Hewlett Packard Enterprise

Reference Architecture

HPE Reference Architecture for backup and recovery of SAP HANA Database on HPE Scale-up Server 3200

Scale-up and Scale-out configurations built with the Intel® Xeon® Scalable Processor (Intel® Sapphire Rapids) using HPE StoreOnce and Commvault

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EXECUTIVE SUMMARY

SAP HANA® is an in-memory computing platform from SAP®. SAP is strategically porting all its 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 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 (SLA) for Recovery Time Objectives (RTO) and Recovery Point Objectives (RPO).
- Quick and reliable recovery

This Reference Architecture describes a solution for backup and recovery of SAP HANA databases running on the HPE Compute Scale-up Server 3200 with four (4) Intel® Xeon® Scalable Processors 8490H/8468H/8454H/8444H/6434H, 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 optimized for use in data center environments where adequate bandwidth is available.

This document lists the advantages of a backup solution using HPE Compute Scale-up Server 3200, 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, 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 Compute Scale-up Server 3200 supports the fourth generation Intel® Xeon® Scalable Processors with a choice of Gold or Platinum.
- HPE Compute Scale-up Server 3200 is available in 4-16 sockets configurations and can be scaled up in 4-socket increments.
- HPE Compute Scale-up Server 3200 supports new 128GB DDR5 DIMMs.
- Commvault 11 security Force per-client certificate management – Commvault uses security certificates to authenticate Commvault clients. A CommCell® server acts as the Certificate Authority and issues certificates to hosts.
- Commvault is tested with RHEL 8.8 & SLES 15SP5 operating system versions.
- SAP HANA Cockpit Server backup and recovery process added.

Target audience: 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 paper should have a functional understanding of SAP HANA, 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 May 2024.

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 needs of current and future rapid data growth.

Example: Customers are managing the HANA backups in their own ways, some of them backup the HANA database into flat files on a 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 a NAS (Network-attached storage) 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 backup a HANA database.

To overcome the above-mentioned challenges, Hewlett Packard Enterprises 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:

- A leader in SAP and SAP HANA market share.
- Most scalable solution on Sapphire Rapids processors.
- Higher RAS / Most mission-critical x86 platform available.
- Based on open standards / x86 Intel processors.
- Large range of solution offerings: Appliances, TDI, bare metal, virtualized and from entry-level to large scale.
- Best support in the industry: SAP HANA CoE.

The data growth leaves 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, cloud-integrated solution providing backup, data recovery, and data retention for Hybrid IT.

Following are the key features that make the HPE StoreOnce 5200 best fit for this solution:

- HPE StoreOnce single node systems 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 Fiber 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).
- Improved GUI, like other HPE Storage products. Including Federated Management to allow customers to configure and monitor multiple Gen4 HPE StoreOnce systems or VSAs in a single pane of glass.
- Role-Based Access Control (RBAC) 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 cost implications of the storage which is used for backup and recovery solutions depend upon the actual consumption of the necessary resources. Customers are looking for storage in their backup and recovery solutions that can fit into their budget without affecting the performance.

This backup solution has been built with HPE Compute Scale-up Server 3200 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 describes an effective way to backup and restore 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) SAP HANA environments. In the Scale-up environment, 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 3'rd party tool that helps vendors to connect their backup agent with the SAP HANA database. In this solution, SAP HANA cockpit software has been used for backup and recovery of SAP HANA databases.

Hewlett Packard Enterprise and SAP have teamed up to provide all the functionality and performance required to support today's complex IT infrastructure. HPE Compute Scale-up Server 3200s for SAP HANA is a portfolio of optimally configured hardware appliances with preloaded software and a full range of included services – design, factory integration, 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 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 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 utilizes the same deduplication engine that enables storing more data without adding more storage.

Figure 1 shows the SAP HANA Scale-up backup environment using Commvault.

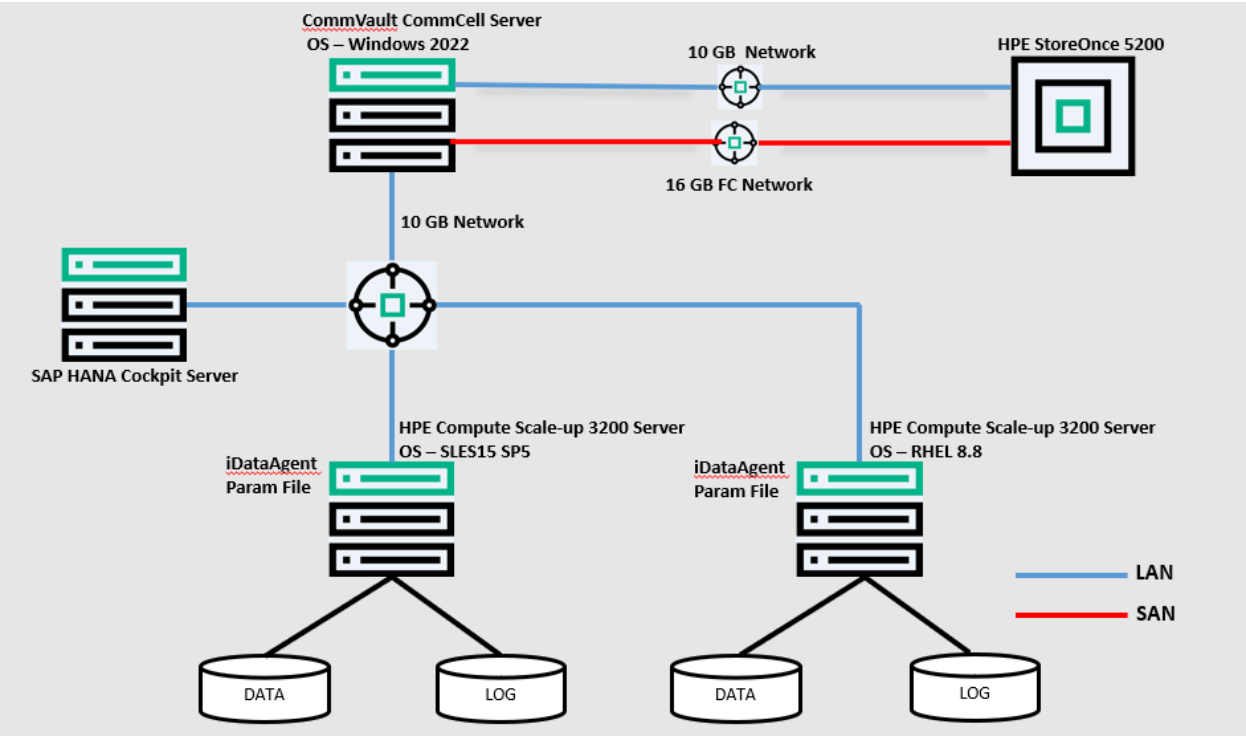

FIGURE 1. SAP HANA Scale-up backup environment using Commvault (tested lab configuration)

Figure 2 shows the HPE Compute Scale-up Server 3200, HPE ProLiant DL380 Gen11, HPE Aruba 8325 network switches, HPE Aruba 6300M SFP switches, HPE StoreFabric 6600B Fibre Channel switches, and HPE StoreOnce 5200 used in the lab environment.

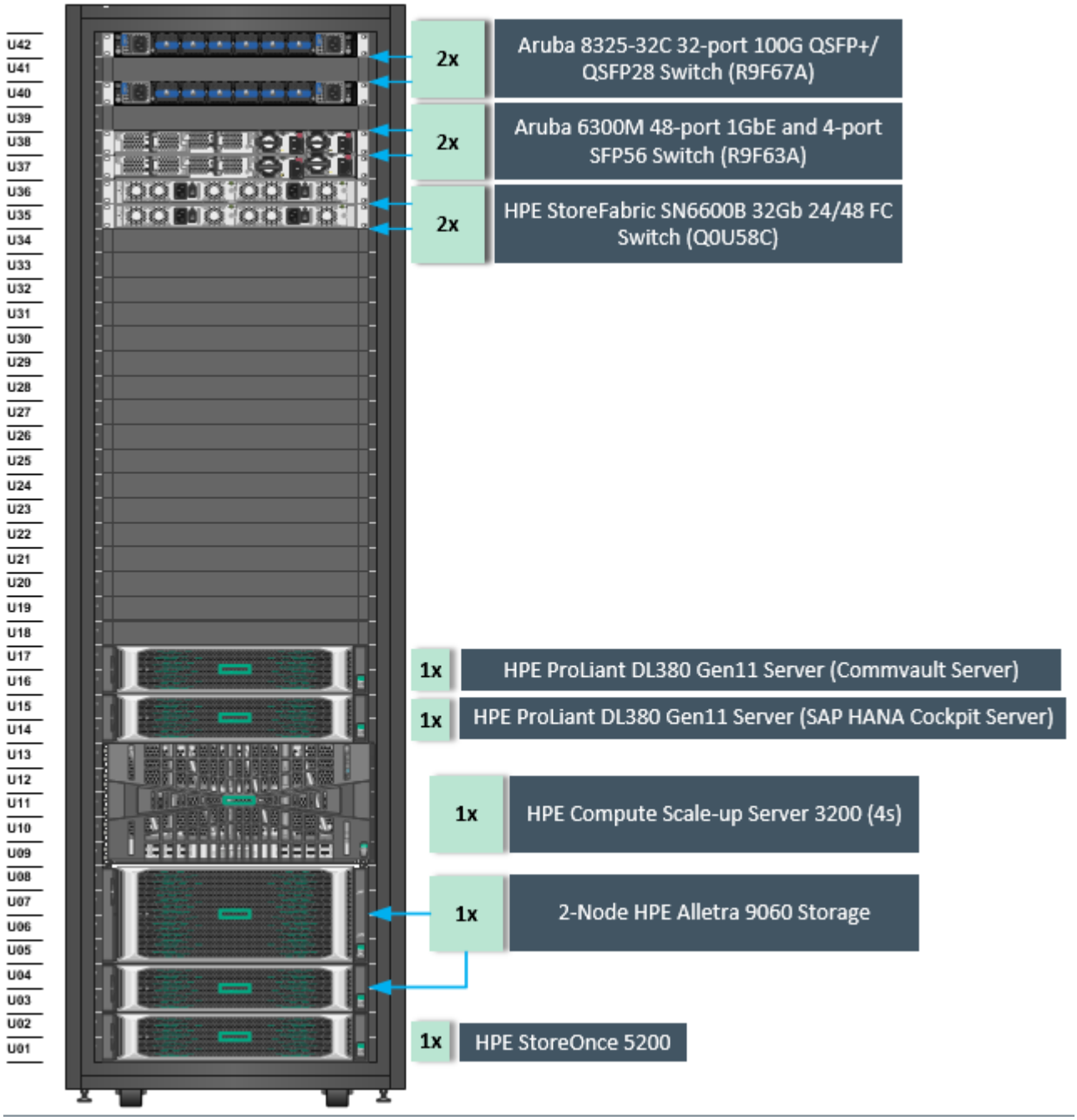

FIGURE 2. Front view of the Hardware used in the lab (tested lab configuration)

SAP HANA backup and recovery

SAP HANA stores 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 a 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 no commit has been 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 Database 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 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 the date- time when those backups were taken. The user must select the backup that needs to be restored. No logs are replayed using this option.

Multi-streaming 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 2023E (11.32) 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 DL380 Gen11, HPE Aruba 8325 network switches, HPE Aruba 6300M SFP switches, HPE StoreFabric 6600B Fibre Channel switches[1], HPE Alletra 9060/9080 Storage and HPE StoreOnce 5200.

Table 1 lists the SAP HANA Database, Server, Storage, and Commvault CommCell Server details.

TABLE 1. Solution Components

Components	Operating System	SAP HANA Database SID	Hardware	Description
Database Server	SLES 15 SP5	TS1	HPE Compute Scale-up Server 3200 (Sapphire Rapids Processor)	Database Server SID – TS1. SAP HANA database 2.0 SPS07
Database Server	RHEL 8.8	TS1	HPE Compute Scale-up Server 3200 (Sapphire Rapids Processor)	Database Server SID – TS1. SAP HANA database 2.0 SPS07
Cockpit Server	RHEL 8.8 / SLES 15 SP5	H4C	HPE ProLiant DL380 Gen11 Server	Cockpit Server can either be installed on a Bare metal server or on a dedicated virtual machine. In the lab environment, a dedicated virtual machine has been configured as SAP HANA Cockpit Server

[1] The FC switches are optional and to be used only if the customer prefers taking backups via Fiber Channels

Components	Operating System	SAP HANA Database SID	Hardware	Description
Commvault CommCell Server (Media Server)	Microsoft® Windows Server® 2022	NA	HPE ProLiant DL380 Gen11 Server	Commvault CommCell Server (Commvault Software version 2023E (11.32)), where backup and restore sessions can be configured and monitored.
Storage	NA	NA	2-Node Controller or 4-Node Controller HPE Alletra 9060/9080 Storage	Used for OS, SAP HANA DATA, LOG, SHARED, and USRSAP
Network Switch (1GbE)	NA	NA	2x Aruba 6300M 48-port 1GbE and 4-port SFP56 Switch	1GbE management network to connect SAP HANA Cockpit Server, SAP HANA server, and Commvault Server
Network Switch (100G)	NA	NA	2x Aruba 8325-32C 32-port 100G QSFP+/QSFP28 Switch	10/25Gb network used for backup and restore traffic
Fibre Channel Host Bus Adapter (HBA)	NA	NA	2x HPE SN1610Q 32Gb 2-port or HPE SN1610E 32Gb 2-port Fibre Channel Host Bus Adapter	Fibre Channel connection has been done between CommCell Server and HPE StoreOnce 5200
Fibre Channel (FC) Switch	NA	NA	2x HPE StoreFabric SN6600B 32Gb 24/48 FC Switch	Zoning has been configured between CommCell server and HPE StoreOnce 5200

HPE Compute Scale-up Server 3200 for SAP HANA Scale-up (Sapphire Rapids)

HPE Compute Scale-up Server 3200 utilizes a unique modular architecture that scales flexibly and seamlessly from four (4) to sixteen (16)-sockets in 4-socket increments in a single system. HPE Compute Scale-up Server 3200s for SAP HANA® Scale-up Configurations, is built with enhanced management, reliability, and security ecosystem. HPE Compute Scale-up Server 3200 featuring new Intel Xeon Scalable Processors with choice of Gold or Platinum processor architecture, 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. HPE Compute Scale-up Server 3200 is ideal for critical SAP S/4HANA and SAP BW/4HANA workloads. The HPE Compute Scale-up Server 3200s for SAP HANA Scale-up is a pre-defined solution of hardware and software that integrates SAP HANA.

HPE ProLiant DL380 Gen11 server

HPE ProLiant servers are industry-leading servers in x86 architecture and are available in various forms such as rackmount, tower, and blade servers. These servers are available with one (1), two (2), or four (4) sockets. For this solution, the HPE ProLiant DL380 Gen11 server was chosen as a management server. This server has been chosen considering the processor and memory requirements of Commvault and the SAP HANA database size. For more information, see the HPE ProLiant DL380 Gen11 QuickSpecs document.

KEY POINTS

The HPE ProLiant DL380 Gen11 Server functions as a Commvault Media Server (Commvault CommCell), which is used for configuration of 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 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 solutions for fast-growing business data.

- **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 (GUI):** Commvault provides the following 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 called 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 Commvault client (i.e. SAP HANA database host) when one or more Commvault client software components are installed on the system.

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

Figure 3 shows the Commvault backup architecture.

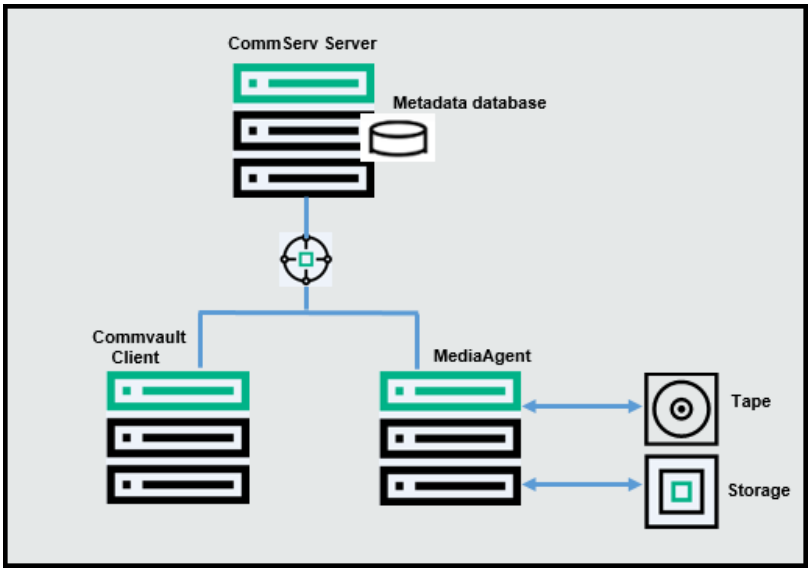

FIGURE 3. Commvault backup architecture

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 target device is called 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 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 Cockpit

SAP HANA cockpit 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 the SAP HANA cockpit. SAP HANA cockpit also

allows administrators to configure, monitor, initiate backups, and restore. SAP HANA cockpit can be either installed on a bare metal server or a virtual machine. In the lab environment, a dedicated virtual machine was used as a cockpit server to manage the HANA landscape.

BEST PRACTICES AND CONFIGURATION GUIDANCE

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

Install Commvault software

Download and install the Commvault software on the Windows management server. To download the Commvault software, the user should have access to the cloud account of Commvault https://cloud.commvault.com/home/.

Enable access to HPE StoreOnce 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 by selecting:

Media Server > Properties > Advanced > Additional Settings > Add >Enter "Activate HPE Catalyst" in the name field and the category will be automatically selected. Change the 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.

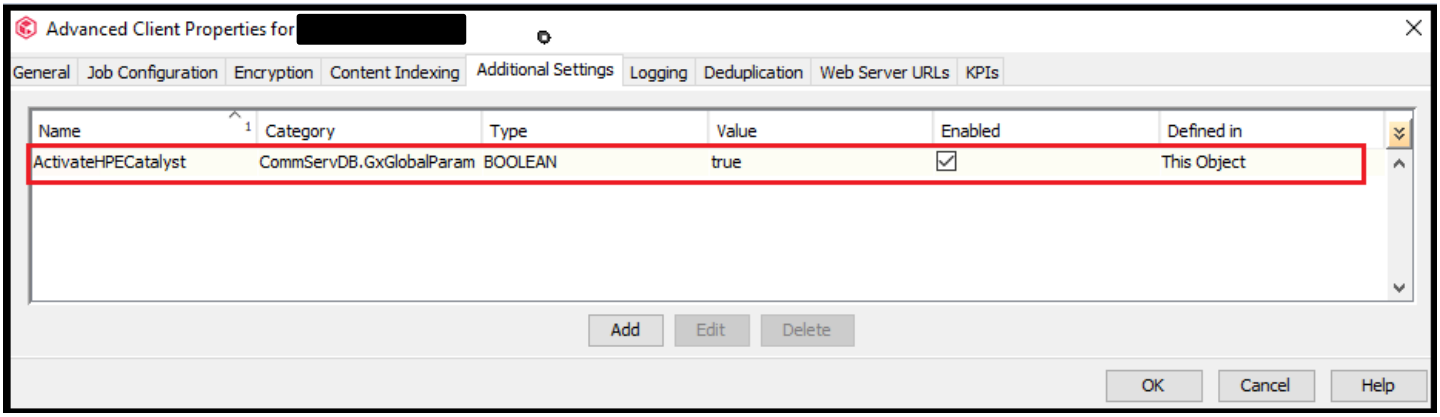

FIGURE 4. Commvault client properties (Advanced) wizard

HPE StoreOnce Catalyst store

To backup 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. If using StoreOnce Virtual Storage Appliance (VSA), similar steps can be applied for creating "Catalyst Store".

As shown in Figure 5, two Catalyst stores are created as backup targets, which were used for IP based backup configuration.

NOTE

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

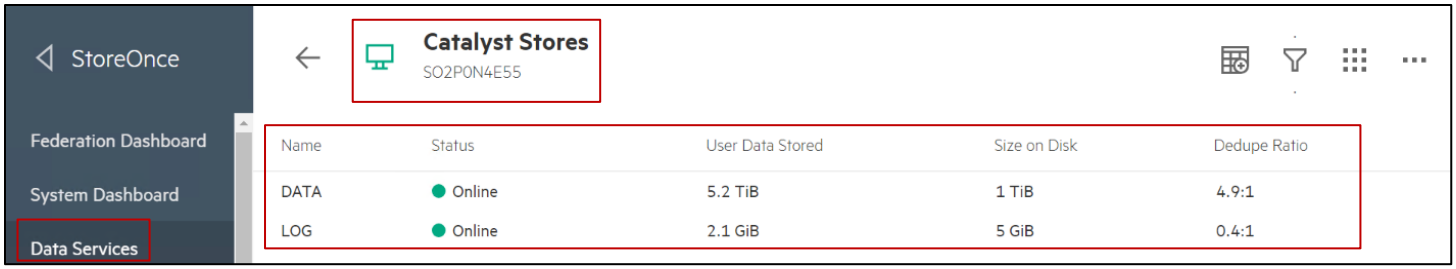

FIGURE 5. HPE StoreOnce Catalyst Stores wizard

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 > 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 Fiber Channel, provide the COFC identifier instead of HPE StoreOnce IP address to access the Catalyst Stores.
3. For more information on setting up Fiber 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.

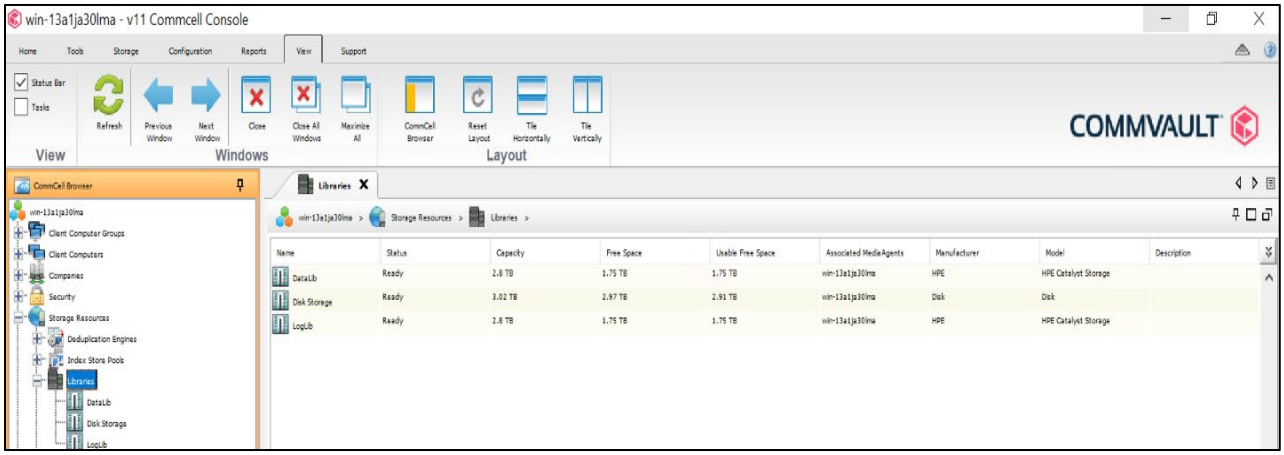

FIGURE 6. CommCell Storage Library Configuration

Create 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 the "**Storage Resources**" from the CommCell Browser.
2. Select **"Storage Pools" > Right Click > Add Storage Pool > Disk**.
3. Select the "Storage Library" which was created in the previous section.

Figure 7 shows the Commcell Storage Pools configuration

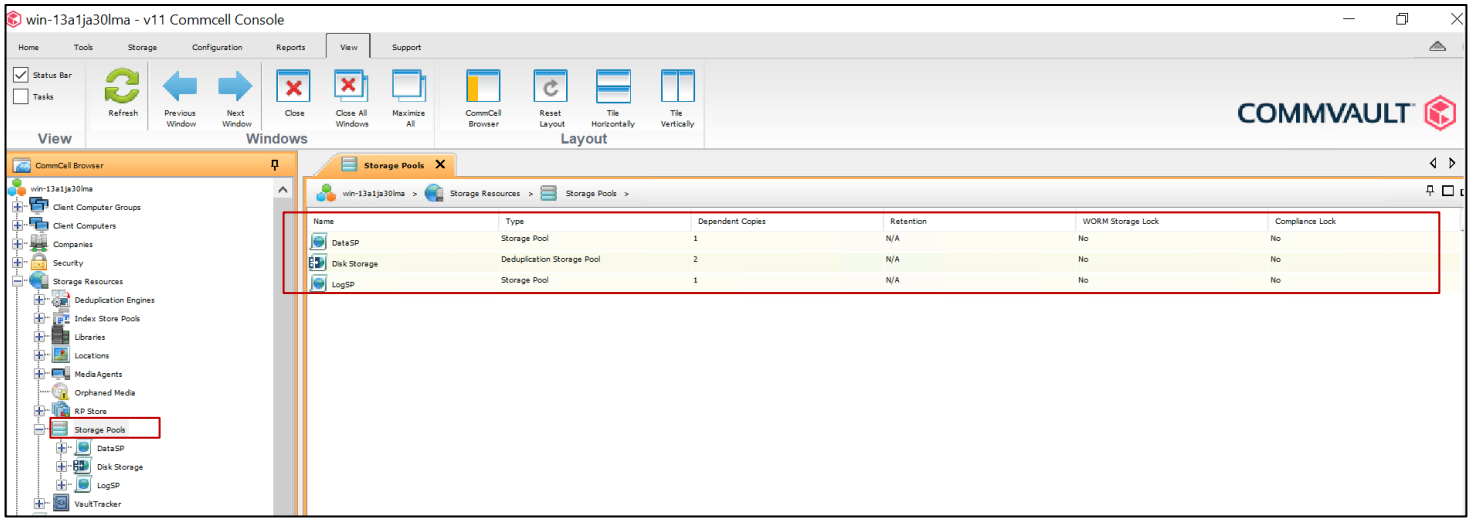

FIGURE 7. CommCell Storage Pools Configuration

4. Select **"Policies" > Right Click > New Storage Policy**.
5. Select Storage Policy type as "**Data Protection**" and provide the Storage Policy name.
6. Select the "**Storage Pool**" 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 8 shows the created storage policies on the CommCell server.

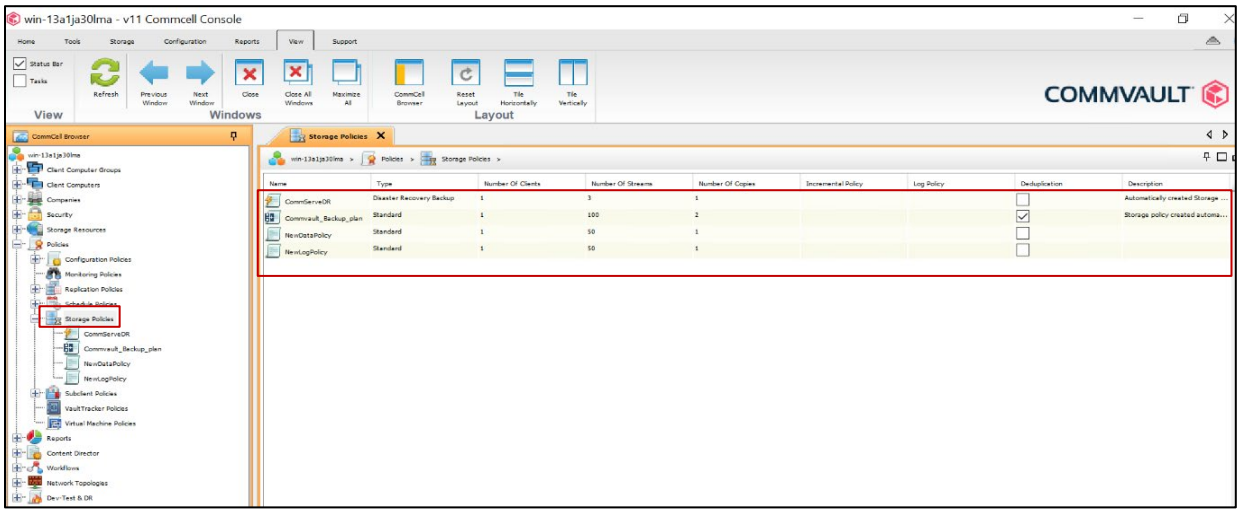

FIGURE 8. CommCell Storage policy (backup) configuration

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

Install Commvault client software

The following are pre-requisites to install Commvault Client software:

1. The operating system (SLES 15 SP5/RHEL 8.8) should be installed on the client.
2. SAP HANA database must 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. Do not provide Storage Policy name during the Client installation (this can be done later). Provide the SAP HANA database group name as "SAPSYS" and continue the installation.

Once the installation is completed, the client would be visible under the "**Client Computers**" in the CommCell Console

Figure 9 shows the SLES 15 SP5 database server has been added as a Commvault client.

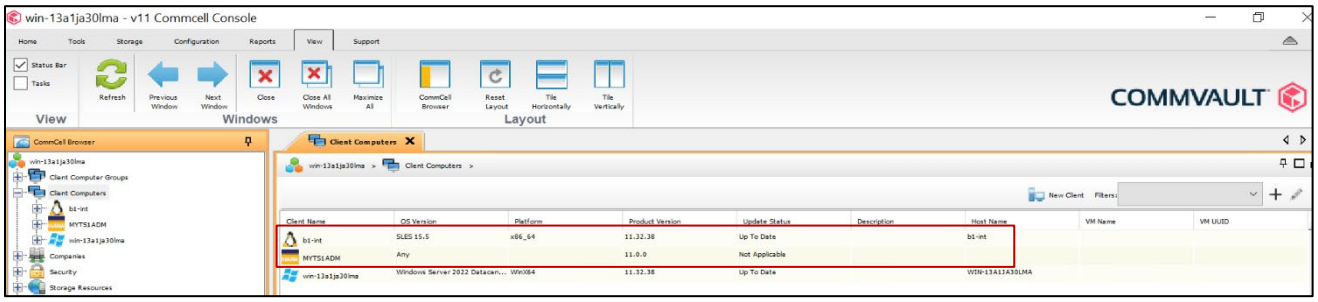

FIGURE 9. Commvault client (SLES 15 SP5)

Similarly, the details can be seen for RHEL 8.8 after it has been added as a Commvault client.

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

```
bl-int:~ # cd /usr/sap/TS1/SYS/global/hdb/opt/hdbconfig
bl-int:/usr/sap/TS1/SYS/global/hdb/opt/hdbconfig # ls
param
bl-int:/usr/sap/TS1/SYS/global/hdb/opt/hdbconfig # cat param
CvInstanceName
Instance001
bl-int:/usr/sap/TS1/SYS/global/hdb/opt/hdbconfig #
```

FIGURE 10. Commvault client parameter file (SAP HANA)

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

```
# cd /usr/sap/<SID>/SYS/global/hdb/opt
# mkdir hdbconfig
# cd /usr/sap/<SID>/SYS/global/hdb/opt/hdbconfig
# ln -s /opt/commvault/iDataAgent64/param /usr/sap/<SID>/SYS/global/hdb/opt/hdbconfig/param
```

```
# cd /usr/sap/<SID>/SYS/global/hdb/opt
```

```
# ln -s /opt/commvault/iDataAgent64/backint hdbbackint
<This step enables the backint interface on the SAP HANA>
```

Where,

TS1 – SAP HANA database instance name

Param – It's a parameter file which contains Commvault instance number and SAP HANA Client name.

For more information on creation of SAP HANA symbolic links, refer
https://documentation.commvault.com/2023e/expert/getting_started_for_sap_hana_agent.html

Create 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 the "**New Client**" → Select "**SAP HANA Client**" under "**Application**".
2. In 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. In the "**details**" tab, click on the "**ADD**" button and add the physical SAP HANA Client name.
4. In 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 shows the SAP HANA client configuration wizard.

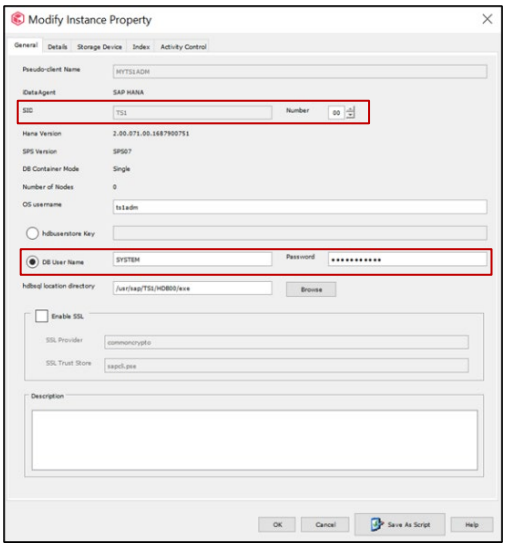

FIGURE 11. Commvault pseudo client configuration wizard (1/3)

Figure 12 shows the SAP HANA client configuration wizard.

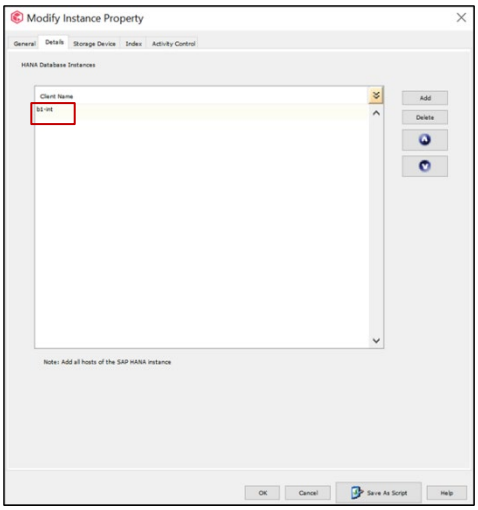

FIGURE 12. Commvault pseudo client configuration wizard (2/3)

Figure 13 shows the SAP HANA client configuration wizard.

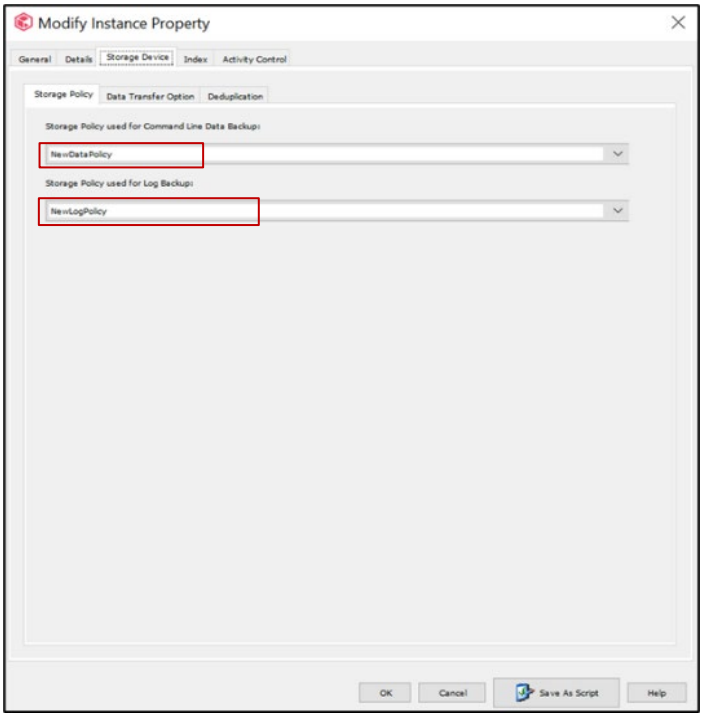

FIGURE 13. Commvault pseudo client configuration wizard (3/3)

Client Certificate authentication

To create authentication between the Client and the CommCell server:

1. From the CommCell Console, click on the control panel > select "**Certificate Administration**" under the "**CommCell**" option.
2. Select the "**Yes**" option from the "Force per-client certificate authentication on CommServe".
3. Click the "**Temp Certificate**" and select the pseudo client name from the list and click the "create" option.

4. The SSH key would be created and copy that from the "clipboard" and create an "exports.txt" file under the "/opt/Commvault/Base/certificates" directory and paste the key. Save the file.
5. Restart the "Commvault" service on the SAP HANA Client.

Figure 14 shows Commvault client certificate wizard.

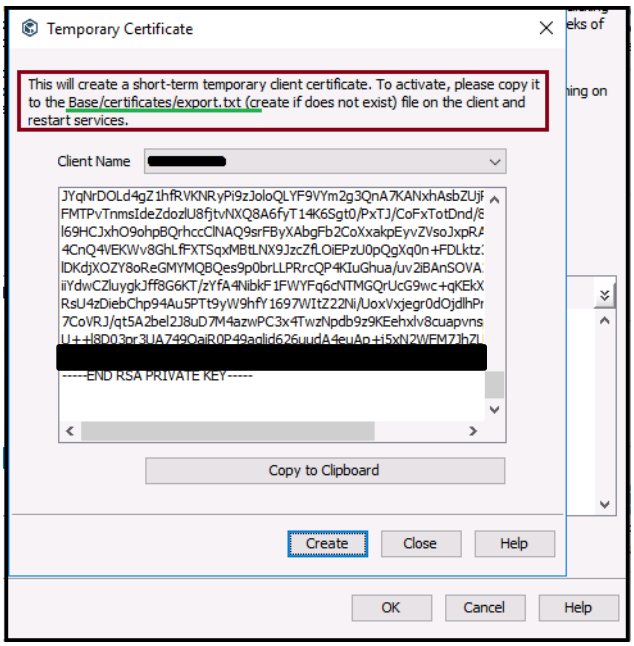

FIGURE 14. Commvault client certificate wizard

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 cockpit configuration for backup and recovery

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

1. Choose "Manage database configuration" from the "Administration" menu of the database instance from the cockpit.

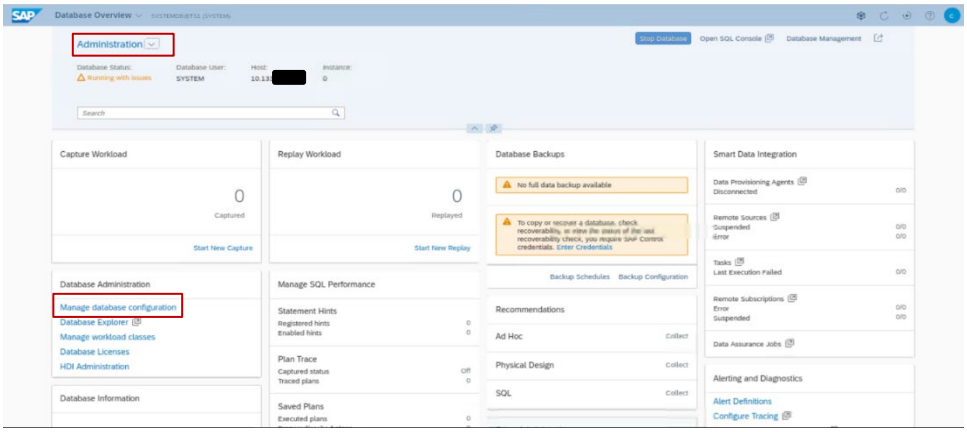

FIGURE 15. Database Administration using cockpit.

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 → Manage database configuration → global.ini → data_backup_parameter_file.

```
/usr/sap/<SID>/SYS/global/hdb/opt/hdbconfig/param
```

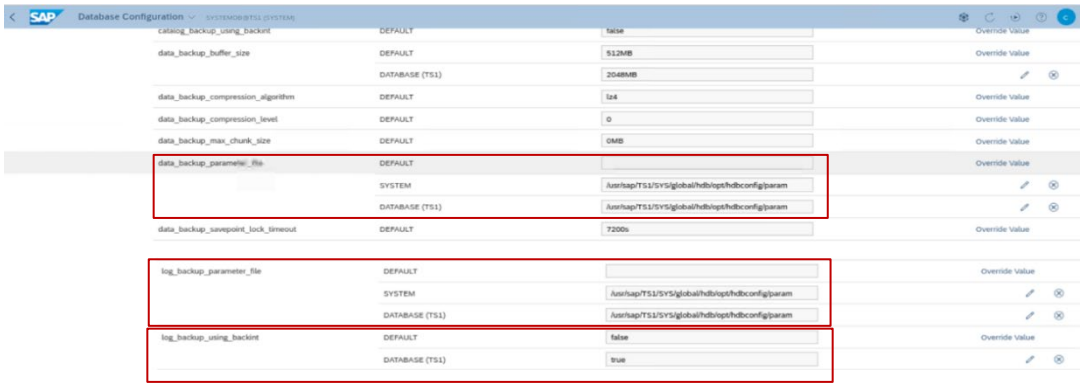

FIGURE 16. DATA and LOG backup parameter file configuration

3. The parameter file "param" must be specified for log in to the SAP HANA database instance configuration. To specify the parameter file, go to Instance → **Manage database 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 → Manage database configuration → global.ini →**

   log_backup_using_backint → SYSTEM = true.

Figure 18 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.

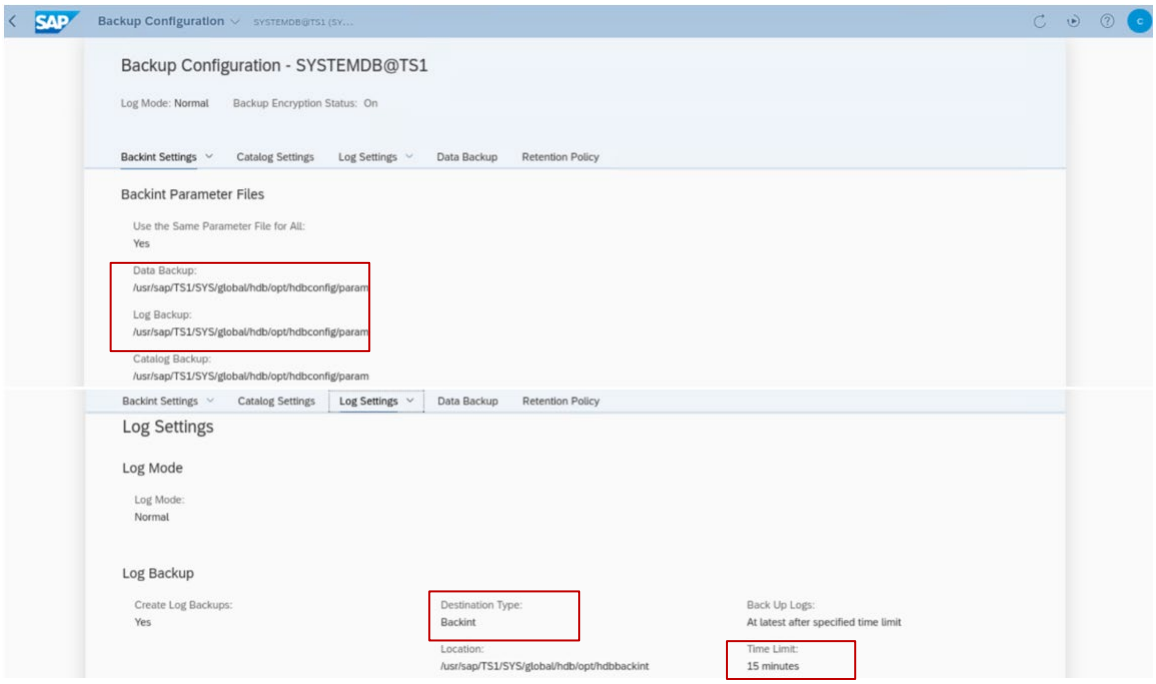

FIGURE 17. SAP HANA backup configuration parameter wizard

Figure 18 shows the backup and recovery options of the SYSTEMDB and TS1 instances from the cockpit server.

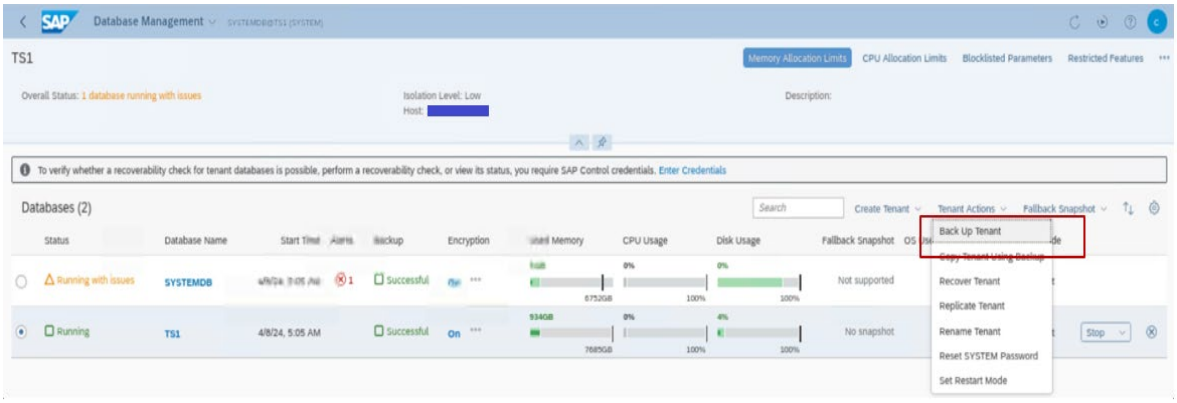

FIGURE 18. SAP HANA backup and recovery options for system and tenant database

Delta backup

Delta backup can be initiated from the SAP HANA cockpit. To initiate delta backup:

1. In SAP HANA cockpit, select database instance.
2. Select **Backup and Recovery → Backup System**.
3. In the Backup of System wizard, you can select "**Complete Data Backup"**, "**Differential Data Backup**", or "**Incremental Data Backup**" as shown in Figure 19.

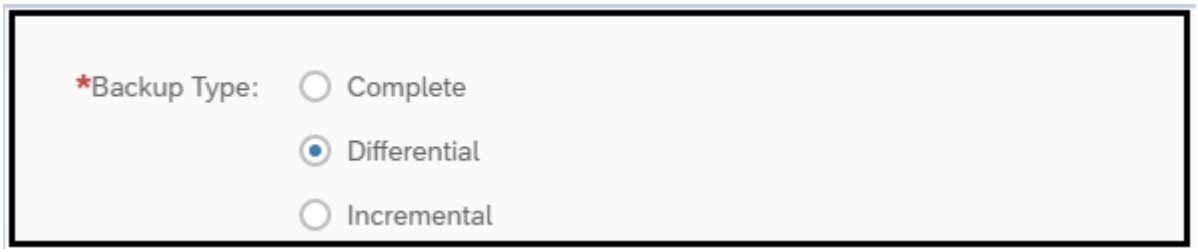

FIGURE 19. Delta backup settings in SAP HANA cockpit backup wizard

Multistreaming data backups

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

1. In SAP HANA Cockpit, go to the configuration tab, expand **global.ini →backup**. Search for "**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 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**" was set to 2048 as shown in Figure 18.

   In SAP HANA Cockpit, go to the configuration tab, expand **global.ini → backup**. Search for **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 128GB. In the lab tested environment, the value of **"parallel_data_backup_backint_channels**" is 10, as shown in Figure 20.

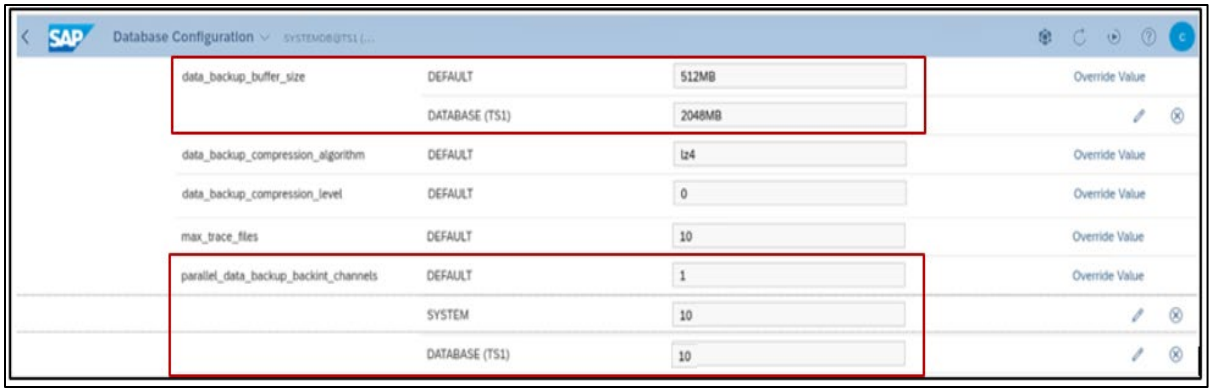

FIGURE 20. Backup parameter (parallel channels) configuration wizard

Figure 21 shows the backup progress of the TS1 instance from the cockpit server.

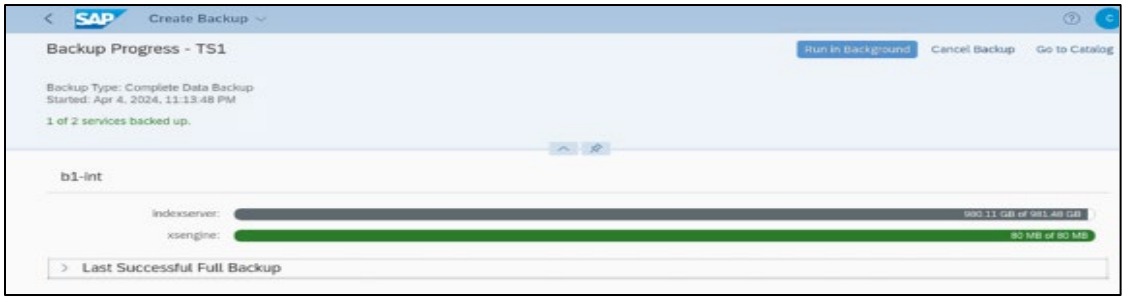

FIGURE 21. Backup operation wizard

SAP HANA database restore

To configure the SAP HANA database, restore, select the option “Search for the backup catalog in the default file system location” that shows the file-based and backint based backups.

Figure 22 and 23 show the restoration of the SAP HANA database with options.

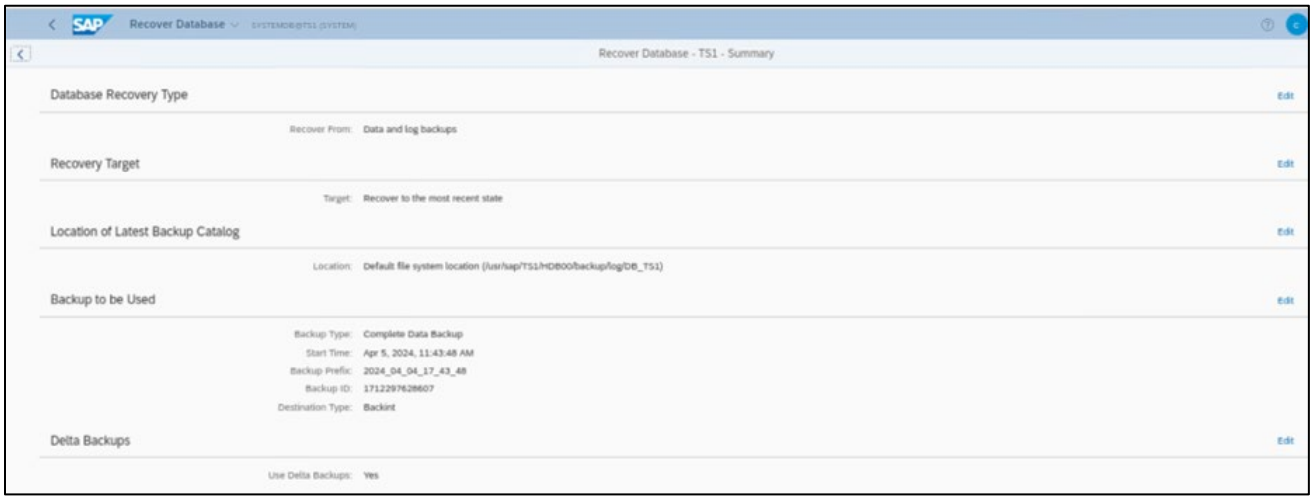

FIGURE 22. Recovery of SAP HANA database operations wizard (1/2)

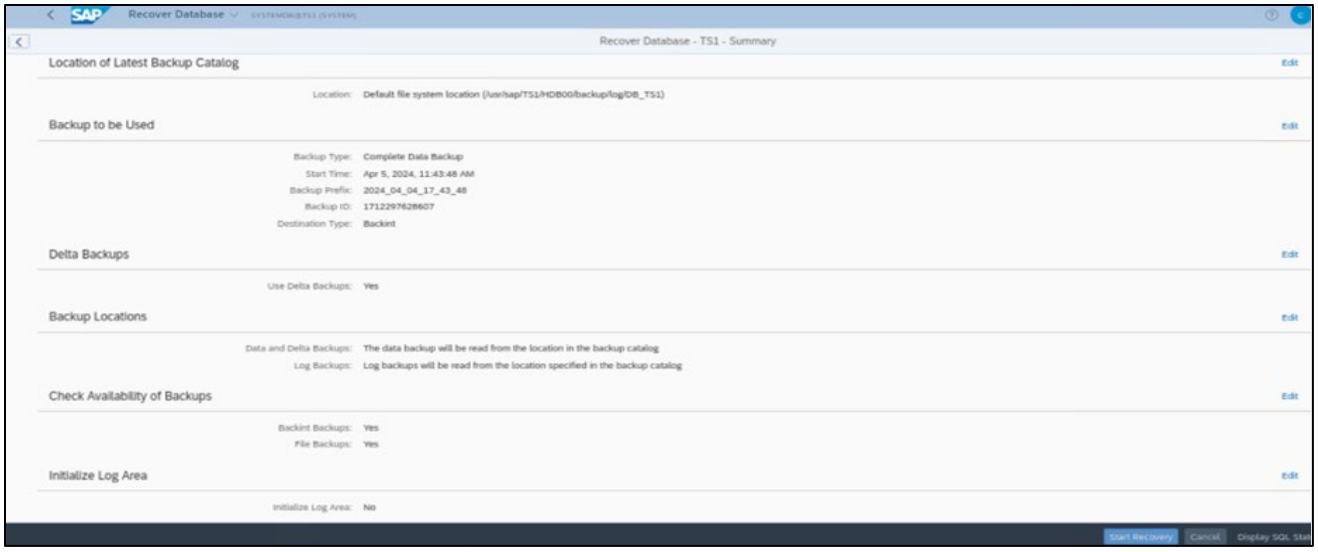

FIGURE 23. Recovery of SAP HANA database operations wizard (2/2)

Figure 24 shows the restoration completion of the SAP HANA database.

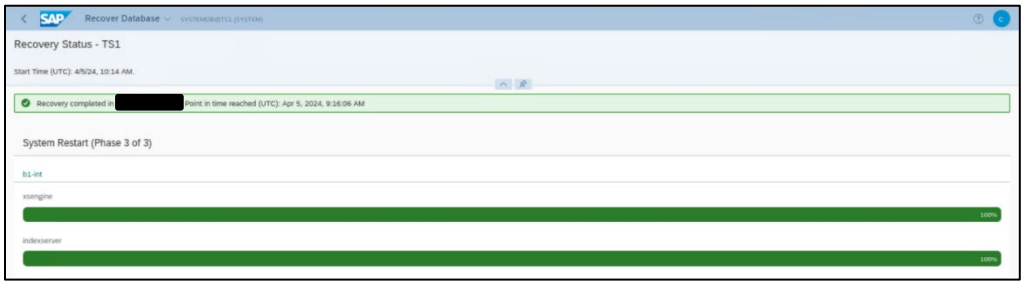

FIGURE 24. Recovery of SAP HANA database

SAP HANA cockpit configuration

SAP HANA cockpit supports 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 cockpit 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.

Steps to create a backup schedule using SAP HANA cockpit

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

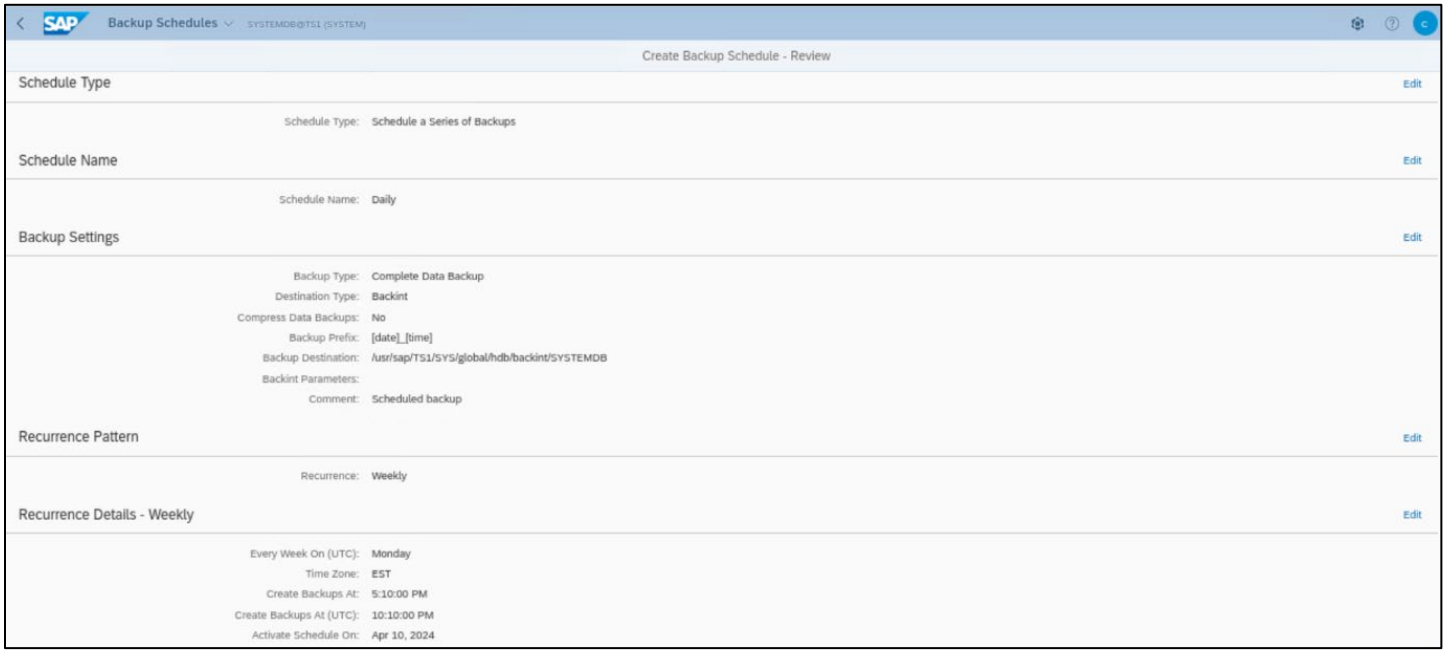

FIGURE 25. Scheduling a sample backup with SAP HANA cockpit

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 26.

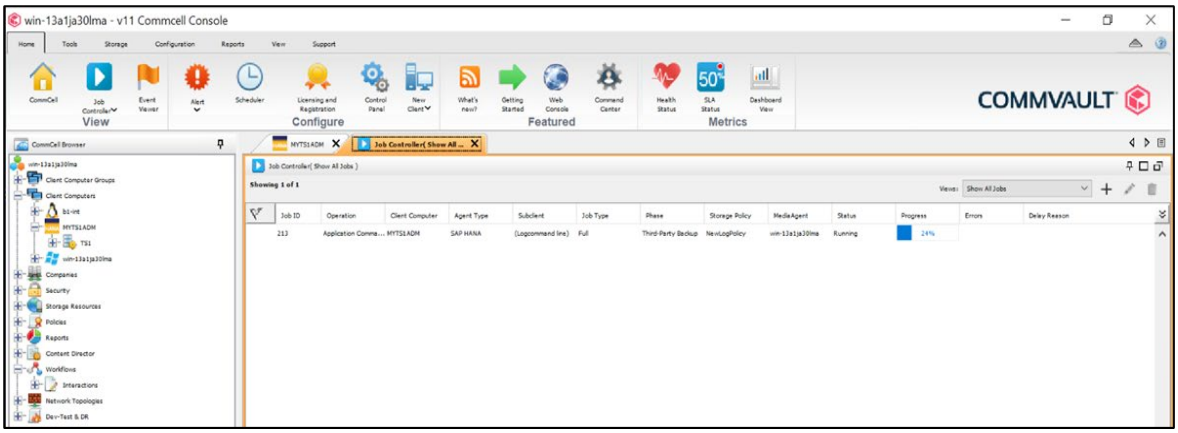

FIGURE 26. Commvault job controller window

SAP HANA database restore operation can be seen on Commvault CommCell server, by selecting the task on the home page, and select the "**Restore History**" as shown in Figure 27.

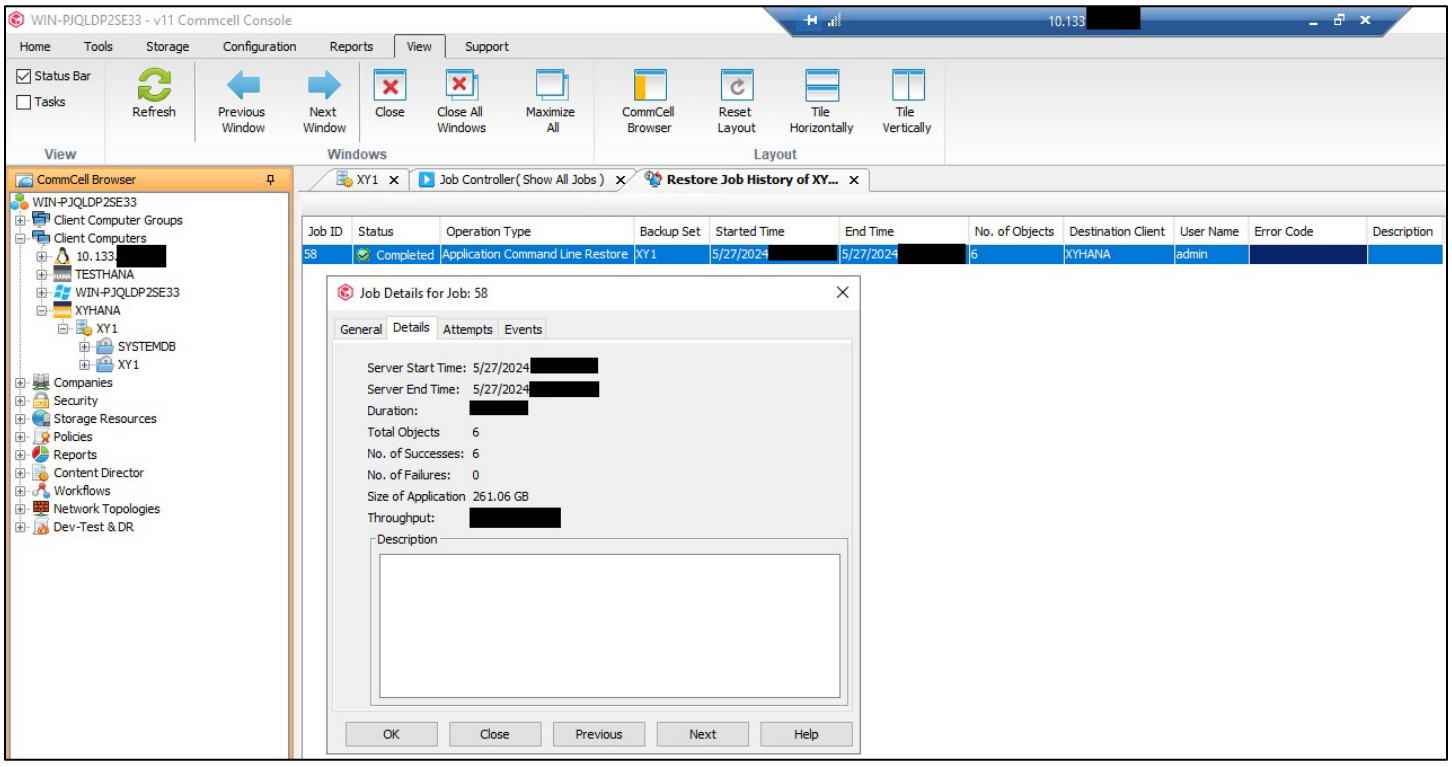

FIGURE 27. Commvault restoration job status

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 on time, 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 Compute Scale-up Server 3200 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 can share, compress, encrypt, multiplex, and deduplicate the data that is going to backup media.

As stated earlier, a customer may have a higher backup frequency if they have a lower recovery time objective 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 1. SAP HANA database backup and recovery 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 2. 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 clearly shows that the HPE StoreOnce 5200 is well suited for all HPE Compute Scale-up Server 3200s for SAP HANA that is in the range of 2.0 TB and 8 TB of memory. A requirement of ~8 TB seems 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. Table 3 shows the suggested backup strategy.

Workload description

Hewlett Packard Enterprise has performed extensive testing of backup and restore solution 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 network is running at 10Gbps speed. Multiple tests were performed in each environment. The SAP HANA database (TS1) was built to a size of approximately 1 TB on SLES 15 SP5 and RHEL 8.8 operating systems.

Workload data

Backups and backup speed are important factors and that should be able to complete in a reasonable amount of time. It is also very important that the restoration 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 the SAP HANA Cockpit. A restore can be from flat file backups or a Backint backup. Except for SAP HANA Indexserver, all the other jobs are very small and will be completed 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 the best performance and make sure the backup and restore happens flawlessly. Required tunables need to be applied in Commvault software and SAP HANA database to achieve the best performance.

NOTE

The backup and restore performance results depend on the setup and configuration used. As an example, backup and restore performance depends on the number of CPU sockets and memory of the CommCell server, network bonding configurations, and tunable in Commvault and SAP HANA databases such as the number of parallel backint channels, etc.

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 log 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 backup the system and all the tenant databases regularly. While recovering the system databases, the whole system (system database and all the tenant databases) needs to be shut down.
- Configure the SAP HANA data backups with multistreaming channel values up to 10 for maximum throughput on an HPE Compute Scale-up Server 3200 for SAP HANA Scale-up configurations.

SUMMARY

To summarize the common things across the industries which expect the data protection to be “Simple; Reliable; 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 of SAP HANA databases.

It is always important to have a good backup management strategy that helps to manage exponential data growth in a customer environment. This backup solution is a compelling solution for an SAP HANA 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 de-duplication
- 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 Recovery Time Objectives (RTO) and Recovery Point Objectives (RPO).

By reading this document, users can deploy this backup and recovery solution in an SAP HANA environment using HPE Compute Scale-up Server 3200, HPE StoreOnce 5200, and Commvault software. As discussed throughout this document, all 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 the most recommended backup and recovery solution in the market.

Implement 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 a Hewlett Packard Enterprise services representative (hpe.com/us/en/services/consulting.html) your Hewlett Packard Enterprise 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 Hewlett Packard Enterprise Reseller or Hewlett Packard Enterprise Sales Representative. For more details, see hpe.com/us/en/services/consulting.html

TABLE A1. Bill of materials (Lab tested environment)

Quantity	Description
1	HPE Compute Scale-up Server 3200 with Intel Sapphire Rapids processor
1	SLES 15 SP5 for SAP Applications
1	RHEL 8.8
1	Microsoft® Windows Server® 2022
1	HPE StoreOnce 5200
1	HPE ProLiant DL380 Gen11 Server
1	HPE Aruba 8325-32C 32-port 100G QSFP+/QSFP28 Switch
1	HPE Aruba 6300M 48-port 1GbE Switch
1	Commvault 2023E (11.32) (CommCell Server)[2]
1	SAP HANA 2.0 SPS 07

[2] Requires a license

APPENDIX B: COMMVAULT RECOMMENDATIONS FOR SAP HANA

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

Commvault media server Storage Policy configuration

1. To change the storage policy in the CommCell Browser.
2. Select **Policies → Storage Policy → Primary →** Select the **"Data Path Configuration" →** Select the **"Round-Robin between Data Paths" →Click OK.**

Figure B1 shows the Round-Robin data path selection on the Commvault storage policy. The same settings should be maintained across all policies.

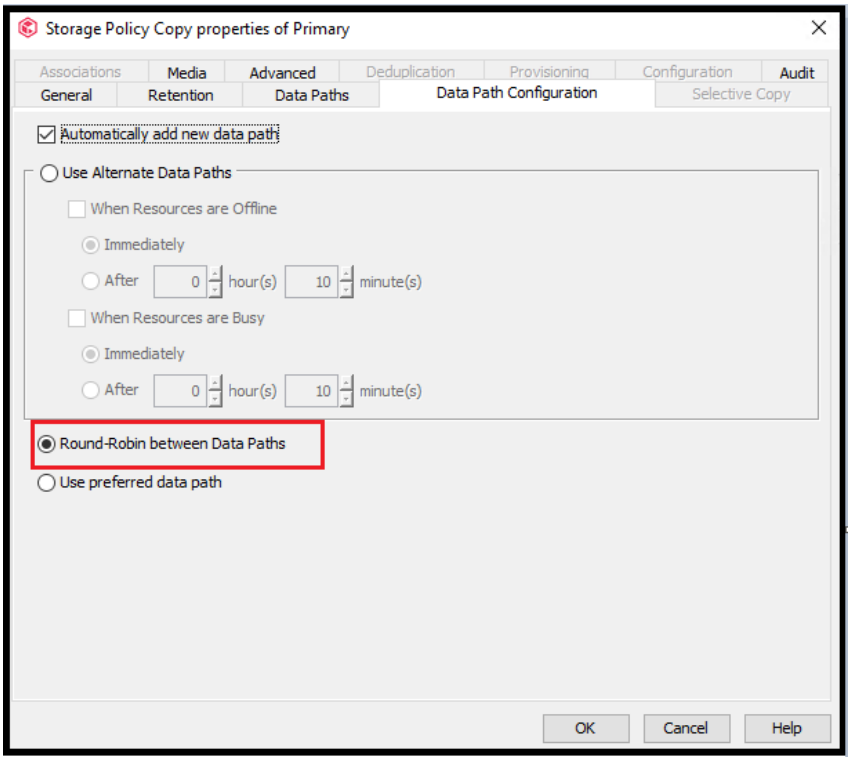

FIGURE B1. Commvault Storage policy configuration

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 C1 were used in the Hewlett Packard Enterprise lab test environment.

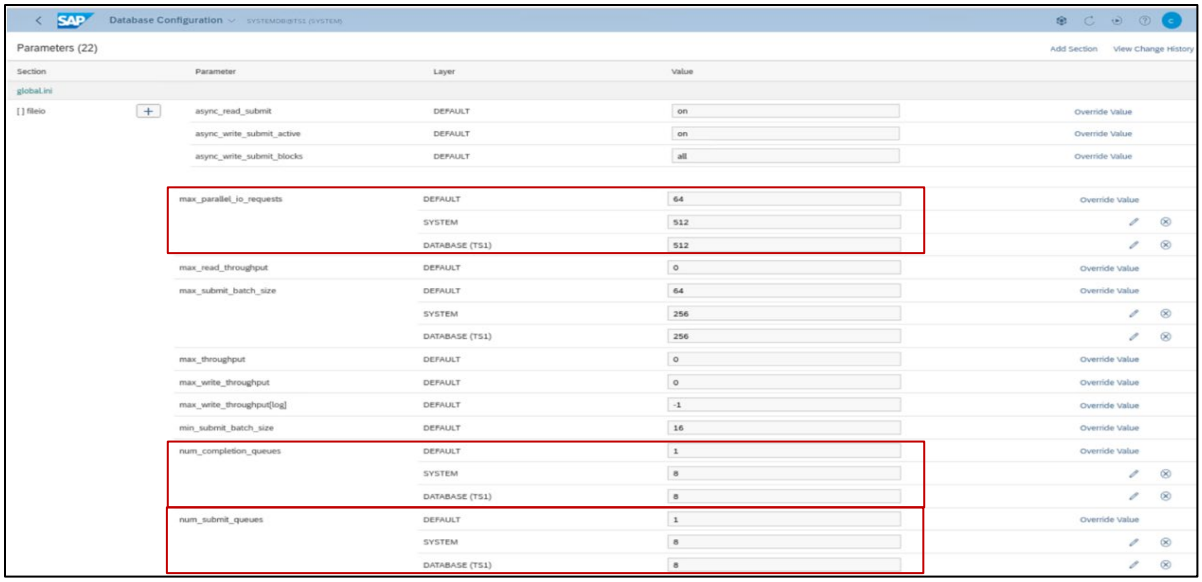

FIGURE C1. SAP HANA database parameters for backint backup

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 POINT

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 Compute Scale-up Server 3200 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 D1 lists the features of the HPE StoreOnce 5200 model that is recommended for backing up SAP HANA.

TABLE D1. 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 System - Product Information Reference.

APPENDIX E: COMMVAULT SOFTWARE UPDATE

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

APPENDIX F: COCKPIT BACKUP AND RECOVERY

It is recommended that backing up the SAP HANA cockpit regularly is important to minimize data loss in the event of a disaster. Following are the procedures to backup and restore the SAP HANA cockpit.

Cockpit Backup

- Install and configure Commvault client software on the cockpit server, the procedure is as same as configuring it for an SAP HANA server
- Configure backint for TS1 instance, the procedure is as same as configuring it for a regular SAP HANA instance.
- Register the TS1 instance of the cockpit server to the same or different cockpit instance.
- Initiate a backint backup from the cockpit server.

The successful "backint" backup of the TS1 instance of the cockpit server shows in Figure F1.

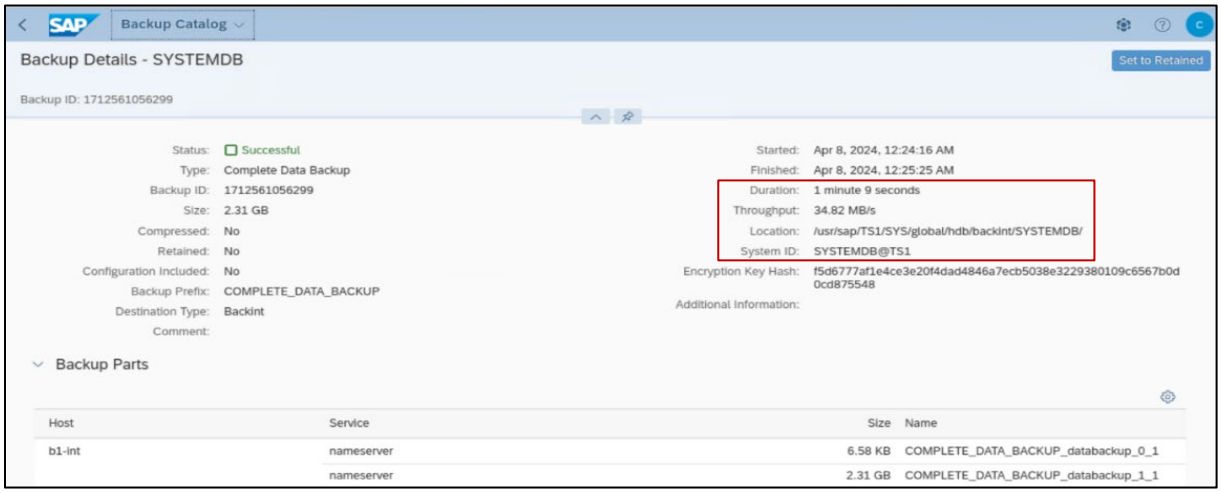

FIGURE F1. Backint backup status of the TS1 instance

Cockpit Restore

In the case of restoring the cockpit instance, it is not possible to initiate restoration using the same cockpit as it requires the H4C instance to be stopped. Following the example cockpit restoration using the command prompt:

1. Login as h4cadm on the cockpit server and stop the H4C instance.

```
h4cadm@hcs:/usr/sap/H4C/HDB96> HDB stop
hdbdaemon will wait maximal 300 seconds for NewDB services finishing.
```

```
Stopping instance using: /usr/sap/H4C/SYS/exe/hdb/sapcontrol -prot NI_HTTP -nr 96 -function Stop
400 08.04.2024 01:37:28

Stop OK

Waiting for stopped instance using: /usr/sap/H4C/SYS/exe/hdb/sapcontrol -prot NI_HTTP -nr 96 -
function WaitforStopped 600 2

08.04.2024 01:37:49

WaitforStopped OK

hdbdaemon is stopped.
```

2. Initiate the restore from the command prompt shown as follows:

```
h4cadm@hcs:/usr/sap/H4C/HDB96>h4cadm@hcs:/usr/sap/H4C/HDB96> HDBSettings.sh recoverSys.py --silent
-- command="RECOVER DATA USING BACKUP_ID 1606837195089 USING CATALOG PATH

('/usr/sap/H4C/HDB96/backup/log/SYSTEMDB') USING DATA PATH
('/usr/sap/H4C/SYS/global/hdb/backint/SYSTEMDB') CLEAR LOG" --masterOnly

using logfile /usr/sap/H4C/HDB96/hcs/trace/backup.log

recoverSys started: ============2024-04-06 22:55:04 ============

testing master: hcs hcs is master

creating file recoverInstance.sql restart database

restart master nameserver: 2024-04-06 22:55:04 start system: hcs

sapcontrol parameter: ['-function', 'Start'] sapcontrol returned successfully:

2024-04-06T22:58:38-05:00       P247637       1762196edb9 INFO     RECOVERY RECOVER DATA finished

successfully

recoverSys finished successfully: 2024-04-06 22:58:39 h4cadm@hcs:/usr/sap/H4C/HDB96
```

APPENDIX G: NETWORK BONDING RECOMMENDATIONS

It is recommended that the mode 802.3ad and xmit_hash_policy=layer3+4 is set on both the LAN switches and operating system for the backup traffic. Edit the bonding configuration file /etc/sysconfig/network/ifcfg-bondX in SLES or /etc/sysconfig/network-scripts/ifcfg-bondX file in RHEL with "xmit_hash_policy=layer3+4" in the BONDING_MODULE_OPTS line as follows:

```
BONDING_MODULE_OPTS='mode=802.3ad  miimon=100  xmit_hash_policy=layer3+4'
```

GLOSSARY

CommCell server/media server – Windows management 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/

SAP HANA best practices guide from Commvault, https://documentation.commvault.com/2023e/expert/sap_hana_best_practices.html

Commvault Support for HPE StoreOnce, https://documentation.commvault.com/2023e/expert/support_for_hpe_storeonce_catalyst_storage.html

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

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