Hewlett Packard Enterprise

Reference Architecture

HPE Reference Architecture for backup and recovery of SAP HANA database on HPE ProLiant DL560 Gen10 server (scale-up configuration built with Intel Cascade Lake)

Using HPE StoreOnce, and Commvault

Contents

Executive summary 3
Introduction 4
Solution overview 5
SAP HANA backup and recovery 7
Solution components 8
HPE ProLiant DL560 Gen10 for SAP HANA scale-up (Cascade Lake) 9
HPE ProLiant DL380 Gen10 server 9
HPE StoreOnce 5200 9
Commvault 9
SAP HANA Studio 10
Best practices and configuration guidance 10
SAP HANA Studio configuration for backup and recovery 17
SAP HANA cockpit configuration 22
Capacity and sizing 25
Workload description 27
Workload data 27
Analysis and recommendations 28
Summary 28
Implementing a proof-of-concept 29
Appendix A: Bill of materials 30
Appendix B: Commvault recommendations for SAP HANA 31
Appendix C: SAP HANA backint backup performance recommendations 32
Appendix D: HPE StoreOnce recommendations 32
Appendix E: Commvault software update 33
Resources and additional links 34



Executive summary

SAP HANA® is an in-memory computing platform from SAP®. SAP is strategically porting all of their existing business applications to SAP HANA. As more and more customers are realizing the benefits of in-memory technology, they are accelerating their plans to deploy/port their existing SAP applications to SAP HANA. Among the customers who have already moved or are planning to migrate to SAP HANA, there is a common concern and a need to backup SAP HANA in a formal way.

The real challenges with backups faced by customers are:

- Exponential data growth in a complex IT environment
- Shrinking backup and recovery windows – Backups which take longer with greater demands on application availability
- Data protection issues – Frequency of backups are not sufficient
- Administration – More administration effort required to manage the backup environments
- Not meeting the Service Level Agreements (SLAs) for Recovery Time Objectives (RTOs) and Recovery Point Objectives (RPOs)
- Ability to perform quick and reliable recovery

This Reference Architecture describes a solution for backup and recovery of SAP HANA databases running on the HPE ProLiant DL560 Gen10 scale-up server with either two or four Intel® Xeon®-Platinum 8280/8276/8280M/8276M/8280L/8276L processors, and the operating system choice of SUSE Linux® Enterprise Server (SLES) or Red Hat Enterprise Linux® (RHEL) using Commvault. This solution covers the streaming backup/restoration method using Commvault. In streaming backup, the data is directly transferred to the storage device without being written to temporary storage. The streaming backups are extremely fast, use very little disk space, and are optimized for use in data center environments with better bandwidth.

This document lists the advantages of a backup solution using HPE ProLiant DL560 Gen10 server, HPE StoreOnce 5200, and the potential benefits that a customer can expect in terms of efficiency. It also substantiates the various internal tests performed by Hewlett Packard Enterprise to ensure that the solution is efficient and all components are integrated well and work together seamlessly.

What's new?
This document briefly demonstrates the latest features of the components that are used in this solution:

- HPE ProLiant DL560 Gen10 server supports the second generation Intel Xeon Scalable processor family with better per-core performance gain.
- HPE ProLiant DL560 Gen10 server has enhanced iLO 5 security features such as Server Configuration Lock, iLO Security Dashboard, and Workload Performance Advisor.
- HPE StoreOnce Catalyst store support – Commvault supports HPE StoreOnce Catalyst store for backup and recovery.
- Commvault11 Force per-client authentication – Commvault uses security certificates to authenticate Commvault clients. A CommCell® server acts as the Certificate Authority and issues certificates to hosts.

Target audience: This Reference Architecture is intended for IT professionals, backup administrators, and SAP Basis consultants responsible for designing and implementing SAP HANA environments with a robust data protection solution. Readers of this Reference Architecture should have a functional understanding of SAP HANA and Commvault concepts and technologies.

Document Purpose: The purpose of this Reference Architecture is to describe a solution, highlighting the recognizable benefits of SAP HANA backup and recovery integration using Commvault to the technical audience.

This solution was tested in July 2019.

Introduction

The demand for backup and the associated data management activities are increasing rapidly in the IT industry. There are various reasons and factors to choose the best backup software. Analyzing the data and the environment plays a vital role in making that choice. Most of the companies run multiple software tools for backup, recovery, archiving, managing data, and storage resources. Most of these methodologies/technologies won't suit the need for todays and futuristic data growth.

As an example, customers are managing the HANA backups in their own ways, some of them back up the HANA database into flat files on an NAS share mounted on the HANA nodes and then backup these flat files using their existing backup solutions. Although this works, this is not an efficient backup and restore solution because it is slow and is a two-step process. The manual intervention required for managing the backups and restore of data and log files adds to administration overheads. Writing backups directly to an NAS share is known to cause performance issues.

The main challenge for the customer is to choose the backup software which should be up to date, cost-effective, feature-rich, and managed efficiently.

There are several SAP HANA TDI configurations available from multiple hardware vendors, but there are very few backup solutions available to back up an SAP HANA database.

To overcome these challenges, Hewlett Packard Enterprise has integrated Commvault software for the data protection of the SAP HANA database. Commvault has developed an SAP HANA backup agent for its enterprise-class backup product. Commvault technology has an effective, efficient way of managing the backup that provides protection, recovery of data, and simplified operations in day-to-day IT operations.

Is backup software only enough for this solution? The answer is No.

There are strong and valid reasons to choose HPE hardware for the SAP HANA platform. Hewlett Packard Enterprise:

- Is the leader in SAP and SAP HANA market share
- Has the most scalable solution on Intel Cascade Lake processors
- Is based on open standards/x86 Intel processors
- Has a large range of solution offerings: Appliances, TDI, from entry-level to large scale
- Provides the best support in the industry: SAP HANA CoE

Does data growth leave you struggling with complex, distributed, and costly data protection? The solution here is to tackle the cost, risk, and complexity of data protection with HPE StoreOnce. HPE StoreOnce is a disk-based, de-duplicating, and cloud-integrated system, providing backup, data recovery, and data retention for Hybrid IT.

The following are the key features which make the HPE StoreOnce 5200 best fit for this solution:

- New HPE StoreOnce single node system based on HPE ProLiant Gen10 technology. It supports a more scalable and flexible VSA structure. New flex I/O choices with 10/25GbE-SFP and 32Gb Fibre Channel.
- New HPE StoreOnce products move to an all-inclusive licensing structure. HPE StoreOnce Catalyst and replication are included with the product at no additional charge (encryption license at a nominal charge).
- New and improved GUI, like other HPE Storage products. This includes Federated Management to allow customers to configure and monitor multiple Gen4 HPE StoreOnce systems or Virtual Software Appliances (VSAs) in a single pane of glass.
- Role Based Access Control (RBAC) which allows customers to assign different roles/permissions to users of their HPE StoreOnce system.
- Addition of Commvault support for Catalyst/Catalyst Copy to enable deeper integration with HPE StoreOnce.

The backup solution has been built with the HPE ProLiant DL560 Gen10 server along with HPE StoreOnce 5200 and Commvault software.

Solution overview

Backint for SAP HANA is the backup approach preferred by many SAP HANA customers and it's the only way to connect the SAP HANA landscape to the centralized backup environment. Hewlett Packard Enterprise uses this preferred backup approach in this solution.

This solution covers the effective way to backup and restore the SAP HANA database using Commvault Enterprise backup and recovery software. Commvault software provides a simplified end-to-end backup and recovery solution for single-node scale-up configurations of SAP HANA. In scale-up environments, all SAP HANA components are running on a single server and the persistent layer resides on internal SSD disks.

In case of any data loss, restoration of the backed up data and the log files can be initiated directly from the media using the SAP backint interface. Backint for SAP HANA is a third party tool that helps the vendors to connect their backup agent with the SAP HANA database. In this solution, SAP HANA Studio and SAP HANA cockpit software have been used for backup and recovery of SAP HANA databases. SAP HANA Studio is the common tool that is used to backup and restore the database because it is preinstalled with SAP HANA. Customers can opt for either SAP HANA Studio or SAP HANA cockpit in their environment.

Hewlett Packard Enterprise and SAP have teamed up to provide all the functionality and performance required to support today's complex IT infrastructure. HPE ProLiant DL560 Gen10 solution for SAP HANA scale-up configurations built with the Intel Xeon Scalable Processors (Intel Cascade Lake) is a portfolio of optimally configured hardware with preloaded software and a full range of included services such as design, factory integration or on-site installation and proactive support with a single point of contact.

Hewlett Packard Enterprise has a service-centered data protection approach for business in the modern world that requires uninterrupted service for users and customers. Data protection is no longer just about backing up and restoring data, but it's also about recovering business applications and restoring critical services for users. HPE StoreOnce is a highly scalable disk-based deduplication solution designed to lower the backup footprint while delivering industry-leading backup and recovery speeds to meet or exceed SLAs.

In this solution, HPE StoreOnce 5200 systems are tightly integrated with Commvault through HPE StoreOnce Catalyst to enable the movement of deduplicated data across the devices. HPE StoreOnce Catalyst also allows some of the deduplication process to be off-loaded to the client. This leads to low-bandwidth transfers and reduced I/O load on HPE StoreOnce because only new data is transmitted.

Following are the key benefits of having a bundled solution using Hewlett Packard Enterprise, SAP HANA, and Commvault:

- **Increase SAP HANA database backup speed:** Commvault with HPE StoreOnce 5200 Catalyst deduplicates backup data for improved SAP HANA database backup throughput performance and reduces the capacity needed to store backups by writing only the new data.
- **Move backup data offsite efficiently and cost-effectively:** Use the HPE StoreOnce 5200 remote replication feature to replicate SAP HANA backups to an HPE StoreOnce backup system in a remote facility seamlessly for simpler recovery in the event of a disaster.
- **Efficient backups:** Commvault and HPE StoreOnce 5200 with HPE StoreOnce Catalyst utilize the same deduplication engine that enables storing more data without adding more storage.

Figure 1 shows the SAP HANA scale-up backup environment that is tested in lab.

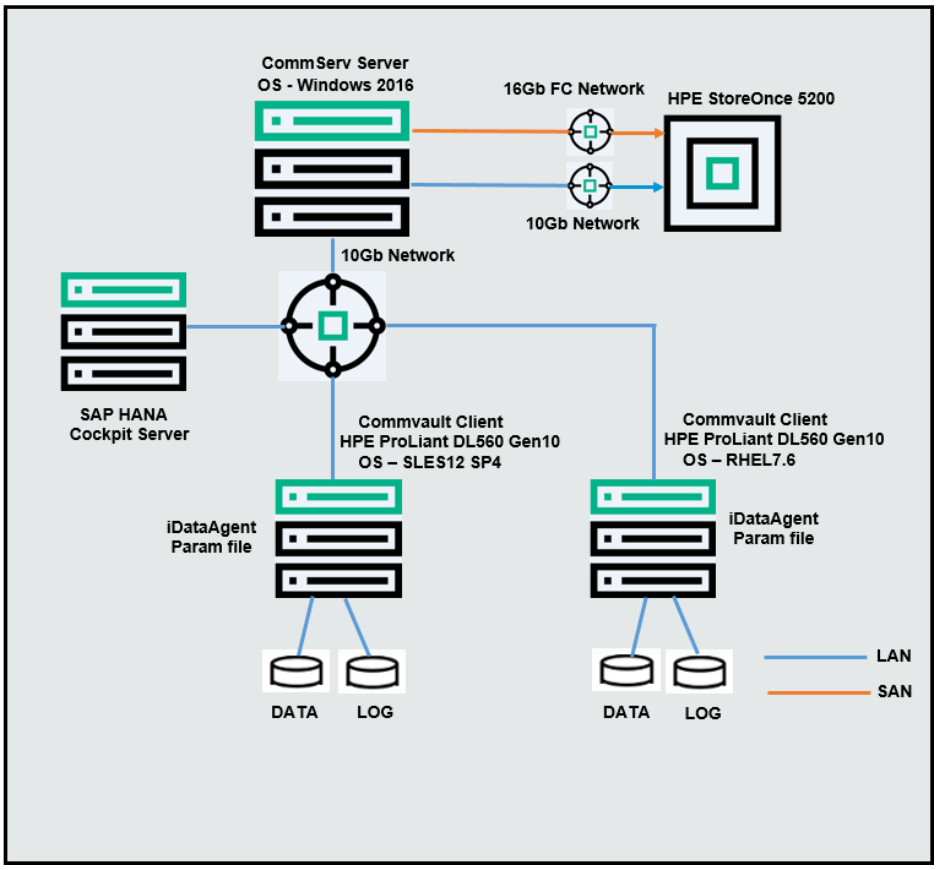


Figure 1. SAP HANA scale-up backup environment using Commvault (tested lab configuration)

Figure 2 shows the HPE ProLiant DL560 Gen10, HPE ProLiant DL380 Gen10, HPE FlexFabric 5945 network switches, HPE FlexFabric 5900 network switches, HPE StoreFabric 6600B Fibre Channel switches, and HPE StoreOnce 5200 used in the lab environment.

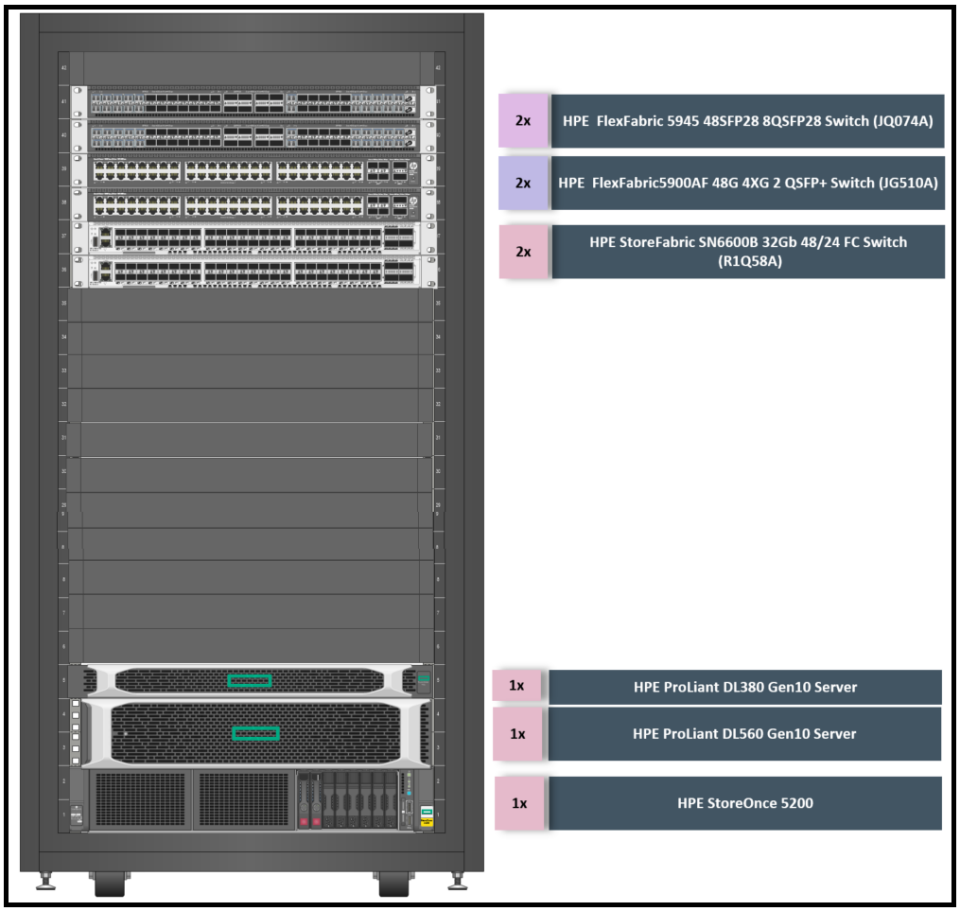


Figure 2. Front view of the hardware components used in the lab (tested lab configuration)

SAP HANA backup and recovery

SAP HANA keeps the data in memory to gain the best performance. However, SAP HANA uses persistent storage to provide a fallback in case of failures. In a standard database operation, the changed data is automatically saved from memory to disk at regular savepoints. In SAP HANA, the default savepoint happens every five minutes even during the backup operation. During a savepoint, the transactions would run as normal, also the new transactions can be started as normal. Changes in data are recorded in the log segments in the redo log buffer. Once the database transaction is committed, these log segments are saved to disk. The redo log buffer is written to disk, even if there is no commit sent.

SAP HANA backup options for data and log backup

The following options are available for data and log backups:

- Backups to the file system
- Backups using third-party backup tools with “Backint for SAP HANA” API support
- Delta backups: Delta backups contain data that was changed since a complete data backup. Delta backups are of two types:
  - Differential backups – stores all of the data changed since the last full data backup
  - Incremental backups – stores the data changed since the last full data backup or the last delta backup (incremental or differential).
- Scheduling SAP HANA backups: SAP HANA cockpit has a provision for scheduling full backups and delta backups at specific intervals

SAP HANA recovery options

There are three ways to perform recovery of an SAP HANA database, based on the requirement:

- Recover the database to its most recent state: This option uses the last backup for restoring the database and then restores and replays all the applicable logs to restore the database to the most recent consistent state.
- Recover the database to the following point in time: This option restores the last database backup taken before the point in time specified and then replays the logs until the point in time is selected. This option is useful to roll back the database to a particular point in time or to a time when the database was in a known consistent state.
- Recover the database to a specific data backup: This option offers the user a list of available database backup images and also the date-time when those backups were taken. The user has to select the backup that needs to be restored. No logs are replayed using this option.

Multistreaming data backups

By default, SAP HANA uses a single channel for data backups. SAP HANA has a provision to increase the number of channels to write the backup data in parallel. Backup data is written in parallel to the specified number of channels. Multiple parallel data streams improve the performance of backup and restore using 3rd party Backint interface.

This document describes the backup and recovery of SAP HANA databases using Commvault 11 SP15/SP16 with "Backint for SAP HANA" support and explains the options and ways in which a customer can deploy Commvault and HPE StoreOnce 5200 to backup SAP HANA database.

Solution components

Hewlett Packard Enterprise solutions for SAP HANA backup and recovery have been designed keeping in mind the available memory on the server and also the SAP HANA database size. The solution components include HPE ProLiant DL560 Gen10 server, HPE ProLiant DL380 Gen10 server, HPE StoreOnce 5200, HPE FlexFabric 5945, and HPE FlexFabric 5900 Network Switches, and HPE SN6600B Fibre Channel Switches.

Table 1 lists the SAP HANA database, server, storage, and Commvault CommCell server details.

Table 1. Solutions components

Components	Operating System	SID	Hardware	Comments
Database server	SLES 12 SP4	AB1	HPE ProLiant DL560 Gen10 scale-up server (Cascade Lake Processor)	Database server SID – AB1. SAP HANA database 2.0 SPS04
Database server	RHEL 7.6	AB1	HPE ProLiant DL560 Gen10 scale-up server (Cascade Lake Processor)	Database server SID – AB1. SAP HANA database 2.0 SPS04
Commvault CommCell Server (Media Server)	Microsoft® Windows Server® 2016	NA	HPE ProLiant DL380 Gen10 server	Commvault CommCell Server (Commvault Software version 11 SP15/SP16) where backup and restore sessions can be configured and monitored. SAP HANA Studio is also configured on the same server.
Fibre Channel HBA	NA	NA	2x HPE SN1100E 16Gb 2P Fibre Channel HBA	Fibre Channel connection has been done between CommCell Server and HPE StoreOnce 5200.
Fibre Channel Switch	NA	NA	2x HPE SN6600B Fibre Channel Switch	Zoning has been done between CommCell server and HPE StoreOnce 5200.

HPE ProLiant DL560 Gen10 for SAP HANA scale-up (Cascade Lake)

HPE ProLiant DL560 Gen10 for SAP HANA scale-up configuration is built with the industry-leading high-density and highly scalable HPE ProLiant DL560 Gen10 server featuring the Intel Xeon Platinum Scalable 2nd generation processor architecture. This allows SAP customers to harness the power of in-memory computing with SAP HANA applications for real-time business results, delivered on a mission-critical, optimized, and high-performance infrastructure. This solution offers an all SSD configuration that supports large data volumes on the SAP HANA database. HPE ProLiant DL560 Gen10 server is ideal for critical SAP S/4HANA and SAP BW/4HANA workloads. HPE ProLiant DL560 Gen10 for SAP HANA scale-up is a pre-defined solution of hardware and software that integrates SAP HANA.

HPE ProLiant DL380 Gen10 server

HPE ProLiant servers are industry-leading servers in x86 architecture and are available in various forms such as rack-mount, tower, and blade servers. These servers are available with one socket and two sockets. For the purpose of this solution, the HPE ProLiant DL380 Gen10 server was chosen as a management server. This server was chosen considering the processor and memory requirements of Commvault and the SAP HANA database size. For more information, see the HPE ProLiant DL380 Gen10 QuickSpecs document.

Key points

The HPE ProLiant DL380 Gen10 server functions as a Commvault Media Server (Commvault CommCell), which is used for configuring the backup devices and monitoring the SAP HANA backup/restore operations.

HPE StoreOnce 5200

The HPE StoreOnce target backup system is a disk-based storage appliance for backing up multiple servers or PCs to target devices on the storage appliance. The total number of backup target devices provided by an HPE StoreOnce backup system varies according to the model. These devices can be HPE StoreOnce Catalyst, Virtual Tape Library (VTL), Network Attached Storage (NAS), or any combination of Catalyst, NAS, and VTL devices. All HPE StoreOnce devices automatically make use of HPE StoreOnce deduplication, ensuring efficient and cost-effective use of disk space. The benefit of HPE StoreOnce Catalyst devices is that deduplication may be configured to occur on the Media Server (low bandwidth) or on the HPE StoreOnce Backup system (high bandwidth), allowing the user to decide what makes the most efficient use of available bandwidth.

Commvault

Commvault architecture

Commvault has a backup solution that is designed to provide fast and reliable backup and recovery solution for fast-growing business data. Commvault has major features such as:

- Centralized and network backup operations: CommCell Server can be used to schedule database backups or start them manually for any client.
- Parallel backup and restore operations: Commvault for SAP supports the parallel backup and restore capabilities of SAP Tools.
- Graphical user interfaces: Commvault provides graphical user interfaces for client users and administrators. A database administrator or Commvault backup administrator can monitor the backup or restore operations for SAP from the Commvault graphical user interface on the CommCell Server.

Commvault security feature

Commvault has a client security feature named “Force per-client certificate authorization on CommServe®”. The authorization certificate is required for a Commvault client to obtain a host-based certificate. The authorization certificate should be created in the CommCell Server. The administrator can then deploy the certificate after installing the Commvault client software by obtaining the authorization certificate from the CommCell Server.

Commvault CommServe

A host that coordinates all activity in a CommCell environment. The host also has the information about the “Metadata database” which manages CommCell information. For more information refer to http://documentation.commvault.com/commvault/v11/article?p=4724.htm.

Commvault client

A host system becomes a Commvault client (i.e. SAP HANA database host) when one or more Commvault client software components are installed on the system.

MediaAgent

A sever that conducts the movement of data from source to destination. The source system is called as a client and the destination is called target devices such as Storage Library and Tape Library.

Figure 3 shows the Commvault backup architecture.

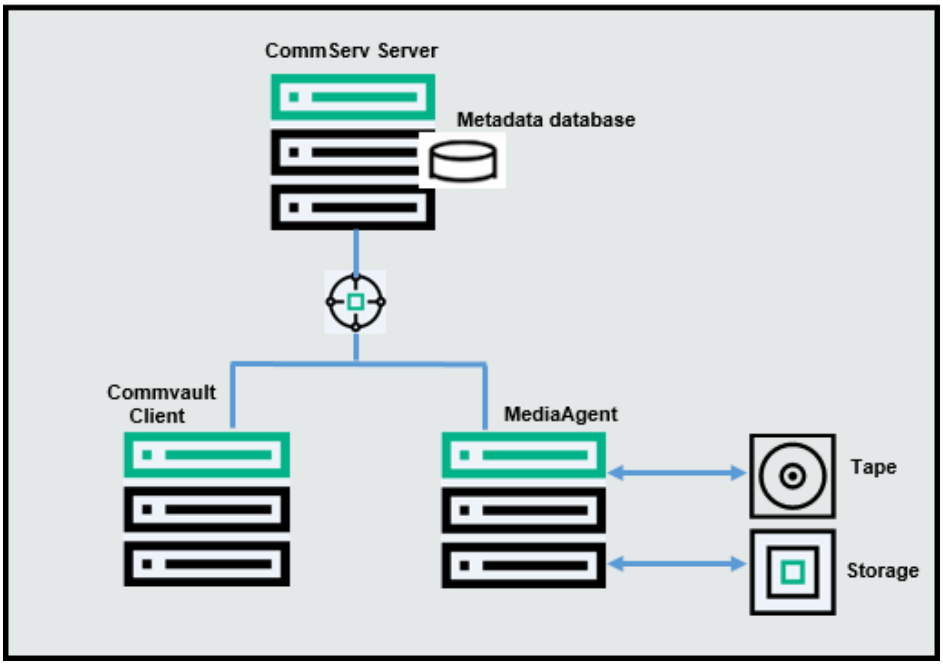


Figure 3. Commvault backup architecture

Commvault SAP HANA agent

A program that can be installed on a server or workstation to allow data on the computer to be backed up remotely over the network to the target device is called a backup agent. Backup agents are software modules that are installed on computers to access and protect data. The backup and recovery system uses these agents to interface with file systems, applications, and databases to facilitate the protection of data on production systems. This Commvault SAP HANA agent gets installed on the SAP HANA database host.

Commvault has developed a backint agent for SAP HANA called iDataAgent. For more information refer to http://documentation.commvault.com/commvault/v11_sp13/article?p=22309.htm.

SAP HANA Studio

SAP HANA Studio is the front end application that can be used for multiple purposes, such as SAP HANA configuration, administration, development, and SQL client queries. You can add multiple SAP HANA database instances to SAP HANA Studio. SAP HANA Studio also allows administrators to configure, monitor, and initiate backups and restore.

Best practices and configuration guidance

Enabling SAP HANA backup using Commvault requires installing Commvault software, configuring HPE StoreOnce, and configuring SAP HANA Studio, or SAP HANA cockpit. The following sections briefly explain the configuration steps required in each of these components.

Installing Commvault software

Download and install the Commvault software on the Windows management server. To download the Commvault software, the user should have access to commvault store.

Enabling access to HPE Catalyst stores

To enable access to the HPE StoreOnce Catalyst stores from Commvault, the parameter "ActivateHPECatalyst" has to be added to the media server. Once the Commvault software is installed, the HPE Catalyst plugin can be added to the media server, to access the HPE Catalyst stores as follows:

1. Select **Media Server → Properties → Advanced → Additional Settings → Add**.
2. Enter "Activate HPE Catalyst" in the "Name" field and the category will be automatically selected.
3. Change "Value" to "true" and click **OK** to finish the task. Now HPE Catalyst Stores can be added as Storage Libraries.

Figure 4 shows the HPE Catalyst plugin configuration on the CommCell server.

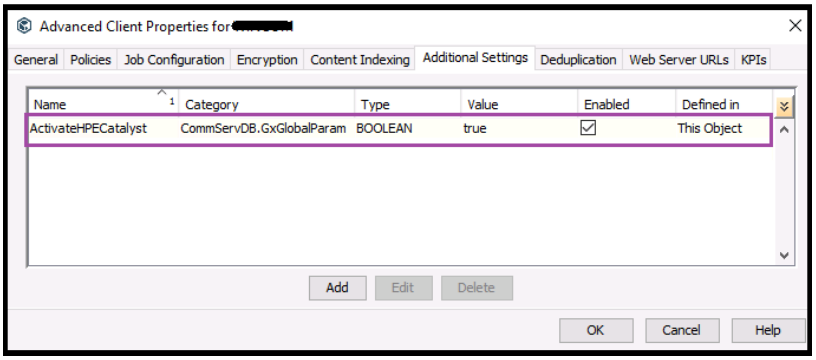


Figure 4. Commvault client properties (advanced) wizard

HPE StoreOnce catalyst store

To back up the SAP HANA database, the target storage device has to be configured. Login to the HPE StoreOnce 5200 and create a new "Catalyst Store" under the StoreOnce Catalyst. Figure 5 shows the "Catalyst Stores" created on HPE StoreOnce 5200.

As shown in Figure 5, four Catalyst stores are created as backup targets. Two Catalyst stores were used for Fibre Channel based backup configuration and the other two were used for IP based backup configuration.

Note

A dedicated 10Gb network has been configured between Commvault clients, media servers, and HPE StoreOnce 5200. An additional 16Gb Fibre Channel network has been configured between the CommCell server (windows mgmt.) and HPE StoreOnce 5200.

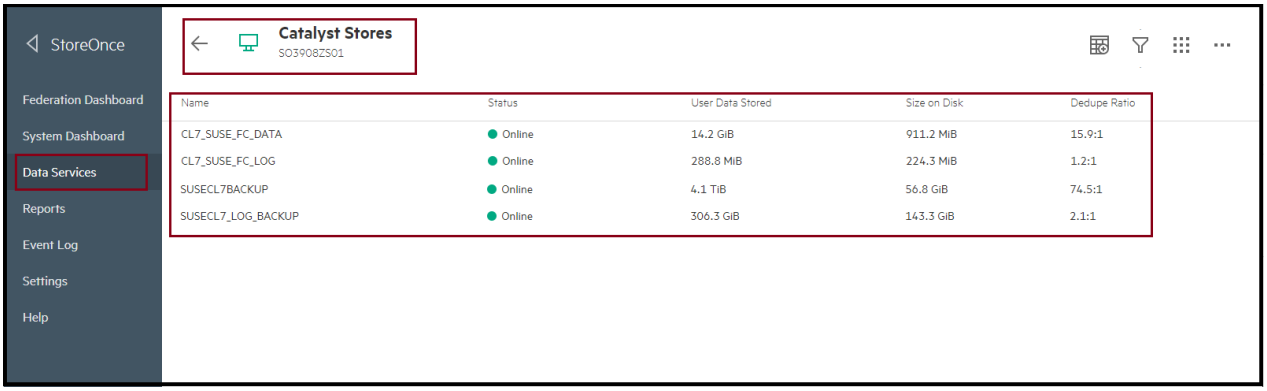


Figure 5. HPE StoreOnce Catalyst stores wizard

Storage Library configuration

Storage Libraries are configured as backup targets.

To configure the Storage Library on the CommCell server:

1. On the CommCell browser, go to **Storage Resources → Libraries.** Right-click and select Add **HPE Catalyst Library**.
2. Provide the name of the Storage Library, Media Agent, HPE StoreOnce access credentials, and the Catalyst Store Name. In the case of Fibre Channel, provide the COFC identifier instead of HPE StoreOnce IP address to access the Catalyst stores.
3. For more information on setting up Fibre Channel for HPE Catalyst Library, refer to https://documentation.commvault.com/commvault/v11_sp13/article?p=102327.htm.

Figure 6 shows the CommCell Storage Library configuration.

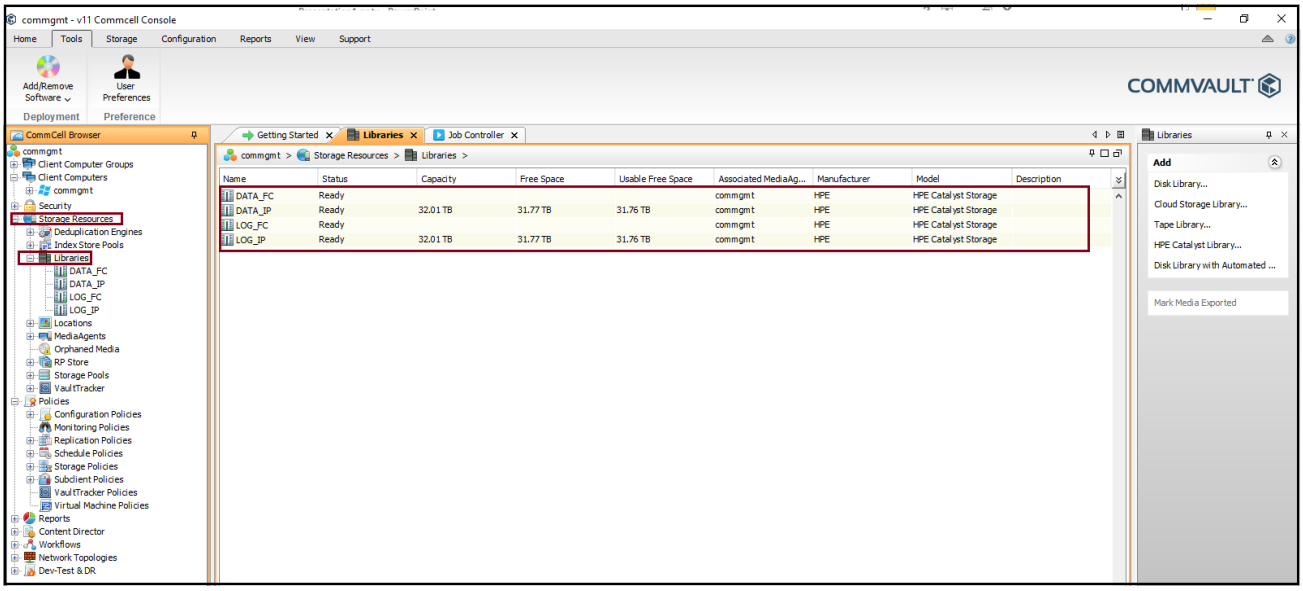


Figure 6. CommCell Storage Library configuration

Creating a Commvault storage policy (backup)

Storage backup policy holds information about the retention and encryption of data. Four storage policies have been created using the available Storage Library.

To create a new storage policy:

1. Select **“Storage Resources”** from the CommCell Browser.
2. Select **“Policies”.** Right-click and select New Storage Policy.
3. Select storage policy type as “Data Protection” and provide the storage policy name.
4. Select “Storage Library” which got created in the previous section and select the media agent name (CommCell Server). Proceed with default settings and complete the task. Perform all four steps for SAP HANA DATA and LOG.

Figure 7 shows the storage policies created on the CommCell Server.

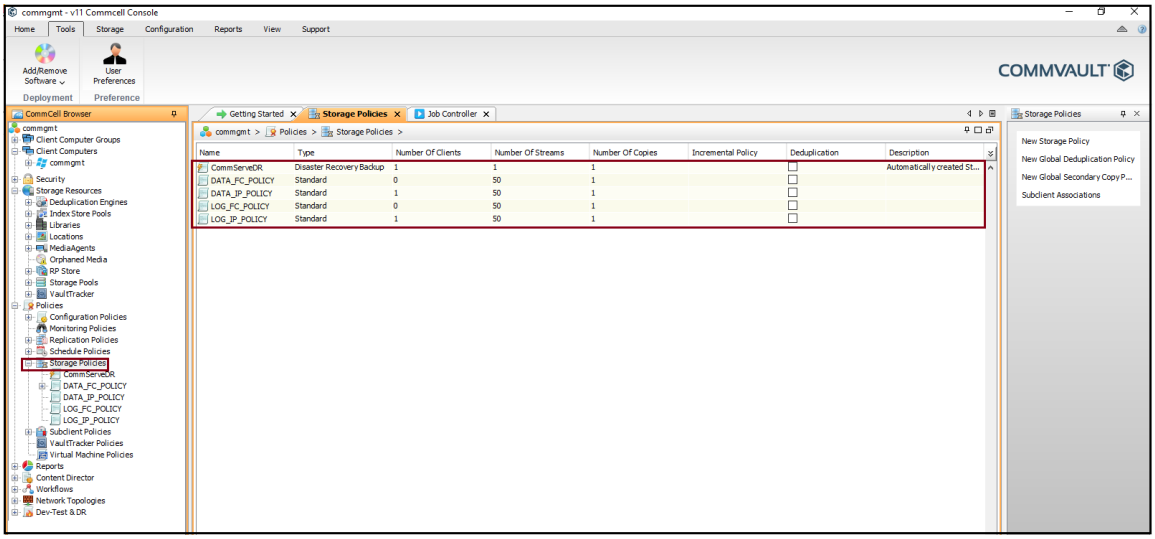


Figure 7. CommCell storage policy (backup) configuration

For more information about Commvault storage policy, refer to http://documentation.commvault.com/commvault/v11/article?p=13804.htm.

Installing Commvault client software

The following are prerequisites to install Commvault Client software:

- Operating system (SLES 12 SP4/RHEL 7.6) should be installed on the client.
- SAP HANA database has to be installed on the client.

To install the Commvault client software:

1. Select “Tools” from the CommCell Console.
2. Select **“Add/Remove Software”** → select **“Install Software”** → select **computer operating system** as “Linux and Unix” and provide the hostname/IP address of the Linux client. Provide the login credentials and select the packages “Media Server” and “SAP for HANA”.
3. Provide the storage policy name also the SAP HANA database group name as “SAPSYS” and continue the installation.
4. Once the installation is completed, the client would be visible under “Client Computers” in the CommCell console.

Figure 8 shows the SLES 12 SP4 database server has been added as a Commvault client.

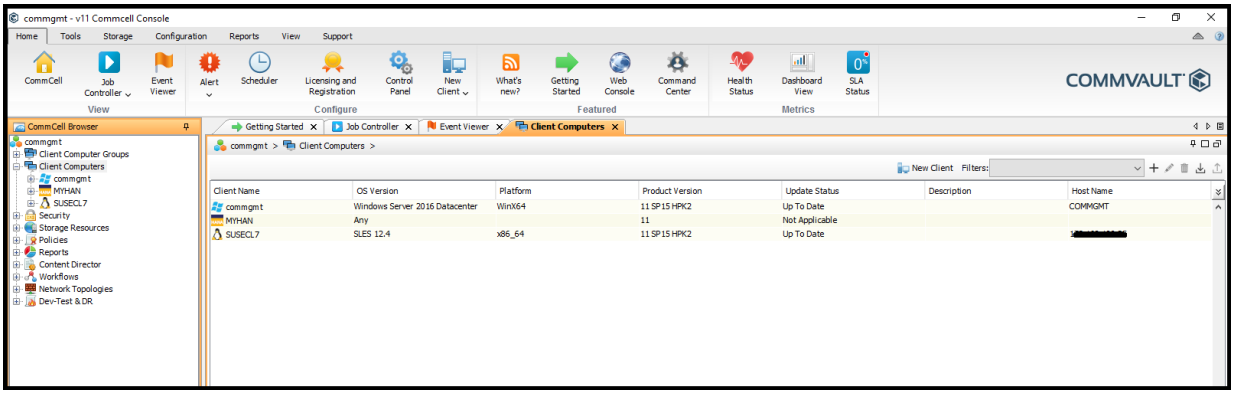


Figure 8. Commvault client (SUSE 12 SP4)

Figure 9 shows the RHEL 7.6 database server has been added as a Commvault client.

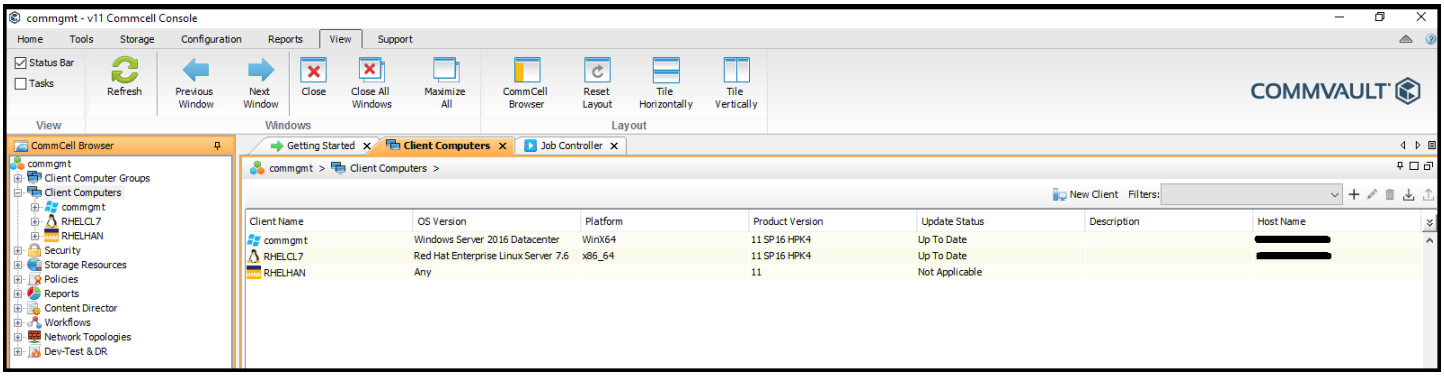


Figure 9. Commvault client (RHEL 7.6)

Since the Commvault client software (media agent, SAP HANA database) gets installed on the SAP HANA node, the parameter file (param) has to be configured on the SAP HANA node.

Figure 10 shows the Commvault client parameter (param file) configuration file.

CvInstanceName and Instance001 are the default entries that get added once the Commvault client software is installed.

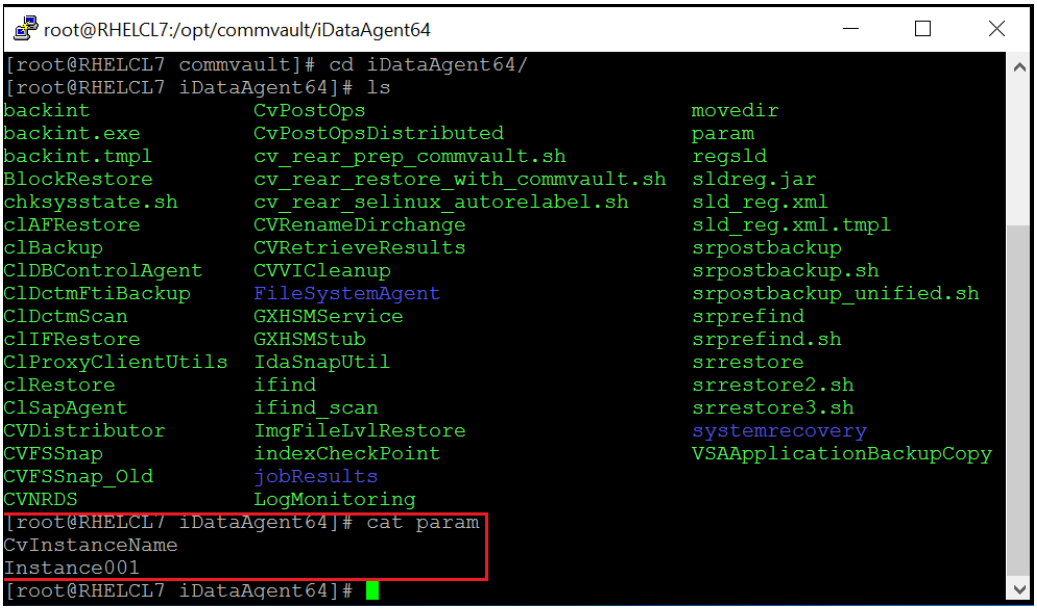


Figure 10. Commvault client parameter file (SAP HANA)

5. Login to the SAP HANA database client with <SIDADM>

```
# cd /usr/sap/AB1/SYS/global/hdb/opt
# mkdir hdbconfig
# cd /usr/sap/AB1/SYS/global/hdb/opt/hdbconfig
# ln -s /opt/commvault/iDataAgent64/param /usr/sap/AB1/SYS/global/hdb/opt/hdbconfig/param
# cd /usr/sap/AB1/SYS/global/hdb/opt
# ln -s /opt/commvault/iDataAgent64/backint hdbbackint   <This step enables the backint interface on the SAP HANA Studio>
```

   Where,

   - AB1 – SAP HANA database instance name.
   - Param – It's a parameter file which contains Commvault instance number and SAP HANA client name.

For more information refer to the creation of SAP HANA symbolic links.

Creating a pseudo client (for SAP HANA)

Using a pseudo client, you can perform a disaster recovery operation to recover one or more components. To create a pseudo client for SAP HANA:

1. Right-click on the **client computers** → Select **"New Client"** → Select **"SAP HANA Client"** under **"Application"**.
2. On the 'General" tab, provide the pseudo-client name (it should be different from the SAP HANA physical client name), SAP HANA SID, instance number, and access credentials (use SYSTEM user as "DB user name").
3. On the "Details" tab, click "ADD" and add the physical SAP HANA client name.

4. On the “Storage Device” tab, provide the “Storage policy name” used for “Command Line Data backup” and “Log Backup”.
5. Finish the task of creating a pseudo client.

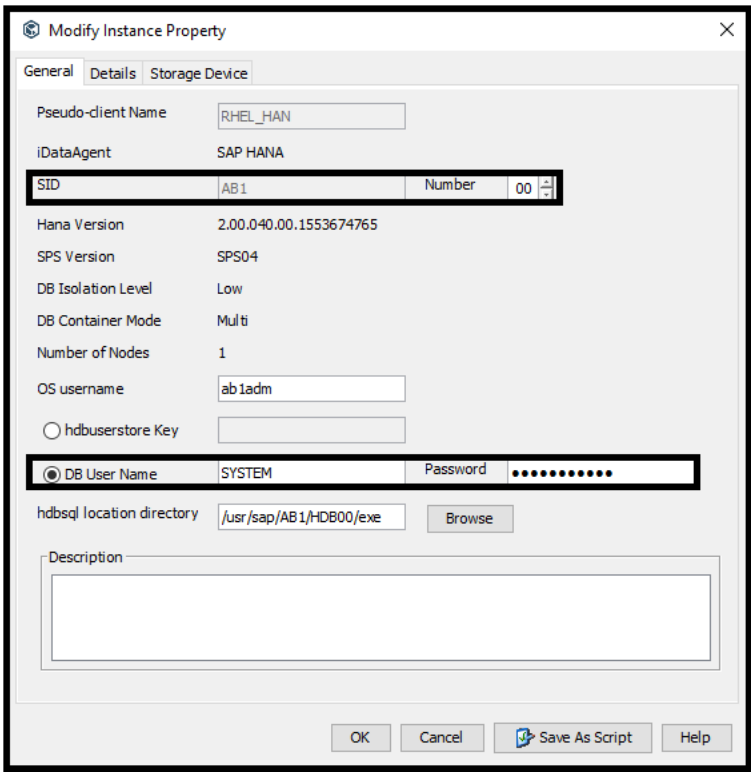


Figure 11. Commvault pseudo client configuration

Client certificate authentication

To create authentication between the client and the CommCell server:

1. From the CommCell console, click **control panel** → select **“Certificate Administration”** under **“CommCell”** option.
2. Select the “Yes” option from the “Force per-client certificate authentication on CommServe”.
3. Click “Temp Certificate” and select the pseudo client name form the list and click “Create” option. The SSH key would be created.
4. Copy the SSH key from the “clipboard” and create an “exports.txt” file under “/opt/Commvault/Base/certificates” directory and paste the key. Save the file.
5. Restart the “Commvault” service on the SAP HANA Client.

Figure 12 shows the Commvault client certification wizard.

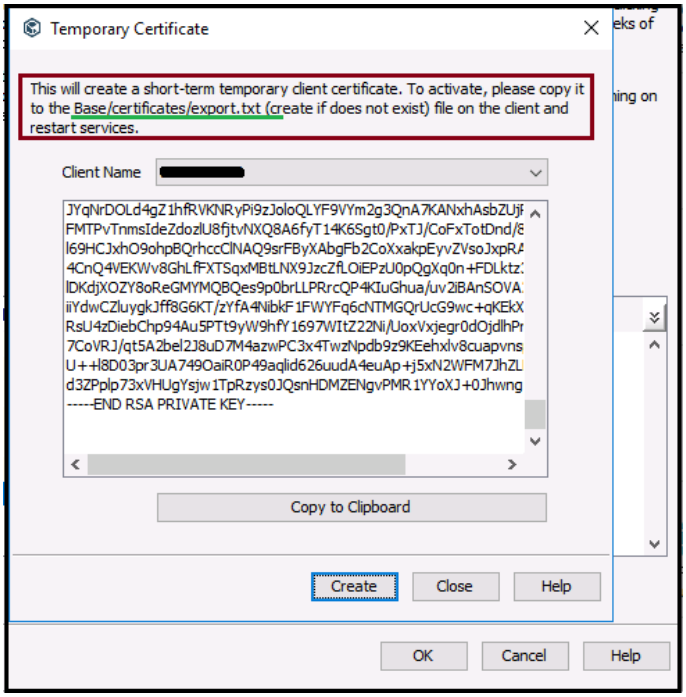


Figure 12. Commvault client certificate wizard

For installed Commvault client software, see the following location: "/opt/Commvault/".

For troubleshooting issues, use log files available at the following location: "/var/log/commvault/Log_Files".

For installed Commvault client registry and instance information, see the following location: "/etc/CommVaultRegistry/Galaxy".

SAP HANA Studio configuration for backup and recovery

The integration of SAP HANA database and Commvault backup is configured in the SAP HANA Studio. The parameter files are used to specify the Commvault Instance name and client name.

1. Choose "Backup" from the expanded menu on the left.
2. The parameter file "param" must be specified for data in the SAP HANA database instance configuration. To specify the parameter file, go to Instance → Configuration → global.ini → data_backup_parameter_file.

   `/usr/sap/<SID>/SYS/global/hdb/opt/hdbconfig/param`
3. The parameter file "param" must be specified for log in the SAP HANA database instance configuration. To specify the parameter file, go to Instance → Configuration → global.ini → log_backup_parameter_file.

   `/usr/sap/<SID>/SYS/global/hdb/opt/hdbconfig/param`
4. To specify backup using the backint file for log, go to Instance → Configuration → global.ini → log_backup_using_backint → SYSTEM = true.
5. Click on the floppy disk icon at the top right-hand side in the backup window of SAP HANA Studio to save the changes in configuration.

Figure 13 shows the backint agent parameter file settings wizard.

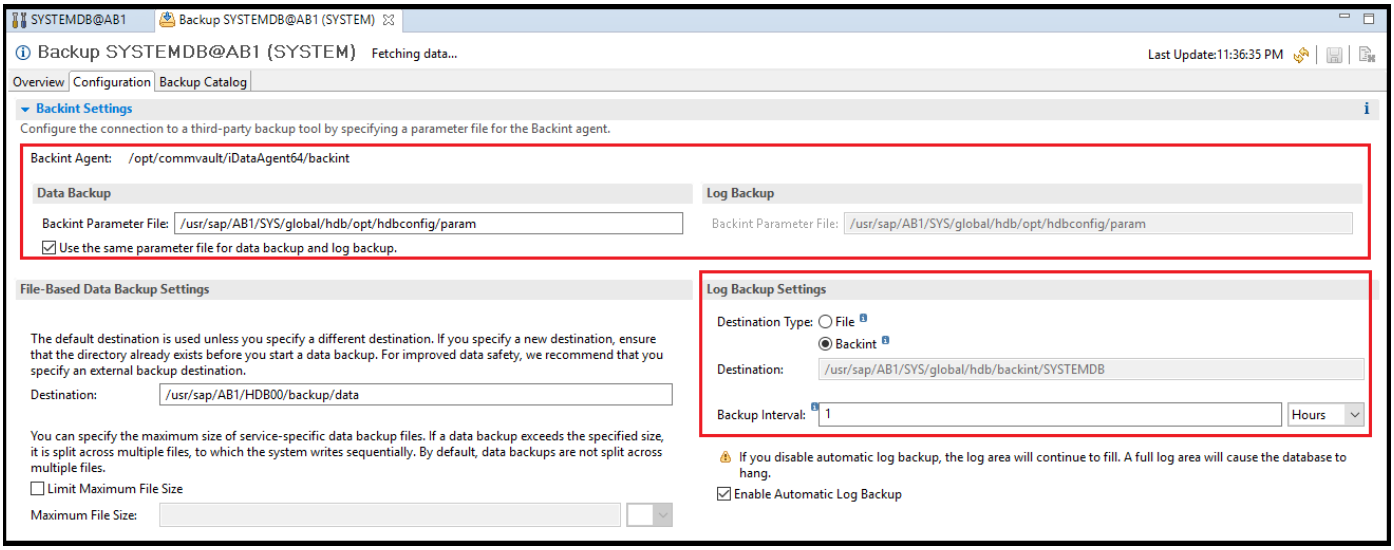


Figure 13. Backint parameter file settings on SAP HANA Studio

Figure 14 shows the backup/recovery options using SAP HANA Studio.

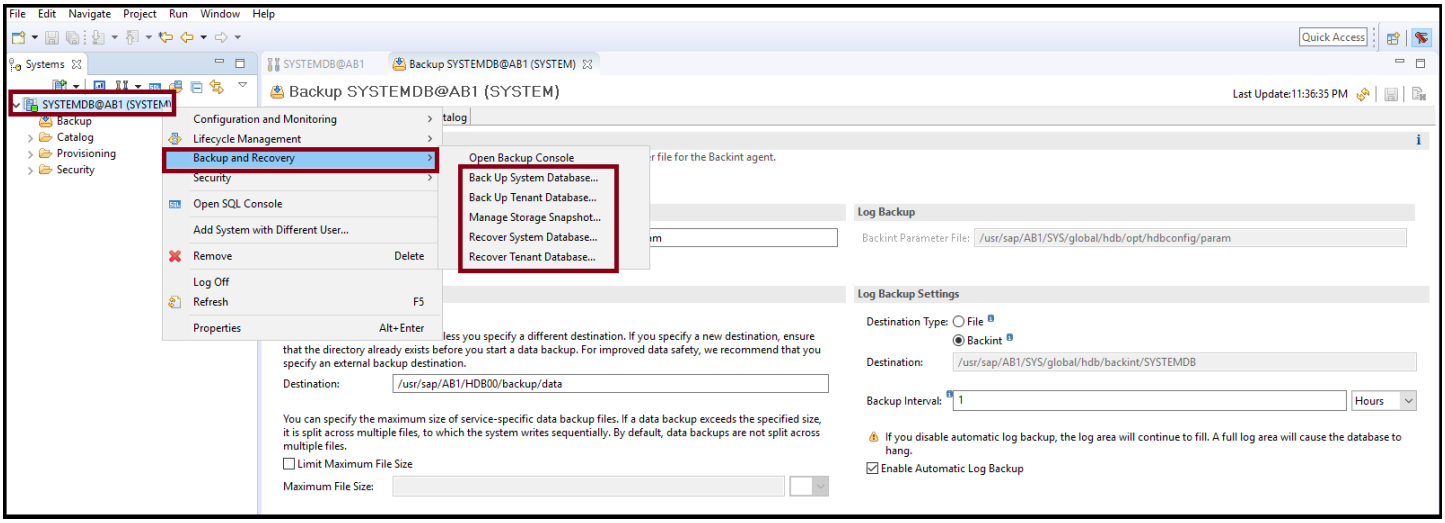


Figure 14. SAP HANA backup and restore options for system and tenant database

Figure 15 shows the backup parameter for data and log. Catalog_backup_parameter_file should have the same parameter file that was used for data and log backup configuration. Catalog_backup_using_backint should be set to "TRUE". If the above parameters are not set, the backint restoration will fail.

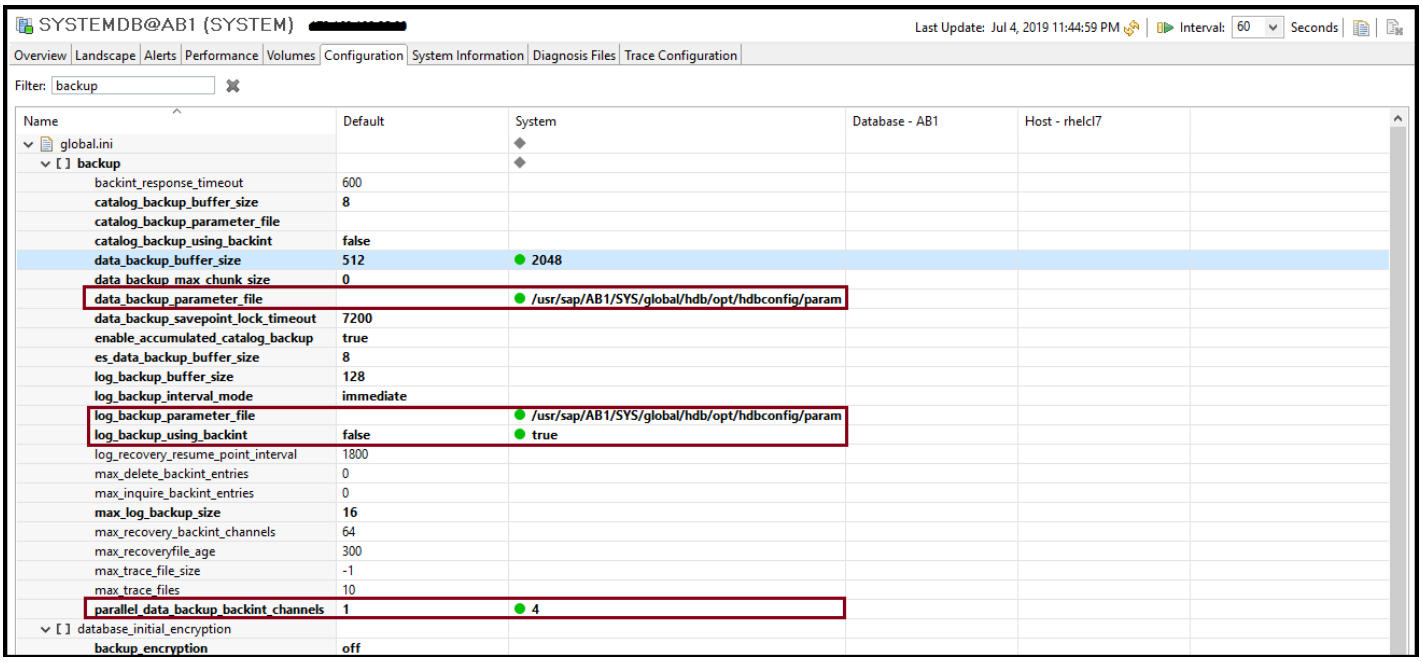


Figure 15. SAP HANA backup configuration parameter wizard

Delta backup

Delta backup can be initiated from the SAP HANA Studio.

To initiate delta backup:

1. In SAP HANA Studio, right-click on **System**.
2. Select **Backup and Recovery → Backup System**.
3. In the Backup of System wizard, in the **Backup Type** drop-down, you can select "Complete Data Backup, "Differential Data Backup", or "Incremental Data Backup" as shown in Figure 16.

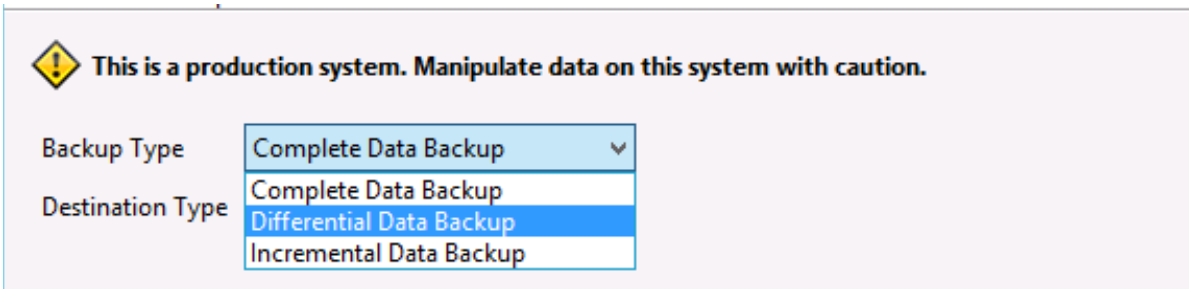


Figure 16. Delta backup settings in SAP HANA Studio backup wizard

Multistreaming data backups

To configure SAP HANA multistreaming channels, change the "`parallel_data_backup_backint_channels`" ini file parameter in the following method:

1. In SAP HANA Studio, go to the configuration tab, expand `global.ini` → `backup`. Search for the `parallel_data_backup_backint_channels` parameter and change the desired value. The default value for this parameter is 1. The maximum number of channels permitted is 32 for each service. Multistream channels can be used with data backup services size larger than 128 GB.
2. Each multistream channel requires an IO buffer of 512 MB. This buffer size can be configured using the "`data_backup_buffer_size`" ini file parameter. Make sure that increasing the buffer size does not affect the memory consumption of the server. In the lab tested environment, the value of "`data_backup_buffer_size`" is 2048 as shown in Figure 17.
3. In SAP HANA Studio, go to the **Configuration** tab, expand `global.ini` → `backup`. Search for the `parallel_data_backup_backint_channels` parameter and change the desired value. The default value for this parameter is 1. The maximum number of channels permitted is 32 for each service. Multistream channels can be used with data backup services size larger than 128 GB. In the lab tested environment, the value of "`parallel_data_backup_backint_channels`" is 4 as shown in Figure 17.

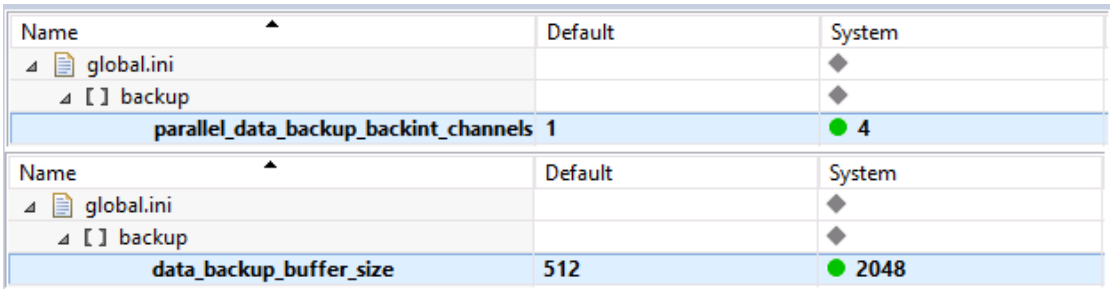


Figure 17. Backup parameter (parallel channels) configuration wizard

Figure 18 shows the SAP HANA backup operating wizard.

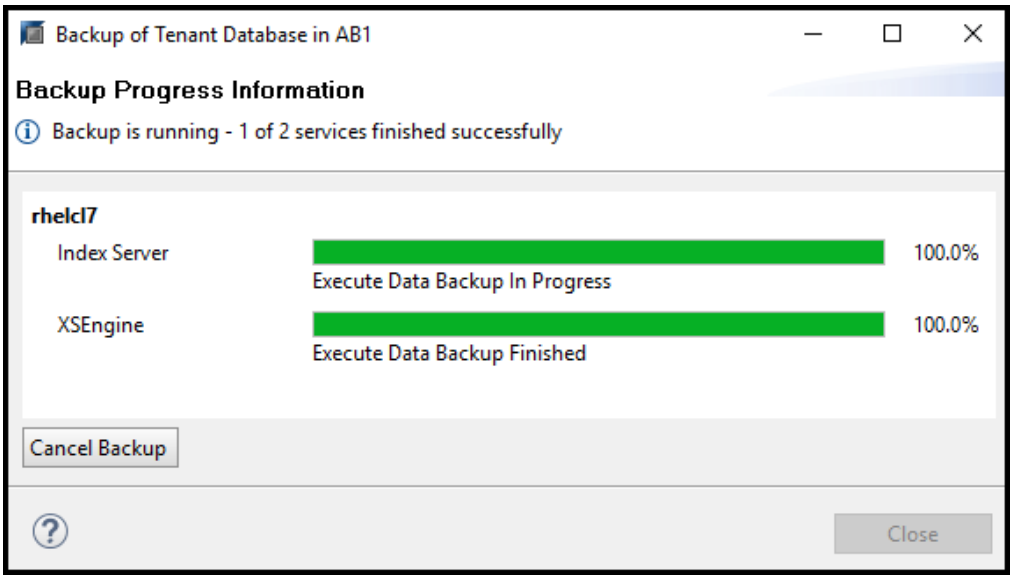


Figure 18. Backup operation wizard

SAP HANA database restore

To configure the SAP HANA database restore, select the option “Search for the backup catalog in the file system only” that shows the file-based and backint based backups. Figure 19 shows the restoration of the SAP HANA database with options.

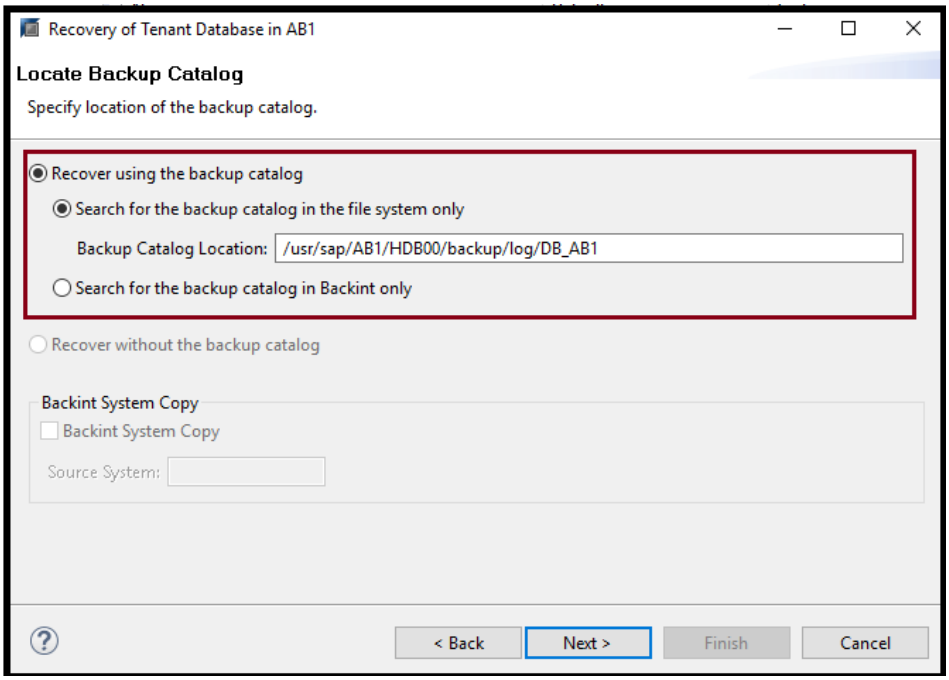


Figure 19. Recovery of SAP HANA database operations wizard

Figure 20 shows the restoration completion of the SAP HANA database.

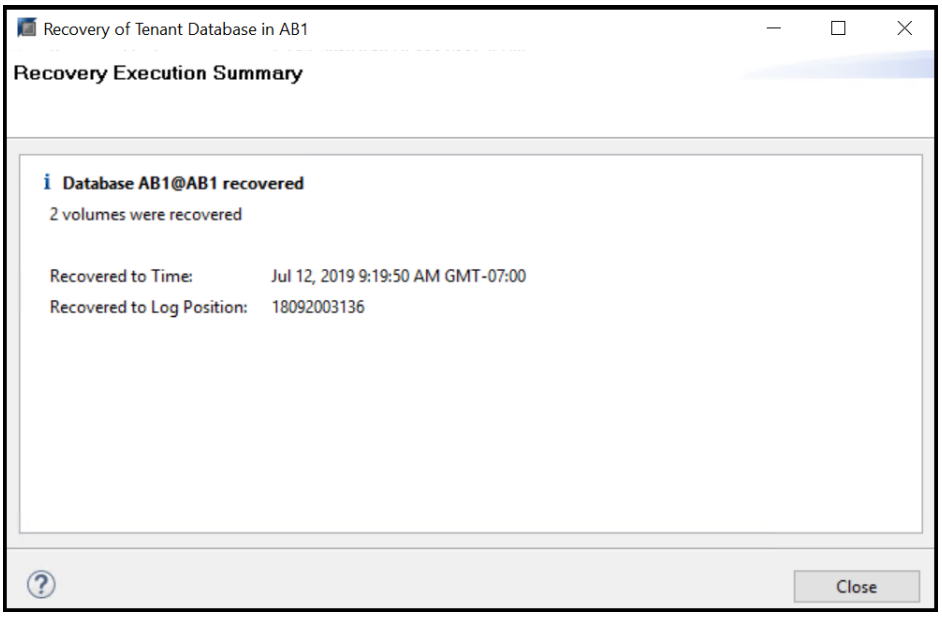


Figure 20. Recovery of SAP HANA database

SAP HANA cockpit configuration

SAP HANA cockpit supports the scheduling of data backups and delta backups (incremental/decremental). The following section provides the configuration guidance for SAP HANA cockpit backup and restore.

SAP HANA cockpit prerequisites

As a best practice, create a backup user using SAP HANA Studio and assign the following granted roles and system privilege:

Granted roles

- sap.hana.backup.roles::Administrator
- sap.hana.backup.roles::Operator
- sap.hana.backup.roles::Scheduler
- sap.hana.xs.admin.roles::Jobadministrator
- sap.hana.xs.admin.roles::HTTPDestAdministrator
- sap.hana.xs.admin.roles::JobSchedullerAdministrator

System privilege

- BACKUP OPERATOR

Note

Scheduling backups using SAP HANA cockpit also requires XS Job Scheduler to be active.

Create a backup schedule using SAP HANA cockpit:

1. In SAP HANA cockpit, click “Resource” directory that will show the running databases.
2. Select the SYSTEMDB database and click “Manage databases”.
3. Click “Manage schedules”, in the schedule settings window, add a new schedule.
4. Provide the schedule name, recurrence pattern, and recurrence details.
5. Click “Save”.

Figure 21 shows the SAP HANA cockpit backup scheduling wizard.

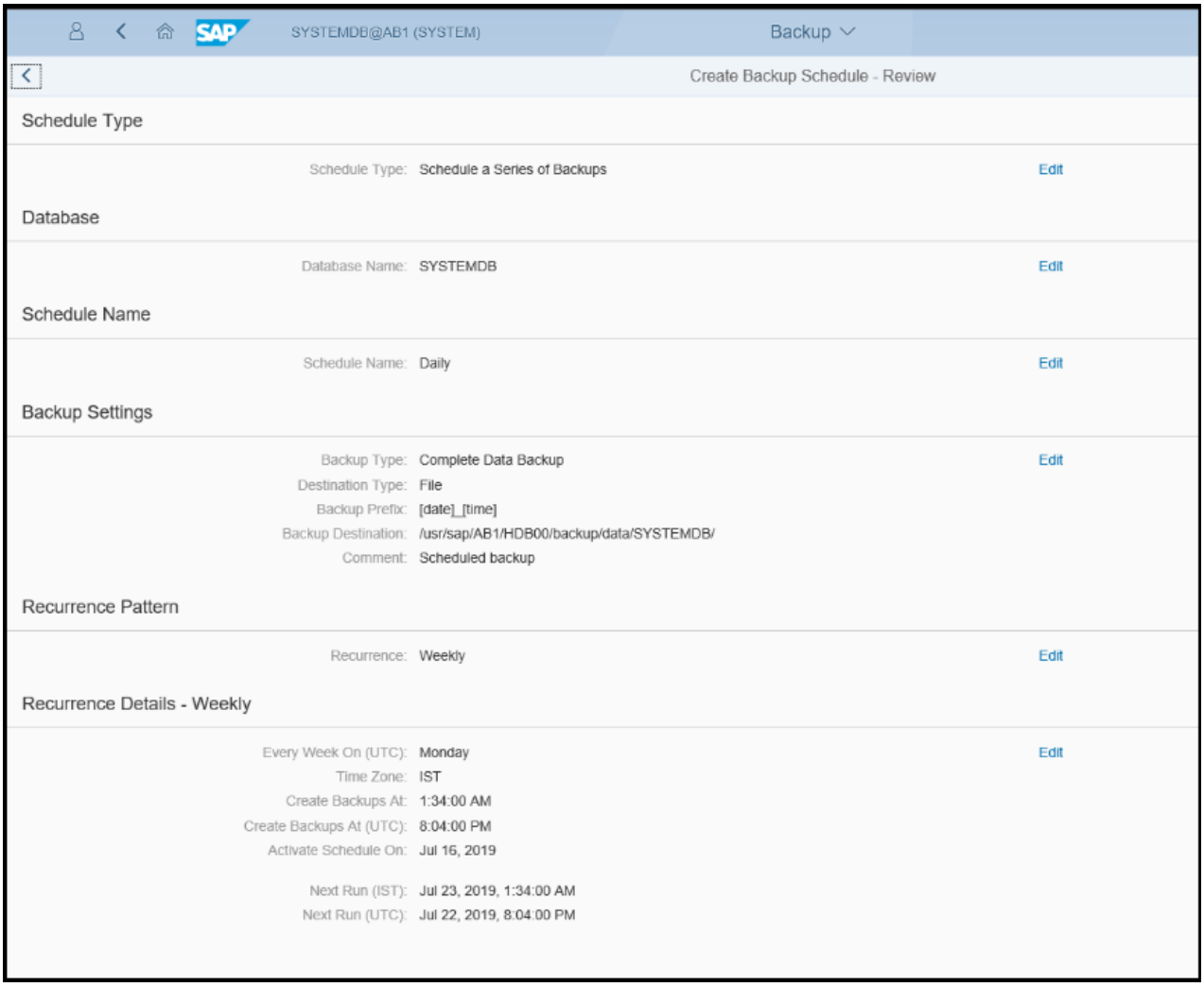


Figure 21. Scheduling backup with SAP HANA cockpit

SAP HANA database backup using cockpit

To configure the SAP HANA database backup using SAP HANA cockpit:

1. In SAP HANA cockpit, click "Resource" directory that will show the running databases.
2. Select the Tenant DB database and click "Manage database backups".
3. Click "Create a backup", select the backup type, destination type, and proceed with the backup.

   On the successful tenant database backup, the status appears as shown in Figure 22.

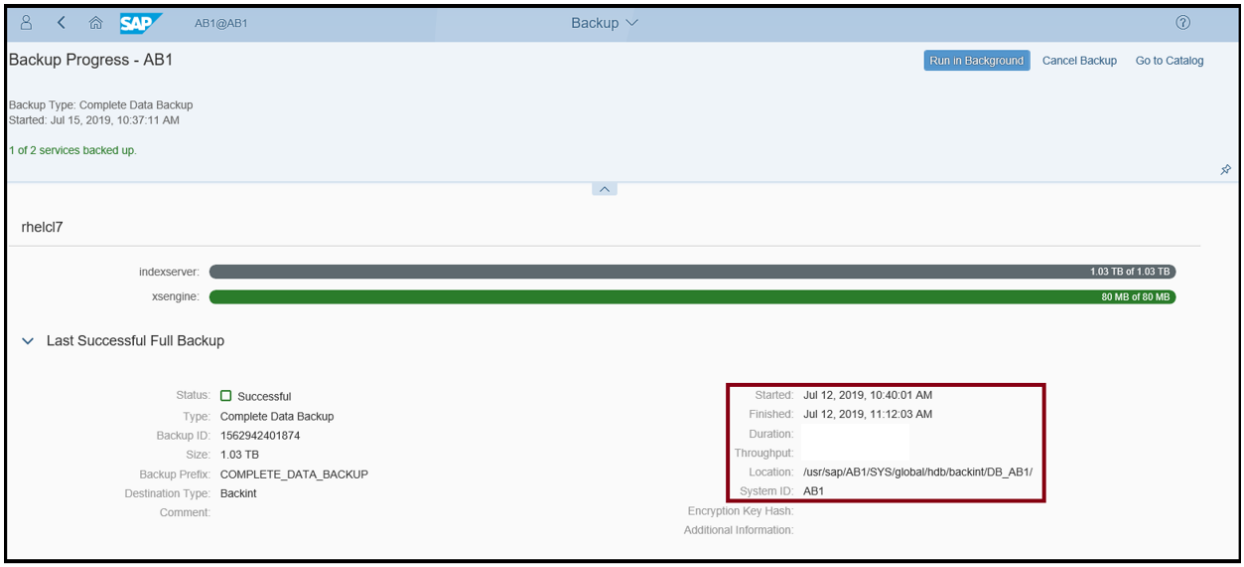


Figure 22. SAP HANA database backup using SAP HANA cockpit

SAP HANA database recovery using cockpit

The SAP HANA database recovery can be configured using SAP HANA cockpit. To do this, select the SYSTEMDB@<SID> under System Overview and click "Manage databases", and then click "Stop Tenant".

Once the tenant database is stopped, the recover tenant database option will be visible. On the successful tenant database recovery, the database starts as shown in Figure 23.

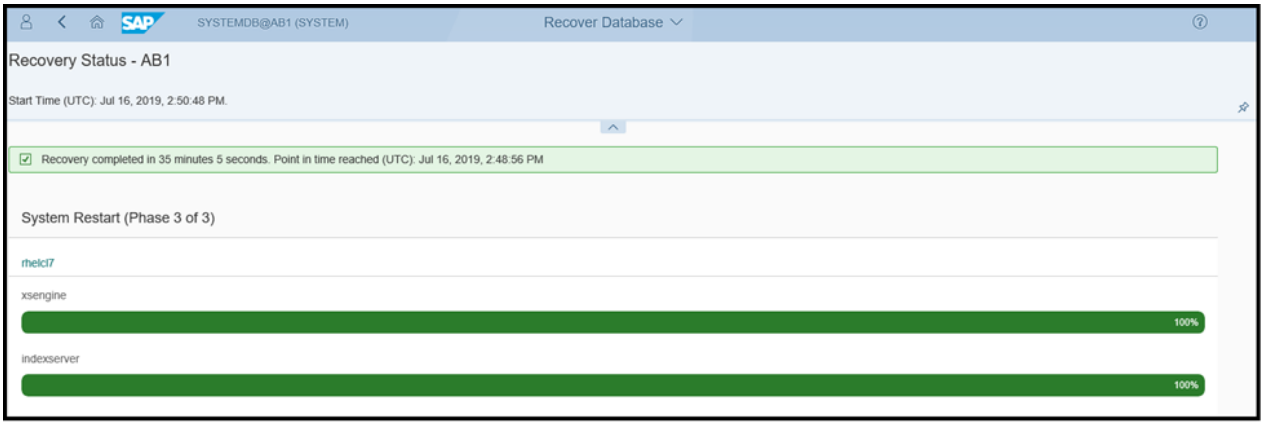


Figure 23. SAP HANA database recovery using SAP HANA cockpit

Commvault backup/restore job monitoring

The database backup operation can be seen on the Commvault CommCell server. Once the backup is initiated, the job controller displays the status of the backup job as shown in Figure 24.

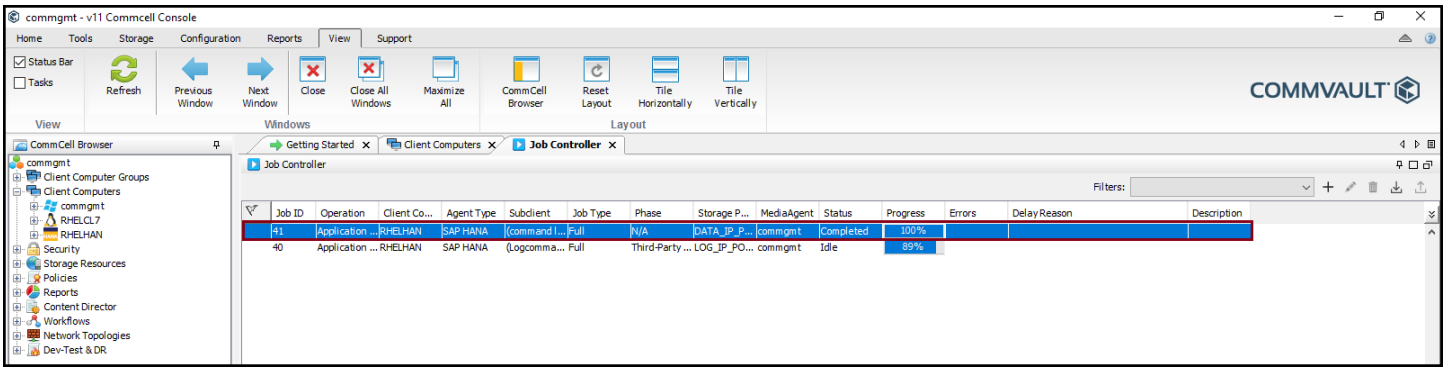


Figure 24. Commvault job controller window

SAP HANA database restore operation can be seen on the Commvault CommCell server, by selecting the task on the home page and select the "Restore History" as shown in Figure 25.

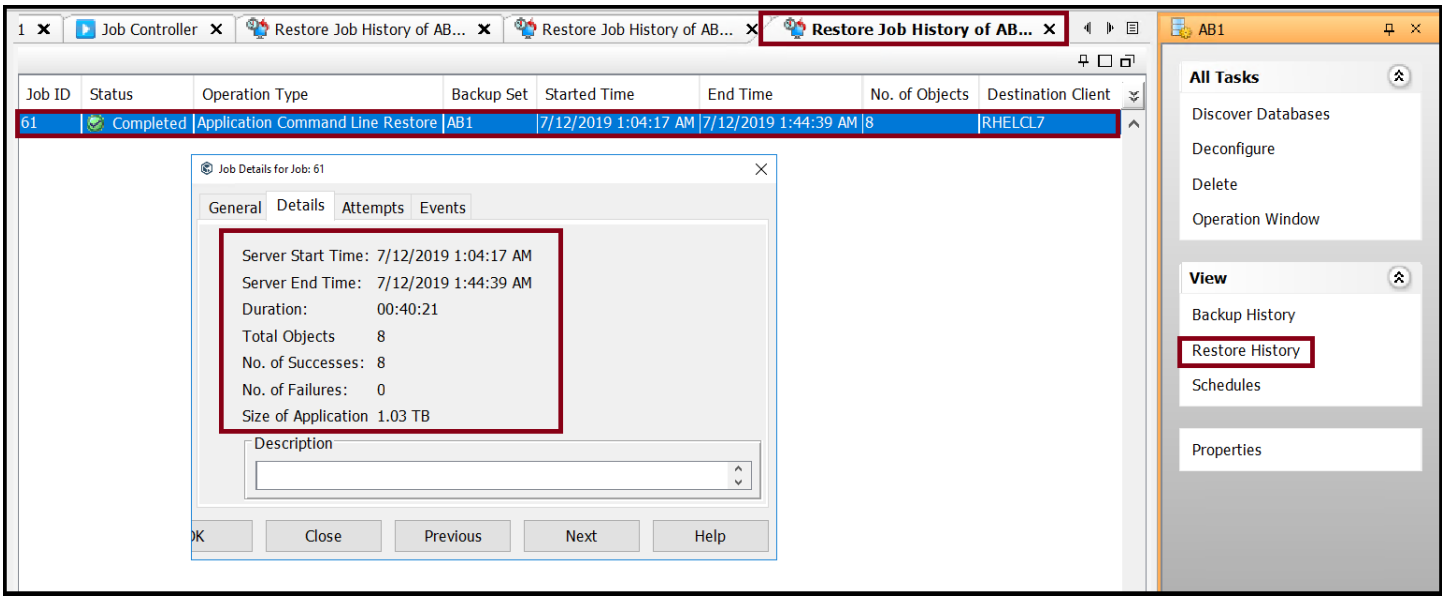


Figure 25. Commvault restoration job status

Capacity and sizing

Planning the capacity for backups is a complex process that is not just limited to the availability of physical storage for storing backups. It also involves defining the CPU/memory requirements on the media server and sizing the Ethernet links. For databases in general and SAP HANA in particular, backups are very critical for the uptime of the database. These backups are important not just for recovery in case of a failure, but if database logs are not backed up in a timely manner, they could fill up the logs filesystem and potentially bring down the database. Proper capacity planning for SAP HANA backups is very important.

The considerations for arriving at the backup capacity required for a predefined solution using HPE ProLiant DL560 Gen10 server for SAP HANA are the SAP HANA database size, the backup frequency, and the change (delta) that a database is witnessing. In traditional backup devices, the sizing would be a simple calculation of the space required for each backup and the number of backups to be retained. Today's advanced backup technology is able to share, compress, encrypt, multiplex, and deduplicate the data that is going to a backup media.

As stated earlier, a customer may have a higher backup frequency if they have a lower RTO and vice-versa. What is presented below is a generic example; therefore, each customer's actual storage requirements will differ accordingly. Another assumption taken in this example is a deduplication ratio of 10:1 (actual data size: size on disk). Table 2 shows the storage capacity calculation for HPE StoreOnce backup.

Table 2. SAP HANA database backup and restore from the target backup device

Disk backups	Scale-up
Daily backup size (data)	1 TB Per backup
Daily backup size (logs)	50 GB (This assumes 100 MB every five minutes for 24 hours. 288 log files will be generated, which adds up to 28,800 MB or approximately 30 GB. 50 GB is taken to be on the safer side)
Maximum number of data backups on the HPE StoreOnce device at any point in time	7 daily, 5 weekly, 12 monthly, 7 yearly, 7 special
	38 backups convert to 38 TB
Maximum number of log backups on the HPE StoreOnce device at any point in time	50 GB * 14 (assuming two weeks' worth of logs are kept on the disk)
	700 GB
Total backup capacity required	38.7 TB
Total backup capacity required on disk assuming a deduplication ratio of 10:1	~4 TB
Available raw capacity	288 TB (HPE StoreOnce 5200)
Available usable capacity	216 TB

Table 3 shows the suggested backup strategy.

Table 3. Suggested backup strategy

Backup policy	Disk-based backup using Catalyst Store	Retention
DATA_IP_POLICY	Daily (Mon-Sun)	7 days
LOG_IP_POLICY	Every 15 minutes (as default)	14 days, Point in time restores have a dependency on logs having retention of 14 days means that we can restore a database to a point in time in the last 14 days.
DATA_IP_POLICY	Weekly (Sat)	4 weeks
DATA_IP_POLICY	Monthly	12 months

The information available in Table 2 shows that the HPE StoreOnce 5200 is well suited for all HPE ProLiant DL560 Gen10 for SAP HANA deployments that is in the range of 192 GB and 6 TB of memory. A requirement of ~6 TB seems to be too less versus the actual usable space available. However, customers should consider all their SAP HANA instances and calculate their total capacity required. This additional capacity would be useful for any future growth and any other applications that could share this HPE StoreOnce unit. Even for customers that have a higher backup frequency and need more backup space, the HPE StoreOnce 5200 has ample scope for expansion and can be scaled up to 288 TB (raw) and 216 TB (usable). It should be noted here that the above calculation is for one production SAP HANA instance, for non-production instances such as QA and development and testing, additional capacity needs to be calculated and procured.

Workload description

Hewlett Packard Enterprise has performed extensive testing to arrive at the achievable backup and restore solution of using Commvault backup software in an SAP HANA database environment using HPE StoreOnce 5200. Figure 1 shows the HPE lab test setup. The entire backup is running at 10 Gbps. Multiple tests were performed in each environment. The SAP HANA database (AB1) was built to a size of approximately 1.01 TB (SLES 12 SP4) and 1.03 TB (RHEL 7.6).

Workload data

Backups and backup speed are an important factor and that should be able to complete in a reasonable amount of time. It is also very important that the restore of the database is quick and smooth. Hewlett Packard Enterprise tested the backup and restoration of the SAP HANA database using the SAP Backint API. The backup and restore for an SAP HANA instance can be initiated from SAP HANA Studio/SAP HANA cockpit. A restore can be from flat file backups or from a Backint backup. Except for SAP HANA Index server, all of the other jobs are very small and will complete in a few minutes. The Index server takes time depending upon the volume of data in the database.

Key challenges

The main challenge is to design the backup solution with performance and making sure the backup and restore happens flawlessly. Required tunables need to be applied in Commvault software and SAP HANA databases to achieve the best performance. As per Commvault's recommendation, required hotfixes have been installed to overcome the performance issues. This solution is tested with Commvault 11 with SP15 HPK2 and SP16 HPK4 hotfixes.

Figure 26 shows the SAP HANA database backup performance of SLES 12 SP4.

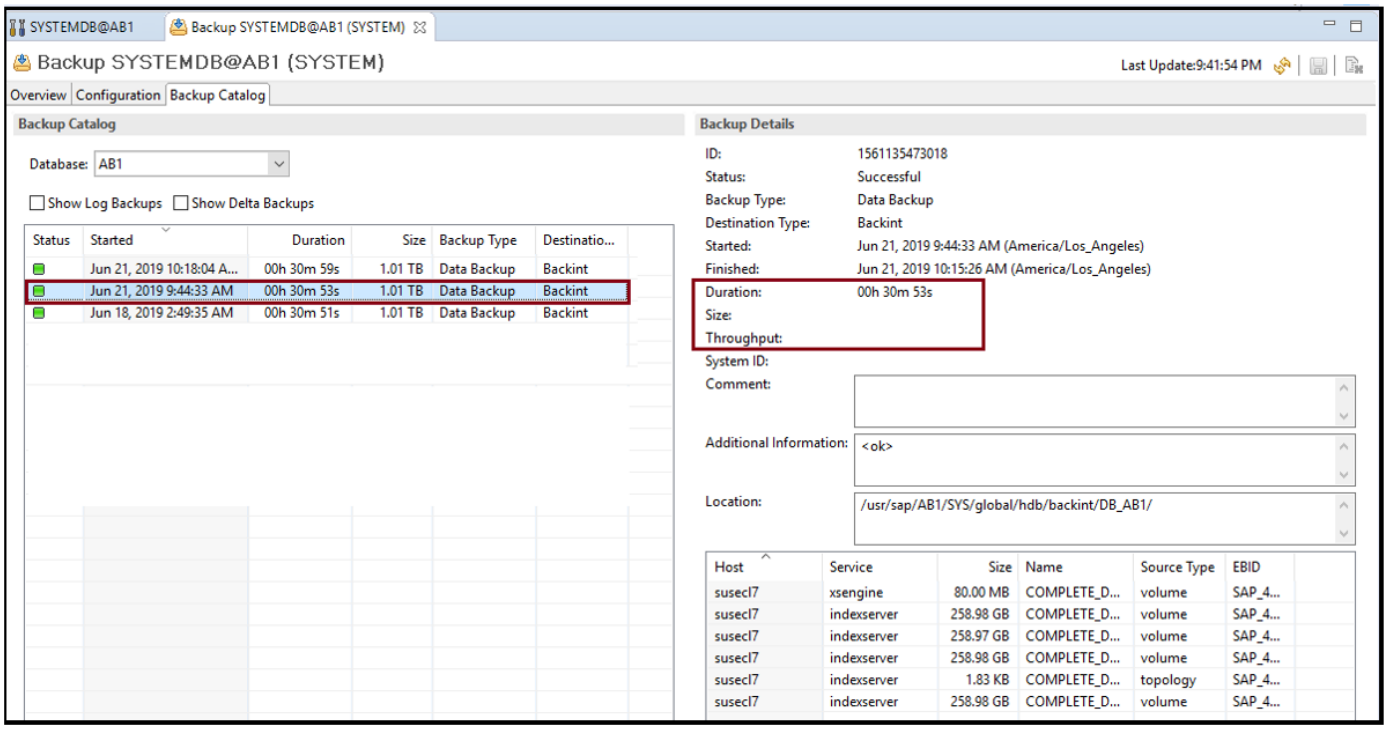


Figure 26. Backup performance monitoring using SAP HANA Studio (for SLES 12 SP4)

Figure 27 shows the SAP HANA database backup performance of RHEL7.6.

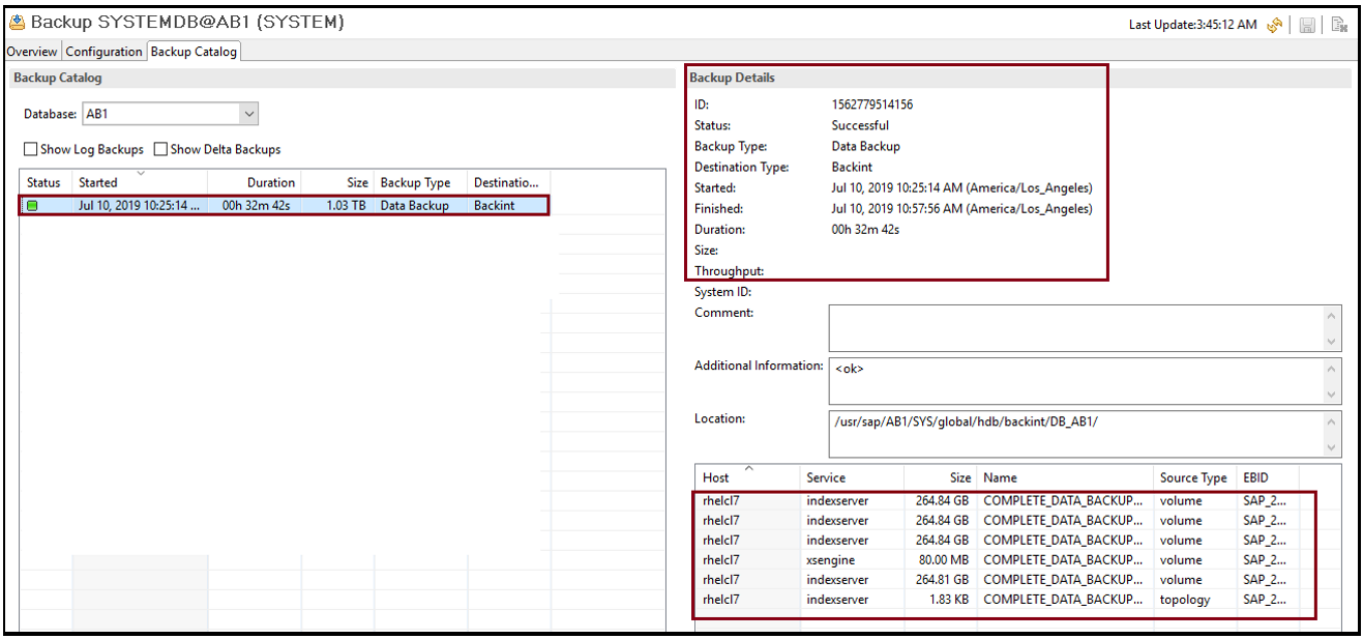


Figure 27. Backup performance monitoring using SAP HANA Studio (for RHEL 7.6)

Analysis and recommendations

- SAP HANA database can only be recovered as a whole and it is not possible to recover a table or an object. The recovery process requires the database to be down, and online recovery is not possible in this condition.
- SAP recommends that in addition to the data and logs, there should also be a backup of the configuration files on the SAP HANA nodes. These files should be backed up before and after an upgrade of the SAP HANA database or any system changes are executed.
- Enable the log backups to initiate automatically rather than manually, this will ensure the logs space is always available and prevent the database from going down due to filesystem full condition.
- While successful backup is very important, it is also very important to ensure that the backup images are expiring in a timely manner, this indirectly ensures that there is sufficient capacity available on the backup device for routine future backups.
- In a multitenant database container environment, it is recommended to back up the system and all the tenant databases regularly. While recovering the system databases, the whole system (system database and all the tenant databases) need to be shut down.
- Configure the SAP HANA data backups with multistreaming channel values up to twenty for maximum throughput on HPE ProLiant DL560 Gen10 for SAP HANA scale-up 1.5 TB configuration.

Summary

To summarize the common things across the industries which expect the data protection to be “Simple, Reliable, and Cost-effective”.

SAP HANA is a high-speed in-memory database (IMDB) commonly used for mission-critical enterprise applications, and therefore customers need an SAP-certified backup solution for SAP HANA databases. Customers demand the highest efficiency and performance in their SAP HANA environment while minimizing the risk of data loss. SAP customers need an enterprise-class backup solution, like Commvault that they can trust to perform reliable backup and restore SAP HANA databases.

It is always important to have a good backup management strategy that helps to manage the exponential data growth in the customer environment. This backup solution is a compelling solution for a challenging data protection environment. It enables efficient backup and data protection for SAP HANA databases.

This tested solution provides the following benefits:

- Reduced backup footprint
- Reduced infrastructure equipment
- Agent-based backup with deduplication
- Simple, reliable, and cost-effective
- Great performance

This HPE backup solution for SAP HANA has been built and tested using the best in class components. The workload data/results section substantiates that using Commvault for SAP HANA solution will enable customers to meet strict SLAs with demanding RTO and RPO.

By reading this document, users can deploy this backup and recovery solution in an SAP HANA environment using HPE ProLiant DL560 Gen10, HPE StoreOnce 5200, and Commvault software. As discussed throughout this document, all of these components work together seamlessly to provide an HPE backup solution for SAP HANA to deliver a return on investment and add to profitability.

Hewlett Packard Enterprise always delivers a solution that excels in reliability and performance while minimizing the costs which makes this as the most recommended backup and recovery solution in the market.

Implementing a proof-of-concept

As a matter of best practice for all deployments, Hewlett Packard Enterprise recommends implementing a proof-of-concept using a test environment that matches as closely as possible to the planned production environment. In this way, appropriate performance and scalability characterizations can be obtained. For help with a proof-of-concept, contact an HPE Services representative (hpe.com/us/en/services/consulting.html) or your HPE partner.

Appendix A: Bill of materials

Note

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

Table 4. Bill of materials (Lab tested environment)

Qty	Description
1	HPE ProLiant DL560 Gen10 server with Cascade Lake processor
1	SLES 12 SP4 for SAP
1	RHEL 7.6 for SAP
1	Windows 2016
1	HPE ProLiant DL360 Gen10
2	HPE FlexFabric 5945 network switches
2	HPE FlexFabric 5900AF network switches
1	HPE StoreOnce 5200
1	Commvault 11 SP15/SP16 software[1] (CommCell Server)
1	SAP HANA 2.0 SPS 04

[1] Requires a license.

Appendix B: Commvault recommendations for SAP HANA

To get the optimal performance and load-balance between the data path, the option "Round-Robin between Data Paths" should be selected.

Commvault media server storage policy configuration

To change the storage policy in the CommCell browser:

1. Select **Policies** → **Storage Policy** → **Primary** → Select **Data Path Configuration** → Select **Round-Robin between Data Paths** → Click **OK**.

Figure 28 shows the Round-Robin data path selection on the Commvault storage policy. The same settings should be maintained across all policies.

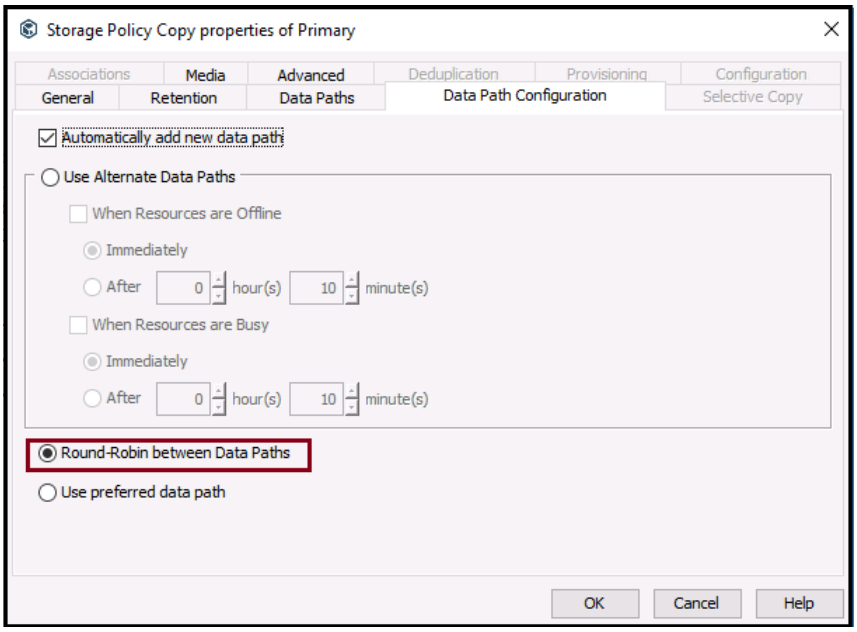


Figure 28. Commvault Storage policy configuration

Appendix C: SAP HANA backint backup performance recommendations

SAP HANA backint performance can be improved by setting the following parameters. The parameters shown in Figure 29 were used in the HPE lab test environment.

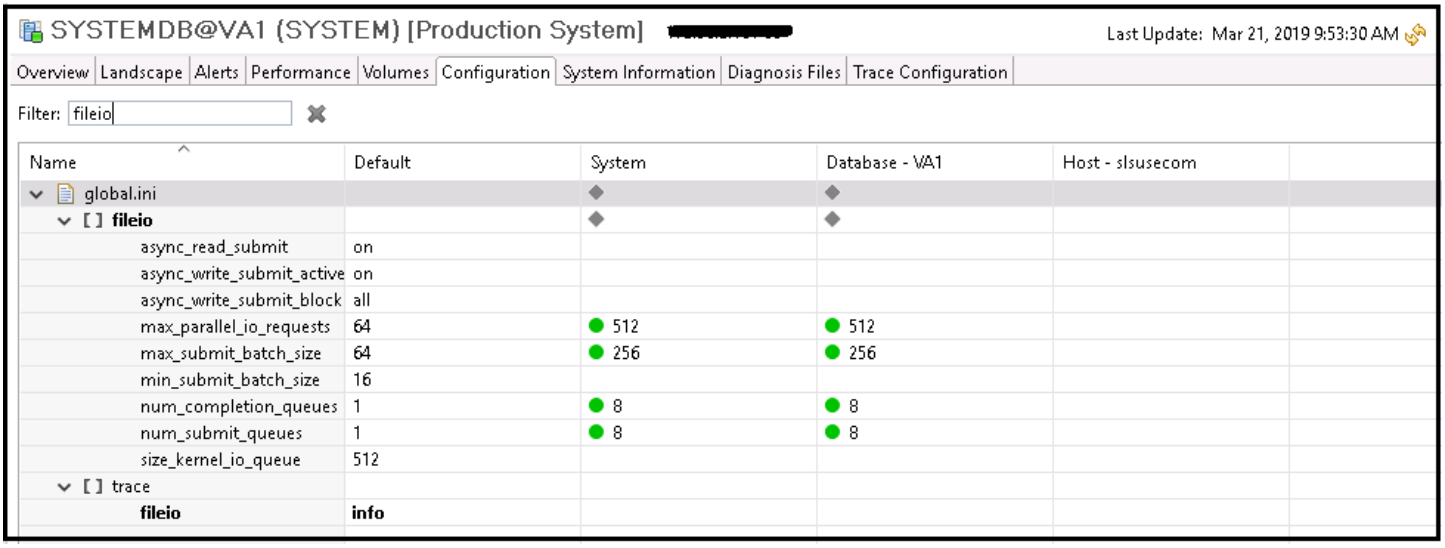


Figure 29. SAP HANA database parameters for backint backup

Setting the above parameters in the global.ini file, restart the database to make the changes effective.

Appendix D: HPE StoreOnce recommendations

HPE StoreOnce 5200 delivers cost-effective, scalable disk-based backup with deduplication for longer-term on-site data retention and off-site disaster recovery for larger data centers or regional offices. It also provides a replication target device for up to 50 remote or branch offices.

Key points

The obvious benefit of in-line deduplication for SAP HANA backups is the opportunity to save on actual storage consumption.

Low bandwidth mode is generally more popular than high bandwidth mode. However, for the purpose of this solution, it is better to use Catalyst stores in high bandwidth mode. The reason for this recommendation is that for an SAP HANA backup solution, a dedicated 10Gbps backup network is used and bandwidth is not a constraint. HPE ProLiant DL560 Gen10 server for SAP HANA scale-up supports both 10GbE and 25GbE network cards.

HPE StoreOnce – models for SAP HANA

HPE StoreOnce has been designed to cater to the needs of all types of customers from entry-level to large scale enterprises. HPE 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. It provides flexibility for future growth/changes. Table 5 lists the features of the HPE StoreOnce 5200 model that is recommended for backing up SAP HANA.

Table 5. HPE StoreOnce backup model for SAP HANA

Product description	**HPE StoreOnce 5200**
Form factor	4U Scalable Rack
Total capacity	Up to 288 TB (raw), Up to 216 TB (usable)
Device interface	16Gb and 32Gb Fibre Channel Ports 10GbE and 25GbE Ethernet Ports 1 Gb Ethernet Ports
Max fan-in/backup Target	32
Maximum Write performance	17 TB/hour
Maximum Catalyst write performance	33 TB/hour

Key Point

HPE StoreOnce backup systems are built using HPE ProLiant servers, hence they share common management tools with Hewlett Packard Enterprise server products (for example, HPE Systems Insight Manager (SIM) and HPE Integrated Lights-Out (iLO)) reducing the time and energy it takes to manage the IT infrastructure. For more information about the HPE StoreOnce 5200 system overview, refer HPE StoreOnce 5200 System Overview.

Appendix E: Commvault software update

Commvault software update and latest patch installation can be downloaded and installed on the CommCell server.

Resources and additional links

HPE Reference Architectures, hpe.com/info/ra

HPE Servers, hpe.com/servers

HPE Storage, hpe.com/storage

HPE Networking, hpe.com/networking

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

Commvault documentation, https://documentation.commvault.com/commvault/v11/article?p=documentation.htm

SAP HANA best practices guide from Commvault, https://kapost-files-prod.s3.amazonaws.com/published/5751bd26dd762a05f700016d/sap-hana-best-practices-guide.pdf

HPE StoreOnce Support for Commvault, https://documentation.commvault.com/commvault/v11_sp13/article?p=99422.htm

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

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