 1 | BW935A 0D1 | Factory integrated |
| 1400 | 1 | BW930A | HP Air Flow Optimization Kit |
| | 1 | BW930A B01 | Include with complete system |
| 1500 | 1 | BW906A | HP 42U 1075mm Side Panel Kit |
| | 1 | BW906A 0D1 | Factory integrated |
| 1600 | 1 | BW891A | HP Rack Grounding Kit |
| | 1 | BW891A 0D1 | Factory integrated |
| 1700 | 6 | AJ836A | HP 5m Multi-mode OM3 LC/LC FC Cable |
| | 6 | AJ836A 0D1 | Factory integrated |
| 1800 | 6 | AJ716B | HP 8Gb Short Wave B-Series SFP+ 1 Pack |
| | 6 | AJ716B 0D1 | Factory integrated |
| 1900 | 3 | AF547A | HP 5xC13 Intlgnt PDU Ext Bars G2 Kit |
| | 3 | AF547A 0D1 | Factory integrated |
| 2000 | 6 | AF520A | HP Intelligent Mod PDU 24a Na/Jpn Core |
| | 6 | AF520A 0D1 | Factory integrated |
| 2100 | 1 | 654081-B21 | HP DL360p Gen8 8-SFF CTO Server |
| | 1 | 654081-B21 0D1 | Factory integrated |
| | 1 | 654081-B21 ABA | U.S. - English localization |
| 2101 | 1 | HA454A1-001 | HP Fctry Express Proliant Svr Pkg 4 SVC |
| 2102 | 1 | 712771-L21 | HP DL360p Gen8 E5-2695v2SDHS FIO Kit |
| 2103 | 1 | 712771-B21 | HP DL360p Gen8 E5-2695v2SDHS Kit |
| | 1 | 712771-B21 0D1 | Factory integrated |
| 2104 | 16 | 708641-B21 | HP 16GB 2Rx4 PC3-14900R-13 Kit |
| | 16 | 708641-B21 0D1 | Factory integrated |
| 2105 | 1 | 631681-B21 | HP 2GB FBWC for P-Series Smart Array |
| | 1 | 631681-B21 0D1 | Factory integrated |
| 2106 | 8 | 652611-B21 | HP 300GB 6G SAS 15K 2.5in SC ENT HDD |
| | 8 | 652611-B21 0D1 | Factory integrated |

**Table 12.** CS700x Bill of materials (Continued)

| Item No | Quantity | Model # | Description |
|---|---|---|---|
| 2107 | 1 | 652238-B21 | HP 9.5mm SATA DVD ROM Jb Kit |
| | 1 | 652238-B21 0D1 | Factory integrated |
| 2108 | 2 | 656363-B21 | HP 750W CS Plat PL Ht Plg Pwr Supply Kit |
| | 2 | 656363-B21 0D1 | Factory integrated |
| 2109 | 1 | 469774-409 | HP Remove Standard Power Cords |
| 2110 | 1 | 647594-B21 | HP Ethernet 1Gb 4-port 331T Adapter |
| | 1 | 647594-B21 0D1 | Factory integrated |
| 2111 | 1 | 684213-B21 | HP FlexFabric 10Gb 554FLR-SFP+ FIO Adptr |
| 2112 | 1 | AJ764A | HP 82Q 8Gb Dual Port PCI-e FC HBA |
| | 1 | AJ764A 0D1 | Factory integrated |
| 2113 | 1 | 663201-B21 | HP 1U SFF BB Rail Kit |
| | 1 | 663201-B21 0D1 | Factory integrated |
| 2114 | 1 | 701594-DN1 | MS WS12 Std FIO Npi en/fr/es/xc SW |
| 2115 | 1 | E5Y43A | HP OV for DL 3yr 24x7 FIO Phys 1 Svr Lic |
| 2200 | 1 | H1K92A3 | HP 3Y 4 hr 24x7 Proactive Care SVC |
| | 1 | H1K92A3 7G2 | HP Proliant DL36x(p) HW Support |
| | 1 | H1K92A3 S8X | HP MS WS12 Standard OS+APP SW SUPP |
| | 1 | H1K92A3 SVN | HP One View w/Ilo Supp |
| 2300 | 2 | SG510A | HP C13-C14 6ft Sgl Data Special |
| | 2 | SG510A 0D1 | Factory integrated |
| 2400 | 1 | 654081-B21 | HP DL360p Gen8 8-SFF CTO Server |
| | 1 | 654081-B21 0D1 | Factory integrated |
| | 1 | 654081-B21 ABA | U.S. - English localization |
| 2401 | 1 | HA454A1-001 | HP Fctry Express Proliant Svr Pkg 4 SVC |
| 2402 | 1 | 712771-L21 | HP DL360p Gen8 E5-2695v2SDHS FIO Kit |
| 2403 | 1 | 712771-B21 | HP DL360p Gen8 E5-2695v2SDHS Kit |
| | 1 | 712771-B21 0D1 | Factory integrated |
| 2404 | 16 | 708641-B21 | HP 16GB 2Rx4 PC3-14900R-13 Kit |
| | 16 | 708641-B21 0D1 | Factory integrated |
| 2405 | 1 | 631681-B21 | HP 2GB FBWC for P-Series Smart Array |

**Table 12.** CS700x Bill of materials (Continued)

| Item No | Quantity | Model # | Description |
|---|---|---|---|
| | 1 | 631681-B21 0D1 | Factory integrated |
| 2406 | 8 | 652611-B21 | HP 300GB 6G SAS 15K 2.5in SC ENT HDD |
| | 8 | 652611-B21 0D1 | Factory integrated |
| 2407 | 1 | 652238-B21 | HP 9.5mm SATA DVD ROM Jb Kit |
| | 1 | 652238-B21 0D1 | Factory integrated |
| 2408 | 2 | 656363-B21 | HP 750W CS Plat PL Ht Plg Pwr Supply Kit |
| | 2 | 656363-B21 0D1 | Factory integrated |
| 2409 | 1 | 469774-409 | HP Remove Standard Power Cords |
| 2410 | 1 | 647594-B21 | HP Ethernet 1Gb 4-port 331T Adapter |
| | 1 | 647594-B21 0D1 | Factory integrated |
| 2411 | 1 | 684213-B21 | HP FlexFabric 10Gb 554FLR-SFP+ FIO Adptr |
| 2412 | 1 | AJ764A | HP 82Q 8Gb Dual Port PCI-e FC HBA |
| | 1 | AJ764A 0D1 | Factory integrated |
| 2413 | 1 | 663201-B21 | HP 1U SFF BB Rail Kit |
| | 1 | 663201-B21 0D1 | Factory integrated |
| 2414 | 1 | BD725A | VMw vCntr Srv Std 3yr SW |
| | 1 | BD725A 0D1 | Factory integrated |
| 2415 | 1 | 701594-DN1 | MS WS12 Std FIO Npi en/fr/es/xc SW |
| 2416 | 1 | E5Y43A | HP OV for DL 3yr 24x7 FIO Phys 1 Svr Lic |
| 2500 | 1 | H1K92A3 | HP 3Y 4 hr 24x7 Proactive Care SVC |
| | 1 | H1K92A3 7G2 | HP Proliant DL36x(p) HW Support |
| | 1 | H1K92A3 R61 | VMw vCntr Srv Std 3yr SW |
| | 1 | H1K92A3 S8X | HP MS WS12 Standard OS+APP SW SUPP |
| | 1 | H1K92A3 SVN | HP One View w/Ilo Supp |
| 2600 | 2 | SG510A | HP C13-C14 6ft Sgl Data Special |
| | 2 | SG510A 0D1 | Factory integrated |
| 2700 | 1 | 433718-B21 | HP BLc7000 10K Rack Ship Brkt Opt Kit |
| | 1 | 433718-B21 0D1 | Factory integrated |
| 2800 | 2 | JG811AAE | HP VSR1001 Virtual Services Router E-LTU |

**Table 12.** CS700x Bill of materials (Continued)

| Item No | Quantity | Model # | Description |
|---|---|---|---|
| 2900 | 1 | JD097C | HP X240 10G SFP+ SFP+ 3m DAC Cable |
| 3000 | 4 | AJ835A | HP 2m Multi-mode OM3 LC/LC FC Cable |
| 3100 | 5 | JD097C | HP X240 10G SFP+ SFP+ 3m DAC Cable |
| 3200 | 2 | TC356A | HP SN6000B 16Gb 24-48 12-port FC Upg LTU |
| 3300 | 4 | J1M61A | HP CS VMw vSOM EntPlus 1P 3yr SW |
| 3400 | 12 | J1M61A | HP CS VMw vSOM EntPlus 1P 3yr SW |
| 3500 | 1 | BC796B | HP 3PAR 7400 App Suite VMware LTU |
| 3600 | 1 | H1K92A3 | HP 3Y 4 hr 24x7 Proactive Care SVC |
| | 2 | H1K92A3 2C2 | HP Networks SW Group 120 License Support |
| | 6 | H1K92A3 7XE | HP BL4xxc Svr Bld HW Support |
| | 1 | H1K92A3 RDR | HP 3PAR 7400 App Suite LTU Supp |
| | 1 | H1K92A3 SVQ | HP One View for blades Supp |
| | 16 | H1K92A3 TGY | HP CS VMw vSOM EntPlus 1P 3yr SW Supp |
| 3700 | 6 | HF385A1 | HP CP Svc for ProLiant Training |
| 3800 | 2 | HA861A1 | HP FE Personalized Install SVC |
| 3900 | 3 | HF482A1 | HP Factory Express Complex Custom SVC |
| 4000 | 1 | HK928A1 | HP Ind Std Server Implem Assist Svc |
| 4100 | 2 | 701606-DN1 | MS WS12 CAL 5USR en/fr/es/xc Lic |
| 4200 | 1 | BW904A | HP 642 1075mm Shock Intelligent Rack |
| | 1 | BW904A 001 | HP Factory Express Base Racking Service |
| 4300 | 1 | QR516B | HP 3PAR 7000 Service Processor |
| | 1 | QR516B 0D1 | Factory integrated |
| 4400 | 6 | QR490A | HP M6710 2.5in 2U SAS Drive Enclosure |
| | 6 | QR490A 0D1 | Factory integrated |
| 4401 | 96 | QR492A | HP M6710 300GB 6G SAS 15K 2.5in HDD |
| | 96 | QR492A 0D1 | Factory integrated |
| 4500 | 1 | QR485A | HP 3PAR StoreServ 7400 4-N Storage Base |
| | 1 | QR485A 0D1 | Factory integrated |
| 4501 | 4 | QR486A | HP 3PAR 7000 4-pt 8Gb/s FC Adapter |
| | 4 | QR486A 0D1 | Factory integrated |

**Table 12.** CS700x Bill of materials (Continued)

| Item No | Quantity | Model # | Description |
|---|---|---|---|
| 4502 | 32 | QR492A | HP M6710 300GB 6G SAS 15K 2.5in HDD |
| | 32 | QR492A 0D1 | Factory integrated |
| 4503 | 1 | BC795A | HP 3PAR 7400 Reporting Suite LTU |
| | 1 | BC795A 0D1 | Factory integrated |
| 4504 | 1 | BC773A | HP 3PAR 7400 OS Suite Base LTU |
| | 1 | BC773A 0D1 | Factory integrated |
| 4505 | 128 | BC774A | HP 3PAR 7400 OS Suite Drive LTU |
| | 128 | BC774A 0D1 | Factory integrated |
| 4506 | 1 | BC781A | HP 3PAR 7400 Virtual Copy Base LTU |
| | 1 | BC781A 0D1 | Factory integrated |
| 4507 | 128 | BC782A | HP 3PAR 7400 Virtual Copy Drive LTU |
| | 128 | BC782A 0D1 | Factory integrated |
| 4600 | 1 | HA114A1 | HP Installation and Startup Service |
| | 1 | HA114A1 5TS | HP Startup 3PAR 7400 4-Nd Strg Base SVC |
| | 4 | HA114A1 5TT | HP Startup 3PAR 7000 FC Adapter SVC |
| | 6 | HA114A1 5TV | HP Startup 3PAR 7000 2U SAS Enclosure SVC |
| 4700 | 1 | TK808A | HP Rack Front Door Cover Kit |
| | 1 | TK808A 0D1 | Factory integrated |
| 4800 | 1 | BW932A | HP 600mm Rack Stabilizer Kit |
| | 1 | BW932A B01 | Include with complete system |
| 4900 | 1 | BW906A | HP 42U 1075mm Side Panel Kit |
| | 1 | BW906A 0D1 | Factory integrated |
| 5000 | 2 | AG730A | HP PDU Pivot Kit |
| | 2 | AG730A 0D1 | Factory integrated |
| 5100 | 3 | AF520A | HP Intelligent Mod PDU 24a Na/Jpn Core |
| | 3 | AF520A 0D1 | Factory integrated |
| 5200 | 2 | A0K04A | HP 1.37m 10A C13-C14 Gray Jpr Cord |
| | 2 | A0K04A 0D1 | Factory integrated |
| 5300 | 2 | 142257-006 | HP 10A IEC320 C14-C13 4.5ft US PDU Cable |

**Table 12.** CS700x Bill of materials (Continued)

| Item No | Quantity | Model # | Description |
|---|---|---|---|
| | 2 | 142257-006 0D1 | Factory integrated |
| 5400 | 1 | HA113A1 | HP Installation Service |
| | 1 | HA113A1 5BY | Rack and Rack Options Installation |
| 5500 | 1 | BD365AAE | HP 3PAR 7000 Service Proc SW E-Media |
| 5600 | 1 | H1K92A3 | HP 3Y 4 hr 24x7 Proactive Care SVC |
| | 1 | H1K92A3 RDD | HP 3PAR 7400 OS Suite Base LTU Supp |
| | 1 | H1K92A3 RDG | HP 3PAR 7400 Virtual Copy Base LTU Supp |
| | 1 | H1K92A3 RDQ | HP 3PAR 7400 Reporting Suite LTU Supp |
| | 1 | H1K92A3 RZ5 | HP 3PAR 7000 Service Processor Supp |
| | 128 | H1K92A3 S7D | HP 3PAR 7400 OS Suite Drive LTU Supp |
| | 128 | H1K92A3 S7H | HP 3PAR 7400 Virtual Copy Drive LTU Supp |
| | 1 | H1K92A3 WSF | HP 3PAR Internal Entitlement Purpose |
| | 128 | H1K92A3 WUS | HP 3PAR 7000 Drives under 1TB Support |
| | 6 | H1K92A3 WUW | HP 3PAR 7000 Drive Enclosure Support |
| | 4 | H1K92A3 WUX | HP 3PAR 7000 Adapter Support |
| | 1 | H1K92A3 WUY | HP 3PAR 7400 4-node Storage Base Support |
| 5700 | 1 | HA124A1 | HP Technical Installation Startup SVC |
| | 2 | HA124A1 5B2 | HP Startup Storage Addl 1/2 Day SVC |
| | 1 | HA124A1 5QW | HP Startup 3PAR Vrt Cpy Lvl 1 Tier 1 SVC |
| | 1 | HA124A1 5TM | HP Startup 3PAR 7000 Reporting Ste SVC |
| 5800 | 2 | HK696A3 | HP 3Y Proactive Select 30 Credit SVC |
| | 2 | HK696A3 2BT | HP Proactive Select Credit SVC |
| 5900 | 24 | AJ837A | HP 15m Multi-mode OM3 LC/LC FC Cable |
| 6000 | 5 | AF547A | HP 5xC13 Intlgnt PDU Ext Bars G2 Kit |
| 6100 | 8 | C7537A | HP Ethernet 25ft CAT5e RJ45 M/M Cable |

## CommVault licensing

The environment described in this document used Simpana's capacity licensing model. Under this model, license usage is measured based on front-end data, or the size of the data being protected, during full backup. Capacity is purchased in terabyte increments. The number of copies being stored does not affect license measurement.

For Simpana CommVault Virtual Server Agents, alternative license models are available that can be mixed with the capacity model. Under the new models, licenses are based on the number of CPU sockets or number of VMs being protected.

**The Oracle documentation uses the following terminology:**

**Table 13.** VMware recovery performance results

| | |
|---|---|
| **RAC** | A Real Application Cluster environment, which allows multiple nodes in a clustered system to access a single database that resides on a shared storage location. |
| **Client** | The computer in which the iDataAgent is installed and contains the data to be secured. |
| **Instance** | The Oracle Database to be used for the backup and restore operations. |
| **Subclient** | The Oracle data to be backed up. |

**Resources**

HP StoreOnce Backup System user guide

HP StoreOnce Backup System Linux and UNIX Configuration Guide

HP D2D Backup systems best practices guide

CommVault Simpana backup and recovery documentation

CommVault Simpana backup and recovery hardware compatibility matrix

HP Storage

HP ConvergedSystem for Virtualization

ConvergedSystem Reference Architecture for Virtualization

VMware

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