

## **Backup, Restore and Disaster Recovery**

NetApp solutions for SAP

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# **Backup, Restore and Disaster Recovery**

# SAP HANA on Amazon FSx for NetApp ONTAP - Backup and recovery with SnapCenter

# TR-4926: SAP HANA on Amazon FSx for NetApp ONTAP - Backup and recovery with SnapCenter

This technical report provides best practices for SAP HANA data protection on Amazon FSx for NetApp ONTAP and NetApp SnapCenter. This document covers SnapCenter concepts, configuration recommendations, and operation workflows, including configuration, backup operations, and restore and recovery operations.

Author: Nils Bauer, NetApp

Companies today require continuous, uninterrupted availability for their SAP applications. They expect consistent performance levels in the face of ever-increasing volumes of data and the need for routine maintenance tasks, such as system backups. Performing backups of SAP databases is a critical task and can have a significant performance impact on the production SAP system.

Backup windows are shrinking while the amount of data to be backed up is increasing. Therefore, it is difficult to find a time when you can perform backups with minimal effect on business processes. The time needed to restore and recover SAP systems is a concern because downtime for SAP production and nonproduction systems must be minimized to reduce cost to the business.

## Backup and recovery using Amazon FSx for ONTAP

You can use NetApp Snapshot technology to create database backups in minutes.

The time needed to create a Snapshot copy is independent of the size of the database because a Snapshot copy does not move any physical data blocks on the storage platform. In addition, the use of Snapshot technology has no performance effect on the live SAP system. Therefore, you can schedule the creation of Snapshot copies without considering peak dialog or batch activity periods. SAP and NetApp customers typically schedule multiple online Snapshot backups during the day; for example, every six hours is common. These Snapshot backups are typically kept for three to five days on the primary storage system before being removed or tiered to cheaper storage for long term retention.

Snapshot copies also provide key advantages for restore and recovery operations. NetApp SnapRestore technology enables the restoration of an entire database or, alternatively, just a portion of a database to any point in time, based on the currently available Snapshot copies. Such restore processes are finished in a few seconds, independent of the size of the database. Because several online Snapshot backups can be created during the day, the time needed for the recovery process is significantly reduced relative to a traditional once per day backup approach. Because you can perform a restore with a Snapshot copy that is at most only a few hours old (rather than up to 24 hours), fewer transaction logs must be applied during forward recovery. Therefore, the RTO is reduced to several minutes rather than the several hours required for conventional streaming backups.

Snapshot copy backups are stored on the same disk system as the active online data. Therefore, NetApp recommends using Snapshot copy backups as a supplement rather than a replacement for backups to a secondary location. Most restore and recovery actions are managed by using SnapRestore on the primary storage system. Restores from a secondary location are only necessary if the primary storage system

containing the Snapshot copies is damaged. You can also use the secondary location if it is necessary to restore a backup that is no longer available on the primary location.

A backup to a secondary location is based on Snapshot copies created on the primary storage. Therefore, the data is read directly from the primary storage system without generating load on the SAP database server. The primary storage communicates directly with the secondary storage and replicates the backup data to the destination by using the NetApp SnapVault feature.

SnapVault offers significant advantages when compared to traditional backups. After an initial data transfer, in which all data has been transferred from the source to the destination, all subsequent backups copy only move the changed blocks to the secondary storage. Therefore, the load on the primary storage system and the time needed for a full backup are significantly reduced. Because SnapVault stores only the changed blocks at the destination, any additional full database backups consume significantly less disk space.

#### Runtime of Snapshot backup and restore operations

The following figure shows a customer's HANA Studio using Snapshot backup operations. The image shows that the HANA database (approximately 4TB in size) is backed up in 1 minute and 20 seconds by using Snapshot backup technology and more than 4 hours with a file-based backup operation.

The largest part of the overall backup workflow runtime is the time needed to execute the HANA backup save point operation, and this step is dependent on the load on the HANA database. The storage Snapshot backup itself always finishes in a couple of seconds.

Stat	Started	Duration	Size	Backup Ty	Destinati
•	Jan 11, 2022 10:26:59 AM	00h 01m 17s	4.51 TB	Data Back	Snapshot
0	Jan 11, 2022 8:40:02 AM	00h 27m 11s	4.51 TB	Data Back	Snapshot
•	Jan 11, 2022 1:00:58 AM	04h 05m 39s	3.82 TB	Data Back	File
8	Jan 9, 2022 4:40:03 PM	00h 01m 23s	4.51 TB	Data Back	Snapshot
8	Jan 9, 2022 8:00:02 AM	02h 39m 04s	3.82 TB	Data Back	File
8	Jan 9. 2022 12:40:03 AM	00h 01m 18s	4.51 TB	Data Back	Snapshot
•	Jan 8, 2022 4:40:03 PM	00h 01m 18s	4.51 TB	Data Back	Snapshot
•	Jan 8, 2022 8:40:03 AM	00h 01m 22s	4.51 TB	Data Back	Snapshot
8	Jan 8, 2022 12:40:03 AM	00h 01m 19s	4.51 TB	Data Back	Snapshot
•	Jan 7, 2022 4:40:03 PM	00h 01m 19s	4.51 TB	Data Back	Snapshot
	Jan 7, 2022 8:40:02 AM	00h 01m 19s	4.51 TB	Data Back	Snapshot
•	Jan 7, 2022 12:40:02 AM	00h 01m 20s	4.51 TB	Data Back	Snapshot
8	Jan 6, 2022 4:40:02 PM	00h 01m 18s	4.51 TB	Data Back	Snapshot
•	Jan 6, 2022 8:40:03 AM	00h 01m 17s	4.51 TB	Data Back	Snapshot
8	Jan 6, 2022 12:40:03 AM	00h 01m 19s	4.51 TB	Data Back	Snapshot
8	Jan 5, 2022 4:40:03 PM	00h 01m 19s	4.51 TB	Data Back	Snapshot

File-based back (~270 MB/s three		ours 05 mir	١
04h 05m 39s	3.82 TB	Data Back F	ile
Snapshot back	up: 1 m	nin 20 sec	
00h 01m 18s	4.51 TB	Data Back	Snapshot
00h 01m 22s	4.51 TB	Data Back	Snapshot
00h 01m 19s	4.51 TB	Data Back	Snapshot

## Backup runtime reduced by 99%

#### Recovery time objective comparison

This section provides a recovery time objective (RTO) comparison of file-based and storage-based Snapshot backups. The RTO is defined by the sum of the time needed to restore, recover, and then start the database.

#### Time needed to restore database

With a file-based backup, the restore time depends on the size of the database and backup infrastructure, which defines the restore speed in megabytes per second. For example, if the infrastructure supports a restore operation at a speed of 250MBps, it takes approximately 4.5 hours to restore a database 4TB in size on the persistence.

With storage Snapshot copy backups, the restore time is independent of the size of the database and is always

in the range of a couple of seconds.

#### Time needed to start database

The database start time depends on the size of the database and the time needed to load the data into memory. In the following examples, it is assumed that the data can be loaded with 1000MBps. Loading 4TB into memory takes around 1hour and 10 minutes. The start time is the same for a file-based and Snapshot based restore and recovery operations.

#### Time needed to recover database

The recovery time depends on the number of logs that must be applied after the restore. This number is determined by the frequency at which data backups are taken.

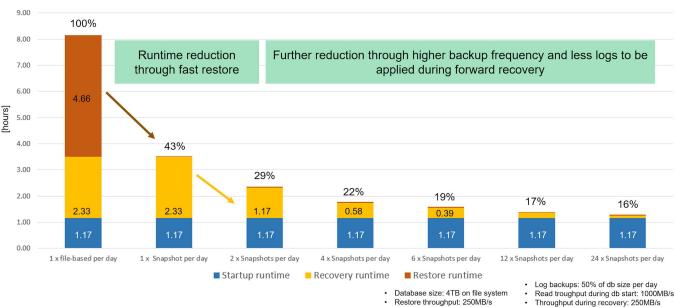
With file-based data backups, the backup schedule is typically once per day. A higher backup frequency is normally not possible, because the backup degrades production performance. Therefore, in the worst case, all the logs that were written during the day must be applied during forward recovery.

Snapshot backups are typically scheduled with a higher frequency because they do not influence the performance of the SAP HANA database. For example, if Snapshot backups are scheduled every six hours, the recovery time would be, in the worst case, one-fourth of the recovery time for a file-based backup (6 hours / 24 hours = .25).

The following figure shows a comparison of restore and recovery operations with a daily file-based backup and Snapshot backups with different schedules.

The first two bars show that even with a single Snapshot backup per day, the restore and recovery is reduced to 43% due to the speed of the restore operation from a Snapshot backup. If multiple Snapshot backups per day are created, the runtime can be reduced further because less logs need to be applied during forward recovery.

The following figure also shows that four to six Snapshot backups per day makes the most sense, because a higher frequency does not have a big influence on the overall runtime anymore.



## Restore and Recovery of a 4TB HANA Database (8TB RAM)

3

Throughput during recovery: 250MB/s

## Use cases and values of accelerated backup and cloning operations

Executing backups is a critical part of any data protection strategy. Backups are scheduled on a regular basis to ensure that you can recover from system failures. This is the most obvious use case, but there are also other SAP lifecycle management tasks, where accelerating backup and recovery operations is crucial.

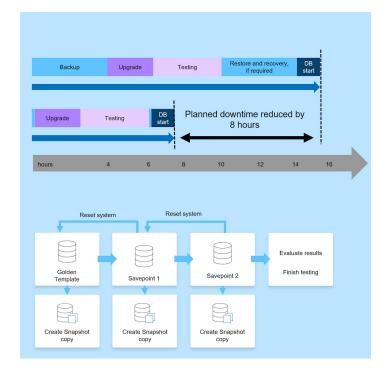
SAP HANA system upgrade is an example of where an on-demand backup before the upgrade and a possible restore operation if the upgrade fails has a significant impact on the overall planned downtime. With the example of a 4TB database, you can reduce the planned downtime by 8 hours by using the Snapshot-based backup and restore operations.

Another use case example would be a typical test cycle, where testing must be done over multiple iterations with different data sets or parameters. When leveraging the fast backup and restore operations, you can easily create save points within your test cycle and reset the system to any of these previous save points if a test fails or needs to be repeated. This enables testing to finish earlier or enables more testing at the same time and improves test results.

# Use Cases for Backup and Recovery Operations

#### Accelerate HANA system upgrade operations

- Fast on-demand backup before HANA system upgrade
- Fast restore operation in case of an upgrade failure
- Reduction of planned downtime



- Acclerate test cycles
  - Fast creation of savepoints after a successful step
  - Fast reset of system to any savepoint
  - Repeat step until successful

When Snapshot backups have been implemented, they can be used to address multiple other use cases, which require copies of a HANA database. With FSx for ONTAP, you can create a new volume based on the content of any available Snapshot backup. The runtime of this operation is a few seconds, independent of the size of the volume.

The most popular use case is the SAP System Refresh, where data from the production system needs to be copied to the test or QA system. By leveraging the FSx for ONTAP cloning feature, you can provision the volume for the test system from any Snapshot copy of the production system in a matter of seconds. The new volume then must be attached to the test system and the HANA database recovered.

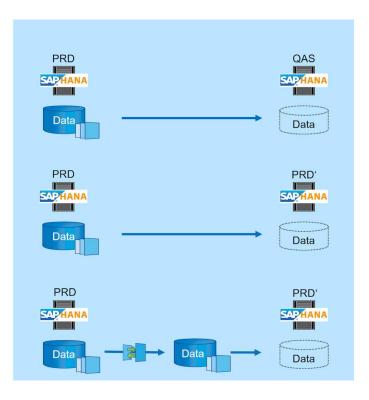
The second use case is the creation of a repair system, which is used to address a logical corruption in the production system. In this case, an older Snapshot backup of the production system is used to start a repair system, which is an identical clone of the production system with the data before the corruption occurred. The repair system is then used to analyze the problem and export the required data before it was corrupted.

The last use case is the ability to run a disaster recover failover test without stopping the replication and therefore without influencing RTO and recovery point objective (RPO) of the disaster recovery setup. When

FSx for ONTAP NetApp SnapMirror replication is used to replicate the data to the disaster recovery site, the production Snapshot backups are available at the disaster recovery site as well and can then be used to create a new volume for disaster recover testing.

## **Use Cases for Cloning Operations**

- · SAP System Refresh
  - Fast creation of a new volume based on a production
     Snapshot backup
  - Attach volume to the test system and recover HANA database with SID change
- Repair System creation to address logical corruption
  - Fast creation of a new volume based on a production Snapshot backup
  - Attach volume to the repair system and recover HANA database w/o SID change
- Disaster Recovery testing
  - Combined with SnapMirror Replication
  - Attach storage clone from a replicated production Snapshot backup to a DR test system



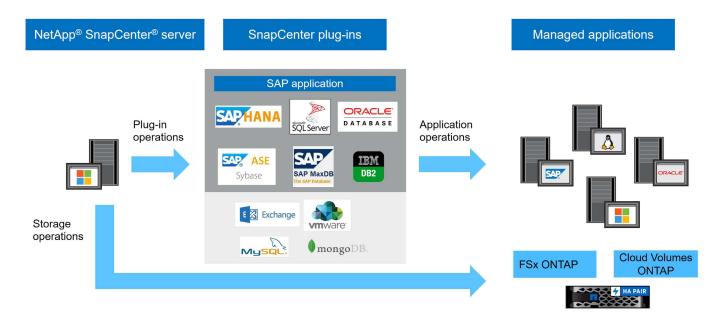
## **SnapCenter architecture**

SnapCenter is a unified, scalable platform for application-consistent data protection. SnapCenter provides centralized control and oversight, while delegating the ability for users to manage application-specific backup, restore, and clone jobs. With SnapCenter, database and storage administrators learn a single tool to manage backup, restore, and cloning operations for a variety of applications and databases.

SnapCenter manages data across endpoints in the data fabric powered by NetApp. You can use SnapCenter to replicate data between on-premises environments; between on-premises environments and the cloud; and between private, hybrid, or public clouds.

## **SnapCenter components**

SnapCenter includes the SnapCenter Server, the SnapCenter Plug-In Package for Windows, and the SnapCenter Plug-In Package for Linux. Each package contains plug-ins to SnapCenter for various applications and infrastructure components.



## SnapCenter SAP HANA backup solution

The SnapCenter backup solution for SAP HANA covers the following areas:

- Backup operations, scheduling, and retention management
  - SAP HANA data backup with storage-based Snapshot copies
  - Non-data volume backup with storage-based Snapshot copies (for example, /hana/shared)
  - Database block integrity checks using a file-based backup
  - · Replication to an off-site backup or disaster recovery location
- · Housekeeping of the SAP HANA backup catalog
  - For HANA data backups (Snapshot and file-based)
  - For HANA log backups
- · Restore and recovery operations
  - Automated restore and recovery
  - · Single tenant restore operations for SAP HANA (MDC) systems

Database data file backups are executed by SnapCenter in combination with the plug-in for SAP HANA. The plug-in triggers the SAP HANA database backup save point so that the Snapshot copies, which are created on the primary storage system, are based on a consistent image of the SAP HANA database.

SnapCenter enables the replication of consistent database images to an off-site backup or disaster recovery location by using SnapVault or the SnapMirror feature. Typically, different retention policies are defined for backups at primary and at the off-site backup storage. SnapCenter handles the retention at primary storage, and ONTAP handles the retention at the off-site backup storage.

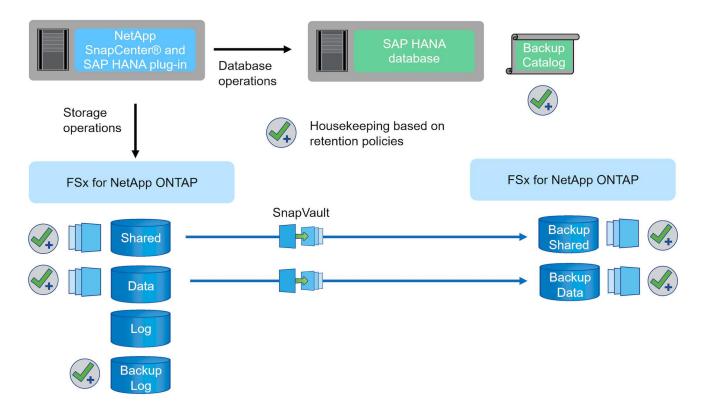
To allow a complete backup of all SAP HANA-related resources, SnapCenter also enables you to back up all non-data volumes by using the SAP HANA plug-in with storage-based Snapshot copies. You can schedule non-data volumes independently from the database data backup to enable individual retention and protection policies.

SAP recommends combining storage-based Snapshot backups with a weekly file-based backup to execute a

block integrity check. You can execute the block integrity check from within SnapCenter. Based on your configured retention policies, SnapCenter manages the housekeeping of data file backups at the primary storage, log file backups, and the SAP HANA backup catalog.

SnapCenter handles the retention at primary storage, while FSx for ONTAP manages secondary backup retention.

The following figure shows an overview of the SnapCenter backup and retention management operations.



When executing a storage-based Snapshot backup of the SAP HANA database, SnapCenter performs the following tasks:

- 1. Creates an SAP HANA backup save point to create a consistent image on the persistence layer.
- 2. Creates a storage-based Snapshot copy of the data volume.
- 3. Registers the storage- based Snapshot back up in the SAP HANA backup catalog.
- 4. Releases the SAP HANA backup save point.
- 5. Executes a SnapVault or SnapMirror update for the data volume, if configured.
- 6. Deletes storage Snapshot copies at the primary storage based on the defined retention policies.
- 7. Deletes SAP HANA backup catalog entries if the backups do not exist anymore at the primary or off-site backup storage.
- 8. Whenever a backup has been deleted based on the retention policy or manually, SnapCenter also deletes all log backups that are older than the oldest data backup. Log backups are deleted on the file system and in the SAP HANA backup catalog.

## Scope of this document

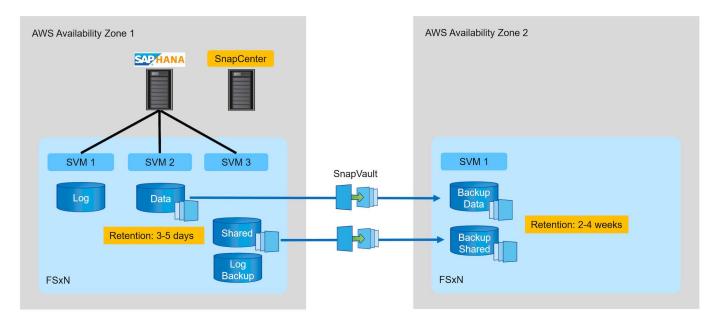
This document describes the most common SnapCenter configuration option for an SAP HANA MDC single host system with a single tenant on FSx for ONTAP. Other configuration options are possible and, in some

cases, required for specific SAP HANA systems, for example, for a multiple host system. For a detailed description about other configuration options, see SnapCenter concepts and best practices (netapp.com).

In this document, we use the Amazon Web Services (AWS) console and the FSx for ONTAP CLI to execute the required configuration steps on the storage layer. You can also use NetApp Cloud Manager to manage FSx for ONTAP, but this is out of scope for this document. For information about using NetApp Cloud Manager for FSx for ONTAP, see Learn about Amazon FSx for ONTAP (netapp.com).

## Data protection strategy

The following figure shows a typical backup architecture for SAP HANA on FSx for ONTAP. The HANA system is located in the AWS availability zone 1 and is using an FSx for ONTAP file system within the same availability zone. Snapshot backup operations are executed for the data and the shared volume of the HANA database. In addition to the local Snapshot backups, which are kept for 3-5 days, backups are also replicated to an offsite storage for longer term retention. The offsite backup storage is a second FSx for ONTAP file system located in a different AWS availability zone. Backups of the HANA data and shared volume are replicated with SnapVault to the second FSx for ONTAP file system and are kept for 2-3 weeks.



Before configuring SnapCenter, the data protection strategy must be defined based on the RTO and RPO requirements of the various SAP systems.

A common approach is to define system types such as production, development, test, or sandbox systems. All SAP systems of the same system type typically have the same data protection parameters.

The following parameters must be defined:

- · How often should a Snapshot backup be executed?
- · How long should Snapshot copy backups be kept on the primary storage system?
- · How often should a block integrity check be executed?
- · Should the primary backups be replicated to an off-site backup site?
- · How long should the backups be kept at the off-site backup storage?

The following table shows an example of data protection parameters for the system types: production, development, and test. For the production system, a high backup frequency has been defined, and the backups are replicated to an off-site backup site once per day. The test systems have lower requirements and

no replication of the backups.

Parameters	Production systems	Development systems	Test systems
Backup frequency	Every 6 hours	Every 6 hours	Every 6 hours
Primary retention	3 days	3 days	3 days
Block integrity check	Once per week	Once per week	No
Replication to off-site backup site	Once per day	Once per day	No
Off-site backup retention	2 weeks	2 weeks	Not applicable

The following table shows the policies that must be configured for the data protection parameters.

Parameters	Policy LocalSnap	Policy LocalSnapAndSnapVaul t	Policy BlockIntegrityCheck
Backup type	Snapshot based	Snapshot based	File based
Schedule frequency	Hourly	Daily	Weekly
Primary retention	Count = 12	Count = 3	Count = 1
SnapVault replication	No	Yes	Not applicable

The policy LocalSnapshot is used for the production, development, and test systems to cover the local Snapshot backups with a retention of two days.

In the resource protection configuration, the schedule is defined differently for the system types:

- Production: Schedule every 4 hours.
- Development: Schedule every 4 hours.
- Test: Schedule every 4 hours.

The policy LocalSnapAndSnapVault is used for the production and development systems to cover the daily replication to the off-site backup storage.

In the resource protection configuration, the schedule is defined for production and development:

- Production: Schedule every day.
- Development: Schedule every day. The policy BlockIntegrityCheck is used for the production and development systems to cover the weekly block integrity check by using a file-based backup.

In the resource protection configuration, the schedule is defined for production and development:

- · Production: Schedule every week.
- Development: Schedule every week.

For each individual SAP HANA database that uses the off-site backup policy, you must configure a protection relationship on the storage layer. The protection relationship defines which volumes are replicated and the retention of backups at the off-site backup storage.

With the following example, for each production and development system, a retention of two weeks is defined at the off-site backup storage.

In this example, protection policies and retention for SAP HANA database resources and non- data volume resources are not different.

## Example lab setup

The following lab setup was used as an example configuration for the rest of this document.

HANA system PFX:

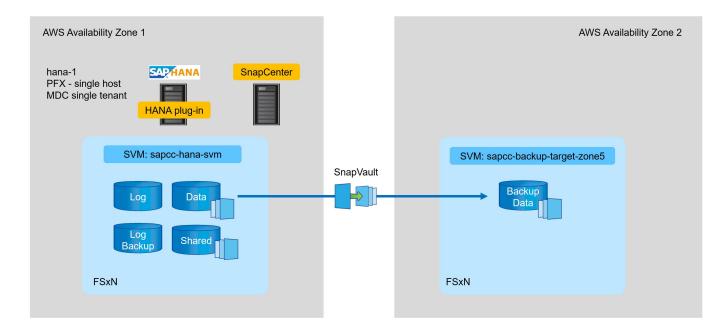
- · Single host MDC system with a single tenant
- HANA 2.0 SPS 6 revision 60
- SLES for SAP 15SP3

## SnapCenter:

- Version 4.6
- HANA and Linux plug-in deployed on a HANA database host

FSx for ONTAP file systems:

- Two FSx for ONTAP file systems with a single storage virtual machine (SVM)
- Each FSx for ONTAP system in a different AWS availability zone
- HANA data volume replicated to the second FSx for ONTAP file system



## **SnapCenter configuration**

You must perform the steps in this section for base SnapCenter configuration and the protection of the HANA resource.

## **Overview configuration steps**

You must perform the following steps for base SnapCenter configuration and the protection of the HANA resource. Each step is described in detail in the following chapters.

- 1. Configure SAP HANA backup user and hdbuserstore key. Used to access the HANA database with the hdbsql client.
- 2. Configure storage in SnapCenter. Credentials to access the FSx for ONTAP SVMs from SnapCenter
- 3. Configure credentials for plug-in deployment. Used to automatically deploy and install the required SnapCenter plug-ins on the HANA database host.
- 4. Add HANA host to SnapCenter. Deploys and installs the required SnapCenter plug-ins.
- 5. Configure policies. Defines the backup operation type (Snapshot, file), retentions, as well asoptional Snapshot backup replication.
- 6. Configure HANA resource protection. Provide hdbuserstore key and attach policies and schedules to the HANA resource.

## SAP HANA backup user and hdbuserstore configuration

NetApp recommends configuring a dedicated database user in the HANA database to run the backup operations with SnapCenter. In the second step, an SAP HANA user store key is configured for this backup user, and this user store key is used in the configuration of the SnapCenter SAP HANA plug-in.

The following figure shows the SAP HANA Studio through which you can create the backup user

The required privileges are changed with the HANA 2.0 SPS5 release: backup admin, catalog read, database backup admin, and database recovery operator. For earlier releases, backup admin and catalog read are sufficient.

For an SAP HANA MDC system, you must create the user in the system database because all backup commands for the system and the tenant databases are executed by using the system database.

hdbstudio - /Security/Users/SNAPCENTER System: SYSTEMDB@PF	X Host: hana-1 Instance: 00 Connected User: SYSTEM Sy	stem Usage: Test System - SAP HANA Studio		- 🗆 X
<u>File Edit Navigate Search Run Window H</u> elp				
□ · · · · · · · · · · · · · · · · · · ·				९ 🔡 隊
😭 Systems × 📑 🕶 🖬 🔹 🚥 🖨 🗧 🔯 🖇 📟 🗆	Backup SYSTEMDB@PFX (SYS	TEM) HANA2.0 SPS5 🛛 👪 SYSTEMDB@PFX	🎄 SYSTEMDB@PFX − SNAPCENTER 🗡	
PFX@PFX (SYSTEM) HANA2.0 SPS5     SYSTEMDB@PFX (SYSTEM) HANA2.0 SPS5	SYSTEMDB@PFX (SYSTEM) HANA2.0	SPS5 hana-1 00		🕞 🏇 🔍 🦑
Backup	i User 'SNAPCENTER' created			0
> Catalog	A OSEI SIVAPCEIVIER Cleated			•
> C Provisioning	User User Parameters			
✓ ➢ Security				^
📒 Security	SNAPCENTER			
✓ Monopolity Users	Disable ODBC/JDBC access			
SAPDBCTRL				
SNAPCENTER	Authentication			
§ SYS	✓ Password		SAML SAP Logon Ticket	
SYSTEM	Password*:	Confirm*:	Configure	
XSSQLCC_AUTO_USER_3094F258A8978F7A7558E080D XSSQLCC_AUTO_USER_5E2492DBCDEDAE8BF85A0EA;	Force password change on next logon: 🔿 Yes	No		
XSSQLCC_AUTO_USER_D5D3B0C4F06A79377BE0D419	C Kerberos		X509 SAP Assertion Ticket	
SYS ADVISOR	External ID*:			
🖞 _SYS_AFL		-		
_SYS_DATA_ANONYMIZATION	Valid From: Feb 21, 2022, 3:08:28 PM GM	r 😢 🧱 Valid Until:		
_SYS_EPM	Session Client:			
SYS_PLAN_STABILITY				
SYS_REPO				
_SYS_SQL_ANALYZER    SYS_STATISTICS	Granted Roles System Privileges Object Privileges	Analytic Privileges Application Privileges Privile		
SYS TABLE REPLICAS	÷ ×			
SYS TASK	System Privilege	Grantor		
SYS_WORKLOAD_REPLAY	BACKUP ADMIN	SYSTEM	Grantable to other users and roles	
> 🙀 Roles	🖙 CATALOG READ	SYSTEM		
	DATABASE BACKUP ADMIN DATABASE RECOVERY OPERATOR	SYSTEM SYSTEM		
	COVERT OPERATOR	STSTEW		
				~
	Properties × 🥺 Error Log			🖬 🖬 🖓 🗔 🗔 📷 🗯 🗖 🗖
	Property	Value		
< >>				
		SYSTE	EMDB@PFX hana-1 00 (SYSTEM):SYSTEM	

The following command is used for the user store configuration with the <sid>adm user:

hdbuserstore set <key> <host>:<port> <database user> <password>

SnapCenter uses the <sid>adm user to communicate with the HANA database. Therefore, you must configure the user store key by using the <`sid>adm` user on the database host. Typically, the SAP HANA hdbsql client software is installed together with the database server installation. If this is not the case, you must install the hdbclient first.

In an SAP HANA MDC setup, port 3<instanceNo>13 is the standard port for SQL access to the system database and must be used in the hdbuserstore configuration.

For an SAP HANA multiple-host setup, you must configure user store keys for all hosts. SnapCenter tries to connect to the database by using each of the provided keys and can therefore operate independently of a failover of an SAP HANA service to a different host. In our lab setup, we configured a user store key for the user pfxadm for our system PFX, which is a single host HANA MDC system with a single tenant.

```
pfxadm@hana-1:/usr/sap/PFX/home> hdbuserstore set PFXKEY hana-1:30013
SNAPCENTER <password>
Operation succeed.
```

```
pfxadm@hana-1:/usr/sap/PFX/home> hdbuserstore list
DATA FILE : /usr/sap/PFX/home/.hdb/hana-1/SSFS_HDB.DAT
KEY FILE : /usr/sap/PFX/home/.hdb/hana-1/SSFS_HDB.KEY
ACTIVE RECORDS : 7
DELETED RECORDS : 0
KEY PFXKEY
ENV : hana-1:30013
USER: SNAPCENTER
KEY PFXSAPDBCTRL
ENV : hana-1:30013
USER: SAPDBCTRL
Operation succeed.
```

You can check the access to the HANA system database that uses the key with the hdbsql command.

```
pfxadm@hana-1:/usr/sap/PFX/home> hdbsql -U PFXKEY
Welcome to the SAP HANA Database interactive terminal.
Type: \h for help with commands
        \q to quit
hdbsql SYSTEMDB=>
```

## **Configure storage**

Follow these steps to configure storage in SnapCenter.

1. In the SnapCenter UI, select Storage Systems.

Dashboard				Last	refreshed: 02/21/2022 03:
Resources	RECENT JOB ACTIVITIES 0	ALERTS ()	LATEST PROTECTION SUMMARY		
Monitor Reports		S 0 Critical 🔺 0 Warning	Primary	Secondary SnapVault SnapMirror	
Reports				знарчани знармитог	
Hosts		No data available			
Storage Systems	No data available		No Plug-ins	No Plug-ins	
Settings					
Alerts			• Failed: 0 • Not configured: 0 • Successful: 0 • Not initiated: 0	• Failed: 0 + Not configured: 0 + Successful: 0	
	See All	See All			
	JOBS 🚯 Last 7 days 🔹	STORAGE 0			
	Backup Restore Clone	0 0 0 Snapshots 0 SnapMirrors	0 SnapVaults Sto	k Irage Savings	
	No data available			Clone Savings	
	No data available	No data a	anable No data	available	
				<ul> <li>Storage Consumed</li> </ul>	
	• Failed: 0 = Warning: 0 = Completed: 0 • Running: 0	Primary Snapshots	<ul> <li>Secondary Snapshots</li> </ul>	imary Storage	
	CONFIGURATION ()				
	🖥 🛈 Hosts 🛛 🗢 0	• 0 • 0	С о svm		

You can select the storage system type, which can be ONTAP SVMs or ONTAP Clusters. In the following example, SVM management is selected.

■ NetApp Snap	Center®					٠	<b>2</b> 6	- 👤 scadmin	SnapCenterAdmin	Sign Out
	ONTAP Storage									
Dashboard	Type ONTAP SVMs   Search by Name	$\supset$							+ New	
Resources	ONTAP Storage Connections									
Solution Monitor	Name 1	IP	Cluster Name	User Name	Platform			Controller Lice	ense	
삶 Reports	There is no match for your search or data is not available.									
🔥 Hosts										
Storage Systems										
📅 Settings										
A Alerte										

2. To add a storage system and provide the required host name and credentials, click New.

The SVM user is not required to be the vsadmin user, as shown in the following figure. Typically, a user is configured on the SVM and assigned the required permissions to execute backup and restore operations. For information about required privileges, see SnapCenter Installation Guide in the section titled "Minimum ONTAP privileges required".

<b>n</b> K	letApp SnapCenter®		
~	ONTAP Storage		
÷		Add Storage System	
		Add Storage System	,
<b>V</b>	ONTAP Storage Connections	Storage System	sapcc-hana-svm
	Name 4	Username	vsadmin
ail	There is no match for your search or data is not available.	Password	
٨		Event Management S	system (EMS) & AutoSupport Settings
ţe.		Send AutoSuppo	rt notification to storage system
		Log SnapCenter !	Server events to syslog
		More Options : Pla	atform, Protocol, Preferred IP etc
▲			
		Submit Cancel	Reset
		Submit	Neser

- 3. To configure the storage platform, click More Options.
- 4. Select All Flash FAS as the storage system to ensure that the license, which is part of FSx for ONTAP, is available for SnapCenter.

Platform	All Flash FAS	5 -	□ Secondary	6	
Protocol	HTTPS	•			
Port	443				
Timeout	60	seconds	0		
Preferred IP					0

The SVM sapcc-hana-svm is now configured in SnapCenter.

■ NetApp Snap	Center®					• =	<b>9</b> *	👤 scadmin	SnapCenterAdmin	🛿 Sign Out
<	ONTAP SE	orage								
Dashboard	Type 🛛	NTAP SVMs    Search by Name							+ New	
Resources	ONTAP	Storage Connections								
Se Monitor		Name 17	IP	Cluster Name	User Name	Platfo	rm	Conti	roller License	
Reports		sapco-hana-svm	198.19.255.9		vsadmin	AFF		~		
📥 Hosts										
Storage Systems										
E Settings										
Alerts										

## Create credentials for plugin deployment

To enable SnapCenter to deploy the required plug-ins on the HANA hosts, you must configure user credentials.

1. Go to Settings, select Credentials, and click New.

<b>NetApp</b> Sna	ipCenter®	•	≅ 0·	👤 scadmin	SnapCenterAdmin	🛿 Sign Out
<	Global Settings Policies Users and Access Roles Credential Software					
Dashboard	Search by Credential Name				ter 🖉	Delete
Resources	Credential Name Author	entication Mode	Details			
Monitor	There is no match for your search or data is not available.					
2017 Reports						
📥 Hosts						
- Storage System	5					
Settings						
Alerts						

2. In the lab setup, we configured a new user, snapcenter, on the HANA host that is used for the plug- in deployment. You must enable sudo prvileges, as shown in the following figure.

Credential Name	PluginOnLinux	
Authentication Mode	Linux	
Username	snapcenter	0
Password		]
2 Use sudo privileges	6	

```
hana-1:/etc/sudoers.d # cat /etc/sudoers.d/90-cloud-init-users
# Created by cloud-init v. 20.2-8.48.1 on Mon, 14 Feb 2022 10:36:40 +0000
# User rules for ec2-user
ec2-user ALL=(ALL) NOPASSWD:ALL
# User rules for snapcenter user
snapcenter ALL=(ALL) NOPASSWD:ALL
hana-1:/etc/sudoers.d #
```

## Add a SAP HANA host

When adding an SAP HANA host, SnapCenter deploys the required plug-ins on the database host and executes auto discovery operations.

The SAP HANA plug-in requires Java 64-bit version 1.8. Java must be installed on the host before the host is added to SnapCenter.

```
hana-1:/etc/ssh # java -version
openjdk version "1.8.0_312"
OpenJDK Runtime Environment (IcedTea 3.21.0) (build 1.8.0_312-b07 suse-
3.61.3-x86_64)
OpenJDK 64-Bit Server VM (build 25.312-b07, mixed mode)
hana-1:/etc/ssh #
```

OpenJDK or Oracle Java is supported with SnapCenter.

To add the SAP HANA host, follow these steps:

1. From the host tab, click Add.

<b>NetApp</b> Snap	Center®						٠	2	9 <b>~ 1</b> si	cadmin	SnapCenterAdmin	🗊 Sign Out
<	Managed Hosts Disks Shares											
Dashboard	Search by Name								401			More
Resources	Name	Ц Туре	i.	System	Plug-in	Version		Overa	ill Status			
Monitor					There is no match for your search or data is not available.							
Reports												
🔥 Hosts												
Storage Systems												
₩ Settings												
Alerts												

2. Provide host information and select the SAP HANA plug-in to be installed. Click Submit.



## 3. Confirm the fingerprint.

Confirm Finger	print		×
Authenticity of the ho	st cannot be determined  🕦		
Host name 1	Fingerprint		Valid
hana-1	ssh-rsa 3072 2A:98:DB:7E:58:A3:7E:51:06:79:83:C6:9D:BA:8E:69		
1261289-2			
		Confirm and Submit	Close
		commune soonic	Close

The installation of the HANA and the Linux plug-in starts automatically. When the installation is finished, the status column of the host shows Configure VMware Plug-in. SnapCenter detects if the SAP HANA plug-in is installed on a virtualized environment. This might be a VMware environment or an environment at a public cloud provider. In this case, SnapCenter displays a warning to configure the hypervisor.

You can remove the warning message by using the following steps.

NetApp Snap	Center®								٠	9-	scadmin	SnapCen	terAdmin	🗊 Sign Out
	Manageo	d Hosts Disks												
Dashboard	Search	n by Name	7											More
Resources		Name	IΈ	Туре	System	Plug-in	Version	Overall Status						
C Monitor		hana-1		Linux	Stand-alone	UNIX, SAP HANA	4.6	Configure VMware p	lug-in 🚯					
Reports														
📥 Hosts														
- Storage Systems														
Settings														
Alerts														

- a. From the Settings tab, select Global Settings.
- b. For the hypervisor settings, select VMs Have iSCSI Direct Attached Disks or NFS For All the Hosts and update the settings.

■ NetApp Snap(	enter®	٠	<b>≅ 0</b>	scadmin	SnapCenterAdmin	🖉 Sign Out
<	Global Settings Policies Users and Access Roles Credential Software					
Dashboard						
Resources	Global Settings					
Monitor						
ាំៅ Reports	Hypervisor Settings 🕕					^
📥 Hosts	Whis have ISCSI direct attached disks or NFS for all the hosts     Update					
Storage Systems	Notification Server Settings 0					~
Settings	Configuration Settings					~
Alerts	Purge Jobs Settings					~
	Domain Settings 0					~
	CA Certificate Settings 0					~
	Disatter Recovery 0					~

The screen now shows the Linux plug-in and the HANA plug-in with the status Running.

NetApp Snap								٠	0 • 1 scadrr	nin SnapCent	erAdmin	🛿 Sign Out
	Managed Hos	ts Disks										
Dashboard	Search by N	lame	V									i More
Resources		Name	1E	Туре	System	Plug-in	Version		Overall Status			
Some Monitor		hana-1		Linux	Stand-alone	UNIX, SAP HANA	4.6		Running			
ណ៍ Reports												
Hosts												
- Storage Systems												
📰 Settings												
A Alerts												

## **Configure policies**

Policies are usually configured independently of the resource and can be used by multiple SAP HANA databases.

A typical minimum configuration consists of the following policies:

- Policy for hourly backups without replication: LocalSnap.
- Policy for weekly block integrity check using a file-based backup: BlockIntegrityCheck.

The following sections describe the configuration of these policies.

#### Policy for Snapshot backups

Follow these steps to configure Snapshot backup policies.

1. Go to Settings > Policies and click New.

E N	letApp SnapC	enter®			٠		9-	👤 scadmin	SnapCenterAdmin	🗊 Sign Out
i i		Global Settings Policies Users and Access Roles Credential								
	Dashboard	SAP HANA				+				
<b>V</b>	Resources	Search by Name				New		lódity.		Delete
۲	Monitor		Backup Type	Schedule Type	Replicatio	n				
<b>111</b>	Reports	There is no match for your search or data is not available.								
٨	Hosts									
50 B	Storage Systems									
譕	Settings									
A	Alerts									

2. Enter the policy name and description. Click Next.

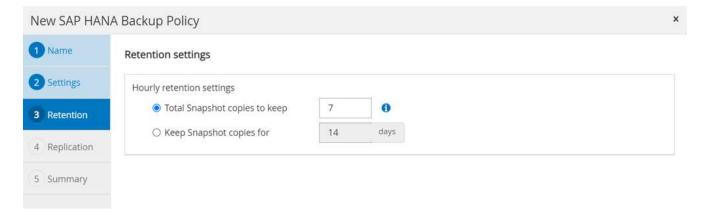
New SAP HAN	IA Backup Policy	/	×
1 Name	Provide a policy	/ name	
2 Settings	Policy name	LocalSnap	0
3 Retention	Details	Snapshot backup at primary volume	
4 Replication			
5 Summary			

3. Select backup type as Snapshot Based and select Hourly for schedule frequency.

The schedule itself is configured later with the HANA resource protection configuration.

New SAP HAN	IA Backup Policy	×
1 Name	Select backup settings	
2 Settings	Backup Type 💿 Snapshot Based 🔿 File-Based 🚯	
3 Retention	Schedule Frequency	
4 Replication	Select how often you want the schedules to occur in the policy. The specific times are set at backup job creation enabling you to stagger your start times.	
5 Summary	On demand     On demand     On demand	
	O Daily	
	O Weekly	
	○ Monthly	

4. Configure the retention settings for on-demand backups.



5. Configure the replication options. In this case, no SnapVault or SnapMirror update is selected.

New SAP HAN	A Backup Policy				×
1 Name	Select secondary repli	ication options 🜖			
2 Settings	Update SnapMirror afi	ter creating a local Sn	apshot copy		
3 Retention	🔲 Update SnapVault afte	er creating a local Sna	pshot copy.		
4 Replication	Secondary policy label	Choose	×	0	
5 Summary	Error retry count	3 🚺			

New SAP HAN	A Backup Policy		×
1 Name	Summary		
2 Settings	Policy name	LocalSnap	
3 Retention	Details	Snapshot backup at primary volume	
Retention	Backup Type	Snapshot Based Backup	
4 Replication	Schedule Type	Hourly	
	Hourly backup retention	Total backup copies to retain : 7	
5 Summary	Replication	none	

## The new policy is now configured.

n Ne	tApp Snap(	٠		0- J	scadmin	SnapCenter	Admin 🕻	🛿 Sign Out			
<	Dashboard	Global Settings Policies Users and Access Roles Credential SAP HANA									
🥑 R	tesources	Search by Name				iow	Modi			1 Details	Delete
😍 N	Aonitor		Backup Type	Schedule Type	Replication						
ай в	leports	LocalSnap	Data Backup	Hourly							
A +											
₩ s	itorage Systems										
÷= s	iettings										
<b>A</b> ^	lerts										

#### Policy for block integrity check

Follow these steps to configure the block integrity check policy.

- 1. Go to Settings > Policies and click New.
- 2. Enter the policy name and description. Click Next.

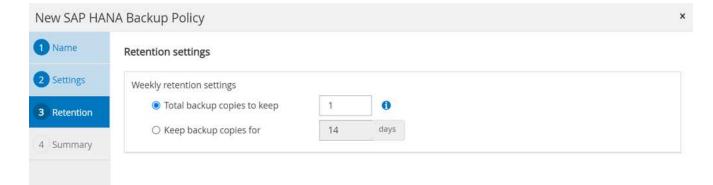
New SAP HAN	NA Backup Policy	y	×
1 Name	Provide a policy	y name	
2 Settings	Policy name	BlockIntegrityCheck	0
3 Retention	Details	Check HANA DB blocks using file-based backup	
4 Replication			
5 Summary			

3. Set the backup type to File-Based and schedule frequency to Weekly. The schedule itself is configured later with the HANA resource protection configuration.

20

New SAP HAI	NA Backup Policy	×
1 Name	Select backup settings	
2 Settings	Backup Type 🛛 Snapshot Based 💿 File-Based 🚯	
3 Retention	Schedule Frequency	
4 Summary	Select how often you want the schedules to occur in the policy. The specific times are set at backup job creation enabling you to stagger your start times. O On demand Hourly D Daily	
	Weekly     Monthly	

4. Configure the retention settings for on-demand backups.



5. On the Summary page, click Finish.

New SAP HAP	New SAP HANA Backup Policy								
1 Name	Summary								
2 Settings	Policy name	BlockIntegrityCheck							
3 Retention	Details	Check HANA DB blocks using file-based backup							
Ketention	Backup Type	File-Based Backup							
4 Summary	Schedule Type	Weekly							
	Weekly backup retention	Total backup copies to retain : 1							

■ ● • ± scadmin SuppCenterð												
	Global Settings Policies Users and Access Roles Credential											
Dashboard	SAP HANA							<b>-</b> 0	•			
Resources	Search by Name				+ New		- A & A & A & A & A & A & A & A & A & A	Copy Details				
Monitor	Name IE	Backup Type	Schedule Type	Replicatio	n							
Reports	BlockIntegrityCheck	File Based Backup	Weekly									
	LocalSnap	Data Backup	Hourly									
🐴 Hosts												
Storage Systems												
🚟 Settings												
A Alerts												

## Configure and protect a HANA resource

After the plug-in installation, the automatic discovery process of the HANA resource starts automatically. In the Resources screen, a new resource is created, which is marked as locked with the red padlock icon. To configure and protect the new HANA resource, follow these steps:

1. Select and click the resource to continue the configuration.

You can also trigger the automatic discovery process manually within the Resources screen by clicking Refresh Resources.

n NetApp SnapCenter®										pCenterAdmin	🗊 Sign Out
nt Database Container 👻 Search databases	8								Refresh Resources Add 5	AP HANA Database P	ew Resource Group
System	System ID (SID)	Tenant Databases	Replication	Plug-in Host	Resource Groups	Policies			Last backup	Overall Status	
PFX	PFX	PFX	None	hana-1						Not protected	
	System	System ID (SID)	System System ID (SID) Tenant Databases	System System ID (SID) Tenant Databases Replication	System D (SID) Tenant Databases Replication Plug-in Host	System D (SID) Tenant Databases Replication Plug-in Host Resource Groups	System ID (SID) Tenant Databases Replication Plug-in Host Resource Groups Policies	System D(SD) Tenant Databases Replication Plug-in Host Resource Groups Policies	System D (SID) Tenant Databases Replication Plug-in Host Resource Groups Policies	System         System ID (SID)         Tenant Databases         Replication         Plug-in Host         Resource Groups         Policies         Last backup	System         System ID (SID)         Tenant Databases         Replication         Plug-in Host         Resource Groups         Policies         Last backup         Overall Status

2. Provide the userstore key for the HANA database.

Configure Databa	se	×
Plug-in host	hana-1	
HDBSQL OS User	pfxadm	
HDB Secure User Store Key	PFXKEY	0

Cancel OK	

The second level automatic discovery process starts in which tenant data and storage footprint information is discovered.

NetApp	SnapCenter®						n ⊠ 0-	1 scadmin	SnapCenterAdmin	🛿 Sign Out
	iana 💌									
Sea	irch databases									
1E Im	System	Details for selected resource								
	PFX	Туре	Mul	itenant Database Container						
		HANA System Name	PFX							
		SID	PFX							
		Tenant Databases	PFX							
		Plug-in Host	han	-1						
		HDB Secure User Store Key	PEX	ΈY						
		HDBSQL OS User	pfxa	dm						
		Log backup location		kup/log						
		Backup catalog location	/ba	kup/log						
		System Replication	Nor							
		plug-in name	SAP	HANA						
		Last backup	Nor							
		Resource Groups	Nor							
		Policy	Nor							
		Discovery Type	Aub							
		Storage Footprint								
		SVM	Volume		Junction Path	u	IN/Qtree			
		sapcc-hana-svm	PFX_data_mnt00001		/PFX_data_mnt00001					

3. From the Resources tab, double click the resource to configure the resource protection.

NetApp Snap	Center®	>								•	a 0-	👤 scadmin Sn	apCenterAdmin	🛿 Sign Out
<		SAPHANA •												
Dashboard	View	Multitenan	t Database Container 👻 Search databases	7								Refresh Resources Add	SAP HANA Database	New Resource Group
Resources	IL P	N	System	System ID (SID)	Tenant Databases	Replication	Plug-in Host	Resource Groups	Policies			Last backup	Overall Status	s
Monitor			PFX	PFX	PFX	None	hana-1						Not protected	
釽 Reports														
🔥 Hosts														
Storage Systems														
₩ Settings														
Alerts														

4. Configure a custom name format for the Snapshot copy.

NetApp recommends using a custom Snapshot copy name to easily identify which backups have been created with which policy and schedule type. By adding the schedule type in the Snapshot copy name, you can distinguish between scheduled and on-demand backups. The schedule name string for on-demand backups is empty, while scheduled backups include the string Hourly, Daily, or Weekly.

	n Net	App S	napCenter®		٠	-	<b>0</b> -	👤 scadmir	n SnapCenterAdmin	🛿 Sign Out
			A 🔽							×
		Search	databases						1 Details	
	0	El	System	i Protect the resource by selecting protection policies, schedules, and notification settings.						×
	۵		PEX	A Configure an SMTP Server to send email notifications for scheduled or on demand jobs by going to Settings-Stobal Settings-Notification Server Settings,						×
1. The second	해 유 는			1 2 3 4 5 Resource Application Settings Policies Notification Summary						
	÷=			Provide format for custom snapshot name						
	<b>A</b>			Ute custom name format for Snapshot copy GCustom TextStoutNameSPolicySScheduleType SnapCenter						

5. No specific setting needs to be made on the Application Settings page. Click Next.



6. Select the policies to be added to the resource.

n Ne	tApp SnapCenter®						٠	<b>E</b> 6	- 👤 scadmir	n SnapCenterAdmin	i 🔋 Sign Out
>	SAP HANA 👻										×
	Search databases										1 Details
U	12 M System										
٠	PFX	00	-0	4 5							
<b>ai</b>		Resource Application Settings	Policies Noti	fication Summary							
٨											
24		Select one or more policies and o	configure schedules								
=		LocalSnap, BlockintegrityCheck     LocalSnap	•								
<b>A</b>		BlockIntegrityCheck	s								
		Policy	11 Applied Schedul	ès	Configure Schedules						
		BlockIntegrityCheck	None		+						
		LocalSnap	None		+						
		Total 2									

7. Define the schedule for the block integrity check policy.

In this example, it is set for once per week.

# Add schedules for policy BlockIntegrityCheck

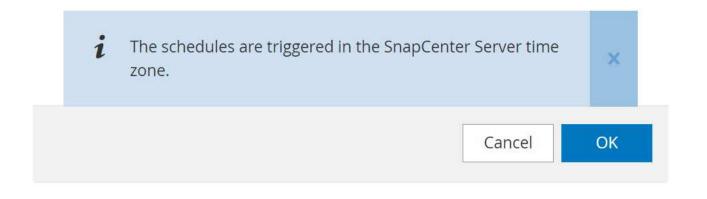
## Weekly Start date 02/22/2022 12:00 pm 1 03/22/2022 12:00 pm Expires on Ê Days Sunday Sunday Monday Tuesday Wednesday Thursday Friday i The schedules are triggered in the SnapCenter Server time × zone. Cancel OK

8. Define the schedule for the local Snapshot policy.

In this example, it is set for every 6 hours.

## Hourly





	Net/	App S	napCenter®								٠	2	0-	👤 scadmin	SnapCenterAdmin	🗊 Sign Out
>			IA 🔽													×
		Search	n databases													1 Defails
Ę		E Im	System													
4			PFX	00	4	5										
â	ì			Resource Application Settings	Policies Notification	Summary										
2	÷.,			Select one or more policies and	d configure schedules											
÷				LocalSnap, BlockIntegrityCheck	· + 0											
#																
4	<u>.</u>			Configure schedules for selected												
					Applied Schedules				Schedules							
				BlockIntegrityCheck	Weekly: Run on days: Sunday		1	×								
				LocalSnap	Hourly: Repeat every 6 hours		1	×								
				Total 2												
				Total Z												

9. Provide information about the email notification.

<b>n</b> N	letApp	SnapCenter®		• =	<b>0</b> -	scadmin SnapCenterAdmin	🛙 Sign C	Dut
>		HANA 👻						×
	Sea	arch databases					(	
•	1210	System	🛕 If you want to send notifications for scheduled or on demand jobs, an SMTP server must be configured. Continue to the summary page to save your information, and then go to Settings>Global Settings>Notification Server	Settings to con	figure the	e SMTP server.		: ×
● 総 ふ		PFX	1 2 3 3 5 Resource Application Settings Policies Notification Summary					
**			Provide email settings 0 Select the service accounts or people to notify regarding protection issues.					
<b>A</b>			Email preference Never •					
			From email					
			To Email to					
			Subject Notification					
			Attach job report					
<b>n</b> N	letApp	• SnapCenter®		• =	0-	₤ scadmin SnapCenterAdmin	🗑 Sign	Dut
>		HANA 🔽						×
	Sea	arch databases					Def	i) mis
	1E lee	System	1 I you want to send notifications for scheduled or on demand jobs, an SMTP server must be configured. Continue to the summary page to save your information, and then go to Settings-Sidobal Settings-Notification Server	Settings to cor	figure the	e SMTP server.		×
-		PFX						
ណ៍								
٨			Resource Application Settings Policies Notification Summary					
÷1			System name PFX					
<b>#</b>			Policy LocalSnap: Hourly BioclintegrinpCheck Weekly					
A			Send email No					
			○ Application Settings					

The HANA resource configuration is now completed, and you can execute backups.

n Ne	<b>tApp</b> Sn	apCenter®				• =	0 - 1 sca	ıdmin Sna	apCenterAdmin	🛿 Sign Out
>		· •	"PR: Topology							×
	Search o	latabases		Remove Protection	U Back up Now	Modify	Maintenance	i Details	Configure Database	<b>≓</b> Refresh
U	1E Im	System	Manage Copies							
		PFX	0 Backups			S	Summary Card			
aii			0 Clones			0 B	ackups			
A			Local copies				Snapshot based back			
34							File-Based backups ()			
						0.0	ionea			
華			Primary Backup(s)							
<b>A</b>			(search T						The Cone	ti 🗄 Restore Delete
			Backup Name	Count	17					End Date
			There is no match for your search.							

## **SnapCenter backup operations**

You can create an on-demand Snapshot backup and an on-demand block integrity check operation.

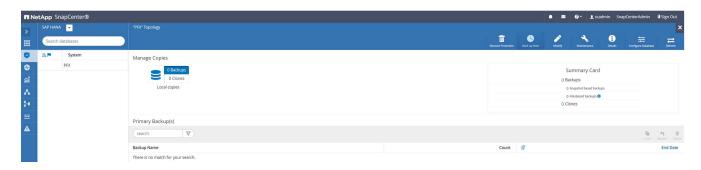
## Create an on-demand Snapshot backup

Follow these steps to create on-demand Snapshot backups.

1. In the Resource view, select the resource and double-click the line to switch to the Topology view.

The Resource Topology view provides an overview of all available backups that have been created by using SnapCenter. The top area of this view displays the backup topology showing the backups on the primary storage (local copies) and, if available, on the off-site backup storage (vault copies).

2. In the top row, select the Back up Now icon to start an on-demand backup.



3. From the drop-down list, select the backup policy LocalSnap, and then click Backup to start the ondemand backup.

Backup				×
Create a backup	for the selected res	ource		
Resource Name	PFX			
Policy	LocalSnap	•	0	

	Cancel	Backup
--	--------	--------

# Confirmation

The policy selected for the on-demand backup is associated with a backup schedule and the ondemand backups will be retained based on the retention settings specified for the schedule type. Do you want to continue ?

	_
Yes	No

A log of the previous five jobs is shown in the Activity area at the bottom of the Topology view.

4. The job details are shown when clicking the job's activity line in the Activity area. You can open a detailed job log by clicking View Logs

x

## Job Details

Backup of Resource Group 'hana-1\_hana\_MDC\_PFX' with policy 'LocalSnap'

✓ ▼ Backup of Resource Group 'hana-1\_hana\_MDC\_PFX' with policy 'LocalSnap'

	Backup  Validate Dataset Parameters	
~	Validate Plugin Parameters	
	Complete Application Discovery	
1	Initialize Filesystem Plugin	
1	Discover Filesystem Resources	
1	<ul> <li>Validate Retention Settings</li> </ul>	
1	Quiesce Application	
1	Quiesce Filesystem	
1	Create Snapshot	
/	UnQuiesce Filesystem	
/	UnQuiesce Application	
1	Get Snapshot Details	
/	Get Filesystem Meta Data	
1	Finalize Filesystem Plugin	
1	Collect Autosupport data	
1	Register Backup and Apply Retention	
1	Register Snapshot attributes	
/	Application Clean-Up	
/	▶ Data Collection	
/	Agent Finalize Workflow	
Task N	ame: Backup Start Time: 02/22/2022 12:08:58 PM End Time: 0	02/22/2022 12:10:21 PM

When the backup is finished, a new entry is shown in the topology view. The backup names follow the same naming convention as the Snapshot name defined in the section "Configure and protect a HANA resource".

30

You must close and reopen the topology view to see the updated backup list.

I Ne	tApp Sn	apCenter®						• =	0- 1	scadmin S	SnapCenterAdmin	🛿 Sign Out
>		-	"PFX" Topology									×
	Search o	atabases				Remove Protection	U Back up Now	Modity	Aaintenance	i Desails	Configure Database	Refresh
•	1F lat	System	Manage Copies									
۲		PFX	1 Backup					S	ummary Ca	rd		
ай (			0 Clones						ickup			
٨			Local copies						Snapshot based ba File-Based backups			
54								0 CI				
=												
			Primary Backup(s)									
A			search V								Cone .	ft II Restore Delete
			Backup Name	Count	17							End Date
			SnapCenter_hana-1_LocalSnap_Hourly_02-22-2022_12.08.54.4516	1							02/22/2022 12	:09:57 PM 🛱

In the SAP HANA backup catalog, the SnapCenter backup name is stored as a Comment field as well as External Backup ID (EBID). This is shown in the following figure for the system database and in the next figure for the tenant database PFX.

Mastudio - System: SYSTEMDB@PFX Hos	st: hana-1 Inst	ance: 00 Connected User: SYS	FEM System Usage: To	est System - SAP HANA Stud	io						-	D ×
Eile Edit Navigate Search Run Window H												
1 • □ □ 2 • 7 • * - * - * - *												९ 🔡 隊
Systems X					MDB@PFX SYS	STEMDB@PFX - SNAPCENT	er 🛛 🖁 🖥 systeme	DB@PFX 👔	PFX@PFX 👛 Back	up SYSTEMDB@PFX	(SYSTEM) HANA2.0 SPS5 $ imes$	- 8
PFX@PFX (SYSTEM) HANA2.0 SPS5	🖄 Back	up SYSTEMDB@PFX	(SYSTEM) HAI	NA2.0 SPS5							Last Update:12:10:00 F	м 🤣 📓 🔒
> SYSTEMDB@PFX (SYSTEM) HANA2.0	Overview C	onfiguration Backup Catalog										
	Backup Ca	italog					Backup Details					^
	Databas	e: SYSTEMDB	~				ID:	16455317621	175			
						Status:	Successful					
		Log Backups Show Delta B					Backup Type: Destination Type:	Data Backup Snapshot				
	Status	Started Feb 22, 2022, 12:09:22 PM	Duration 00h 00m 16s	Size Backup Type 5.50 GB Data Backup	Destination Ty Snapshot		Started:		, 12:09:22 PM (UTC)			
		Feb 21, 2022, 3:01:49 PM	00h 00m 19s	3.56 GB Data Backup	File		Finished:	Feb 22, 2022	, 12:09:38 PM (UTC)			
							Duration:	00h 00m 16s				
							Size: Throughput:	5.50 GB n.a.				
							System ID:	n.a.				
							Comment:	SnapCenter	hana-1_LocalSnap_Hourly	02-22-2022_12.08.54	4.4516	~
												~
							Additional Informati	ion: <ok></ok>				^
												~
							Location:	/hana/data/	PFX/mnt00001/			^
												~
							Host Serv		Size Name	Source Type	EBID	
							hana-1 nam	heserver 5.50 GB hdb00001		volume	SnapCenter_hana-1_LocalSnap_	.Hour
												~
		es 🗙 🤨 Error Log									📑 🔁	7 🖾 🕯 🗖 🗖
	Property			Value								
٢ >												

2 ・荷・や <i>中</i>   -  -		FX 🏼 🖄 Backup SYSTEMDB	MOPEX (SYSTEM) HA	NA2 0 SPS5	II SYSTEM	ADR@PEX S	STEMDR@PEX - SNAPCENTE	R 🚺 S	YSTEMDRØ		X 🖄 Backup	SYSTEMDR@PEX	(SYSTEM) HANA2.0 SPS5 ×	Q			
11 - 💷 🖉 🖻 😫 🕴	A Back	up SYSTEMDB@PFX	(SYSTEM) HAI	VA2 ILSP:	55								Last Update:12:12:0	08 DM			
		Configuration Backup Catalog											Last optime. In the	orm 🔷			
DB@PFX (STSTEM) HANA2.0	Backup Ca							Backup Deta	ils								
			-					ID:		1645531762174							
	Databas	e: PFX	~					Status:		Successful							
	Show	Log Backups 🗌 Show Delta Ba	ackups					Backup Type		Data Backup							
	Status	Started	Duration	Size	Backup Type	Destination Ty		Destination		Snapshot							
	•	Feb 22, 2022, 12:09:22 PM	00h 00m 16s		Data Backup	Snapshot		Started:		Feb 22, 2022, 12:09:22							
	•	Feb 21, 2022, 3:02:31 PM	00h 00m 19s	3.64 GB	Data Backup	File		Finished: Duration:		Feb 22, 2022, 12:09:38 00h 00m 16s	PM (UTC)						
								Size:		5.94 GB							
								Throughput:		5.94 GB n.a.							
								System ID:		11.0.							
								Comment:		SnapCenter_hana-1_L	ocalSnap Hourly 02	-22-2022 12.08.5	4516				
								Additional In	nformation:	coko.							
								Location:									
	Location: /hana/data/PFX/mnt00001/																
								Host	Service		Name	Source Type	EBID SnapCenter hana-1 LocalSna				
								hana-1 hana-1	indexsen xsengine		hdb00003.00003	volume	SnapCenter_hana-1_LocalSna SnapCenter_hana-1_LocalSna				
								nunu i	Ascrigine	250.00 112	1000002.00005	Tolume	Shapeenter_nana r_eocaisne	ip_riour			
													-				
		ies 🗙 🤨 Error Log												76			
	Property				Value												

On the FSx for ONTAP file system, you can list the Snapshot backups by connecting to the console of the SVM.

<pre>sapcc-hana-svm::&gt; sna Blocks</pre>	apshot show -volume PFX_data_mnt00001		
	napshot	Size Tot	al%
sapcc-hana-svm			
PFX_data_mnt	100001		
Sna	apCenter_hana-1_LocalSnap_Hourly_02-2	2-	
2022_12.08.54.4516			
		126.6MB	0%
2%			
<pre>sapcc-hana-svm::&gt;</pre>			

## Create an on-demand block integrity check operation

An on-demand block integrity check operation is executed in the same way as a Snapshot backup job, by selecting the policy BlockIntegrityCheck. When scheduling backups using this policy, SnapCenter creates a standard SAP HANA file backup for the system and tenant databases.

	×
for the selected resource	
PFX	
BlockIntegrityCheck 🔹 🜖	
8	
	PFX

Cancel	Backup

## Job Details

Backup of Resource Group 'hana-1\_hana\_MDC\_PFX' with policy 'BlockIntegrityCheck'

- ✓ ▼ Backup of Resource Group 'hana-1\_hana\_MDC\_PFX' with policy 'BlockIntegrityCheck'
- 🖌 🔻 hana-1

1	File-Based Backup
~	Validate Plugin Parameters
~	Start File-Based Backup
~	Check File-Based Backup
~	Register Backup and Apply Retention
~	► Data Collection

Task Name: File-Based Backup Start Time: 02/22/2022 12:55:21 PM	End Time: 02/22/2022 12:56:36 PM
---	----------------------------------

View Logs Cancel Job

Close

×

SnapCenter does not display the block integrity check in the same manner as Snapshot copy-based backups.

Instead, the summary card shows the number of file-based backups and the status of the previous backup.

Maintenance	i)
Summary Card	
1 Snapshot based backup	
	Cone Restore Delete
	End Date
	02/22/2022 12:09:57 PM 🛱
	Summary Card

The SAP HANA backup catalog shows entries for both the system and the tenant databases. The following figures show the SnapCenter block integrity check in the backup catalog of the system and the tenant database.

Eile Edit Navigate Search Run Window H C ← C ← C ← C ← C ← C ← C ← C ← C ← C ←				<b>T H</b>	MDB@PFX SYSTEMDE		SYSTEMDB	PFX II PFX@I			(SYSTEM) HANA2.0 SPS5 ×	Q : 🖻 隊		
	👔 PYX@PFX 🛎 Backup SYSTEMDB@PFX (SYSTEM) HANA2.0 SPS5 👔 SYSTEMDB@PFX SYSTEMDB@PFX - SNAPCENTER 👔 SYSTEMDB@PFX 👔 PFX@PFX 🛎 Backup SYSTEMDB@PFX (SYSTEM) HANA2.0 SPS5 🔧 🔰													
> PFX@PFX (SYSTEM) HANA2.0 SPS5		Configuration Backup Catalog		NA2.0 3F 35							Last Update:12:57:5	3 PM 🚱 🔡		
> 📳 SYSTEMDB@PFX (SYSTEM) HANA2.0	Backup C					Perde	Backup Details							
	васкир с	atalog												
	Database: SYSTEMDB							ID: 1645534521466 Status: Successful						
	Show Log Backups Show Delta Backups							Data Backup						
	Status	Started	Duration	Size Backup Type	Destination Ty	Desti	nation Type:	File						
		Feb 22, 2022, 12:55:21 PM	2, 12:55:21 PM 00h 00m 21s 3.56 G	3.56 GB Data Backup		Starte		Feb 22, 2022, 12:55:2						
			00h 00m 16s 00h 00m 19s	5.50 GB Data Backup		Finish Dura		Feb 22, 2022, 12:55:4 00h 00m 21s	3 PM (UTC)					
		Peb 21, 2022, 3.01.49 PW	oon oom 195	5.56 GB Data Backup		Size:	ion:	3.56 GB						
							ighput:	173.71 MB/s						
						Syste								
						Com	nent:	SnapCenter_hana-1_BlockIntegrityCheck,Weekly.02-22-2022_12.55.18.7966 formation: <a href="https://www.sciencematication.com">com</a>						
						Addit	ional Information:							
											~			
						Locat	ion:	/backup/data/SYSTEMDB/				^		
											~			
					Host	Service		e Name	Source Type	EBID				
						hana								
						hani	-1 namese	rver 3.56 G	B SnapCenter_Snap	volume				
	-										-0 1-	758 - 0		
	Property	ties 🗙 🤨 Error Log		Value								D LG 8 U		
	Property			value										
< >														

• 🗐 🕼 ½ • 🕅 • ∜⊃ ೆ≯ 🗢 Systems × 👘 🗖	FX@F		B@PFX (SYSTEM) HAI	NA2.0 SPS5 📲 SYSTEM	ADB@PFX SYSTEMDB@I	FX - SNAPCENTER	SYSTEMDB@	IPFX 🕌 PFX@PI	X 🖄 Backup	SYSTEMDB@PFX	( (SYSTEM) HANA2.0 SPS5 $ imes$	Q 😢 🕈	
🔐 🕶 🛄 👔 👻 💷 💋 😫 🖇											Last Update:12:58:19	РМ 🤣 🔚 🗈	
PFX@PFX (SYSTEM) HANA2.0 SPS5 SYSTEMDB@PFX (SYSTEM) HANA2.0	Overview	Configuration Backup Catalog											
	Backup (	atalog				Backup Deta	Backup Details						
	Database: PFX							ID: 1645534534230 Status: Successful					
	Show Log Backups						e:	Data Backup					
		Feb 22, 2022, 12:55:34 PM	2022, 12:55:34 PM 00h 00m 27s	3.64 GB Data Backup File 5.94 GB Data Backup Snapsh		Destination Started:	Туре:	File Feb 22, 2022, 12:55:34					
			00h 00m 16s 00h 00m 19s			Finished: Duration:		Feb 22, 2022, 12:56:01 00h 00m 27s	I PM (UTC)				
		100 21, 2022, 302,31111	001100111103	3.04 OD Data backap	110	Size:		3.64 GB					
							Throughput System ID:						
						Comment:		SnapCenter_hana-1_BlockIntegrityCheck_Weekly_02-22-2022_12.55.18.7966					
						Additional I	Additional Information:		ion: <ok></ok>				
					Location:		/backup/data/DB_PFX/				~		
					Host ^			Name Source Type SnapCenter_Snap topology		e EBID			
						hana-1	xsengine						
						hana-1	indexser	lexserver 3.56 GB S	SnapCenter_Snap	volume			
	Proper	ties 🔀 🥺 Error Log										7 🖪 🕴 🗖 🗖	
	Property			Value									

A successful block integrity check creates standard SAP HANA data backup files. SnapCenter uses the backup path that has been configured with the HANA database for file-based data backup operations.

hana-1:~ # ls -al /backup/data/\* /backup/data/DB PFX: total 7665384 drwxr-xr-- 2 pfxadm sapsys 4096 Feb 22 12:56 . drwxr-xr-x 4 pfxadm sapsys 4096 Feb 21 15:02 .. -rw-r---- 1 pfxadm sapsys 155648 Feb 21 15:02 COMPLETE DATA BACKUP databackup 0 1 -rw-r---- 1 pfxadm sapsys 83894272 Feb 21 15:02 COMPLETE DATA BACKUP databackup 2 1 -rw-r---- 1 pfxadm sapsys 3825213440 Feb 21 15:02 COMPLETE DATA BACKUP databackup 3 1 -rw-r---- 1 pfxadm sapsys 155648 Feb 22 12:55 SnapCenter SnapCenter hana-1\_BlockIntegrityCheck\_Weekly\_02-22-2022 12.55.18.7966 databackup 0 1 -rw-r---- 1 pfxadm sapsys 83894272 Feb 22 12:55 SnapCenter SnapCenter hana-1 BlockIntegrityCheck Weekly 02-22-2022 12.55.18.7966 databackup 2 1 -rw-r---- 1 pfxadm sapsys 3825213440 Feb 22 12:56 SnapCenter SnapCenter hana-1 BlockIntegrityCheck Weekly 02-22-2022 12.55.18.7966 databackup 3 1 /backup/data/SYSTEMDB: total 7500880 drwxr-xr-- 2 pfxadm sapsys 4096 Feb 22 12:55 . drwxr-xr-x 4 pfxadm sapsys 4096 Feb 21 15:02 .. -rw-r---- 1 pfxadm sapsys 159744 Feb 21 15:01 COMPLETE DATA BACKUP databackup 0 1 -rw-r---- 1 pfxadm sapsys 3825213440 Feb 21 15:02 COMPLETE DATA BACKUP databackup 1 1 -rw-r---- 1 pfxadm sapsys 159744 Feb 22 12:55 SnapCenter SnapCenter hana-1 BlockIntegrityCheck Weekly 02-22-2022 12.55.18.7966 databackup 0 1 -rw-r---- 1 pfxadm sapsys 3825213440 Feb 22 12:55 SnapCenter SnapCenter hana-1 BlockIntegrityCheck Weekly 02-22-2022 12.55.18.7966 databackup 1 1 hana-1:~ #

## Backup of non-data volumes

The backup of non-data volumes is an integrated part of the SnapCenter and the SAP HANA plug-in.

Protecting the database data volume is sufficient to restore and recover the SAP HANA database to a given point in time, provided that the database installation resources, and the required logs are still available.

To recover from situations where other non-data files must be restored, NetApp recommends developing an additional backup strategy for non-data volumes to augment the SAP HANA database backup. Depending on

your specific requirements, the backup of non-data volumes might differ in scheduling frequency and retention settings, and you should consider how frequently non-data files are changed. For instance, the HANA volume /hana/shared contains executables but also SAP HANA trace files. While executables only change when the SAP HANA database is upgraded, the SAP HANA trace files might need a higher backup frequency to support analyzing problem situations with SAP HANA.

SnapCenter non-data volume backup enables Snapshot copies of all relevant volumes to be created in a few seconds with the same space efficiency as SAP HANA database backups. The difference is that there is no SQL communication with SAP HANA database required.

#### Configure non-data volume resources

Follow these steps to configure non-data volume resources:

1. From the Resources tab, select Non-Data-Volume and click Add SAP HANA Database.



2. In step one of the Add SAP HANA Database dialog, in the Resource Type list, select Non- data Volumes. Specify a name for the resource and the associated SID and the SAP HANA plug-in host that you want to use for the resource, then click Next.

Add SAP HANA Dat	abase		×
1 Name	Provide Resource Det	ails	
2 Storage Footprint	Resource Type	Non-data Volume	•
3 Summary	Resource Name	PFX-Shared-Volume	
	Associated SID	PFX	0
	Plug-in Host	hana-1	0
		Previous	Next

3. Add the SVM and the storage volume as storage footprint, then click Next.

4. To save the settings, in the summary step, click Finish.

Add SAP HANA Dat	abase		>
1 Name	Summary		
2 Storage Footprint	Resource Type	Non-data Volume	
3 Summary	Resource Name	PFX-Shared-Volume	
3 Summary	Associated SID	PFX	
	Plug-in Host	hana-1	
	Storage Footprint		
	Storage System	Volume	LUN/Qtree
	sapcc-hana-svm	PFX_shared	
			Previous Finish

The new non-data volume is now added to SnapCenter. Double click the new resource to execute the resource protection.



The resource protection is done in the same way as described before with a HANA database resource.

5. You can now execute a backup by clicking on Backup Now.

<b>m</b> N	letApp SnapCenter®		•	🛛 🖾 🛛 🕹 🗠 🖬 Scar	dmin SnapCer	iterAdmin	🛿 Sign Out
>	SAP HANA						×
	Search databases		Femore Protection	Back up Now Modify	Maintenance	i Details	Refresh
۲	J≟ I™ Name	Manage Copies					
٠	PFX-Shared-Volume	0 Backups		Summary Card			
<b>a</b> i		0 Clones Local copies		Backups     O Snapshot based backup			
٨		Local Copica		0 Clones	ps		
÷.							
蔀		Primary Backup(s)					
A	-	(search T				Core	t II Restore Delete
		Backup Name	Count 17				End Date
		There is no match for your search.					

6. Select the policy and start the backup operation.

Backup	×			
Create a backup	o for the selected reso	urce		
Resource Name	PFX-Shared-Volume			
Policy	LocalSnap	٠	0	



The SnapCenter job log shows the individual workflow steps.

## Job Details

Backup of Resource Group 'hana-1\_hana\_NonDataVolume\_PFX\_PFX-Shared-Volume' with policy 'LocalSnap'

 Backup of Resource Group 'hana-1\_hana\_NonDataVolume\_PFX\_PFX-Shared-Volume' with policy 'LocalSnap'

1	🔻 hana-1
e.	Backup
1	Validate Dataset Parameters
1	Validate Plugin Parameters
1	Validate Retention Settings
1	Create Snapshot
/	Get Snapshot Details
1	Collect Autosupport data
1	Register Backup and Apply Retention
1	Register Snapshot attributes
1	Data Collection
1	Agent Finalize Workflow

Task Name: Backup Start Time: 02/22/2022 3:27:48 PM End Time:

 View Logs Cancel Job Close

The new backup is now visible in the resource view of the non- data volume resource.

🗖 Ne	tApp SnapCenter®					• = •	Ø∙ 1 scar	ímin SnapCe	nterAdmin	🗊 Sign Out
>	SAP HANA 👻	*PFX-Shared-Volume* Topology								×
	Search databases				Remove Protection	United States	Modity	Maintenance	i Details	1 Refresh
0	11 Name	Manage Copies								
	26 PFX-Shared-Volume	1 Backup				Sum	mary Card			
ай		0 Clones				1 Backu	ib.			
Α.		Local copies					pshot based backu	5		
241						0 Clone	s			
80 B										
#		Primary Backup(s)								
		(search 🛛							Circe	ti 🗄 Restore Delete
		Backup Name	Count	17						End Date
		SnapCenter_hana-1_LocalSnap_Hourly_02-22-2022_15.27.47.6832	1						02/22/2022 3:2	7:57 PM 🛱

## **Restore and recover**

With SnapCenter, automated restore and recovery operations are supported for HANA single host MDC systems with a single tenant. For multiple-host systems or MDC systems with multiple tenants, SnapCenter only executes the restore operation and you must perform the recovery manually.

You can execute an automated restore and recovery operation with the following steps:

- 1. Select the backup to be used for the restore operation.
- 2. Select the restore type. Select Complete Restore with Volume Revert or without Volume Revert.
- 3. Select the recovery type from the following options:
  - To most recent state
  - Point in time
  - To specific data backup
  - No recovery

The selected recovery type is used for the recovery of the system and the tenant database.

Next, SnapCenter performs the following operations:

- 1. It stops the HANA database.
- 2. It restores the database. Depending on the selected restore type, different operations are executed.
  - If Volume Revert is selected, then SnapCenter unmounts the volume, restores the volume by using volume-based SnapRestore on the storage layer, and mounts the volume.
  - If Volume Revert is not selected, then SnapCenter restores all files by using single file SnapRestore operations on the storage layer.
- 3. It recovers the database:
  - a. By recovering the system database
  - b. recovering the tenant database
  - c. starting the HANA database

If No Recovery is selected, SnapCenter exits, and you must perform the restore operation for the system and the tenant database manually.

To perform a manual restore operation, follow these steps:

1. Select a backup in SnapCenter to be used for the restore operation.

letApp SnapCenter®					• •	9- 1:	cadmin Sr	apCenterAdmin	🛙 Sign Out
SAP HANA 👻	PFX Topology								
Search databases				Protection Back up		Maintenance	i Details	Configure Database	Refresh
ji_I™ System	Manage Copies								
PFX	4 Backups					Summary Car	d		
	0 Clones				5	Backups			
	Local copies					4 Snapshot based ba			
						1 File-Based backup Clones	~		
						ciones			
	Primary Backup(s)								D
	(search T							Clone	Restore
	Backup Name	Count	17						End D
	SnapCenter_hana-1_LocalSnap_Hourly_02-23-2022_14.00.05.4361	1						02/23/2022 2:0	01:11 PM
	SnapCenter_hana-1_LocalSnap_Hourly_02-22-2022_20.00.01.4482	1						02/22/2022 8:0	)1:01 PM
	SnapCenter_hana-1_LocalSnap_Hourly_02-22-2022_14.00.02.8713	1						02/22/2022 2:0	)1:01 PM
	SnapCenter_hana-1_LocalSnap_Hourly_02-22-2022_12.08.54.4516	1						02/22/2022 12:0	)9:57 PM

2. Select the restore scope and type.

The standard scenario for HANA MDC single tenant systems is to use complete resource with volume revert. For a HANA MDC system with multiple tenants, you might want to restore only a single tenant. For more information about the single tenant restore, see Restore and recovery (netapp.com).

Restore from Sna	apCenter_hana-1_LocalSnap_Hourly_02-23-2022_14.00.05.4361	×
1 Restore scope	Select the restore types	
2 Recovery scope	Complete Resource	
3 PreOps	Volume Revert As part of Complete Resource restore, if a resource contains volumes as Storage Footprint, then the latest Snapshot	
4 PostOps	copies on such volumes will be deleted permanently. Also, if there are other resources hosted on the same volumes, then it will result in data loss for such resources.	
5 Notification	O Tenant Database	
6 Summary		
🛕 The newer tenant	s added on the host after the backup was created cannot be restored and will be lost after restore operation.	
🛕 Configure an SMT	P Server to send email notifications for Restore jobs by going to <u>Settings&gt;Global Settings&gt;Notification Server Settings</u> .	
	Previous Next	

3. Select Recovery Scope and provide the location for log backup and catalog backup.

SnapCenter uses the default path or the changed paths in the HANA global.ini file to pre-populate the log and catalog backup locations.

Restore from Sna	apCenter_hana-1_LocalSnap_Hourly_02-23-2022_14.00.05.4361	×
Restore scope	Recover database files using	
2 Recovery scope	Recover to most recent state	
3 PreOps	<ul> <li>Recover to point in time 1</li> <li>Recover to specified data backup 1</li> </ul>	
4 PostOps	O No recovery 🚯	
5 Notification	Specify log backup locations 🚯	
6 Summary	Add /backup/log	
	Specify backup catalog location 1	
	/backup/log	
A Recovery options	are applicable to both system database and tenant database.	
🛕 Configure an SMTI	P Server to send email notifications for Restore jobs by going to <u>Settings&gt;Global Settings&gt;Notification Server Settings</u> .	
	Previous	Next

4. Enter the optional pre-restore commands.

Restore from Sna	apCenter_hana-1_LocalSnap_Hourly_02-23-2022_14.00.05.4361
Restore scope	Enter optional commands to run before performing a restore operation 🚯
2 Recovery scope	Pre restore.command
3 PreOps	
4 PostOps	
5 Notification	
6 Summary	
A Configure an SMTF	<sup>2</sup> Server to send email notifications for Restore jobs by going to <u>Settings&gt;Global Settings&gt;Notification Server Settings</u>
	Previous Next

×

5. Enter the optional post-restore commands.

48

1 Restore scope	Enter optional commands to run after performing a restore operation <b>1</b>
2 Recovery scope	Post restore command
3 PreOps	
4 PostOps	
5 Notification	
6 Summary	
A Configure an SMTF	Server to send email notifications for Restore jobs by going to <u>Settings&gt;Global Settings&gt;Notification Server Settings</u>
	Previous

6. To start the restore and recovery operation, click Finish.

×

Restore from Snap	pCenter_hana-1_LocalSnap_H	ourly_02-23-2022_14.00.05.4361	×
1 Restore scope	Summary		
2 Recovery scope	Backup Name	SnapCenter_hana-1_LocalSnap_Hourly_02-23-2022_14.00.05.4361	
<b>A</b>	Backup date	02/23/2022 2:01:11 PM	
3 PreOps	Restore scope	Complete Resource with Volume Revert	
4 PostOps	Recovery scope	Recover to most recent state	
	Log backup locations	/backup/log	
5 Notification	Backup catalog location	/backup/log	
6 Summary	Pre restore command		
	Post restore command		
	Send email	No	
	notifications for Restore Jobs, an SMTP so Solobal Settings>Notification Server Setti	erver must be configured. Continue to the Summary page to save your information, a ngs to configure the SMTP server.	nd
		Previous	nish

SnapCenter executes the restore and recovery operation. This example shows the job details of the restore and recovery job.

# Job Details

## Restore 'hana-1\hana\MDC\PFX'

~	Restore 'hana-1\hana\MDC\PFX'
~	▼ hana-1
~	▼ Restore
~	Validate Plugin Parameters
~	Pre Restore Application
~	Stopping HANA instance
~	Filesystem Pre Restore
~	▼ Restore Filesystem
~	Filesystem Post Restore
~	Recover Application
~	Recovering system database
~	Checking HDB services status
~	Recovering tenant database 'PFX'
~	Starting HANA instance
~	Clear Catalog on Server
~	Application Clean-Up
~	Data Collection
~	Agent Finalize Workflow

Task Name: Recover Application Start Time: 02/23/2022 2:07:31 PM End Time:

View Logs	Cancel Job	Close	
-----------	------------	-------	--

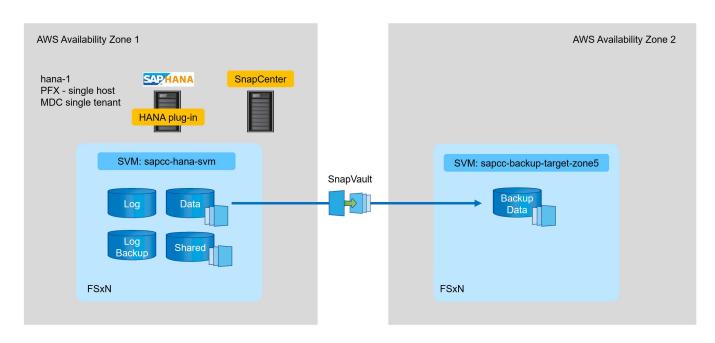
×

## Backup replication with SnapVault

## **Overview - Backup replication with SnapVault**

In our lab setup, we use a second FSX for ONTAP file system in a second AWS availability zone to showcase the backup replication for the HANA data volume.

As discussed in chapter "Data protection strategy", the replication target must be a second FSx for ONTAP file system in another availability zone to be protected from a failure of the primary FSx for ONTAP file system. Also, the HANA shared volume should be replicated to the secondary FSx for ONTAP file system.



### **Overview of configuration steps**

There are a couple of configuration steps that you must execute on the FSx for ONTAP layer. You can do this either with NetApp Cloud Manager or the FSx for ONTAP command line.

- 1. Peer FSx for ONTAP file systems. FSx for ONTAP file systems must be peered to allow replication between each other.
- 2. Peer SVMs. SVMs must be peered to allow replication between each other.
- 3. Create a target volume. Create a volume at the target SVM with volume type DP. Type DP is required to be used as a replication target volume.
- 4. Create a SnapMirror policy. This is used to create a policy for replication with type vault.
  - a. Add a rule to policy. The rule contains the SnapMirror label and the retention for backups at the secondary site. You must configure the same SnapMirror label later in the SnapCenter policy so that SnapCenter creates Snapshot backups at the source volume containing this label.
- 5. Create a SnapMirror relationship. Defines the replication relationship between the source and target volume and attaches a policy.
- 6. Initialize SnapMirror. This starts the initial replication in which the complete source data is transferred to the target volume.

When volume replication configuration is complete, you must configure the backup replication in SnapCenter

as follows:

- 1. Add the target SVM to SnapCenter.
- 2. Create a new SnapCenter policy for Snapshot backup and SnapVault replication.
- 3. Add the policy to HANA resource protection.
- 4. You can now execute backups with the new policy.

The following chapters describe the individual steps in more detail.

### Configure replication relationships on FSx for ONTAP file systems

You can find additional information about SnapMirror configuration options in the ONTAP documentation at SnapMirror replication workflow (netapp.com).

- Source FSx for ONTAP file system: FsxId00fa9e3c784b6abbb
- Source SVM: sapcc-hana-svm
- Target FSx for ONTAP file system: FsxId05f7f00af49dc7a3e
- Target SVM: sapcc-backup-target-zone5

### Peer FSx for ONTAP file systems

FsxId00fa9e	3c784b6abbb	::> network	interface show -ro	le intercluste:	r
	Logical	Status	Network	Current	Current
Is					
Vserver	Interface	Admin/Oper	Address/Mask	Node	Port
Home					
FsxId00fa9e	3c784b6abbb				
	inter_1	up/up	10.1.1.57/24		
FsxId00fa9e	3c784b6abbb	-01			
					e0e
true					
	inter_2	up/up	10.1.2.7/24		
FsxId00fa9e	3c784b6abbb	-02			
					e0e
true					
2 entries w	ere display	ed.			

FsxId05f7f00af49dc7a3e::> network interface show -role intercluster Current Current Logical Status Network Is Vserver Interface Admin/Oper Address/Mask Node Port Home \_\_\_\_ FsxId05f7f00af49dc7a3e inter 1 up/up 10.1.2.144/24 FsxId05f7f00af49dc7a3e-01 e0e true inter 2 up/up 10.1.2.69/24 FsxId05f7f00af49dc7a3e-02 e0e true 2 entries were displayed.

FsxId05f7f00af49dc7a3e::> cluster peer create -address-family ipv4 -peer -addrs 10.1.1.57, 10.1.2.7 Notice: Use a generated passphrase or choose a passphrase of 8 or more characters. To ensure the authenticity of the peering relationship, use a phrase or sequence of characters that would be hard to guess. Enter the passphrase: Confirm the passphrase: Notice: Now use the same passphrase in the "cluster peer create" command in the other cluster.

peer-addrs are cluster IPs of the destination cluster.

i.

#### Peer SVMs

```
FsxId05f7f00af49dc7a3e::> vserver peer create -vserver sapcc-backup-
target-zone5 -peer-vserver sapcc-hana-svm -peer-cluster
FsxId00fa9e3c784b6abbb -applications snapmirror
Info: [Job 41] 'vserver peer create' job queued
```

```
FsxId00fa9e3c784b6abbb::> vserver peer accept -vserver sapcc-hana-svm
-peer-vserver sapcc-backup-target-zone5
Info: [Job 960] 'vserver peer accept' job queued
```

FsxId05f7f00af49dc7a3e::> vserver peer show								
	Peer	Peer		Peering				
Remote								
Vserver	Vserver	State	Peer Cluster	Applications				
Vserver								
sapcc-backı	up-target-zor	ne5						
	peer-source	e-cluster						
		peered	FsxId00fa9e3c784k	o6abbb				
				snapmirror				
sapcc-hana-svm								

#### Create a target volume

You must create the target volume with the type DP to flag it as a replication target.

```
FsxId05f7f00af49dc7a3e::> volume create -vserver sapcc-backup-target-zone5
-volume PFX_data_mnt00001 -aggregate aggr1 -size 100GB -state online
-policy default -type DP -autosize-mode grow_shrink -snapshot-policy none
-foreground true -tiering-policy all -anti-ransomware-state disabled
[Job 42] Job succeeded: Successful
```

#### Create a SnapMirror policy

The SnapMirror policy and the added rule define the retention and the Snapmirror label to identify Snapshots that should be replicated. When creating the SnapCenter policy later, you must use the same label.

```
FsxId05f7f00af49dc7a3e::> snapmirror policy create -policy snapcenter-
policy -tries 8 -transfer-priority normal -ignore-atime false -restart
always -type vault -vserver sapcc-backup-target-zone5
```

```
FsxId05f7f00af49dc7a3e::> snapmirror policy add-rule -vserver sapcc-
backup-target-zone5 -policy snapcenter-policy -snapmirror-label
snapcenter -keep 14
```

```
FsxId00fa9e3c784b6abbb::> snapmirror policy showVserver Policy
Policy Number Transfer
Name Name Type Of Rules Tries Priority Comment
------FsxId00fa9e3c784b6abbb
snapcenter-policy vault 1 8 normal -
SnapMirror Label: snapcenter Keep: 14
Total Keep: 14
```

#### Create SnapMirror relationship

Now the relation between the source and target volume is defined as well as the type XDP and the policy we created earlier.

```
FsxId05f7f00af49dc7a3e::> snapmirror create -source-path sapcc-hana-
svm:PFX_data_mnt00001 -destination-path sapcc-backup-target-
zone5:PFX_data_mnt00001 -vserver sapcc-backup-target-zone5 -throttle
unlimited -identity-preserve false -type XDP -policy snapcenter-policy
Operation succeeded: snapmirror create for the relationship with
destination "sapcc-backup-target-zone5:PFX_data_mnt00001".
```

#### Initialize SnapMirror

With this command, the initial replication starts. This is a full transfer of all data from the source volume to the target volume.

```
FsxId05f7f00af49dc7a3e::> snapmirror initialize -destination-path sapcc-
backup-target-zone5:PFX_data_mnt00001 -source-path sapcc-hana-
svm:PFX_data_mnt00001
Operation is queued: snapmirror initialize of destination "sapcc-backup-
target-zone5:PFX data mnt00001".
```

You can check the status of the replication with the snapmirror show command.

```
FsxId05f7f00af49dc7a3e::> snapmirror show
Progress
Source
               Destination Mirror Relationship
                                             Total
Last
         Type Path State Status
Path
                                             Progress Healthy
Updated
_____
                           _____ ____
sapcc-hana-svm:PFX data mnt00001
          XDP sapcc-backup-target-zone5:PFX data mnt00001
                         Uninitialized
                                Transferring 1009MB
                                                     true
02/24 12:34:28
```

FsxId05f7f00af49dc7a3e::> snapmirror show												
Progress												
Source		Destination	Mirror	Relationship	Total							
Last												
Path	Туре	Path	State	Status	Progress	Healthy						
Updated												
sapcc-hana-	svm:PF	'X_data_mnt00	001									
	XDP	sapcc-backup	-target-	zone5:PFX_data_	mnt00001							
			Snapmir	rored								
				Idle	-	true -						

## Add a backup SVM to SnapCenter

To add a backup SVM to SnapCenter, follow these steps:

1. Configure the SVM where the SnapVault target volume is located in SnapCenter.

1		10. 40 M							
•	letAp	p SnapCenter®							
~	ON	ITAP Storage							
				Add Storage System 🚯					
				Add Storage System					
	ON	NTAP Storage Connections		Storage System	saptc-backup-target-zone5				
-		Name	11	Username	vsadmin				
<b>a</b> il		sapcc-hana-svm		Password					
~				Event Management Sy	ystem (EMS) & AutoSupport Settings				
24				Send AutoSuppor	rt notification to storage system				
***				Log SnapCenter S	Server events to syslog				
				More Options : Pla	atform, Protocol, Preferred IP etc				
A									
				Submit Cancel	Reset				
				Source					

2. On the More Options window, select All Flash FAS as the platform and select Secondary.

Platform	All Flash FAS	•	Secondary	0	
Protocol	HTTPS				
Port	443	]			
Timeout	60	seconds	0		
Preferred IP				0	

The SVM is now available in SnapCenter.

	NetApp Snap(	Center®	)				• =	0-	🧘 scadmin	SnapCenterAdmin	🖡 Sign Out
		ONTAP	Storage								
	Dashboard	Туре	ONTAP SVMs 🔹 Se	arch by Name						New	
<b>V</b>	Resources	ONTAI	P Storage Connections								
	Monitor		Name	18	IP	Cluster Name	User Nam	e	Platform	Controller Licen	ıse
<i>.</i>	Reports		sapcc-backup-target-zone5		10.1.2.31		vsadmin		AFF	Not applicable	
A	Hosts		sapcc-hana-svm		198.19.255.9		vsadmin		AFF	~	
þ.	Storage Systems										
÷	Settings										
▲	Alerts										

### Create a new SnapCenter policy for backup replication

You must configure a policy for the backup replication as follows:

1. Provide a name for the policy.

NetApp Snap				٠		<b>8-</b>	👤 scadmin	SnapCente	erAdmin (	Sign Out
	Global Settings Policies Users and Access Roles Credential									
Dashboard	SAP HANA				+					
Resources	Search by Name				New		lodfy	Сору		
Monitor	Name 1	Backup Type	Schedule Type	Replication	n					
- Reports	BlockIntegrityCheck	File Based Backup	Weekly							
a reports	LocalSnap	Data Backup	Hourly							
Hosts										
Storage Systems										
E Settings										
Alerts										

2. Select Snapshot backup and a schedule frequency. Daily is typically used for backup replication.

New SAP HAN	VA Backup Policy	1	×
1 Name	Provide a policy	name	
2 Settings	Policy name	LocalSnapAndSnapVault	0
3 Retention	Details	Replication to backup volume	
4 Replication			
5 Summary			

3. Select the retention for the Snapshot backups.

New SAP HAN	A Backup Policy	×
1 Name	Select backup settings	
2 Settings	Backup Type 💿 Snapshot Based 🔿 File-Based 🚯	
3 Retention	Schedule Frequency	
4 Replication	Select how often you want the schedules to occur in the policy. The specific times are set at backup job creation enabling you to stagger your start times.	
5 Summary	O On demand O Hourly	
	Daily	
	O Weekly	
	O Monthly	

This is the retention for the daily Snapshot backups taken at the primary storage. The retention for secondary backups at the SnapVault target has already been configured previously using the add rule command at the ONTAP level. See "Configure replication relationships on FSx for ONTAP file systems" (xref).

New SAP HAN	IA Backup Policy				×
1 Name	Retention settings				
2 Settings	Daily retention settings				
3 Retention	Total Snapshot copies to keep	3 \$	0		
4 Replication	<ul> <li>Keep Snapshot copies for</li> </ul>	14	days		
5 Summary					

4. Select the Update SnapVault field and provide a custom label.

This label must match the SnapMirror label provided in the add rule command at ONTAP level.

New SAP HAN	A Backup Policy		×
1 Name	Select secondary repl	cation options 🚯	
2 Settings	Update SnapMirror af	er creating a local Snapshot copy.	
3 Retention	Update SnapVault afte	r creating a local Snapshot copy.	
4 Replication	Secondary policy label	Custom Label 👻 🚯	
		snapcenter	
5 Summary	Error retry count	3 🚯	
New SAP HAN	A Backup Policy		×
1 Name	Summary		
2 Settings	Policy name	LocalSnapAndSnapVault	
3 Retention	Details	Replication to backup volume	
e Recention	Backup Type	Snapshot Based Backup	
4 Replication	Schedule Type	Daily	
5 Summary	Daily backup retention	Total backup copies to retain : 3	
Juninary	Replication	SnapVault enabled , Secondary policy label: Custom Label : snapcenter , Error retry count: 3	

The new SnapCenter policy is now configured.

NetApp Snap	Center®			٠	2	@- 1 sca	dmin Sr	apCenterAdmin	🛿 Sign Out
2	Global Settings Policies Users and Access Roles Credential								
Dashboard	SAP HANA				÷		P		_
Resources	Search by Name				New	Modify	Copy		Delete
Monitor	Name	Backup Type	Schedule Type	Replication	n				
Reports	BlockIntegrityCheck	File Based Backup	Weekly						
init kepons	LocalSnap	Data Backup	Hourly						
🐴 Hosts	LocalSnapAndSnapVault	Data Backup	Daily	SnapVault					
Storage Systems									
₩ Settings									
Alerts									

You must add the new policy to the HANA resource protection configuration, as shown in the following figure.

I Ne	App Sna	pCenter®						• =	<b>0</b> -	👤 scadmin	SnapCenterAdmin	🛿 Sign Out
>	SAP HANA	_	PFX Topology	X Multitenant Database Container - Protect								×
	Search dat	tabases										Details
U	15 let	System	Manage Copies									
<b>ଡ</b> ଲୀ	1	PFX	Primary Backup(s)	1 2 Resource Application Settings	3 4 5 Policies Notification Summary							
Α.			Backup Name		d C							
<u>ه</u>			SnapCenter_hana-1_LocalSnap_Hourly_02 24-2022_14.00.03.6698	Select one or more policies an LocalSnap, BlockintegrityCheck	- + O							
=			SnapCenter_hana-1_LocalSnap_Hourly_02 24-2022_08.00.02.2808	<ul> <li>LocalSnap</li> <li>BlockIntegrityCheck</li> </ul>	s							
			SnapCenter_hana-1_LocalSnap_Hourly_02 24-2022_02.00.02.1758		1 Schedules	Cor	figure Schedules					
			SnapCenter_hana-1_LocalSnap_Hourly_02	BlockIntegrityCheck	Weekly: Run on days: Sunday	1	×					
			23-2022_20.00.02.3280	LocalSnap	Hourly: Repeat every 6 hours	1	×					
			SnapCenter_hana-1_LocalSnap_Hourly_02 23-2022_14.00.05.4361									
			SnapCenter_hana-1_LocalSnap_Hourly_02 22-2022_20.00.01.4482	Total 2								
			SnapCenter_hana-1_LocalSnap_Hourly_02 22-2022_14.00.02.8713									

A daily schedule is defined in our setup.

II Ne	tApp Si	napCenter®									۰	6.	1	scadmin	SnapCenterAdmin	🗊 Sign Out
> 	SAP HAN	databases	PFX Topology	×												) Details
♥ ☆ ☆ * * * * *		System FFX	Manage Copies Primary Backup(s) search Backup Name SnapCenter, hana 1, LocalSnap, Hourly, 0, 24-2022, 140.003.6698 SnapCenter, hana 1, LocalSnap, Hourly, 0, 24-2022, 800.02.2808 SnapCenter, hana 1, LocalSnap, Hourly, 0, 23-0022, 200.002.3808 SnapCenter, hana 1, LocalSnap, Hourly, 0, 23-0022, 200.002.4808 SnapCenter, hana 1, LocalSnap, Hourly, 0, 22-0022, 200.001.4828 SnapCenter, hana 1, LocalSnap, Hourly, 0, 22-0022, 200.001.4828 SnapCenter, hana 1, LocalSnap, Hourly, 0, 22-0022, 200.001.4828	02- 02- 02- 02- 02-	Select one or more policies and co LocalSnap, BlockintegrityCheck, LocalSna Configure schedules for selected p	PAI™ <b>+</b> 0	1	x x x	dules							

## Create a backup with replication

A backup is created in the same way as with a local Snapshot copy.

To create a backup with replication, select the policy that includes the backup replication and click Backup.

Backup
--------

Create a backup for the selected resource

lesource Name	PFX			
Policy	LocalSnapAndSnapVault	•	0	
				**
			Cancel	Backup

Within the SnapCenter job log, you can see the Secondary Update step, which initiates a SnapVault update operation. Replication changed blocks from the source volume to the target volume.

×

# Job Details

	r hana-1	
	▼ Backup	
	Validate Dataset Parameters	
	Validate Plugin Parameters	
	Complete Application Discovery	
Ē.	Initialize Filesystem Plugin	
	Discover Filesystem Resources	
	Validate Retention Settings	
	Quiesce Application	
۴.	Quiesce Filesystem	
,	Create Snapshot	
1	UnQuiesce Filesystem	
•	UnQuiesce Application	
	Get Snapshot Details	
	Get Filesystem Meta Data	
	Finalize Filesystem Plugin	
	Collect Autosupport data	
	Secondary Update	
	Register Backup and Apply Retention	
	Register Snapshot attributes	
	Application Clean-Up	
	Data Collection	
	Agent Finalize Workflow	
	/ Job 49 ) SnapVault update	~
Task I	Name: Secondary Update Start Time: 02/24/2022 3:14:37 PM End Time: 02/24/2022 3:14:46 PM	

On the FSx for ONTAP file system, a Snapshot on the source volume is created using the SnapMirror label,

×

snapcenter, as configured in the SnapCenter policy.

FsxId00fa9e3c784b6abbb::> snapshot show -vserver sapcc-hana-svm -volume PFX data mnt00001 -fields snapmirror-label vserver volume snapshot snapmirror-label ------\_\_\_\_\_ \_\_\_\_\_ sapcc-hana-svm PFX data mnt00001 SnapCenter hana-1 LocalSnap Hourly 03-31-2022 13.10.26.5482 sapcc-hana-svm PFX data mnt00001 SnapCenter hana-1 LocalSnap Hourly 03-31-2022 14.00.05.2023 sapcc-hana-svm PFX data mnt00001 SnapCenter hana-1 LocalSnap Hourly 04-05-2022 08.00.06.3380 sapcc-hana-svm PFX data mnt00001 SnapCenter hana-1 LocalSnap Hourly 04-05-2022\_14.00.01.6482 sapcc-hana-svm PFX data mnt00001 SnapCenter hana-1 LocalSnap Hourly 04-14-2022 20.00.05.0316 sapcc-hana-svm PFX data mnt00001 SnapCenter hana-1 LocalSnap Hourly 04-28-2022 08.00.06.3629 sapcc-hana-svm PFX\_data\_mnt00001 SnapCenter\_hana-1\_LocalSnap\_Hourly\_04-28-2022 14.00.01.7275 sapcc-hana-svm PFX data mnt00001 SnapCenter hana-1 LocalSnapAndSnapVault Daily 04-28-2022 16.21.41.5853 snapcenter 8 entries were displayed.

At the target volume, a Snapshot copy with the same name is created.

The new Snapshot backup is also listed in the HANA backup catalog.

ackup Ca	talog					Backup Details					
Databas	SYSTEMDB	~				ID:	1651162926424				
Dutubus						Status:	Successful				
Show	Log Backups 🗌 Show Delta B	ackups				Backup Type:	Data Backup				
Status	Started	Duration	Size	Backup Type	Destination Ty	Destination Type:	Snapshot				
	Apr 28, 2022, 4:22:06 PM	00h 00m 15s		Data Backup	Snapshot	Started:	Apr 28, 2022, 4:2	2:06 PM (UTC)			
	Apr 28, 2022, 2:00:26 PM	00h 00m 15s		Data Backup	Snapshot	Finished:	Apr 28, 2022, 4:2	2:21 PM (UTC)			
	Apr 28, 2022, 8:00:35 AM	00h 00m 15s	5.50 GB	Data Backup	Snapshot	Duration:	00h 00m 15s				
	Apr 15, 2022, 5:00:44 PM	00h 06m 59s	5.50 GB	Data Backup	Snapshot	Size:	5.50 GB				
	Apr 14, 2022, 8:00:32 PM	00h 00m 16s	5.50 GB	Data Backup	Snapshot	Throughput:	n.a.				
)	Apr 5, 2022, 2:00:29 PM	00h 00m 15s	5.50 GB	Data Backup	Snapshot	5,	n.a.				
	Apr 5, 2022, 8:00:39 AM	00h 00m 15s	5.50 GB	Data Backup	Snapshot	System ID:					
	Mar 31, 2022, 2:00:29 PM	00h 00m 15s	5.50 GB	Data Backup	Snapshot	Comment:	SnapCenter_hana-1_LocalSnapAndSnapVault_Daily_04-28-2022_16.21.41.5853			41.5853	
9	Mar 31, 2022, 1:10:57 PM	00h 00m 16s	5.50 GB	Data Backup	Snapshot						
	Feb 22, 2022, 12:55:21 PM	00h 00m 21s	3.56 GB	Data Backup	File	Additional Information	: <ok></ok>				
						Additional mormation	. <ok></ok>				
						Location:	/hana/data/PFX	/mnt00001/			
						Host	Service	Size Name	Source Type	EBID	
							nameserver	5.50 GB hdb00001	volume	SnapCent	

In SnapCenter, you can list the replicated backups by clicking Vault Copies in the topology view.

II Ne	<b>tApp</b> Sr	apCenter®						• =	0- 1s	cadmin	SnapCenterAdmin	🖡 Sign Oi	
>		< <u>-</u>	PFX Topology										×
==	Search	databases				we Protection	U.S. Back up Now	Nosity	Production	1 Details	Configure Database	Refres	
•	1EIM	System	Manage Copies										
<ul> <li></li> <li></li></ul>		PFX	B Backups O Cones Local copies Vault copies Secondary Vault Backup(s)					10	Summary ( ) Backups 9 Snepshot base 1 File Based bac ) Clones	ed backups			
A			search T									<b>H</b> Restore	
			Backup Name	Count	17							End Da	
			SnapCenter_hana-1_LocalSnapAndSnapVault_Dally_04-28-2022_16.21.41.5853	1							04/28/2022 4	:22:40 PM	3

### Restore and recover from secondary storage

To restore and recover from secondary storage, follow these steps:

To retrieve the list of all the backups on the secondary storage, in the SnapCenter Topology view, click Vault Copies, then select a backup and click Restore.

n Ne	etApp SnapCenter®						<u>ه</u> ه	0- 1 sc	admin Si	napCenterAdmin	🗊 Sign Out
>	SAP HANA 👻	PFX Topology									×
	Search databases				Protection	U Back up Now	<i>∕∕</i> Modity	Production	1 Details	Configure Database	<b>≓</b> Rotresh
•	🛓 🍽 System	Manage Copies									
Sector 1 A in the sector 1	PFX	E 8 Backups 0 Ciones Local copies						Summary C Backups 9 Snapshot based 1 File-Based back	i backups		
}• ≆		Vault copies Secondary Vault Backup(s)					c	) Clones			Restore
▲		(search V)									Restore
		Backup Name	Count	15							End Date
		SnapCenter_hana-1_LocalSnapAndSnapVault_Daily_04-28-2022_16.21.41.5853	1							04/28/2022 4:	22:40 PM 🗎

The restore dialog shows the secondary locations.

Restore from Sna	pCenter_hana-1_LocalSnapAndSnapVault_Daily_0	4-28-2022_16.21.41.5853	×
1 Restore scope	Select the restore types		
2 Recovery scope	Complete Resource		
3 PreOps	O Tenant Database		
4 PostOps	Choose archive location		
5 Notification	sapcc-hana-svm:PFX_data_mnt00001	sapcc-backup-target-zone5:PFX_data_mnt00 🕶	
6 Summary			
A The newer tenants	added on the host after the backup was created cannot be restored	and will be lost after restore operation.	
	Server to send email notifications for Restore jobs by going to <u>Setti</u>		
		Previous	

Further restore and recovery steps are identical to those previously covered for a Snapshot backup at the primary storage.

## Where to find additional information

To learn more about the information that is described in this document, review the following documents and/or websites:

• FSx for NetApp ONTAP user guide — What is Amazon FSx for NetApp ONTAP?

https://docs.aws.amazon.com/fsx/latest/ONTAPGuide/what-is-fsx-ontap.html

SnapCenter resources page

https://www.netapp.com/us/documentation/snapcenter-software.aspx

SnapCenter Software documentation

https://docs.netapp.com/us-en/snapcenter/index.html

• TR-4667: Automating SAP HANA System Copy and Clone Operations with SnapCenter

Automating SAP HANA System Copy and Clone Operations with SnapCenter

• TR-4719: SAP HANA System Replication — Backup and Recovery with SnapCenter

Backup and Recovery with SnapCenter

## Version history

Version	Date	Document version history
Version 1.0	May 2022	Initial release.

# SAP HANA backup and recovery with SnapCenter

## TR-4614: SAP HANA backup and recovery with SnapCenter

Companies today require continuous, uninterrupted availability for their SAP applications. They expect consistent performance levels in the face of ever-increasing volumes of data and the need for routine maintenance tasks such as system backups. Performing backups of SAP databases is a critical task and can have a significant performance effect on the production SAP system.

Author: Nils Bauer, NetApp

Backup windows are shrinking, while the amount of data to be backed up is increasing. Therefore, it is difficult to find a time when backups can be performed with minimal effect on business processes. The time needed to restore and recover SAP systems is a concern, because downtime for SAP production and nonproduction systems must be minimized to reduce data loss and cost to the business.

The following points summarize the challenges facing SAP backup and recovery:

- **Performance effects on production SAP systems.** Typically, traditional copy-based backups create a significant performance drain on production SAP systems because of the heavy loads placed on the database server, the storage system, and the storage network.
- Shrinking backup windows. Conventional backups can only be made when few dialog or batch activities are in process on the SAP system. The scheduling of backups becomes more difficult when SAP systems are in use around the clock.
- **Rapid data growth.** Rapid data growth and shrinking backup windows require ongoing investment in backup infrastructure. In other words, you must procure more tape drives, additional backup disk space, and faster backup networks. You must also cover the ongoing expense of storing and managing these tape assets. Incremental or differential backups can address these issues, but this arrangement results in a very slow, cumbersome, and complex restore process that is harder to verify. Such systems usually increase recovery time objective (RTO) and recovery point objective (RPO) times in ways that are not acceptable to

the business.

- **Increasing cost of downtime.** Unplanned downtime of an SAP system typically affects business finances. A significant part of any unplanned downtime is consumed by the requirement to restore and recover the SAP system. Therefore, the desired RTO dictates the design of the backup and recovery architecture.
- **Backup and recovery time for SAP upgrade projects.** The project plan for an SAP upgrade includes at least three backups of the SAP database. These backups significantly reduce the time available for the upgrade process. The decision to proceed is generally based on the amount of time required to restore and recover the database from the previously created backup. Rather than just restoring a system to its previous state, a rapid restore provides more time to solve problems that might occur during an upgrade.

### The NetApp solution

NetApp Snapshot technology can be used to create database backups in minutes. The time needed to create a Snapshot copy is independent of the size of the database because a Snapshot copy does not move any physical data blocks on the storage platform. In addition, the use of Snapshot technology has no performance effect on the live SAP system because the NetApp Snapshot technology does not move or copy data blocks when the Snapshot copy is created or when data in the active file system is changed. Therefore, the creation of Snapshot copies can be scheduled without considering peak dialog or batch activity periods. SAP and NetApp customers typically schedule multiple online Snapshot backups during the day; for example, every four hours is common. These Snapshot backups are typically kept for three to five days on the primary storage system before being removed.

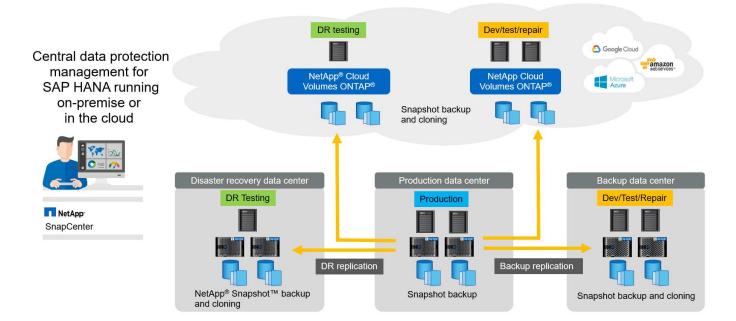
Snapshot copies also provide key advantages for restore and recovery operations. NetApp SnapRestore data recovery software enables the restore of an entire database or, alternatively, a portion of a database to any point in time, based on the available Snapshot copies. Such restore processes are finished in a few minutes, independent of the size of the database. Because several online Snapshot backups are created during the day, the time needed for the recovery process is significantly reduced relative to a traditional backup approach. Because a restore can be performed with a Snapshot copy that is only a few hours old (rather than up to 24 hours), fewer transaction logs must be applied. Therefore, the RTO is reduced to several minutes rather than the several hours required for conventional single-cycle tape backups.

Snapshot copy backups are stored on the same disk system as the active online data. Therefore, NetApp recommends using Snapshot copy backups as a supplement rather than a replacement for backups to a secondary location. Most restore and recovery actions are handled by using SnapRestore on the primary storage system. Restores from a secondary location are only necessary if the primary storage system containing the Snapshot copies is damaged. The secondary location can also be used if it is necessary to restore a backup that is no longer available from a Snapshot copy: a month-end backup, for example.

A backup to a secondary location is based on Snapshot copies created on the primary storage. Therefore, the data is read directly from the primary storage system without generating load on the SAP database server. The primary storage communicates directly with the secondary storage and sends the backup data to the destination by using a NetApp SnapVault disk-to-disk backup.

SnapVault offers significant advantages when compared to traditional backups. After an initial data transfer, in which all data has been transferred from the source to the destination, all subsequent backups copy only the changed blocks to the secondary storage. Therefore, the load on the primary storage system and the time needed for a full backup are significantly reduced. Because SnapVault stores only the changed blocks at the destination, a full database backup requires less disk space.

The solution can also be seamlessly extended to a hybrid cloud operation model. Data replication for disaster recovery or offsite backup purposes can be done from on-premises NetApp ONTAP systems to Cloud Volumes ONTAP instances running in the cloud. You can use SnapCenter as a central tool to manage the data protection and data replication, independent if the SAP HANA system run on-premises or in the cloud. The following figure shows an overview of the backup solution.



# **Runtime of Snapshot backups**

The next screenshot shows a customer's HANA Studio running SAP HANA on NetApp storage. The customer is using Snapshot copies to back up the HANA database. The image shows that the HANA database (approximately 2.3TB in size) is backed up in 2 minutes and 11 seconds by using Snapshot backup technology.



The largest part of the overall backup workflow runtime is the time needed to execute the HANA backup savepoint operation, and this step is dependent on the load on the HANA database. The storage Snapshot backup itself always finishes in a couple of seconds.

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C Show				ID: Status		149862351457							
Status	Started *	Duration	Size	Backup Type	Destinatio		Shuts: Succesful Beckup Type Data Backup				Backup Details		
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8	Jun 27, 2017 1:04:16	00h 02m 32s	2.32 TB	D ta Backup	Snapshot				Status:	Successful			
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#### Recovery time objective comparison

This section provides an RTO comparison of file-based and storage-based Snapshot backups. The RTO is defined by the sum of the time needed to restore the database and the time needed to start and recover the database.

#### Time needed to restore database

With a file-based backup, the restore time depends on the size of the database and backup infrastructure, which defines the restore speed in megabytes per second. For example, if the infrastructure supports a restore

operation at a speed of 250MBps, it takes approximately 1 hour and 10 minutes to restore a database 1TB in size.

With storage Snapshot copy backups, the restore time is independent of the size of the database and is in the range of a couple of seconds when the restore can be performed from primary storage. A restore from secondary storage is only required in the case of a disaster when the primary storage is no longer available.

#### Time needed to start database

The database start time depends on the size of the row and column store. For the column store, the start time also depends on how much data is preloaded during the database start. In the following examples, we assume that the start time is 30 minutes. The start time is the same for a file-based restore and recovery and a restore and recovery based on Snapshot.

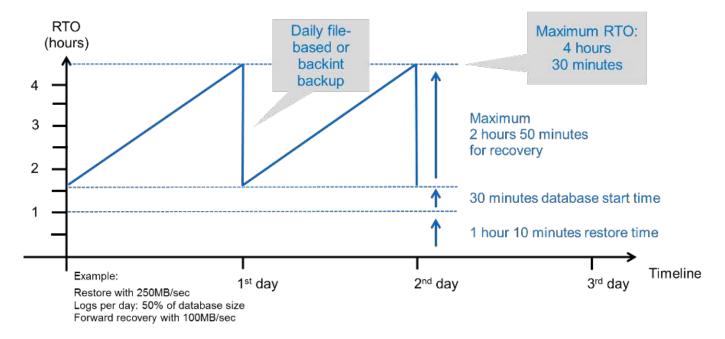
### Time needed to recover database

The recovery time depends on the number of logs that must be applied after the restore. This number is determined by the frequency at which data backups are taken.

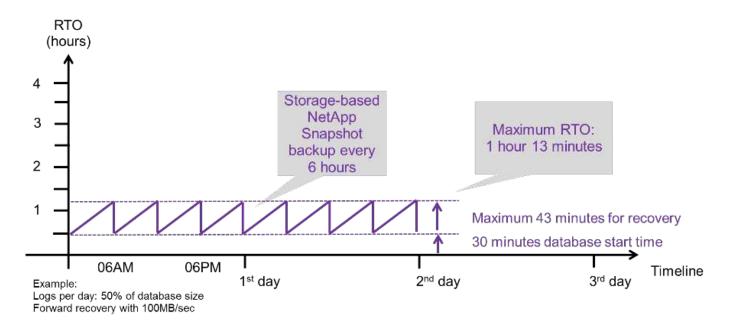
With file-based data backups, the backup schedule is typically once per day. A higher backup frequency is normally not possible, because the backup degrades production performance. Therefore, in the worst case, all the logs that were written during the day must be applied during forward recovery.

Storage Snapshot copy data backups are typically scheduled with a higher frequency because they do not influence the performance of the SAP HANA database. For example, if Snapshot copy backups are scheduled every six hours, the recovery time would be, in the worst case, one-fourth of the recovery time for a file-based backup (6 hours / 24 hours = 1/4).

The following figure shows an RTO example for a 1TB database when file-based data backups are used. In this example, a backup is taken once per day. The RTO differs depending on when the restore and recovery were performed. If the restore and recovery were performed immediately after a backup was taken, the RTO is primarily based on the restore time, which is 1 hour and 10 minutes in the example. The recovery time increased to 2 hours and 50 minutes when restore and recovery were performed immediately before the next backup was taken, and the maximum RTO was 4 hours and 30 minutes.

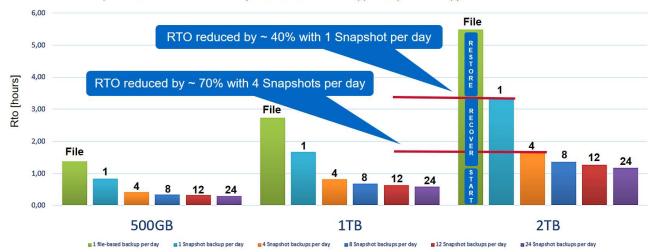


The following figure shows an RTO example for a 1TB database when Snapshot backups are used. With storage-based Snapshot backups, the RTO only depends on the database start time and the forward recovery time because the restore is completed in a few seconds, independent of the size of the database. The forward recovery time also increases depending on when the restore and recovery are done, but due to the higher frequency of backups (every six hours in this example), the forward recovery time is 43 minutes at most. In this example, the maximum RTO is 1 hour and 13 minutes.



The following figure shows an RTO comparison of file-based and storage-based Snapshot backups for different database sizes and different frequencies of Snapshot backups. The green bar shows the file-based backup. The other bars show Snapshot copy backups with different backup frequencies.

With a single Snapshot copy data backup per day, the RTO is already reduced by 40% when compared to a file-based data backup. The reduction increases to 70% when four Snapshot backups are taken per day. The figure also shows that the curve goes flat if you increase the Snapshot backup frequency to more than four to six Snapshot backups per day. Our customers therefore typically configure four to six Snapshot backups per day.



RTO Comparison: Restore and Recovery from File versus NetApp<sup>®</sup> Snapshot<sup>™</sup> Copy

Assumptions: Restore from file with 250MB/sec; database start with 400MB/s; log files per day: 50% of database size; forward recovery with 250MB/sec



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The graph shows the HANA server RAM size. The database size in memory is calculated to be half of the server RAM size.

The restore and recovery time is calculated based on the following assumptions. The database can be restored at 250MBps. The number of log files per day is 50% of the database size. For example, a 1TB database creates 500MB of log files per day. A recovery can be performed at 100MBps.

# **SnapCenter architecture**

SnapCenter is a unified, scalable platform for application-consistent data protection. SnapCenter provides centralized control and oversight, while delegating the ability for users to manage application-specific backup, restore, and clone jobs. With SnapCenter, database and storage administrators learn a single tool to manage backup, restore, and cloning operations for a variety of applications and databases.

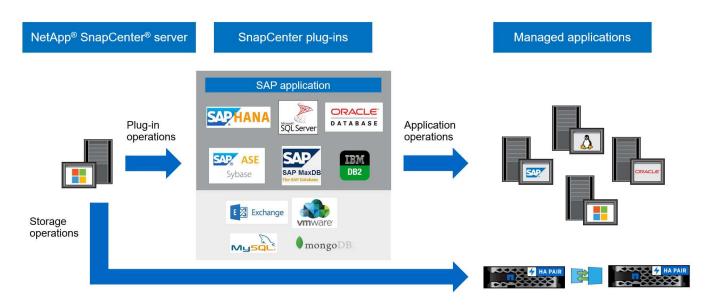
SnapCenter manages data across endpoints in the data fabric powered by NetApp. You can use SnapCenter to replicate data between on-premises environments; between on-premises environments and the cloud; and between private, hybrid, or public clouds.

# **SnapCenter components**

SnapCenter includes the SnapCenter Server, the SnapCenter Plug-In Package for Windows, and the SnapCenter Plug-Ins Package for Linux. Each package contains plug-ins to SnapCenter for various applications and infrastructure components.

The SnapCenter custom plug-ins enable you to create your own plug-ins and protect your application using the same SnapCenter interface.

The following figure depicts SnapCenter components.



# SnapCenter SAP HANA backup solution

This section lists the components, supported SAP HANA releases and configurations,

and SnapCenter 4.6 enhancements used in this solution.

# Solution components

The SnapCenter backup solution for SAP HANA covers the following areas:

- SAP HANA data backup with storage-based Snapshot copies:
  - Backup scheduling
  - Retention management
  - $\circ\,$  Housekeeping of the SAP HANA backup catalog
- Non-data volume (for example, /hana/shared) backup with storage-based Snapshot copies:
  - Backup scheduling
  - Retention management
- Replication to an off-site backup or disaster recovery location:
  - SAP HANA data Snapshot backups
  - Non-data volumes
  - Retention management configured at off-site backup storage
  - $\circ\,$  Housekeeping of the SAP HANA backup catalog
- Database block integrity checks using a file-based backup:
  - Backup scheduling
  - Retention management
  - $\circ\,$  Housekeeping of the SAP HANA backup catalog
- Retention management of HANA database log backup:
  - · Retention management based on data backup retention
  - Housekeeping of the SAP HANA backup catalog
- · Automatic discovery of HANA databases
- · Automated restore and recovery
- · Single-tenant restore operations with SAP HANA multitenant database container (MDC) systems

Database data file backups are executed by SnapCenter in combination with the plug-in for SAP HANA. The plug-in triggers an SAP HANA database backup save point so that the Snapshot copies, which are created on the primary storage system, are based on a consistent image of the SAP HANA database.

SnapCenter enables the replication of consistent database images to an off-site backup or disaster recovery location by using SnapVault or the NetApp SnapMirror. feature. Typically, different retention policies are defined for backups at primary and at the off-site backup storage. SnapCenter handles the retention at primary storage, and ONTAP handles the retention at the off-site backup storage.

To allow a complete backup of all SAP HANA-related resources, SnapCenter also allows you to back up all non- data volumes using the SAP HANA plug-in with storage-based Snapshot copies. Non-data volumes can be scheduled independently from the database data backup to enable individual retention and protection policies.

The SAP HANA database automatically executes log backups. Depending on the recovery point objectives, there are several options for the storage location of the log backups:

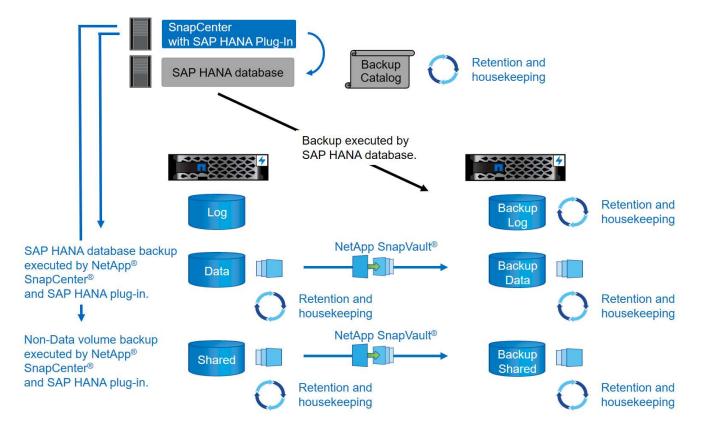
- The log backup is written to a storage system that synchronously mirrors the data to a second location with NetApp MetroCluster high-availability (HA) and disaster recovery storage software.
- The log backup destination can be configured on the same primary storage system and then replicated synchronously or asynchronously to a secondary storage with SnapMirror.
- The log backup destination can be configured on the same off-site backup storage in which the database backups are replicated with SnapVault. With this configuration, the off-site backup storage has availability requirements like those of the primary storage so that log backups can be written to the off-site backup storage.

SAP recommends combining storage-based Snapshot backups with a weekly file-based backup to execute a block integrity check. The block integrity check can be executed from within SnapCenter. Based on your configurable retention policies, SnapCenter manages the housekeeping of data file backups at the primary storage, log file backups, and the SAP HANA backup catalog.



SnapCenter handles the retention at primary storage, while ONTAP manages secondary backup retention.

The following figure shows an overview of the database and log backup configuration, where the log backups are written to an NFS mount of the off-site backup storage.



When executing a storage-based Snapshot backup of non-data volumes, SnapCenter performs the following tasks:

- 1. Creation of a storage Snapshot copy of the non-data volume.
- 2. Execution of a SnapVault or SnapMirror update for the data volume, if configured.
- 3. Deletion of storage Snapshot copies at the primary storage based on the defined retention policy.

When executing a storage-based Snapshot backup of the SAP HANA database, SnapCenter performs the

following tasks:

- 1. Creation of an SAP HANA backup save point to create a consistent image on the persistence layer.
- 2. Creation of a storage Snapshot copy of the data volume.
- 3. Registration of the storage Snapshot back up in the SAP HANA backup catalog.
- 4. Release of the SAP HANA backup save point.
- 5. Execution of a SnapVault or SnapMirror update for the data volume, if configured.
- 6. Deletion of storage Snapshot copies at the primary storage based on the defined retention policy.
- 7. Deletion of SAP HANA backup catalog entries if the backups do not exist anymore at the primary or off-site backup storage.
- 8. Whenever a backup has been deleted based on the retention policy or manually, SnapCenter deletes all log backups that are older than the oldest data backup. Log backups are deleted on the file system and in the SAP HANA backup catalog.

# Supported SAP HANA releases and configurations

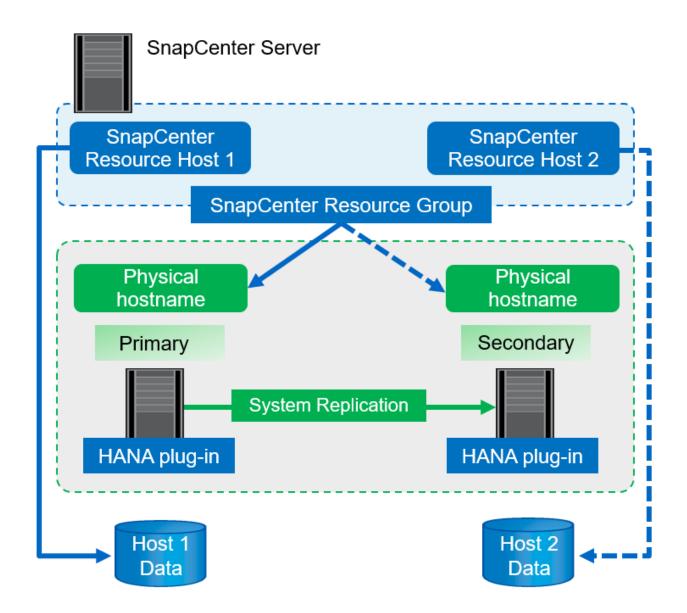
SnapCenter supports SAP HANA single-host and multiple-host configurations using NFS- or FC-attached NetApp storage systems (AFF and FAS), as well as SAP HANA systems running on Cloud Volumes ONTAP at AWS, Azure, the Google Cloud Platform, and AWS FSx ONTAP using NFS.

SnapCenter supports the following SAP HANA architectures and releases:

- SAP HANA single container: SAP HANA 1.0 SPS12
- SAP HANA multitenant-database container (MDC) single tenant: SAP HANA 2.0 SPS3 and later
- SAP HANA multitenant-database container (MDC) multiple tenants: SAP HANA 2.0 SPS4 and later

# SnapCenter 4.6 enhancements

Starting with version 4.6, SnapCenter supports auto-discovery of HANA systems configured in a HANA System Replication relationship. Each host is configured using its physical IP address (host name) and its individual data volume on the storage layer. The two SnapCenter resources are combined in a resource group, SnapCenter automatically identifies which host is primary or secondary, and it then executes the required backup operations accordingly. Retention management for Snapshot and file-based backups created with SnapCenter is performed across both hosts to ensure that old backups are also deleted at the current secondary host. The following figure shows a high-level overview. A detailed description of the configuration and operation of HANA System Replication-enabled HANA systems in SnapCenter can be found in TR-4719 SAP HANA System Replication, Backup and Recovery with SnapCenter.



# **SnapCenter concepts and best practices**

This section describes SnapCenter concepts and best practices as they relate to SAP HANA resource configuration and deployment.

# SAP HANA resource configuration options and concepts

With SnapCenter, SAP HANA database resource configuration can be performed with two different approaches.

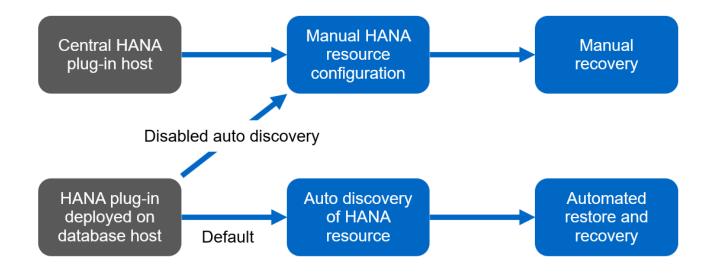
- **Manual resource configuration.** HANA resource and storage footprint information must be provided manually.
- Automatic discovery of HANA resources. Automatic discovery simplifies the configuration of HANA databases in SnapCenter and enables automated restore and recovery.

It is important to understand that only HANA database resources in SnapCenter that have been automatically discovered are enabled for automated restore and recovery. HANA database resources that are configured manually in SnapCenter must be recovered manually after a restore operation in SnapCenter.

On the other hand, automatic discovery with SnapCenter is not supported for all HANA architectures and infrastructure configurations. Therefore, HANA landscapes might require a mixed approach in which some HANA systems (HANA multiple host systems) require manual resource configuration and all others can be configured using automatic discovery.

Automatic discovery and automated restore and recovery depend on the ability to execute OS commands on the database host. Examples of this are file system and storage footprint discovery, and unmount, mount, or LUN discovery operations. These operations are executed with the SnapCenter Linux plug-in, which is automatically deployed together with the HANA plug-in. Therefore, it is prerequisite to deploy the HANA plug-in on the database host to enable automatic discovery as well as automated restore and recovery. It is also possible to disable the auto discovery after the deployment of the HANA plug-in on the database host. In this instance, the resource will be a manually configured resource.

The following figure summarizes the dependencies. More details on the HANA deployment options are covered in the section "Deployment options for the SAP HANA plug-in."



The HANA and Linux plug-ins are currently only available for Intel-based systems. If the HANA databases are running on IBM Power Systems, a central HANA plug-in host must be used.

#### Supported HANA architectures for automatic discovery and automated recovery

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With SnapCenter, automatic discovery and automated restore and recovery is supported for most HANA configurations with the exception that HANA multiple host systems require a manual configuration.

The following table shows supported HANA configurations for automatic discovery.

HANA plug-in installed on:	HANA architecture	HANA system configuration	Infrastructure
HANA database host	Single host	<ul> <li>HANA single container</li> <li>SAP HANA multitenant database containers (MDC) with single or multiple tenants</li> <li>HANA System Replication</li> </ul>	<ul> <li>Bare metal with NFS</li> <li>Bare metal with XFS and FC with or without Linux Logical Volume Manager (LVM)</li> <li>VMware with direct OS NFS mounts</li> </ul>



HANA MDC systems with multiple tenants are supported for automatic discovery, but not for automated restore and recovery with the current SnapCenter release.

#### Supported HANA architectures for manual HANA resource configuration

Manual configuration of HANA resources is supported for all HANA architectures; however, it requires a central HANA plug-in host. The central plug-in host can be the SnapCenter server itself or a separate Linux or Windows host.



When the HANA plug-in is deployed on the HANA database host, by default, the resource is auto discovered. Auto discovery can be disabled for individual hosts, so that the plug-in can be deployed; for example, on a database host with activated HANA System Replication and a SnapCenter release < 4.6, where auto discovery is not supported. For more information, see the section "Disable auto discovery on the HANA plug-in host."

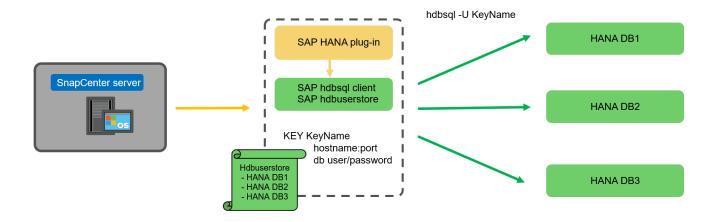
The following table shows supported HANA configurations for manual HANA resource configuration.

HANA Plug-In installed on:	HANA architecture	HANA system configuration	Infrastructure
Central plug-in host (SnapCenter Server or separate Linux host)	Single or multiple host	<ul> <li>HANA single container</li> <li>HANA MDC with single or multiple tenants</li> <li>HANA System Replication</li> </ul>	<ul> <li>Bare metal with NFS</li> <li>Bare metal with XFS and FC with or without Linux LVM</li> <li>VMware with direct OS NFS mounts</li> </ul>

# Deployment options for the SAP HANA plug-in

The following figure shows the logical view and the communication between the SnapCenter Server and the SAP HANA databases.

The SnapCenter Server communicates through the SAP HANA plug-in with the SAP HANA databases. The SAP HANA plug-in uses the SAP HANA hdbsql client software to execute SQL commands to the SAP HANA databases. The SAP HANA hdbuserstore is used to provide the user credentials, the host name, and the port information to access the SAP HANA databases.





The SAP HANA plug-in and the SAP hdbsql client software, which include the hdbuserstore configuration tool, must be installed together on the same host.

The host can be the SnapCenter Server itself, a separate central plug-in host, or the individual SAP HANA database hosts.

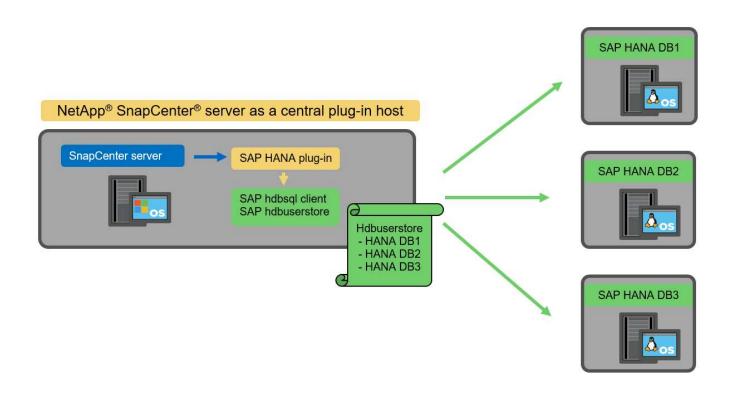
### SnapCenter server high availability

SnapCenter can be set up in a two-node HA configuration. In such a configuration, a load balancer (for example, F5) is used in an active/passive mode using a virtual IP address pointing to the active SnapCenter host. The SnapCenter repository (the MySQL database) is replicated by SnapCenter between the two hosts so that the SnapCenter data is always in-sync.

SnapCenter server HA is not supported if the HANA plug-in is installed on the SnapCenter server. If you plan to set up SnapCenter in an HA configuration, do not install the HANA plug-in on the SnapCenter server. More details on SnapCenter HA can be found at this NetApp Knowledge Base page.

#### SnapCenter server as a central HANA plug-in host

The following figure shows a configuration in which the SnapCenter Server is used as a central plug-in host. The SAP HANA plug-in and the SAP hdbsql client software are installed on the SnapCenter Server.



Since the HANA plug-in can communicate with the managed HANA databases using the hdbclient through the network, you do not need to install any SnapCenter components on the individual HANA database hosts. SnapCenter can protect the HANA databases by using a central HANA plug-in host on which all userstore keys are configured for the managed databases.

On the other hand, enhanced workflow automation for automatic discovery, automation of restore and recovery, as well as SAP system refresh operations require SnapCenter components to be installed on the database host. When using a central HANA plug-in host, these features are not available.

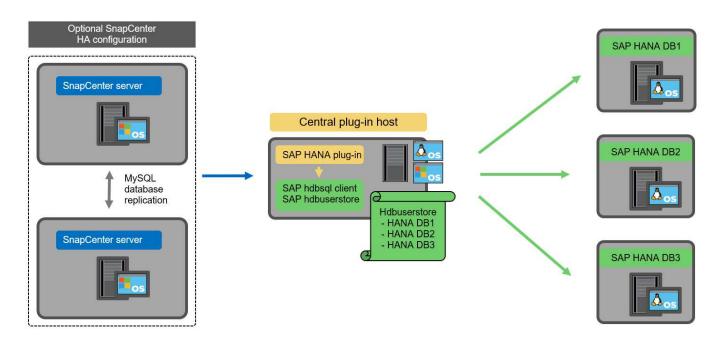
Also, high availability of the SnapCenter server using the in-build HA feature cannot be used when the HANA plug-in is installed on the SnapCenter server. High availability can be achieved using VMware HA if the SnapCenter server is running in a VM within a VMware cluster.

#### Separate host as a central HANA plug-in host

The following figure shows a configuration in which a separate Linux host is used as a central plug-in host. In this case, the SAP HANA plug-in and the SAP hdbsql client software are installed on the Linux host.



The separate central plug-in host can also be a Windows host.

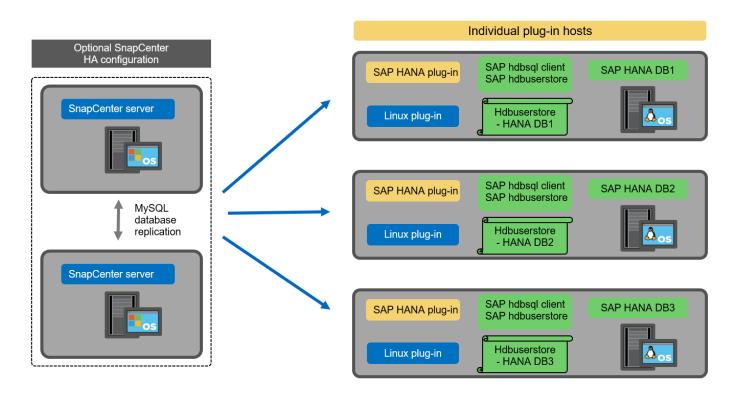


The same restriction regarding feature availability described in the previous section also applies for a separate central plug-in host.

However, with this deployment option the SnapCenter server can be configured with the in-build HA functionality. The central plug-in host must also be HA, for example, by using a Linux cluster solution.

### HANA plug-in deployed on individual HANA database hosts

The following figure shows a configuration in which the SAP HANA plug-in is installed on each SAP HANA database host.



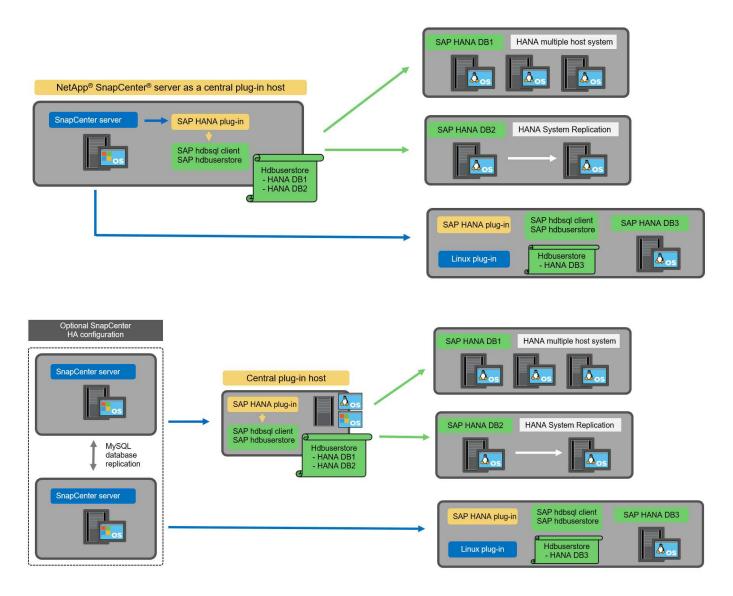
When the HANA plug-in is installed on each individual HANA database host, all features, such as automatic discovery and automated restore and recovery, are available. Also, the SnapCenter server can be set up in an HA configuration.

#### Mixed HANA plug-in deployment

As discussed at the beginning of this section, some HANA system configurations, such as multiple-host systems, require a central plug-in host. Therefore, most SnapCenter configurations require a mixed deployment of the HANA plug-in.

NetApp recommends that you deploy the HANA plug-in on the HANA database host for all HANA system configurations that are supported for automatic discovery. Other HANA systems, such as multiple-host configurations, should be managed with a central HANA plug-in host.

The following two figures show mixed plug-in deployments either with the SnapCenter server or a separate Linux host as a central plug-in host. The only difference between these two deployments is the optional HA configuration.



#### Summary and recommendations

In general, NetApp recommends that you deploy the HANA plug-in on each SAP HANA host to enable all

available SnapCenter HANA features and to enhance workflow automation.



The HANA and Linux plug-ins are currently only available for Intel- based systems. If the HANA databases are running on IBM Power Systems, a central HANA plug-in host must be used.

For HANA configurations in which automatic discovery is not supported, such as HANA multiple-host configurations, an additional central HANA plug-in host must be configured. The central plug-in host can be the SnapCenter server if VMware HA can be leveraged for SnapCenter HA. If you plan to use the SnapCenter inbuild HA capability, use a separate Linux plug-in host.

The following table summarizes the different deployment options.

Deployment option	Dependencies
Central HANA plug-in host Plug-in installed on SnapCenter server	Pros: * Single HANA plug-in, central HDB user store configuration * No SnapCenter software components required on individual HANA database hosts * Support of all HANA architectures Cons: * Manual resource configuration * Manual recovery * No single tenant restore support * Any Pre- and post-script steps are executed on the central plug-in host * In-build SnapCenter high availability not supported * Combination of SID and tenant name must be unique across all managed HANA databases * Log backup retention management enabled/disabled for all managed HANA databases
Central HANA plug-in host Plug-in installed on separate Linux or Windows server	Pros: * Single HANA plug-in, central HDB user store configuration * No SnapCenter software components required on individual HANA database hosts * Support of all HANA architectures * In-build SnapCenter high availability supported Cons: * Manual resource configuration * Manual recovery * No single tenant restore support * Any Pre- and post-script steps are executed on the central plug-in host * Combination of SID and tenant name must be unique across all managed HANA databases * Log backup retention management enabled/disabled for all managed HANA databases

Deployment option	Dependencies
Individual HANA plug-in host Plug-in installed on HANA database server	<ul> <li>Pros:</li> <li>* Automatic discovery of HANA resources</li> <li>* Automated restore and recovery</li> <li>* Single tenant restore</li> <li>* Pre- and post-script automation for SAP system refresh</li> <li>* In-build SnapCenter high availability supported</li> <li>* Log backup retention management can be enabled/disabled for each individual HANA database Cons:</li> <li>* Not supported for all HANA architectures. Additional central plug-in host required, for HANA multiple host systems.</li> <li>* HANA plug-in must be deployed on each HANA database hosts</li> </ul>

# Data protection strategy

Before configuring SnapCenter and the SAP HANA plug-in, the data protection strategy must be defined based on the RTO and RPO requirements of the various SAP systems.

A common approach is to define system types such as production, development, test, or sandbox systems. All SAP systems of the same system type typically have the same data protection parameters.

The parameters that must be defined are:

- · How often should a Snapshot backup be executed?
- How long should Snapshot copy backups be kept on the primary storage system?
- · How often should a block integrity check be executed?
- Should the primary backups be replicated to an off-site backup site?
- · How long should the backups be kept at the off-site backup storage?

The following table shows an example of data protection parameters for the system type's production, development, and test. For the production system, a high backup frequency has been defined, and the backups are replicated to an off-site backup site once per day. The test systems have lower requirements and no replication of the backups.

Parameters	Production systems	Development systems	Test systems
Backup frequency	Every 4 hours	Every 4 hours	Every 4 hours
Primary retention	2 days	2 days	2 days
Block integrity check	Once per week	Once per week	No
Replication to off-site backup site	Once per day	Once per day	No
Off-site backup retention	2 weeks	2 weeks	Not applicable

The following table shows the policies that must be configured for the data protection parameters.

Parameters	PolicyLocalSnap	PolicyLocalSnapAndSna pVault	PolicyBlockIntegrityChe ck
Backup type	Snapshot based	Snapshot based	File based
Schedule frequency	Hourly	Daily	Weekly
Primary retention	Count = 12	Count = 3	Count = 1
SnapVault replication	No	Yes	Not applicable

The policy LocalSnapshot is used for the production, development, and test systems to cover the local Snapshot backups with a retention of two days.

In the resource protection configuration, the schedule is defined differently for the system types:

- Production. Schedule every 4 hours.
- **Development.** Schedule every 4 hours.
- Test. Schedule every 4 hours.

The policy LocalSnapAndSnapVault is used for the production and development systems to cover the daily replication to the off-site backup storage.

In the resource protection configuration, the schedule is defined for production and development:

- Production. Schedule every day.
- Development. Schedule every day.

The policy BlockIntegrityCheck is used for the production and development systems to cover the weekly block integrity check using a file-based backup.

In the resource protection configuration, the schedule is defined for production and development:

- Production. Schedule every week.
- Development. Schedule every week.

For each individual SAP HANA database that uses the off-site backup policy, a protection relationship must be configured on the storage layer. The protection relationship defines which volumes are replicated and the retention of backups at the off-site backup storage.

With our example, for each production and development system, a retention of two weeks is defined at the offsite backup storage.



In our example, protection policies and retention for SAP HANA database resources and nondata volume resources are not different.

# **Backup operations**

SAP introduced the support of Snapshot backups for MDC multiple tenant systems with HANA 2.0 SPS4. SnapCenter supports Snapshot backup operations of HANA MDC systems with multiple tenants. SnapCenter also supports two different restore operations of a HANA MDC system. You can either restore the complete system, the System DB and all tenants, or you can restore just a single tenant. There are some pre-requisites to enable SnapCenter to execute these operations. In an MDC System, the tenant configuration is not necessarily static. Tenants can be added or tenants can be deleted. SnapCenter cannot rely on the configuration that is discovered when the HANA database is added to SnapCenter. SnapCenter must know which tenants are available at the point in time the backup operation is executed.

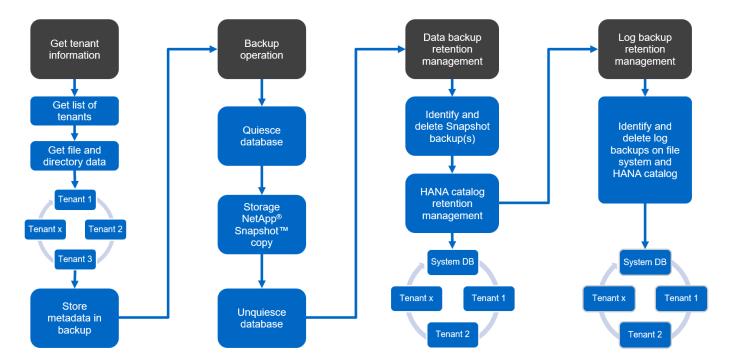
To enable a single tenant restore operation, SnapCenter must know which tenants are included in each Snapshot backup. In addition, it must know which files and directories belong to each tenant included in the Snapshot backup.

Therefore, with each backup operation, the first step in the workflow is to get the tenant information. This includes the tenant names and the corresponding file and directory information. This data must be stored in the Snapshot backup metadata in order to be able to support a single tenant restore operation. The next step is the Snapshot backup operation itself. This step includes the SQL command to trigger the HANA backup savepoint, the storage Snapshot backup, and the SQL command to close the Snapshot operation. By using the close command, the HANA database updates the backup catalog of the system DB and each tenant.



SAP does not support Snapshot backup operations for MDC systems when one or more tenants are stopped.

For the retention management of data backups and the HANA backup catalog management, SnapCenter must execute the catalog delete operations for the system database and all tenant databases that were identified in the first step. In the same way for the log backups, the SnapCenter workflow must operate on each tenant that was part of the backup operation.



The following figure shows an overview of the backup workflow.

# Backup workflow for Snapshot backups of the HANA database

SnapCenter backs up the SAP HANA database in the following sequence:

- 1. SnapCenter reads the list of tenants from the HANA database.
- 2. SnapCenter reads the files and directories for each tenant from the HANA database.

- 3. Tenant information is stored in the SnapCenter metadata for this backup operation.
- 4. SnapCenter triggers an SAP HANA global synchronized backup save point to create a consistent database image on the persistence layer.



For an SAP HANA MDC single or multiple tenant system, a synchronized global backup save point for the system database, and for each tenant database is created.

- SnapCenter creates storage Snapshot copies for all data volumes configured for the resource. In our example of a single-host HANA database, there is only one data volume. With an SAP HANA multiple-host database, there are multiple data volumes.
- 6. SnapCenter registers the storage Snapshot backup in the SAP HANA backup catalog.
- 7. SnapCenter deletes the SAP HANA backup save point.
- 8. SnapCenter starts a SnapVault or SnapMirror update for all configured data volumes in the resource.



This step is only executed if the selected policy includes a SnapVault or SnapMirror replication.

9. SnapCenter deletes the storage Snapshot copies and the backup entries in its database as well as in the SAP HANA backup catalog based on the retention policy defined for backups at the primary storage. HANA backup catalog operations are done for the system database and all tenants.



If the backup is still available at the secondary storage, the SAP HANA catalog entry is not deleted.

10. SnapCenter deletes all log backups on the file system and in the SAP HANA backup catalog that are older than the oldest data backup identified in the SAP HANA backup catalog. These operations are done for the system database and all tenants.



This step is only executed if log backup housekeeping is not disabled.

#### Backup workflow for block integrity check operations

SnapCenter executes the block integrity check in the following sequence:

- 1. SnapCenter reads the list of tenants from the HANA database.
- 2. SnapCenter triggers a file-based backup operation for the system database and each tenant.
- 3. SnapCenter deletes file-based backups in its database, on the file system, and in the SAP HANA backup catalog based on the retention policy defined for block integrity check operations. Backup deletion on the file system and HANA backup catalog operations are done for the system database and all tenants.
- 4. SnapCenter deletes all log backups on the file system and in the SAP HANA backup catalog that are older than the oldest data backup identified in the SAP HANA backup catalog. These operations are done for the system database and all tenants.



This step is only executed if log backup housekeeping is not disabled.

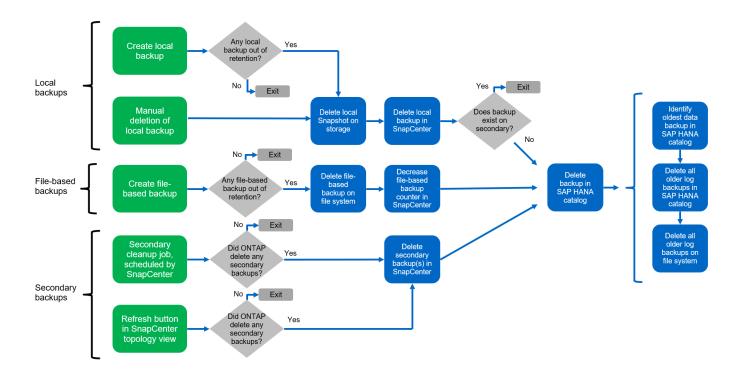
#### Backup retention management and housekeeping of data and log backups

The data backup retention management and log backup housekeeping can be divided into five main areas,

including retention management of:

- · Local backups at the primary storage
- · File-based backups
- · Backups at the secondary storage
- · Data backups in the SAP HANA backup catalog
- · Log backups in the SAP HANA backup catalog and the file system

The following figure provides an overview of the different workflows and the dependencies of each operation. The following sections describe the different operations in detail.



#### Retention management of local backups at the primary storage

SnapCenter handles the housekeeping of SAP HANA database backups and non-data volume backups by deleting Snapshot copies on the primary storage and in the SnapCenter repository according to a retention defined in the SnapCenter backup policy.

Retention management logic is executed with each backup workflow in SnapCenter.



Be aware that SnapCenter handles retention management individually for both scheduled and on-demand backups.

Local backups at the primary storage can also be deleted manually in SnapCenter.

#### Retention management of file-based backups

SnapCenter handles the housekeeping of file-based backups by deleting the backups on the file system according to a retention defined in the SnapCenter backup policy.

Retention management logic is executed with each backup workflow in SnapCenter.



Be aware that SnapCenter handles retention management individually for scheduled or ondemand backups.

#### Retention management of backups at the secondary storage

The retention management of backups at the secondary storage is handled by ONTAP based on the retention defined in the ONTAP protection relationship.

To synchronize these changes on the secondary storage in the SnapCenter repository, SnapCenter uses a scheduled cleanup job. This cleanup job synchronizes all secondary storage backups with the SnapCenter repository for all SnapCenter plug-ins and all resources.

The cleanup job is scheduled once per week by default. This weekly schedule results in a delay with deleting backups in SnapCenter and SAP HANA Studio when compared with the backups that have already been deleted at the secondary storage. To avoid this inconsistency, customers can change the schedule to a higher frequency, for example, once per day.



The cleanup job can also be triggered manually for an individual resource by clicking the refresh button in the topology view of the resource.

For details about how to adapt the schedule of the cleanup job or how to trigger a manual refresh, refer to the section "Change scheduling frequency of backup synchronization with off-site backup storage."

#### Retention management of data backups within the SAP HANA backup catalog

When SnapCenter has deleted any backup, local Snapshot or file based, or has identified the backup deletion at the secondary storage, this data backup is also deleted in the SAP HANA backup catalog.

Before deleting the SAP HANA catalog entry for a local Snapshot backup at the primary storage, SnapCenter checks if the backup still exists at the secondary storage.

#### Retention management of log backups

The SAP HANA database automatically creates log backups. These log backup runs create backup files for each individual SAP HANA service in a backup directory configured in SAP HANA.

Log backups older than the latest data backup are no longer required for forward recovery and can therefore be deleted.

SnapCenter handles the housekeeping of log file backups on the file system level as well as in the SAP HANA backup catalog by executing the following steps:

- 1. SnapCenter reads the SAP HANA backup catalog to get the backup ID of the oldest successful file-based or Snapshot backup.
- 2. SnapCenter deletes all log backups in the SAP HANA catalog and the file system that are older than this backup ID.



SnapCenter only handles housekeeping for backups that have been created by SnapCenter. If additional file-based backups are created outside of SnapCenter, you must make sure that the file-based backups are deleted from the backup catalog. If such a data backup is not deleted manually from the backup catalog, it can become the oldest data backup, and older log backups are not deleted until this file-based backup is deleted.

**(i)** 

Even though a retention is defined for on-demand backups in the policy configuration, the housekeeping is only done when another on-demand backup is executed. Therefore, on-demand backups typically must be deleted manually in SnapCenter to make sure that these backups are also deleted in the SAP HANA backup catalog and that log backup housekeeping is not based on an old on-demand backup.

Log backup retention management is enabled by default. If required, it can be disabled as described in the section "Disable auto discovery on the HANA plug-in host."

### Capacity requirements for Snapshot backups

You must consider the higher block change rate on the storage layer relative to the change rate with traditional databases. Due to the HANA table merge process of the column store, the complete table is written to disk, not just the changed blocks.

Data from our customer base shows a daily change rate between 20% and 50% if multiple Snapshot backups are taken during the day. At the SnapVault target, if the replication is done only once per day, the daily change rate is typically smaller.

### **Restore and recovery operations**

#### **Restore operations with SnapCenter**

From the HANA database perspective, SnapCenter supports two different restore operations.

- **Restore of the complete resource.** All data of the HANA system is restored. If the HANA system contains one or more tenants, the data of the system database and the data of all tenants are restored.
- Restore of a single tenant. Only the data of the selected tenant is restored.

From the storage perspective, the above restore operations must be executed differently depending on the used storage protocol (NFS or Fibre Channel SAN), the configured data protection (primary storage with or without offsite backup storage), and the selected backup to be used for the restore operation (restore from primary or offsite backup storage).

#### Restore of complete resource from primary storage

When restoring the complete resource from primary storage, SnapCenter supports two different ONTAP features to execute the restore operation. You can choose between the following two features:

- **Volume-based SnapRestore.** A volume based SnapRestore reverts the content of the storage volume to the state of the selected Snapshot backup.
  - Volume Revert check box available for auto discovered resources using NFS.
  - Complete Resource radio button for manual configured resources.
- File-based SnapRestore. A file-based SnapRestore, also known as Single File SnapRestore, restores all individual files (NFS), or all LUNs (SAN).
  - Default restore method for auto discovered resources. Can be changed using the Volume revert check box for NFS.
  - File-level radio button for manual configured resources.

The following table provides a comparison of the different restore methods.

	Volume-based SnapRestore	File-based SnapRestore
Speed of restore operation	Very fast, independent of the volume size	Very fast restore operation but uses background copy job on the storage system, which blocks the creation of new Snapshot backups
Snapshot backup history	Restore to an older Snapshot backup, removes all newer Snapshot backups.	No influence
Restore of directory structure	Directory structure is also restored	NFS: Only restores the individual files, not the directory structure. If the directory structure is also lost, it must be created manually before executing the restore operation SAN: Directory structure is also restored
Resource configured with replication to offsite backup storage	A volume-based restore cannot be done to a Snapshot copy backup that is older than the Snapshot copy used for SnapVault synchronization	Any Snapshot backup can be selected

#### Restore of complete resource from offsite backup storage

A restore from the offsite backup storage is always executed using a SnapVault restore operation where all files or all LUNs of the storage volume are overwritten with the content of the Snapshot backup.

#### Restore of a single tenant

Restoring a single tenant requires a file-based restore operation. Depending on the used storage protocol, different restore workflows are executed by SnapCenter.

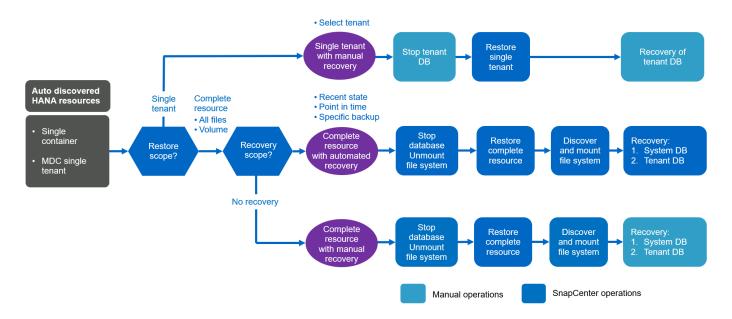
- NFS:
  - Primary storage. File-based SnapRestore operations are executed for all files of the tenant database.
  - Offsite backup storage: SnapVault restore operations are executed for all files of the tenant database.
- SAN:
  - Primary storage. Clone and connect the LUN to the database host and copy all files of the tenant database.
  - Offsite backup storage. Clone and connect the LUN to the database host and copy all files of the tenant database.

#### Restore and recovery of auto-discovered HANA single container and MDC single tenant systems

HANA single container and HANA MDC single tenant systems that have been auto discovered are enabled for automated restore and recovery with SnapCenter. For these HANA systems, SnapCenter supports three different restore and recovery workflows, as shown in the following figure:

• Single tenant with manual recovery. If you select a single tenant restore operation, SnapCenter lists all tenants that are included in the selected Snapshot backup. You must stop and recover the tenant database manually. The restore operation with SnapCenter is done with single file SnapRestore operations for NFS, or clone, mount, copy operations for SAN environments.

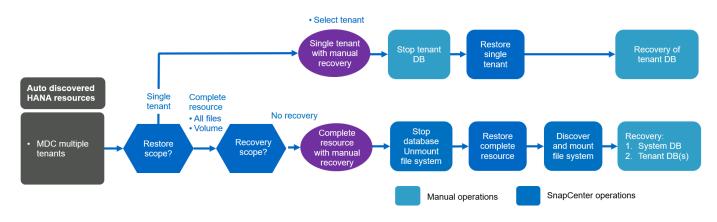
- **Complete resource with automated recovery.** If you select a complete resource restore operation and automated recovery, the complete workflow is automated with SnapCenter. SnapCenter supports up to recent state, point in time, or to specific backup recovery operations. The selected recovery operation is used for the system and the tenant database.
- **Complete resource with manual recovery.** If you select No Recovery, SnapCenter stops the HANA database and executes the required file system (unmount, mount) and restore operations. You must recover the system and tenant database manually.



#### Restore and recovery of automatically discovered HANA MDC multiple tenant systems

Even though HANA MDC systems with multiple tenants can be automatically discovered, automated restore and recovery is not supported with the current SnapCenter release. For MDC systems with multiple tenants, SnapCenter supports two different restore and recovery workflows, as shown in the following figure:

- · Single tenant with manual recovery
- · Complete resource with manual recovery



The workflows are the same as described in the previous section.

# Restore and recovery of manual configured HANA resources

Manual configured HANA resources are not enabled for automated restore and recovery. Also, for MDC systems with single or multiple tenants, a single tenant restore operation is not supported.

For manual configured HANA resources, SnapCenter only supports manual recovery, as shown in the following figure. The workflow for manual recovery is the same as described in the previous sections.



#### Summary restore and recovery operations

The following table summarizes the restore and recovery operations depending on the HANA resource configuration in SnapCenter.

SnapCenter resource configuration	Restore and recovery options	Stop HANA database	Unmount before, mount after restore operation	Recovery operation
Auto discovered Single container MDC single tenant	Complete resource with either	Automated with SnapCenter	Automated with SnapCenter	Automated with SnapCenter
	<ul> <li>Default (all files)</li> </ul>			
	<ul> <li>Volume revert (NFS from primary storage only)</li> </ul>			
	Automated recovery selected			
	Complete resource with either	Automated with SnapCenter	Automated with SnapCenter	Manual
	<ul> <li>Default (all files)</li> </ul>			
	<ul> <li>Volume revert (NFS from primary storage only)</li> </ul>			
	<ul> <li>No recovery selected</li> </ul>			
	Tenant restore	Manual	Not required	Manual

SnapCenter resource configuration	Restore and recovery options	Stop HANA database	Unmount before, mount after restore operation	Recovery operation
Auto discovered MDC multiple tenants	<ul> <li>Complete resource with either</li> <li>Default (all files)</li> <li>Volume revert (NFS from primary storage only)</li> <li>Automated recovery not supported</li> </ul>	Automated with SnapCenter	Automated with SnapCenter	Manual
	Tenant restore	Manual	Not required	Manual
All manual configured resources	<ul> <li>Complete resource (= Volume revert, available for NFS and SAN from primary storage only)</li> <li>File level (all files)</li> <li>Automated recovery not supported</li> </ul>	Manual	Manual	Manual

# Lab setup used for this report

The lab setup used for this technical report includes five different SAP HANA configurations:

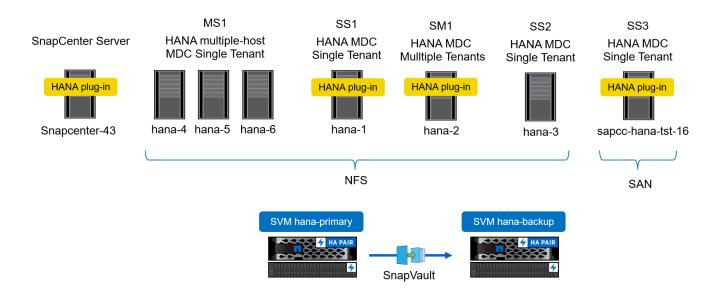
- MS1.
  - SAP HANA multiple-host MDC single tenant system
  - Managed with a central plug-in host (SnapCenter server)
  - Uses NFS as storage protocol
- SS1.
  - SAP HANA single-host MDC single tenant system
  - $\,\circ\,$  Auto discovered with HANA plug-in installed on HANA database host
  - Uses NFS as storage protocol
- SM1.

- · SAP HANA single-host MDC multiple tenant system
- · Auto discovered with HANA plug-in installed on HANA database host
- Uses NFS as storage protocol
- SS2.
  - · SAP HANA single-host MDC single tenant system
  - · Managed with a central plug-in host (SnapCenter Server)
  - Uses NFS as storage protocol
- SS3.
  - · SAP HANA single-host MDC single tenant system
  - · Auto discovered with HANA plug-in installed on HANA database host
  - Uses Fibre Channel SAN as storage protocol

The following sections describe the complete configuration and the backup, restore, and recovery workflows. The description covers local Snapshot backups as well as replication to backup storage using SnapVault. The storage virtual machines (SVMs) are hana-primary for the primary storage and hana-backup for the offsite backup storage.

The SnapCenter Server is used as a central HANA plug-in host for the HANA systems MS1 and SS2.

The following figure shows the lab setup.

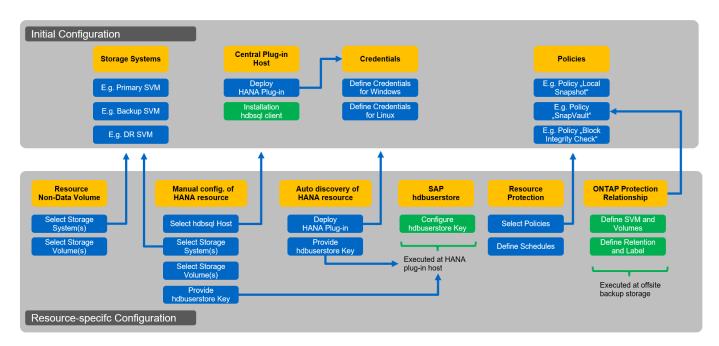


# **SnapCenter configuration**

The SnapCenter configuration can be separated into two main areas:

- Initial configuration. Covers generic configurations, independent of an individual SAP HANA database. Configurations such as storage systems, central HANA plug-in hosts, and policies, which are selected when executing the resource-specific configurations.
- **Resource-specific configuration.** Covers SAP HANA system-specific configurations and must be done for each SAP HANA database.

The following figure provides an overview of the configuration components and their dependencies. The green boxes show configuration steps that must be done outside of SnapCenter; the blue boxes show the steps that are done using the SnapCenter GUI.



With the initial configuration, the following components are installed and configured:

• **Storage system.** Credential configuration for all SVMs that are used by the SAP HANA systems: typically, primary, off-site backup, and disaster recovery storage.

Storage cluster credentials can the also be configured instead of individual SVM credentials.

- Credentials. Configuration of credentials used to deploy the SAP HANA plug-in on the hosts.
- Hosts (for central HANA plug-in hosts). Deployment of SAP HANA plug-in. Installation of the SAP HANA hdbclient software on the host. The SAP hdbclient software must be installed manually.
- **Policies.** Configuration of backup type, retention, and replication. Typically, at least one policy for local Snapshot copies, one for SnapVault replication, and one for file-based backup is required.

The resource-specific configuration must be performed for each SAP HANA database and includes the following configurations:

- SAP HANA non-data volume resource configuration:
  - Storage systems and volumes
- SAP hdbuserstore key configuration:
  - The SAP hdbuserstore key configuration for the specific SAP HANA database must be performed either on the central plug-in host, or on the HANA database host, depending on where the HANA plugin is deployed.
- Auto discovered SAP HANA database resources:
  - · Deployment of SAP HANA plug-in on database host
  - Provide hdbuserstore key
- Manual SAP HANA database resource configuration:

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- SAP HANA database SID, plug-in host, hdbuserstore key, storage systems and volumes
- Resource protection configuration:
  - Selection of required policies
  - Definition of schedules for each policy
- ONTAP data protection configuration:
  - $\circ\,$  Only required if the backups should be replicated to an off-site backup storage.
  - Definition of relationship and retention.

# Initial SnapCenter configuration

Initial configuration includes the following steps:

- 1. Storage system configuration
- 2. Credentials configuration for plug-in installation
- 3. For a central HANA plug-in host:
  - a. Host configuration and SAP HANA plug-in deployment
  - b. SAP HANA hdbsql client software installation and configuration
- 4. Policies configuration

The following sections describe the initial configuration steps.

# Storage system configuration

1. Log in to the SnapCenter Server GUI.

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🔛 Ap	ops 📊 OnComma	and Syste 💋 Vspere 📊 SnapCenter			
I SI	napCenter®				?→ L sapcc\scadmin SnapCenterAdmin I Sign Out
<		Status Get Started			
	Dashboard				Last refreshed: 11/19/2019 02:27 AM
	Resources	RECENT JOB ACTIVITIES 🚯	ALERTS ()	LATEST PROTECTION SUMMARY	All Plug-ins 🗢
	Monitor		S 0 Critical 🔺 0 Warning	Primary	Secondary SnapVault SnapMirror
<b>11</b>	Reports				
<b>A</b> (	Hosts		No data available	No Plug-ins	No Plug-ins
20.0	Storage Systems	No data available		No Fide III	10105.00
÷= :	Settings				
	Alerts			Failed: 0     Not configured: 0     Successful: 0     Not initiated: 0	● Failed: 0 ● Not configured: 0 ● Successful: 0
		See All	See All		
		JOBS 🚺 Last 7 days 👻	STORAGE () 0 0	0	0 x
		Backup Restore Clone	0 Snapshots 0 SnapMirrors	0 SnapVaults	Storage Savings
		No data available	No data a	No	Clone Savings
			ino uata a	valiable	<ul> <li>Snapsnot savings</li> </ul>
			Last 90	Dave	<ul> <li>Storage Consumed</li> </ul>
		• Failed: 0 • Warning: 0 • Completed: 0 • Running: 0		Secondary Snapshots	Primary Storage
				• 0 🛢 0 svr	
		🖥 🛈 Hosts 🛛 🔴 0	0	• 0 🖻 0 svi	Лs

2. Select Storage Systems.

()

In the screen, you can select the storage system type, which can be ONTAP SVMs or ONTAP Clusters. If you configure the storage systems on SVM level, you need to have a management LIF configured for each SVM. As an alternative, you can use a SnapCenter management access on cluster level. SVM management is used in the following example.

SnapCent	r®			<b>♦ ⊠ 9</b> -	sapcc\scadmin SnapCenterAdmin	🖡 Sign Out
	Storage Systems					
Dashboard	Type ONTAP SVMs   Search by Name				New	
🥺 Resources	Storage Connections					
	Name	IE IP	Cluster Name	User Name	Controller License	
Reports	There is no match for your search or data is not available.					
🔒 Hosts						
Storage Syst	ms					
Settings						
Alerts						

3. Click New to add a storage system and provide the required host name and credentials.



The SVM user is not required to be the vsadmin user, as shown in the screenshot. Typically, a user is configured on the SVM and assigned the required permissions to execute backup and restore operations. Details on required privileges can be found in the SnapCenter Installation Guide in the section titled "Minimum ONTAP privileges required".

Storage Systems				•		<b>8</b> -	👤 sapcc\scadmin	SnapCenterAdmin	1
	Add Storage System								
	Add Storage System 🚺								
Storage Connections	Storage System	hana-primary	]						
Name IE	Username	vsadmin							
There is no match for your search or data is not available.	Password								
	Event Management Sy	stem (EMS) & AutoSupport Settings							
	Send AutoSuppor	t notification for failed operations to storage system							
	Log SnapCenter S	erver events to syslog							
	🏠 More Options : Pla	tform, Protocol, Preferred IP etc							
	Submit Cancel	Reset							
	Name IL There is no match for your search or data	Name     Ii       There is no match for your search or data     Bassword       is not available.     Event Management Sy       Image: Send AutoSupport     Cog SnapCenter Sy       Image: Send AutoSupport     Cog SnapCenter Sy       Image: Send AutoSupport     Send AutoSupport	Name     I≟     Username     vsadmin       There is no match for your search or data is not available.     Password        Event Management System (EMS) & AutoSupport Settings     Send AutoSupport notification for failed operations to storage system       Image: Comparison of the system of the system (EMS) is a system of the system (EMS) is a system of the system (EMS) is a system of the system o	Name       Iš         There is no match for your search or data       Username         vsadmin       Password         Is not available.       Pessword         Event Management System (EMS) & AutoSupport Settings       Send AutoSupport notification for failed operations to storage system         Image: Comparison of the system set of the system       More Options : Platform, Protocol, Preferred IP etc	Name     L       There is no match for your search or data     Username     vadmin       is not available.     Password        Event Management System (EMS) & AutoSupport Settings       Image: Send AutoSupport notification for failed operations to storage system       Image: Log SnapCenter Server events to syslog       Image: More Options : Platform, Protocol, Preferred IP etc.,	Name       Iš         Username       vsadmin         Password          Event Management System (EMS) & AutoSupport Settings       Send AutoSupport notification for failed operations to storage system         Is not available.       Is sond Center Server events to syslog         More Options: Platform, Protocol, Preferred IP etc	Name     Ii       There is no match for your search or data is not available.     Username       Vsadmin     Password       Send AutoSupport Settings       Send AutoSupport notification for failed operations to storage system       Log SnapCenter Server events to syslog       More Options : Platform, Protocol, Preferred IP etc.,	Name       Iš         There is no match for your search or data       Vsamame       vsadmin         is not available.       Password          Event Management System (EMS) & AutoSupport Settings       Send AutoSupport notification for failed operations to storage system         Is not available.       Is not available.       Send AutoSupport notification for failed operations to storage system	Name       Is         Username       vsadmin         Is not available.       Password         Event Management System (EMS) & AutoSupport Settings       Send AutoSupport notification for failed operations to storage system         Is not available.       Log SnapCenter Server events to syslog         More Options : Platform, Protocol, Preferred IP etc

4. Click More Options to configure the storage platform.

Storage platform can be FAS, AFF, ONTAP Select, or Cloud Volumes ONTAP.



For a system used as a SnapVault or SnapMirror target, select the Secondary icon.

Sr	napCenter®				1		8-	L sapcc\scadmin	SnapCenterAdmin	🖡 Sign Out
>	Storage Systems									
		More options					×			
<b>V</b>	Storage Connections						1			
	Name 🔒	Platform	All Flash FAS	•	Secondary 1					
<b>111</b>	There is no match for your search or data is not available.	Protocol	HTTPS	•						
A	IS NOU aVallable.	Port	443							
		Timeout	60	seconds	0					
ł.		Preferred IP				0				
部										
A		Save Cancel								

5. Add additional storage systems as required. In our example, an additional offsite backup storage and a disaster recovery storage has been added.

Sna	pCenter®						•	-	<b>0-</b>	L sapcc\scadmin	SnapCenterAdmin	🖡 Sign Out
<		Storage	Systems									
	shboard	Туре	ONTAP SVMs    Search by Name	e							New	
🥑 Res	sources	Storag	ge Connections									
🛞 Mor	nitor		Name	4年	IP	Cluster Name		Use	r Name	Co	ontroller License	
Rep	ports		hana-backup.sapcc.stl.netapp.com		10.63.150.45			vsa	dmin	N	ot applicable	
			hana-dr.sapcc.stl.netapp.com		10.63.150.247			vsa	dmin	N	ot applicable	
📥 Hos	sts		hana-primary.sapcc.stl.netapp.com		10.63.150.248			vsa	dmin		•	
- Stor	rage Systems											
📰 Sett	tings											
A Aler	rts											
🚎 Sett	rage Systems tings		hana-primary.sapcc.stl.netapp.com		10.63.150.248			vsa	dmin	,	,	

#### **Credentials configuration**

1. Go to Settings, select Credentials, and click New.

n s	napCenter®									٠	2	0-	L sapcc\scadmin	SnapCe	enterAdmin	🗊 Sign Out
<		Global Settings	Policies	Users and Access	Roles	Credential	Software	Scheduled Configuration Checker								
	Dashboard	Search by Creder	ntial Name											New		
<b>V</b>	Resources	Credential Name					Usernam	e	Authentication m	ode						
	Monitor	There is no match f	for your searc	ch or data is not avail	able.											
<i>.</i>	Reports															
*	Hosts															
80	Storage Systems															
	Settings															
A	Alerts															

2. Provide the credentials for the user that are used for plug-in installations on Linux systems.

Provide informa	tion for the Credential ye	ou want to add	
Credential Name	InstallPluginOnLinux		
Username	root		0
Password			
Authentication	Linux	•	
Use sudo privile,	ges 🕕		

3. Provide the credentials for the user that are used for plug-in installations on Windows systems.

Credential Name	InstallPluginOnWindows		
Jsername	sapcc\scadmin		
Password			
Authentication	Windows	•	

The following figure shows the configured credentials.

п	SnapCenter®		•	<b>8-</b>	1 sapcc\scadmin	SnapCenterAdmi	🛙 🔋 Sign Out
<		Global Settings Policies Users and Access Roles Credential Software Scheduled Configuration Checker					
	Dashboard	Search by Credential Name				hew Modify	Delete
	Resources	Credential Name Username Au	uthentication mode				
-	Monitor		lnux				
<b>a</b>	Reports	InstallPluginOnWindows sapcc\scadmin Wi	Vindows				
	Hosts						
	Storage Systems						
	Settings						
	Alerts						

### SAP HANA plug-in installation on a central plug-in host

In the lab setup, the SnapCenter Server is also used as a central HANA plug-in host. The Windows host on which SnapCenter Server runs is added as a host, and the SAP HANA plug-in is installed on the Windows host.



The SAP HANA plug-in requires Java 64-bit version 1.8. Java needs to be installed on the host before the SAP HANA plug-in is deployed.

1. Go to Hosts and click Add.

•	SnapCenter®										٠		<b>0</b> -	L sapcc\scad	nin SnapC	enterAdmin	🖡 Sign Out
<		Managed Hosts	Disks	Shares	initiator Groups	ISCSI Session											
-	Dashboard	Search by Name		Y										Add			More
<b>I</b>	Resources	Name		41	Туре	System		Plug-in			V	ersion			Overall Statu:	s	
۲	Monitor						Tł	nere is no match for your searc	ch or data is not ava	ailable.							
<b>11</b>	Reports																
А	Hosts																
20	Storage Systems																
-	Settings																
▲	Alerts																

2. Provide the required host information. Click Submit.

Sr	napCenter®					٠	2	8-	L sapcc\scadmin	SnapCenterAdmin	🖡 Sign Out	
>	Managed Hosts										>	ĸ
	Search by Name	Add Host										
	Name	Host Type	Windows •									
	There is no mat	Host Name	SnapCenter-43									
		Credentials	InstallPluginOnWindows 🔻	+								
A		Select Plug-ins to Inst	all SnapCenter Plug-ins Package 4.3 for Windows									
20			Microsoft Windows Microsoft SQL Server									
÷			Microsoft Exchange Server									
A			SAP HANA									
		More Options : Po	rt, Install Path, Custom Plug-Ins									
		Submit Cancel	]									

The following figure shows all the configured hosts after the HANA plug-in is deployed.

I Sr	napCenter®						•	<b>≅ 0</b> -	L sapcc\scadmin	SnapCenterAdmin	🗊 Sign Out
		Managed Hosts Disks Sha	ares Initiator Groups iS	CSI Session							
	Dashboard	Search by Name	2						+ Add		More
🕗 R	Resources	Name	48	Туре	System	Plug-in		Version	Overall Statu	5	
🏵 🛚	Monitor	SnapCenter-43.sapcc.stl.net	tapp.com	Windows	Stand-alone	Microsoft Windows Server, SAP HANA		4.3	Configure	e VMware plug-in 🐧	
a R	Reports										
A +	losts										
- s	Storage Systems										
\Xi s	Settings										
<u>A</u> ^	Verts										

#### SAP HANA hdbsql client software installation and configuration

The SAP HANA hdbsql client software must be installed on the same host on which the SAP HANA plug-in is installed. The software can be downloaded from the SAP Support Portal.

The HDBSQL OS user configured during the resource configuration must be able to run the hdbsql executable. The path to the hdbsql executable must be configured in the hana.properties file.

• Windows:

```
C:\More C:\Program Files\NetApp\SnapCenter\Snapcenter Plug-in
Creator\etc\hana.properties
HANA HDBSQL CMD=C:\\Program Files\\sap\\hdbclient\\hdbsql.exe
```

• Linux:

```
cat /opt/NetApp/snapcenter/scc/etc/hana.properties
HANA HDBSQL CMD=/usr/sap/hdbclient/hdbsql
```

# **Policy configuration**

As discussed in the section "Data protection strategy," policies are usually configured independently of the resource and can be used by multiple SAP HANA databases.

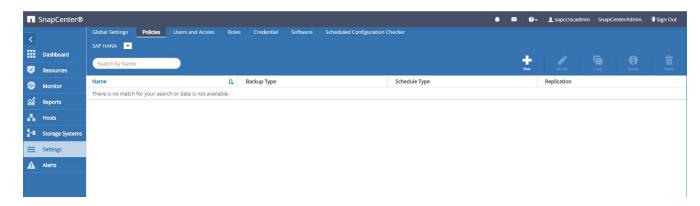
A typical minimum configuration consists of the following policies:

- Policy for hourly backups without replication: LocalSnap
- Policy for daily backups with SnapVault replication: LocalSnapAndSnapVault
- Policy for weekly block integrity check using a file-based backup: BlockIntegrityCheck

The following sections describe the configuration of these three policies.

#### Policy for hourly Snapshot backups

1. Go to Settings > Policies and click New.



2. Enter the policy name and description. Click Next.

1 Name	Provide a policy	y name	
2 Settings	Policy name	LocalSnap	6
3 Retention	Description	Snapshot backup at primary storage	
4 Replication			

3. Select backup type as Snapshot Based and select Hourly for schedule frequency.

New SAP HAN	NA Backup Policy	×
1 Name	Select backup settings	
2 Settings	Backup Type 💿 Snapshot Based 🔘 File-Based 🚯	
3 Retention	Schedule Frequency	
4 Replication	Select how often you want the schedules to occur in the policy. The specific times are set at backup job creation enabling you to stagger your start times.	
5 Summary	<ul> <li>None</li> <li>Hourly</li> <li>Daily</li> <li>Weekly</li> <li>Monthly</li> </ul>	
	<ul> <li>Daily</li> <li>Weekly</li> </ul>	

4. Configure the retention settings for on-demand backups.

1 Name	Retention settings	
2) Settings	On demand backup retention settings	~
B Retention	Backup retention settings 0	
4 Replication	Total Snapshot copies to keep     2	
5 Summary	Keep Snapshot copies for     14     days	
	Hourly retention settings	~

5. Configure the retention settings for scheduled backups.

New SAP HAN	IA Backup Policy			
1 Name	Retention settings			
2 Settings	On demand backup retention settings			~
3 Retention	Hourly retention settings			^
4 Replication	Total Snapshot copies to keep	12	0	
5 Summary	Keep Snapshot copies for	14	days	

6. Configure the replication options. In this case, no SnapVault or SnapMirror update is selected.

New SAP HAN	NA Backup Policy				
1 Name	Select secondary replicati	on options  🚯			
2 Settings	🔲 Update SnapMirror after d	reating a local Snaps	hot copy.		
3 Retention	🔲 Update SnapVault after cr	eating a local Snapsh	ot copy.		
4 Replication	Secondary policy label	One Time	- 0	•	
5 Summary	Error retry count 3	v			

7. On the Summary page, click Finish.

New SAP HAN	IA Backup Policy		×
1 Name	Summary		
2 Settings	Policy name	LocalSnap	
	Description	Snapshot backup at primary storage	
3 Retention	Backup Type	Snapshot Based Backup	
Replication	Schedule Type	Hourly	
	On demand backup retention	Total backup copies to retain : 2	
5 Summary	Hourly backup retention	Total backup copies to retain ; 12	
	Replication	none	

#### Policy for daily Snapshot backups with SnapVault replication

- 1. Go to Settings > Policies and click New.
- 2. Enter the policy name and description. Click Next.

1 Name	Provide a policy	y name	
2 Settings	Policy name	LocalSnapAndSnapVault	
3 Retention	Description	Local Snapshot backup replicated to backup storage	
4 Replication			
5 Summary			

x

3. Set the backup type to Snapshot Based and the schedule frequency to Daily.

New SAP HAN	NA Backup Policy	×
1 Name	Select backup settings	
2 Settings	Backup Type 💿 Snapshot Based 🔘 File-Based 🚺	
3 Retention	Schedule Frequency	
4 Replication	Select how often you want the schedules to occur in the policy. The specific times are set at backup job creation enabling you to stagger your start times.	
5 Summary	<ul> <li>None</li> <li>Hourly</li> <li>Daily</li> <li>Weekly</li> <li>Monthly</li> </ul>	

4. Configure the retention settings for on-demand backups.

1 Name	Retention settings	
2 Settings	On demand backup retention settings	^
3 Retention	Backup retention settings 🚯	
4 Replication	Total Snapshot copies to keep	
5 Summary	Keep Snapshot copies for 14 days	
	Daily retention settings	~

5. Configure the retention settings for scheduled backups.

New SAP HAP	IA Backup Policy	ډ
1 Name	Retention settings	
2 Settings	On demand backup retention settings	~
3 Retention	Daily retention settings	<u>^</u>
4 Replication	Total Snapshot copies to keep     3	
5 Summary	Keep Snapshot copies for	ys
	-	

6. Select Update SnapVault after creating a local Snapshot copy.



The secondary policy label must be the same as the SnapMirror label in the data protection configuration on the storage layer. See the section "Configuration of data protection to off-site backup storage."

Modify SAP H	IANA Backup Policy	×
Name	Select secondary replication options 0	
Settings	Update SnapMirror after creating a local Snapshot copy.	
<ul> <li>Retention</li> <li>Replication</li> <li>Summary</li> </ul>	<ul> <li>Update SnapVault after creating a local Snapshot copy.</li> <li>Secondary policy label Daily          <ul> <li>Daily</li> <li>Tror retry count</li> <li>3</li> <li>3</li> </ul> </li> </ul>	
		Previous Next

7. On the Summary page, click Finish.

Name	Summary	
Settings	Policy name	LocalSnapAndSnapVault
	Description	Local Snapshot backup replicated to backup storage
Retention	Backup Type	Snapshot Based Backup
Replication	Schedule Type	Daily
	On demand backup retention	Total backup copies to retain : 3
Summary	Daily backup retention	Total backup copies to retain : 3
	Replication	SnapVault enabled , Secondary policy label: Daily , Error retry count: 3

## Policy for Weekly Block Integrity Check

- 1. Go to Settings > Policies and click New.
- 2. Enter the policy name and description. Click Next.

1 Name	Provide a policy	/ name	
2 Settings	Policy name	BlockIntegrityCheck	0
3 Retention	Description	Block integrity check using file based backup	
4 Replication			
5 Summary			

3. Set the backup type to File-Based and schedule frequency to Weekly.

New SAP HA	NA Backup Policy	×
1 Name	Select backup settings	
2 Settings	Backup Type 💿 Snapshot Based 💽 File-Based 🚺	
3 Retention	Schedule Frequency	
4 Summary	Select how often you want the schedules to occur in the policy. The specific times are set at backup job creation enabling you to stagger your start times.  None Hourly Daily Weekly Monthly	

4. Configure the retention settings for on-demand backups.

New SAP HA	NA Backup Policy	,
1 Name	Retention settings	
2 Settings	On demand backup retention settings	Å
3 Retention	Backup retention settings 🚯	
4 Summary	Total backup copies to keep	
	Keep backup copies for     14     days	
	Weekly retention settings	~

5. Configure the retention settings for scheduled backups.

New SAP HAN	IA Backup Policy	×
1 Name	Retention settings	
2 Settings	On demand backup retention settings	~
3 Retention	Backup retention settings 0	
4 Summary	Total backup copies to keep	
	Keep backup copies for     14     days	
	Weekly retention settings	~

6. On the Summary page, click Finish.

Name	Summary		
Settings	Policy name	BlockIntegrityCheck	
Serrings	Description	Block integrity check using file based backup	
Retention	Backup Type	File-Based Backup	
to a literature of the	Schedule Type	Weekly	
ummary	On demand backup retention	Total backup copies to retain : 1	
	Weekly backup retention	Total backup copies to retain : 1	

The following figure shows a summary of the configured policies.

SnapCenter	Global Settings Policies Users and Access	Role	s Credential Software Scheduled Configuration	Charker					SnapCenterAdmin	
<	SAP HANA -	Note	s credential soluvare schedules comparation							
Dashboard	SAP HANA						1			-
Resources	Search by Name					Ne		Modify	Copy Details	Delete
Monitor	Name	11	Backup Type Schedule Type					Replication		
	BlockIntegrityCheck		File Based Backup	Weekly						
Reports	LocalSnap		Data Backup	Hourly						
Hosts	LocalSnapAndSnapVault		Data Backup	Daily				SnapVault		
- Storage System	ns									
Settings										
Alerts										

# SnapCenter resource-specific configuration for SAP HANA database backups

This section describes the configuration steps for two example configurations.

- SS2.
  - Single-host SAP HANA MDC single-tenant system using NFS for storage access

- The resource is manually configured in SnapCenter.
- The resource is configured to create local Snapshot backups and perform block integrity checks for the SAP HANA database using a weekly file-based backup.
- SS1.
  - Single-host SAP HANA MDC single-tenant system using NFS for storage access
  - The resource is auto-discovered with SnapCenter.
  - The resource is configured to create local Snapshot backups, replicate to an off-site backup storage using SnapVault, and perform block integrity checks for the SAP HANA database using a weekly filebased backup.

The differences for a SAN-attached, a single-container, or a multiple-host system are reflected in the corresponding configuration or workflow steps.

### SAP HANA backup user and hdbuserstore configuration

NetApp recommends configuring a dedicated database user in the HANA database to run the backup operations with SnapCenter. In the second step, an SAP HANA user store key is configured for this backup user, and this user store key is used in the configuration of the SnapCenter SAP HANA plug-in.

The following figure shows the SAP HANA Studio through which the backup user can be created.



The required privileges were changed with the HANA 2.0 SPS5 release: backup admin, catalog read, database backup admin, and database recovery operator. For earlier releases, backup admin and catalog read are sufficient.



For an SAP HANA MDC system, the user must be created in the system database because all backup commands for the system and the tenant databases are executed using the system database.

hdbstudio - /Security/Users/SNAPCENTER System: SYSTEMDB@SS	1 Host: hana-1 Instance: 00 Connected User: SYSTEM System Usage	Test System - SAP HANA Studio	- 🗆 X
Eile Edit Navigate Search Run Window Help	in the second		<b>u</b> ~
□ • □ □ □ 1 • □ • □ • □ • □ • □			Q 😰 😵
‱ Systems 🛛 📑 ▾ 💷 👬 ▾ 💷 🛃 🖻 🎭 🖇 🖶 🗖	Backup SYSTEMDB@SS1 (SYSTEM)	🖄 Backup SYSTEMDB@QS1 (SYSTEM 🔥 S)	/STEMDB@QS1 - SNAPCENTER 👔 SYSTEMDB@SS1 - SNAPCENTER 🛛 🗖 🗖
CS1 - System Refresh Target     CS1@QS1 (SYSTEM) QS1 - System Refresh Target     SII SYSTEMDB@QS1 (SYSTEM) QS1 - System Refresh Target	SYSTEMDB@SS1 (SYSTEM) SS1 - MDC s User User Parameters	ngle tenant - 2.0SPS5 hana-1.00	Ba   🏇   👁   🔗
<ul> <li>✓ Construct Start - 2.0595</li> <li>✓ Start - MDC Single tenant - 2.0595</li> <li>✓ Start - 2.0595</li> <li>✓ StrembB@SSI (SYSTEM) SSI - MDC single tenant - 2.0595</li> <li>✓ Start - 2.0</li></ul>	Status Privilege System Status EACKUP ADMIN Syste DATABASE EACKUP ADMIN Syste DATABASE RECOVERY OPERATOR System	m* Configure	
	🔲 Properties 🔀 🤨 Error Log		1 · · · · · · · · · · · · · · · · · · ·
	Property	Value	
< >>	¢	SYSTEM	DB@SS1 han (SYSTEM):SYSTEM :

At the HANA plug-in host, on which the SAP HANA plug-in and the SAP hdbsql client are installed, a userstore key must be configured.

#### Userstore configuration on the SnapCenter server used as a central HANA plug-in host

If the SAP HANA plug-in and the SAP hdbsql client are installed on Windows, the local system user executes the hdbsql commands and is configured by default in the resource configuration. Because the system user is not a logon user, the user store configuration must be done with a different user and the -u <User> option.

```
hdbuserstore.exe -u SYSTEM set <key> <host>:<port> <database user>
<password>
```

The SAP HANA hdbclient software must be first installed on the Windows host.

#### Userstore configuration on a separate Linux host used as a Central HANA plug-in host

If the SAP HANA plug-in and SAP hdbsql client are installed on a separate Linux host, the following command is used for the user store configuration with the user defined in the resource configuration:

hdbuserstore set <key> <host>:<port> <database user> <password>

 $(\mathbf{i})$ 

(;

The SAP HANA hdbclient software must be first installed on the Linux host.

#### Userstore configuration on the HANA database host

If the SAP HANA plug-in is deployed on the HANA database host, the following command is used for the user store configuration with the <sid>adm user:

hdbuserstore set <key> <host>:<port> <database user> <password>



SnapCenter uses the <sid>adm user to communicate with the HANA database. Therefore, the user store key must be configured using the <`sid>adm` user on the database host.



Typically, the SAP HANA hdbsql client software is installed together with the database server installation. If this is not the case, the hdbclient must be installed first.

#### Userstore configuration depending on HANA system architecture

In an SAP HANA MDC single-tenant setup, port 3<instanceNo>13 is the standard port for SQL access to the system database and must be used in the hdbuserstore configuration.

For an SAP HANA single-container setup, port 3<instanceNo>15 is the standard port for SQL access to the index server and must be used in the hdbuserstore configuration.

For an SAP HANA multiple-host setup, user store keys for all hosts must be configured. SnapCenter tries to connect to the database using each of the provided keys and can therefore operate independently of a failover of an SAP HANA service to a different host.

#### Userstore configuration examples

In the lab setup, a mixed SAP HANA plug-in deployment is used. The HANA plug-in is installed on the SnapCenter Server for some HANA systems and deployed on the individual HANA database servers for other systems.

#### SAP HANA system SS1, MDC single tenant, instance 00

The HANA plug-in has been deployed on the database host. Therefore, the key must be configured on the database host with the user ss1adm.

```
hana-1:/ # su - ssladm
ssladm@hana-1:/usr/sap/SS1/HDB00>
ssladm@hana-1:/usr/sap/SS1/HDB00>
ssladm@hana-1:/usr/sap/SS1/HDB00> hdbuserstore set SS1KEY hana-1:30013
SnapCenter password
ssladm@hana-1:/usr/sap/SS1/HDB00> hdbuserstore list
DATA FILE
                : /usr/sap/SS1/home/.hdb/hana-1/SSFS HDB.DAT
KEY FILE
                : /usr/sap/SS1/home/.hdb/hana-1/SSFS HDB.KEY
KEY SS1KEY
  ENV : hana-1:30013
 USER: SnapCenter
KEY SS1SAPDBCTRLSS1
 ENV : hana-1:30015
 USER: SAPDBCTRL
ssladm@hana-1:/usr/sap/SS1/HDB00>
```

#### SAP HANA system MS1, multiple-host MDC single tenant, instance 00

For HANA multiple host systems, a central plug-in host is required, in our setup we used the SnapCenter Server. Therefore, the user store configuration must be done on the SnapCenter Server.

```
hdbuserstore.exe -u SYSTEM set MS1KEYHOST1 hana-4:30013 SNAPCENTER
password
hdbuserstore.exe -u SYSTEM set MS1KEYHOST2 hana-5:30013 SNAPCENTER
password
hdbuserstore.exe -u SYSTEM set MS1KEYHOST3 hana-6:30013 SNAPCENTER
password
C:\Program Files\sap\hdbclient>hdbuserstore.exe -u SYSTEM list
DATA FILE
                : C:\ProgramData\.hdb\SNAPCENTER-43\S-1-5-18\SSFS HDB.DAT
KEY FILE
                : C:\ProgramData\.hdb\SNAPCENTER-43\S-1-5-18\SSFS HDB.KEY
KEY MS1KEYHOST1
  ENV : hana-4:30013
 USER: SNAPCENTER
KEY MS1KEYHOST2
 ENV : hana-5:30013
 USER: SNAPCENTER
KEY MS1KEYHOST3
 ENV : hana-6:30013
 USER: SNAPCENTER
KEY SS2KEY
  ENV : hana-3:30013
  USER: SNAPCENTER
C:\Program Files\sap\hdbclient>
```

## Configuration of data protection to off-site backup storage

The configuration of the data protection relation as well as the initial data transfer must be executed before replication updates can be managed by SnapCenter.

The following figure shows the configured protection relationship for the SAP HANA system SS1. With our example, the source volume SS1\_data\_mnt00001 at the SVM hana-primary is replicated to the SVM hana-backup and the target volume SS1\_data\_mnt00001 dest.



The schedule of the relationship must be set to None, because SnapCenter triggers the SnapVault update.

OnCommand S	ystem Manage	er							ø	🗩 🌼	?	2
						Ту	pe: All	•	Q Search	all Objects		+
	Volume Relati	ionships										
Dashboard	+ Create 🖌 Ec	dit 🥤 Delete 🔍 Operation:	• C Refresh									
Applications & Tiers	Source Storage Vi	. 👳 Source Volume 🦷	Destination Volume	Destination Stora	Is Healthy \Xi Obje	ct 👳 🛛 Rela.	. 👳 🛛 Transf 🖶	Relationship Ty	pe Lag Tim	Policy Name	Policy Type	T
Storage	hana-primary	SS1_data_mnt00001	SS1_data_mnt00001_dest	hana-backup	🥝 Yes 🛛 Volui	me Snap	mi Idle	Asynchronous \	/ 21 hr(s).	. SnapCenterVault	t Asynchronou	is Vault
Network					-0							
Protection •	*											
Volume Relationships												
SVM DR Relationships												
Protection Policies												
Schedules												
Snapshot Policies												
Events & Jobs												
Configuration	Source Location	hana-primary:SS1_data	is Healthy:	🖉 Yes	Transfer Status:	Id	e					
	Destination Loca	ation: hana-backup:SS1_data_m	Relationship State:	Snapmirrored	Current Transfer Ty	pe: N	one					
	Source Cluster:	a700-marco	Network Compression	Not Applicable	Current Transfer Er	ror: N	one					
	Destination Clus	ter: a700-marco	Ratio:		Current Transfer Pr	ogress: N	one					
	Transfer Schedu	ile: None			Last Transfer Error:	N	one					
	Data Transfer Ra	ate: Unlimited			Last Transfer Type:	U	odate					
	Lag Time:	21 hr(s) 23 min(s)			Latest Snapshot Tin	nestamp: 11	/26/2019 11:03:5	3				
					Latest Snapshot Co		apCenter_LocalS 19_08.17.01.897	napAndSnapVault, 9	Daily_11-26-			
	Details	Policy Details	Snapshot Copies									

The following figure shows the protection policy. The protection policy used for the protection relationship defines the SnapMirror label, as well as the retention of backups at the secondary storage. In our example, the used label is Daily, and the retention is set to 5.



The SnapMirror label in the policy being created must match the label defined in the SnapCenter policy configuration. For details, refer to Policy for daily Snapshot backups with SnapVault replication.



The retention for backups at the off-site backup storage is defined in the policy and controlled by ONTAP.

	OnCommand	Sys	tem Manager									(	୭	🗩 🗘	: ?	2	
										Type:	All	•	Q Search	n all Objects		+ -	
			Volume Relationship	ps													
8	Dashboard		+ Create 🖌 Edit 🔋 I	Delete 🔧 Operati	ons • C Refre	sh											
-	Applications & Tiers	¥	Source Storage Vi = So	urce Volume	S Destination V	olume	🖶 Destination Stora	😇 Is Healthy	😇 Object '	🖶 Rela 😇	Transf 🐨	Relationship Typ	Lag Tim	e Policy Name	= Policy Type	Ŧ	٠
1	Storage	×	hana-primary SS	1_data_mnt00001	SS1_data_mn	t00001_dest	hana-backup	🥝 Yes	Volume	Snapmi	Idle	Asynchronous V	21 hr(s).	SnapCenterVa	ult Asynchrono	us Vault	-
*	Network	×															
<b>V</b>	Protection	•															
	Volume Relationships																
	SVM DR Relationships																
	Protection Policies																
	Schedules																
	Snapshot Policies																
	Events & Jobs	×	Policy Name: SnapCenter	rVault													
볞	Configuration	٠	Comments:	, rourc													
			Label			- Number of	Copies 🕾	Matching Snaps	hot copy Schedules	in Source Vol	ume					3	7
			Daily			5		Source does not	have any schedule	s with this lab	el						
			Details	Policy Details	Snaps	shot Copies											_

### Manual HANA resource configuration

This section describes the manual configuration of the SAP HANA resources SS2 and MS1.

- SS2 is a single-host MDC single-tenant system
- MS1 is a multiple-host MDC single-tenant system.
  - 1. From the Resources tab, select SAP HANA and click Add SAP HANA Database.
  - 2. Enter the information for configuring the SAP HANA database and click Next.

Select the resource type in our example, Multitenant Database Container.



For a HANA single container system, the resource type Single Container must be selected. All the other configuration steps are identical.

For our SAP HANA system, the SID is SS2.

The HANA plug-in host in our example is the SnapCenter Server.

The hdbuserstore key must match the key that was configured for the HANA database SS2. In our example it is SS2KEY.

Add SAP HANA Da	tabase		
1 Name	Provide Resource Det	ails	
2 Storage Footprint	Resource Type	Multitenant Database Container	
3 Summary	HANA System Name	SS2 - HANA 20 SPS4 MDC Single Tenant	
	SID	552	(
	Plug-in Host	SnapCenter-43.sapcc.stl.netapp.com	- 0
	HDB Secure User Store Keys	SS2KEY	0
	HDBSQL OS User	SYSTEM	6

For an SAP HANA multiple-host system, the hdbuserstore keys for all hosts must be included, as shown in the following figure. SnapCenter will try to connect with the first key in the list, and will continue with the other case, in case the first key does not work. This is required to support HANA failover in a multiple-host system with worker and standby hosts.

Modify SAP HANA	Database			×
1 Name	Provide Resource Det	ails		
2 Storage Footprint	Resource Type	Multitenant Database Container		
3 Summary	HANA System Name	M51 - Multiple Hosts MDC Single Tenant		
Summary	SID	MS1		0
	Plug-in Host	SnapCenter-43.sapcc.stl.netapp.com	•	0
	HDB Secure User Store Keys	MS1KEYHOST1,MS1KEYHOST2,MS1KEYHOST3	li	0
	HDBSQL OS User	SYSTEM		0

3. Select the required data for the storage system (SVM) and volume name.

(i)

Add SAP HANA Da	itabase			
1 Name	Provide Storage F	ootprint Details		
2 Storage Footprint	Add Storage Fo	ootprint		,
3 Summary	Storage System	hana-primary.sapcc.stl	I.netapp.com   their associated Qtrees and LUNs	
	Volume name		LUNs or Qtrees	
SS2_data_mnt0		001	Default is 'None' or type to find	



For a Fibre Channel SAN configuration, the LUN needs to be selected as well.

()

For an SAP HANA multiple-host system, all data volumes of the SAP HANA system must be selected, as shown in the following figure.

Add SAP HANA Da	abase	:
1 Name	Provide Storage Footprint Details	
2 Storage Footprint	Add Storage Footprint	
3 Summary	Storage System hana-primary.sapcc. Select one or more volumes and if required Volume name MS1_data_mnt00001 MS1_data_mnt00002	X

The summary screen of the resource configuration is shown.

4. Click Finish to add the SAP HANA database.

Add SAP HANA Da	tabase			×
1 Name	Summary			
2 Storage Footprint	Resource Type	Multitenant Database Container		
	HANA System Name	SS2 - HANA 20 SPS4 MDC Single	Tenant	
3 Summary	SID	552		
	Plug-in Host	SnapCenter-43.sapcc.stl.netapp.	com	
	HDB Secure User Store Keys	SS2KEY		
	HDBSQL OS User	SYSTEM		
	Storage Footprint			
	Storage System	Volume	LUN/Qtree	
	hana-primary.sapcc.stl.netapp.com	SS2_data_mnt00001		

5. When resource configuration is finished, perform the configuration of resource protection as described in the section Resource protection configuration.

#### Automatic discovery of HANA databases

This section describes the automatic discovery of the SAP HANA resource SS1 (single host MDC single tenant system with NFS). All the described steps are identical for a HANA single container, HANA MDC multiple tenants' systems, and a HANA system using Fibre Channel SAN.



The SAP HANA plug-in requires Java 64-bit version 1.8. Java must be installed on the host before the SAP HANA plug-in is deployed.

- 1. From the host tab, click Add.
- 2. Provide host information and select the SAP HANA plug-in to be installed. Click Submit.

I Sr	apCente	r®					٠	••	L sapcc\scadmin	SnapCenterAdmin	🖡 Sign Ou	t
	Managed	Hosts										>
> 	Search	by Name	Add Host									
]		Name	Host Type	Linux	•							
)		SnapCenter-43.sapcc.stl.netapp.cc	Host Name	hana-1								
i			Credentials	InstallPluginOnLinux •	•	+						
			Select Plug-ins to Inst	all SnapCenter Plug-ins Package 4.3 for Linux								
				Oracle Database								
				SAP HANA rt, Install Path, Custom Plug-Ins								
			Submit Cancel	1								
			Submit Cancel	ļ								

3. Confirm the fingerprint.

Host name 11 Fingerprint	Valid
hana- ssh-rsa 2048 6E:80:F0:B7:6E:8F:E4:9A:E5:2E:E8:6A:0C:0A:18:C7 1.sapcc.stl.netapp.com	

The installation of the HANA plug-in and the Linux plug-in starts automatically. When the installation is finished, the status column of the host shows Running. The screen also shows that the Linux plug-in is installed together with the HANA plug-in.

	SnapCenter®								• •	a ()-	👤 sapcc\sca	idmin SnapCe	nterAdmin 🗊	Sign Out
<		Managed Hosts	Disks Shares	Initiator Groups	iSCSI Session									
	Dashboard	Search by Name	V								+ ~			More
1	Resources	Name			45	Туре	System	Plug-in				Version	Overall Sta	atus
-	Monitor		cc.stl.netapp.com			Linux	Stand-alone	UNIX, SAP HANA				4.3	Runnir	ng
		<u>SnapCente</u>	r-43.sapcc.stl.netapp.ce	om		Windows	Stand-alone	Microsoft Windows Server, Se	AP HANA			4.3	Runnir	ng
	Reports													
~	Hosts													
24	Storage Systems													
=	Settings													
A	Alerts													

After the plug-in installation, the automatic discovery process of the HANA resource starts automatically. In the Resources screen, a new resource is created, which is marked as locked with the red padlock icon.

4. Select and click on the resource to continue the configuration.



You can also trigger the automatic discovery process manually within the Resources screen, by clicking Refresh Resources.

<	SAP HAN	A 🔽								
Dashboard	View	Aultitenant Databa	se Container 🔹 Sea	rch databases 🛛 🏹				Refresh Resources	Add SAP HANA Da	atabase New Resource Gro
Resources	11.19	System	System ID (SID)	Tenant Database	Plug-in Host	Resource Groups	Policies	Last	t backup	Overall Status
Monitor		SS1	SS1	551	hana-1.sapcc.stl.netapp.com				ħ	Not protected
Reports										
Reports										
Hosts	5									
Hosts	5,									

5. Provide the userstore key for the HANA database.

Configure Databas	se		×
Plug-in host	hana-1.sapcc.stl.netapp.com		
HDBSQL OS User	ss1adm		
HDB Secure User Store Keys	SS1KEY		0
<b>O</b> Configuring Databa	se	Cancel	ж

The second level automatic discovery process starts in which tenant data and storage footprint information is discovered.

6. Click Details to review the HANA resource configuration information in the resource topology view.

SAP	HANA 🔽	SS1 Topology							
Se	arch databases		Remove Protection	Back up Now	Modify	Maintenance	i Details Cor	ifigure Database	Refres
12	System	Manage Copies				<u> </u>			
20	MS1 - Multiple Hosts MDC Single Tenant					-	<i>c</i>		
20	SS2 - HANA 20 SPS4 MDC Single Tenant	17 Backups					mary Card		
	SM1	0 Clones					ckups Snapshot based ba	-	
	551	Local copies 5 Backups					File-Based backups		
		0 Clones				0 Cl			
		Vault copies							
		Primary Backup(s)							
		search Y						Cone .	49 Sectors
		Backup Name	Count	1F					End Date
		SnapCenter_LocalSnap_Hourly_11-27-2019_02.30.01.1788	1				11/2	7/2019 2:30:5	55 AM 🛱
		SnapCenter_LocalSnap_Hourly_11-26-2019_22.30.01.0413	1				11/26	2019 10:30:5	55 PM 🛱
		SnapCenter_LocalSnap_Hourly_11-26-2019_18.30.01.0738	1				11/2	5/2019 6:30:5	55 PM 🛱
		SnapCenter_LocalSnap_Hourly_11-26-2019_14.30.01.0340	1				11/2	5/2019 2:30:5	55 PM 🛱
		SnapCenter_LocalSnap_Hourly_11-26-2019_10.30.01.0649	1				11/26	2019 10:30:5	55 AM 🛱
		SnapCenter_LocalSnapAndSnapVault_Daily_11-26-2019_08.17.01.8979	1				11/2	5/2019 8:17:5	56 AM 🛱
		SnapCenter_LocalSnap_Hourly_11-26-2019_06.30.01.0003	1				11/2	5/2019 6:30:5	55 AM 🛱
		SnapCenter_LocalSnap_Hourly_11-26-2019_02.30.00.9915	1				11/2	5/2019 2:30:5	55 AM 🛱
		SnapCenter_LocalSnap_Hourly_11-25-2019_22.30.01.0536	1				11/25	2019 10:30:5	55 PM 🛱
		SnapCenter_LocalSnap_Hourly_11-25-2019_18.30.01.0250	1				11/2	5/2019 6:30:5	55 PM 🛱
		SnapCenter_LocalSnap_Hourly_11-25-2019_14.30.01.0151	1				11/2	5/2019 2:30:5	55 PM 🛱
		SnapCenter_LocalSnap_Hourly_11-25-2019_10.30.00.9895	1				11/25	2019 10:30:5	55 AM 🛱
		SnapCenter_LocalSnapAndSnapVault_Daily_11-25-2019_08.17.01.8577	1				11/2	5/2019 8:17:5	55 AM 🛱
Total		SnanCenter LocalSnan Hourly 11-25-2019 06 30 00 9717 Total 17	1				11/2	5/2019 6:30:5	55 AM 🖻

SAP	HANA 🔽	Resource - Details					
	earch databases						
56	earch databases						
Ph.	System	Details for selected resource					
20	MS1 - Multiple Hosts MDC Single Tenant	Туре	Multitenant	Database Container			
20	SS2 - HANA 20 SPS4 MDC Single Tenant	HANA System Name	551				
	SM1	SID	SS1				
	SS1	Tenant Database	SS1				
		Plug-In Host	hana-1.sapi	c.stl.netapp.com			
		HDB Secure User Store Keys	5S1KEY				
		HDBSQL OS User	ss1adm				
		plug-in name	SAP HANA				
		Last backup		2:30:55 AM (Completed)			
		Resource Groups		c_stl_netapp_com_hana_MDC_551			
		Policy		tyCheck, LocalSnap, LocalSnapAndSnapVault			
		Discovery Type	Auto				
		Storage Footprint					
		SVM	Volume	Junction Path		LUN/Qtree	
		hana-primary.sapcc.stl.netapp.com	SS1_data_mnt00001	/SS1_data_mnt0000	1		
Tota	al 4						

When the resource configuration is finished, the resource protection configuration must be executed as described in the following section.

#### **Resource protection configuration**

This section describes the resource protection configuration. The resource protection configuration is the same, whether the resource has been auto discovered or configured manually. It is also identical for all HANA architectures, single or multiple hosts, single container, or MDC systems.

- 1. From the Resources tab, double-click the resource.
- 2. Configure a custom name format for the Snapshot copy.



NetApp recommends using a custom Snapshot copy name to easily identify which backups have been created with which policy and schedule type. By adding the schedule type in the Snapshot copy name, you can distinguish between scheduled and on-demand backups. The schedule name string for on-demand backups is empty, while scheduled backups include the string Hourly, Daily, or Weekly.

In the configuration shown in the following figure, the backup and Snapshot copy names have the following format:

- Scheduled hourly backup: SnapCenter\_LocalSnap\_Hourly\_<time\_stamp>
- Scheduled daily backup: SnapCenter\_LocalSnapAndSnapVault\_Daily\_<time\_stamp>
- On-demand hourly backup: SnapCenter\_LocalSnap\_<time\_stamp>
- On-demand daily backup: SnapCenter\_LocalSnapAndSnapVault\_<time\_stamp>



Even though a retention is defined for on-demand backups in the policy configuration, the housekeeping is only done when another on-demand backup is executed. Therefore, on-demand backups must typically be deleted manually in SnapCenter to make sure that these backups are also deleted in the SAP HANA backup catalog and that the log backup housekeeping is not based on an old on-demand backup.

I Si	napCenter®		• =	i 0	sapcc\scadmin	SnapCenterAdmin	🖡 Sign Out
>	SAP HANA 💌		Multitenant Database Container - Protect				×
	Search databa	ses					i Details
0	11 Im	System	Configure an SMTP Server to send email notifications for scheduled or on demand jobs by going to Settings-Sciobal Settings-Notification Serve	er Settings.			×
		551					
<b>a</b> ii							
A			Resource Application Settings Policies Notification Summary				
80			Provide format for custom snapshot name				
=							
▲			Use custom name format for Snapshot copy				
			SnapCenter				
	Total 1					Prev	vious Next
Activi	ty The 5 m	est recent jobs are displayed	🛇 0 Completed 🔺 0 Warnings 🔀 0 Falled 🥥 0 Canceled 📀 0 Running 💿 0 Queued				^

3. No specific setting needs to be made on the Application Settings page. Click Next.

Sr	napCenter®					<b>8-</b>	L sapcc\scadmin	SnapCenterAdmin	🖡 Sign Out
>	SAP HANA 💌		Multitenant Database Container - Protect						×
	Search databa	ses							i Details
	IE IN	System							Details
•		SS1							
24			1 2 3 4 5 Resource Application Settings Policies Notification Summary						
<i></i>			resource oppication sectings instances restinguishing summery						
*			Backups		~				
84 -			Select consistency group option for backup						
罪									
▲			Enable consistency group backup						
			Scripts		~				
			Custom Configurations Snapshot Copy Tool		~				
			andpartec copy rear.		~				
	Total 1							Prev	ious Next
Activit https://sr	The 5 mo apcenter-43.sapcc.stl.	st recent jobs are displayed netapp.com:8146/PluginCreatorInv	entoryProtect/ProtectInder/Resource O Completed 💧 0 Warnings 🔀 0 Failed 🥝 0 Canceled 🧿 0 Running 🌚 0	Queued					^

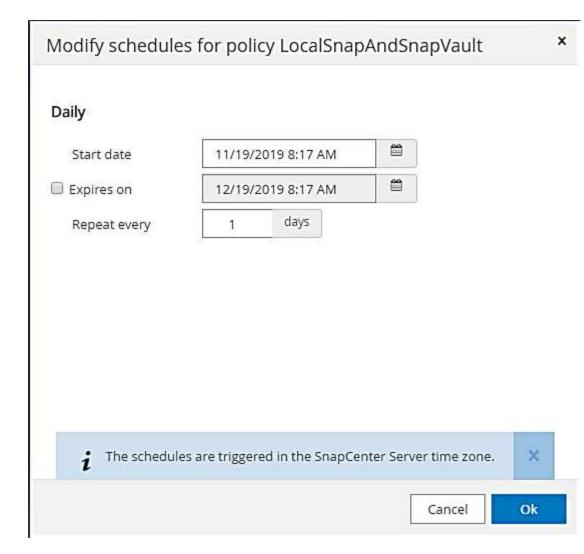
4. Select the policies to add to the resource.

Sr	napCenter®			• =	O→         L sapcc\scadmin         SnapCenterAdmin	🖡 Sign Out
>	SAP HANA 💌	Multitenant Database Container - Protect				×
	Search databases					i
						Details
0	JE P System					
٠	551	0 2	3 4 5			
<b>M</b>		Resource Application Settings F	olicies Notification Summar	X		
٨						
24		Select one or more policies and cor				
		LocalSnap, BlockIntegrityCheck	· + 0			
華		LocalSnap     BlockIntegrityCheck	S			
▲		LocalSnapAndSnapVault	Applied Schedules	Configure Schedules		
		BlockIntegrityCheck	None	+		
		LocalSnap	None	+		
		Total 2				
	Total 1				Previ	vious Next
Activit	ty The 5 most recent jobs are displayed	🔗 0 Completed 🧉 🖉	0 Warnings 🔀 0 Failed 🥝 0 Cancel	ed 🧿 0 Running 🧐 0 Queued		^

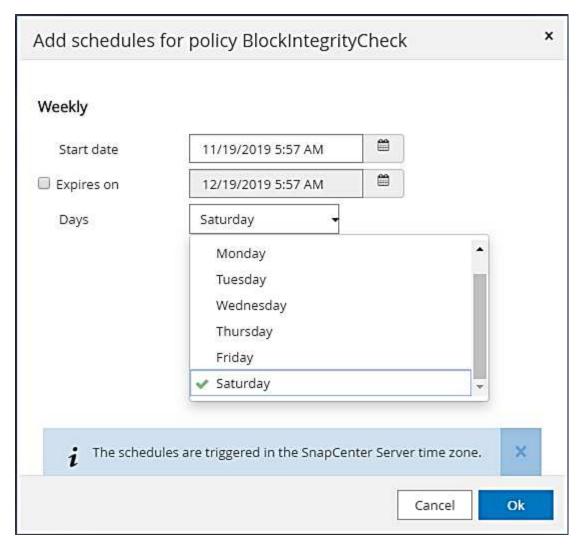
5. Define the schedule for the LocalSnap policy (in this example, every four hours).

Hourly						
Start date	11/19/2	019 6:30 AM		0	]	
Expires on	12/19/2	019 5:59 AM		8	]	
Repeat every	4	hours	0	m	ins	

6. Define the schedule for the LocalSnapAndSnapVault policy (in this example, once per day).



7. Define the schedule for the block integrity check policy (in this example, once per week).



8. Provide information about the email notification.

Sr	napCenter®	🌲 💆 🚱 - 💄 sapcriscadmin SnapCenterAdmin	🖡 Sign Out
>	SAP HANA 🔽	Multitenant Database Container - Protect	×
	Search databases		i Details
U	📙 🎮 System	If you want to send notifications for scheduled or on demand jobs, an SMTP server must be configured. Continue to the summary page to save your information, and then go to Settings>Global	×
٠	551	Settings-Notification Server Settings to configure the SMTP server.	
*			
Å		Resource Application Settings Policies Notification Summary	
10			
#		Provide email settings 🕦 Select the service accounts or people to notify regarding protection issues.	
<b>A</b>		Email preference Never	
_		From Email from	
		To Email to	
		Subject Notification	
		Attach job report	
	Total 1	Previo	us Next
A	And the second		
Activit	Y The 5 most recent jobs are displayed	🥪 0 Completed 🔺 0 Warnings 🗙 D Failed 🔗 D Canceled 💿 0 Running 🗐 0 Queued	

9. On the Summary page, click Finish.

Sr	apCenter®						•	2	0-	L sapcc\scadmin	SnapCenterAdmin	🖡 Sign Out
>	SAP HANA 💌	Multitenant Database Container - Protect										×
	Search databases											i
												Details
U	11 System	If you want to send notifications for scheduled Settings>Notification Server Settings to config			nust be configured	d. Continue to the s	ummary page to	o save yo	our info	rmation, and then go	to Settings>Global	
	551											. A
<i></i>		00		_								
		Resource Application Settings	Policies	Notification	Summary							
Å		insource inpproximition seconds	1 Oncies	Houncadon	Junning							
80 B			551									
**		System name Policy	LocalSnap: Ho	ourly								
A		i oncy		Check: Weekly								
		Send email	No									
		⊙ Application Settings										
		Enable consistency group	false									
		Consistency group timeout	Urgent									
		Disable WAFL sync	false									
		Pre Quiesce commands	None									
		Post Quiesce commands	None									
		Pre Snapshot commands	None									
		Post Snapshot commands	None									
		Pre UnQuiesce commands	None									
		Post UnQuiesce commands Pre Exit commands	None									
		Custom parameters	None									
		Snapshot copy tool type		without File System	consistency							
	Total 1											
	Total I			-							Previous	Finish
Activit	The 5 most recent jobs are displayed apcenter-43.sapcc.stl.netapp.com:8146/PluginCreatorInv	/entoryProtect/ProtectIndex?ResourceType=MultipleContaine	n Warnings rs&Host=null&Plugin	Name=hana#id-sm-di	A Canceled	📀 0 Running	🗐 0 Queue	d				

10. On-demand backups can now be created on the topology page. The scheduled backups are executed based on the configuration settings.

								• • •	l← L sapcc\scadmin	SnapCenterAd	min 🔋 Sign Ou
<	SAP HANA	×.									
Dashboard	View M	ultitenant Datab	oase Container 💌 🤇 Sea	rch databases					Refresh Resources	Add SAP HANA Datab	ase New Resource C
Resources	IE IN	System	System ID (SID)	Tenant Database	Plug-in Host	Resource	Groups	Policies	12		verall Status
		551	SS1	SS1	hana-1.sapcc.stl.netapp.com		Lo	ockintegrityCheck calSnap calSnapAndSnapVault	11/19/2019 6:30:	:54 AM 🛱 Bac	kup succeeded
Reports											
🕂 Hosts											
<ul> <li>Storage System:</li> </ul>											
E Settings											
Alerts											
	Total 1										

## Additional configuration steps for Fibre Channel SAN environments

Depending on the HANA release and the HANA plug-in deployment, additional configuration steps are required for environments in which the SAP HANA systems are using Fibre Channel and the XFS file system.



These additional configuration steps are only required for HANA resources, which are configured manually in SnapCenter. It is also only required for HANA 1.0 releases and HANA 2.0 releases up to SPS2.

When a HANA backup save point is triggered by SnapCenter in SAP HANA, SAP HANA writes Snapshot ID files for each tenant and database service as a last step (for example,

/hana/data/SID/mnt00001/hdb00001/snapshot\_databackup\_0\_1). These files are part of the data volume on the storage and are therefore part of the storage Snapshot copy. This file is mandatory when performing a recovery in a situation in which the backup is restored. Due to metadata caching with the XFS file system on the Linux host, the file is not immediately visible at the storage layer. The standard XFS configuration for metadata caching is 30 seconds.



With HANA 2.0 SPS3, SAP changed the write operation of these Snapshot ID files to synchronously so that metadata caching is not a problem.



With SnapCenter 4.3, if the HANA plug-in is deployed on the database host, the Linux plug-in executes a file system flush operation on the host before the storage Snapshot is triggered. In this case, the metadata caching is not a problem.

In SnapCenter, you must configure a postquiesce command that waits until the XFS metadata cache is flushed to the disk layer.

The actual configuration of the metadata caching can be checked by using the following command:

```
stlrx300s8-2:/ # sysctl -A | grep xfssyncd_centisecs
fs.xfs.xfssyncd_centisecs = 3000
```

NetApp recommends using a wait time that is twice the value of the fs.xfs.xfssyncd\_centisecs parameter. Because the default value is 30 seconds, set the sleep command to 60 seconds.

If the SnapCenter server is used as a central HANA plug-in host, a batch file can be used. The batch file must have the following content:

```
@echo off
waitfor AnyThing /t 60 2>NUL
Exit /b 0
```

The batch file can be saved, for example, as C:\Program Files\NetApp\Wait60Sec.bat. In the resource protection configuration, the batch file must be added as Post Quiesce command.

If a separate Linux host is used as a central HANA plug-in host, you must configure the command /bin/sleep 60 as the Post Quiesce command in the SnapCenter UI.

The following figure shows the Post Quiesce command within the resource protection configuration screen.

🗖 S	napCe	enter®		🌲 🜌 😌 - 🗜 sapcc\scadmin SnapCenterAdmin 🖇 Sig	gn Out
>	SAP	HANA 🔽	SS2 - HANA 20 SPS4 MDC Singl X	Multitenant Database Container - Protect	×
	Se	arch databases			1 Details
	1 <u>1</u>	arch databases  System  MS1 - Multiple Hosts MDC Single Tenant  SS2 - HANA 20 SPS4 MDC Single Tenant  SM1  SS1	Search           Backup Name	Image: Control of the second defore and after returning the application to normal operational state	i
	Total	4	19_10.05.01.3522 SnapCenter_LocalSnap_Hourly_12-10-20 Total 12	Pre UnQuiesce	Ŧ
Activi	ty	The 5 most recent jobs are displayed	S Completed	d 🙆 0 Warnings 🔀 0 Failed 🧭 0 Canceled 📀 0 Running 🗐 0 Queued	^

## SnapCenter resource-specific configuration for non-data volume backups

The backup of non-data volumes is an integrated part of the SAP HANA plug-in. Protecting the database data volume is sufficient to restore and recover the SAP HANA database to a given point in time, provided that the database installation resources and

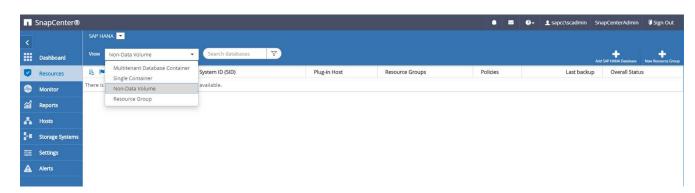
## the required logs are still available.

To recover from situations where other non-data files must be restored, NetApp recommends developing an additional backup strategy for non-data volumes to augment the SAP HANA database backup. Depending on your specific requirements, the backup of non-data volumes might differ in scheduling frequency and retention settings, and you should consider how frequently non-data files are changed. For instance, the HANA volume /hana/shared contains executables but also SAP HANA trace files. While executables only change when the SAP HANA database is upgraded, the SAP HANA trace files might need a higher backup frequency to support analyzing problem situations with SAP HANA.

SnapCenter non-data volume backup enables Snapshot copies of all relevant volumes to be created in a few seconds with the same space efficiency as SAP HANA database backups. The difference is that there is no SQL communication with SAP HANA database required.

### Configuration of non-data volume resources

In this example, we want to protect the non-data volumes of the SAP HANA database SS1.



1. From the Resource tab, select Non-Data-Volume and click Add SAP HANA Database.

 In step one of the Add SAP HANA Database dialog, in the Resource Type list, select Non-data Volumes. Specify a name for the resource and the associated SID and the SAP HANA plug-in host you want to use for the resource, then click Next.

Add SAP HANA Dat	abase			×
1 Name	Provide Resource Deta	ails		
2 Storage Footprint	Resource Type	Non-data Volumes		•
3 Summary	Resource Name	SS1-Shared-Volume		
	Associated SID	SS1		0
	Plug-in Host	hana-1.sapcc.stl.netapp.com	8.	0
			Previous	Next

3. Add the SVM and the storage volume as storage footprint, then click Next.

2 Storage Footprint Add Storage Footprint	Add SAP HANA Da	itabase			
3 Summary       Storage System       hana-primary.sapcc.stl.netapp.com <ul> <li>Select one or more volumes and if required their associated Qtrees and LUNs</li> <li>Volume name</li> <li>LUNs or Qtrees</li> <li>SS1_shared</li> <li>SM1_log_mnt00001</li> <li>SS1_data_mnt00001</li> <li>SS1_shared</li> <li>SS1_shared<!--</th--><th>1 Name</th><th>Provide Storage Footprint Deta</th><th>ails</th><th></th><th></th></li></ul>	1 Name	Provide Storage Footprint Deta	ails		
Storage System hana-primary.sapcc.stl.netapp.com  Select one or more volumes and if required their associated Qtrees and LUNs  Volume name  LUNs or Qtrees  SS1_shared  SS1_shared  SS1_log_mnt00001  SS1_log_mnt00001  SS1_log_mnt00001  SS1_shared  SS1_shared SS1_shared  SS1_shared SS1_shared SS1_shared SS1_shared SS1_shared SS1_sh	2 Storage Footprint	Add Storage Footprint —			
Volume name LUNs or Qtrees   SS1_shared   Jmin_data_(inineocor)   SM1_log_mnt00001   SM1_shared   SS1_data_mnt00001   SS1_shared	3 Summary				×
SM1_log_mnt00001 SM1_shared SS1_data_mnt00001 SS1_log_mnt00001 SS1_shared					
SM1_log_mnt00001 SM1_shared SS1_data_mnt00001 SS1_log_mnt00001 SS1_shared		SS1_shared	▼ Defau	lt is 'None' or type to find	+ ×
SS1_shared		SM1_log_mnt00001 SM1_shared SS1_data_mnt00001			Sav
		SS1_shared			
				Pre	evious Nex

- 4. In the summary step, click Finish to save the settings.
- 5. Repeat these steps for all the required non-data volumes.
- 6. Continue with the protection configuration of the new resource.



Data protection for a non- data volume resources is identical to the workflow for SAP HANA database resources and can be defined on an individual resource level.

The following figure shows the list of the configured non-data volume resources.

	SnapCenter®						٠	<b>=</b> (	→ <b>1</b> sapcc\scadmin	SnapCenterAc	min 🛛 🖡 Sign Out
<		SAP HANA	•								
	Dashboard	View No	n-Data Volume	Search databases						Add SAP HANA Data	ase New Resource Grou
U	Resources	15 🛤	Name	Associated System ID (SID)	Plug-in Host	Resource Groups	Po	licies	Las	t backup C	verall Status
✤	Monitor	20	SS1-Shared-Volume	551	hana-1.sapcc.stl.netapp.com		Loca	lSnap		Bac	kup not run
<b>~1</b>	Reports										
Å	Hosts										
Þ	Storage Systems										
	Settings										
A	Alerts										

## **Resource groups**

Resource groups are a convenient way to define the protection of multiple resources that require the same protection policies and schedule. Single resources that are part of a resource group can still be protected on an individual level.

Resource groups provide the following features:

- You can add one or more resources to a resource group. All resources must belong to the same SnapCenter plug-in.
- Protection can be defined on a resource group level. All resources in the resource group use the same policy and schedule when protected.
- All backups in the SnapCenter repository and the storage Snapshot copies have the same name defined in the resource protection.
- Restore operations are applied on a single resource level, not as part of a resource group.
- When using SnapCenter to delete the backup of a resource that was created on a resource group level, this backup is deleted for all resources in the resource group. Deleting the backup includes deleting the backup from the SnapCenter repository as well as deleting the storage Snapshot copies.
- The main use case for resource groups is when a customer wants to use backups created with SnapCenter for system cloning with SAP Landscape Management. This is described in the next section.

## Using SnapCenter together with SAP landscape management

With SAP Landscape Management (SAP LaMa), customers can manage complex SAP system landscapes in on-premises data centers as well as in systems that are running in the cloud. SAP LaMa, together with NetApp Storage Services Connector (SSC), can execute storage operations such as cloning and replication for SAP system clone, copy, and refresh use cases using Snapshot and FlexClone technology. This allows you to completely automate an SAP system copy based on storage cloning technology while also including the required SAP postprocessing. For more details about NetApp's solutions for SAP LaMa, refer to TR-4018: Integrating NetApp ONTAP Systems with SAP Landscape Management.

NetApp SSC and SAP LaMa can create on-demand Snapshot copies directly using NetApp SSC, but they can also utilize Snapshot copies that have been created using SnapCenter. To utilize SnapCenter backups as the basis for system clone and copy operations with SAP LaMa, the following prerequisites must be met:

- SAP LaMa requires that all volumes be included in the backup; this includes SAP HANA data, log and shared volumes.
- All storage Snapshot names must be identical.
- Storage Snapshot names must start with VCM.



In normal backup operations, NetApp does not recommend including the log volume. If you restore the log volume from a backup, it overwrites the last active redo logs and prevents the recovery of the database to the last recent state.

SnapCenter resource groups meet all these requirements. Three resources are configured in SnapCenter: one resource each for the data volume, the log volume, and the shared volume. The resources are put into a resource group, and the protection is then defined on the resource group level. In the resource group protection, the custom Snapshot name must be defined with VCM at the beginning.

# Database backups

In SnapCenter, database backups are typically executed using the schedules defined within the resource protection configuration of each HANA database.

On-demand database backup can be performed by using either the SnapCenter GUI, a PowerShell command line, or REST APIs.

## Identifying SnapCenter backups in SAP HANA Studio

The SnapCenter resource topology shows a list of backups created using SnapCenter. The following figure shows the backups available on the primary storage and highlights the most recent backup.

1	Search databases									
12	Search databases		Remove Protection	U Back up Now	/ Modify	Maintenance	i Details	Configure Databas	se R	fres
	System	Manage Copies							, mar 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	
- 24	MS1 - Multiple Hosts MDC Single Tenant									
24	SS2 - HANA 20 SP54 MDC Single Tenant	15 Backups					Summary Ca	ard		
	/ 1	0 Clones				2	21 Backups			
	SM1	Local copies 5 Backups					20 Snapshot ba 1 File-Based bi			
	SS1	0 Clones					0 Clones	ackup 9		
		Vault copies								
		Primary Backup(s)								
		(search )						Clone	4	
		Backup Name	Count	17				Clone	Restore End Da	t
		SnapCenter_LocalSnap_Hourly_12-03-2019_02.30.01.5053	1					12/03/2019 2:3		
		SnapCenter_LocalSnap_Hourly_12-02-2019_22.30.01.4925	1				1	12/02/2019 10:3	0:55 PM	-
		SnapCenter_LocalSnap_Hourly_12-02-2019_18.30.01.3834	1					12/02/2019 6:3	0:55 PM	
		SnapCenter_LocalSnap_Hourly_12-02-2019_14.30.01.3366	1					12/02/2019 2:3	0:55 PM	ć
		SnapCenter_LocalSnap_Hourly_12-02-2019_10.30.01.4510	1				1	2/02/2019 10:3	0:55 AM	ć
		SnapCenter_LocalSnapAndSnapVault_Daily_12-02-2019_08.17.01.9273	1					12/02/2019 8:1	7:56 AM	ċ
		SnapCenter_LocalSnap_Hourly_12-02-2019_06.30.01.3164	1					12/02/2019 6:3	0:55 AM	ċ
		SnapCenter_LocalSnap_Hourly_12-02-2019_02.30.01.3555	1					12/02/2019 2:3	0:55 AM	È
		SnapCenter_LocalSnap_Hourly_12-01-2019_22.30.01.3859	1				1	12/01/2019 10:3	0:55 PM	e
		SnapCenter_LocalSnap_Hourly_12-01-2019_18.30.01.3834	1					12/01/2019 6:3	0:55 PM	-
		SnapCenter_LocalSnap_Hourly_12-01-2019_14.30.01.3255	1					12/01/2019 2:3	0:55 PM	-
		SnapCenter_LocalSnap_Hourly_12-01-2019_10.30.01.2508	1				1	2/01/2019 10:3	0:55 AM	e
		SnapCenter_LocalSnapAndSnapVault_Daily_12-01-2019_08.17.01.9654	1					12/01/2019 8:1	7:56 AM	e
		SnapCenter_LocalSnap_Hourly_12-01-2019_06.30.01.2968	1					12/01/2019 6:3	0:55 AM	e
	otal 4	SnapCenter LocalSnapAndSnapVault Daily 11-30-2019 08.17.01.8590 Total 15	1					11/30/2019 8:1	7:55 AM	e

When performing a backup using storage Snapshot copies for an SAP HANA MDC system, a Snapshot copy of the data volume is created. This data volume contains the data of the system database as well as the data of all tenant databases. To reflect this physical architecture, SAP HANA internally performs a combined backup of the system database as well as all tenant databases whenever SnapCenter triggers a Snapshot backup. This results in multiple separate backup entries in the SAP HANA backup catalog: one for the system database and one for each tenant database.



For SAP HANA single-container systems, the database volume contains only the single database, and there is only one entry in SAP HANA's backup catalog.

In the SAP HANA backup catalog, the SnapCenter backup name is stored as a Comment field as well as External Backup ID (EBID). This is shown in the following screenshot for the system database and in the screenshot after that for the tenant database SS1. Both figures highlight the SnapCenter backup name stored in the comment field and EBID.



 $(\mathbf{i})$ 

The HANA 2.0 SPS4 (revision 40 and 41) release always shows a backup size of zero for Snapshot-based backups. This was fixed with revision 42. For more information, see the SAP Note https://launchpad.support.sap.com/#/notes/2795010.

hdbstudio - System: SYSTEMDB@SS1 Host: hana-1 Instance:	00 Connected User: SYSTEM System L	Isage: Test System	- SAP HANA Studio				_	
le <u>E</u> dit <u>N</u> avigate <u>Project Run W</u> indow <u>H</u> elp								
3 • 🖬 🐚 : [ 원 • 전 • 전 • 주 •							Quick Acc	cess 🕴 🔡
3 Systems 🔀 🖳 🗖	Backup SYSTEMDB@SS1 (SYSTEM	() SS1 - HANA2	🔀 🙆 Backup SYSTEMD	3@SM1 (SYSTEM) SM1 - HANA	🙆 Backup SYSTEMDB@MS1 (S	SYSTEM) MS1 - Multi	🖄 Backup SYSTEMDB@SS2 (SYSTEM) SS2 - HANA2.	
📸 🖛 💷 🖬 🖛 🛲 🛤 🖘 🗸	Backup SYSTEMDB	assi (sysi	EM) SS1 - HANA	20 SPS4 MDC Single 1	enant		Last Update:6:21:16 AM	
Bernant Bernant Bernant	Overview Configuration Backup C						and a particular of the second	Q 1 USU
B MS1@MS1 (SYSTEM) MS1 - Multiple Hosts     B SYSTEMDB@MS1 (SYSTEM) MS1 - Multiple Hosts		stalog						
Single Host - MDC Multiple Tenants	Backup Catalog				Backup Details			
> 🔠 SM1@SM1 (SYSTEM) SM1 - HANA20 SPS4 MDC Mult	Database: SYSTEMDB	~			ID: Status:	1575369024442 Successful		
> B SYSTEMDB@SM1 (SYSTEM) SM1 - HANA20 SPS4 MD Single Host - MDC Single Tenant	Show Log Backups Show	Dolta Packups			Backup Type:	Data Backup		
Single Host - WDC single renant SIG SS1@SS1 (SYSTEM) SS1 - HANA20 SPS4 MDC Single T	Show Log Backups Show	Deita Backups			Destination Type:	Snapshot		
> I SYSTEMDB@SS1 (SYSTEM) SS1 - HANA20 SPS4 MDC	Status Started	Duration	Size Backup Type	Destinatio	Started:	Dec 3, 2019 2:30:24 AN	1 (America/Los_Angeles)	
Single Host - MDC Single Tenant	Dec 3, 2019 2:30:24	00h 00m 14s	0 B Data Backup	Snapshot	Finished:	Dec 3, 2019 2:30:38 AN	1 (America/Los_Angeles)	
SS2@SS2 (SYSTEM) SS2 - HANA20SS2 MDC Single Ter	Dec 2, 2019 10:30:23		0 B Data Backup	Snapshot	Duration:	00h 00m 14s		
> 🖺 SYSTEMDB@SS2 (SYSTEM) SS2 - HANA20 SPS4 MDC	Dec 2, 2019 6:30:23	00h 00m 14s	0 B Data Backup	Snapshot	Size:	0 B		
	<ul> <li>Dec 2, 2019 2:30:23</li> <li>Dec 2, 2019 10:30:24</li> </ul>	00h 00m 14s	0 B Data Backup	Snapshot	Throughput:	n.a.		
	<ul> <li>Dec 2, 2019 10:30:24</li> <li>Dec 2, 2019 8:17:24</li> </ul>	00h 00m 14s	0 B Data Backup 0 B Data Backup	Snapshot Snapshot	System ID:			
	Dec 2, 2019 6:30:24	00h 00m 14s	0 B Data Backup	Snapshot	Comment:	SnapCenter_LocalSna	p_Hourly_12-03-2019_02.30.01.5053	
	Dec 2, 2019 2:30:24	00h 00m 13s	0 B Data Backup	Snapshot				
	Dec 1, 2019 10:30:24		0 B Data Backup	Snapshot	Additional Information:	calo		
	Dec 1, 2019 6:30:23	00h 00m 14s	0 B Data Backup	Snapshot		NOR-		
	Dec 1, 2019 2:30:24	00h 00m 13s	0 B Data Backup	Snapshot				
	Dec 1, 2019 10:30:24		0 B Data Backup	Snapshot	Location:	/hana/data/SS1/mnt0	00001/	
	Dec 1, 2019 8:17:24	00h 00m 14s	0 B Data Backup	Snapshot				
	Dec 1, 2019 6:30:24	00h 00m 14s	0 B Data Backup	Snapshot	Host Service	Name	EBID	
	Nov 30, 2019 8:17:24		0 B Data Backup	Snapshot			SnapCenter LocalSnap Hourly 12-03-2019 02.30.01.5053	
	<ul> <li>Nov 30, 2019 6:00:04</li> <li>Nov 29, 2019 8:17:24</li> </ul>		1.48 GB Data Backup 0 B Data Backup	File Snapshot	hana-1 nameserv	/er nabuuuu i	SnapCenter_LocalSnap_Hourly_12-03-2019_02.30.01.3033	- here and
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	Properties 23 9 Error Log						<b>三</b> 章 国 1	
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3•2•40											Quick Access	tol mus
Systems 🖾 👘 🗖	🐣 Backup	SYSTEMDB@SS1 (SYSTEM	I) SS1 - HANA2	🖾 🙆 Bac	kup SYSTEMDB	@SM1 (SYSTEM) SM1 - HANA	🖄 Backup SYSTEM	DB@MS1 (S	YSTEM) MS1 - Multi	Backup SYSTEMDB@SS2 (S)	STEM) SS2 - HANA2	-
📸 🕶 🔛 🖬 🐨 📾 😫 🖻 📚 🗢	👛 Back	kup SYSTEMDB@	9SS1 (SYS1	FEM) SS	1 - HANA2	0 SPS4 MDC Single Te	enant			La	st Update:6:22:40 AM 🤞	
> Multiple Hosts - MDC single Tenant > MS1@MS1 (SYSTEM) MS1 - Multiple Hosts	Overview	Configuration Backup Ca	talog									
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Single Host - MDC Multiple Tenants							ID:		1575369024443			
> SM1@SM1 (SYSTEM) SM1 - HANA20 SPS4 MDC Mult	Databas	se: SS1	~				Status:		Successful			
> I SYSTEMDB@SM1 (SYSTEM) SM1 - HANA20 SPS4 MD Single Host - MDC Single Tenant	Char	v Log Backups 🗌 Show I	Jolta Packups				Backup Type	e e	Data Backup			
Single Host - WDC Single Tenant Single SS1@SS1 (SYSTEM) SS1 - HANA20 SPS4 MDC Single T	0 3000	veg backups	veita backups				Destination		Snapshot			
> SYSTEMDB@SS1 (SYSTEM) SS1 - HANA20 SPS4 MDC	Status	Started	Duration	Size	Backup Type	Destinatio	Started:			M (America/Los_Angeles)		
Single Host - MDC Single Tenant		Dec 3, 2019 2:30:24	00h 00m 14s	0 B	Data Backup	Snapshot	Finished:			M (America/Los_Angeles)		
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	•	Dec 2, 2019 10:30:24	00h 00m 14s		Data Backup	Snapshot	System ID:				1	
		Dec 2, 2019 8:17:24 Dec 2, 2019 6:30:24	00h 00m 13s 00h 00m 14s		Data Backup	Snapshot	Comment:	1	SnapCenter_LocalSn	ap_Hourly_12-03-2019_02.30.01.5053		
	8	Dec 2, 2019 6:30:24 Dec 2, 2019 2:30:24	00h 00m 14s		Data Backup Data Backup	Snapshot Snapshot				15 15 T	45	
		Dec 1, 2019 10:30:24	00h 00m 14s		Data Backup	Snapshot	Additional In	1 10				
	8	Dec 1, 2019 6:30:23	00h 00m 14s		Data Backup	Snapshot	Additional in	ntormation:	<ok></ok>			
		Dec 1, 2019 2:30:24	00h 00m 13s		Data Backup	Snapshot			2			
		Dec 1, 2019 10:30:24	00h 00m 13s		Data Backup	Snapshot	Location:		/hana/data/SS1/mm	100001/		
		Dec 1, 2019 8:17:24	00h 00m 14s	0 B	Data Backup	Snapshot						
		Dec 1, 2019 6:30:24	00h 00m 14s	0 B	Data Backup	Snapshot						
		Nov 30, 2019 8:17:24	00h 00m 14s		Data Backup	Snapshot	Host	Service	Name	EBID		
	8	Nov 30, 2019 6:00:10	00h 00m 03s		Data Backup	File	hana-1	indexserve		SnapCenter_LocalSnap_Hourly_12-03		
	•	Nov 29, 2019 8:17:24	00h 00m 14s		Data Backup	Snapshot	hana-1	xsengine	hdb00002	SnapCenter_LocalSnap_Hourly_12-03	-2019_02.30.01.5053	
	8	Nov 28, 2019 8:17:25	00h 00m 13s	0 B	Data Backup	Snapshot						
	-											
	Properti	ies 🖾 👰 Error Log									😺 🎘 🗔 🗹	~ -
	Property			Value								

SnapCenter is only aware of its own backups. Additional backups created, for example, with SAP HANA Studio, are visible in the SAP HANA catalog but not in SnapCenter.

#### Identifying SnapCenter backups on the storage systems

To view the backups on the storage layer, use NetApp OnCommand System Manager and select the database volume in the SVM—Volume view. The lower Snapshot Copies tab displays the Snapshot copies of the volume. The following screenshot shows the available backups for the database volume SS1 data mnt00001 at the primary storage. The highlighted backup is the backup shown in SnapCenter and

SAP HANA Studio in the previous images and has the same naming convention.

OnCommand	Sys	stem Manager	t					Ø	$\sim$	¢ 0	2
						Type:	All 🔻	Q, Se	arch all Object	s	+
		Volumes									
Dashboard		Volume: SS1_data	a_mnt00001				< Back to All volumes	/ Edit	Delete	More Actions	C Refre
Applications & Tiers	•	Overview S	napshots Copies Dat	a Protection Storage Efficiency Performance							
Storage	+										
Nodes		+ Create	🔦 Configuration Setting	s   More Actions    Delete C Refresh							٥
Aggregates &		Status	👳 State 👳	Snapshot Name	Ŧ	Date Time	Total Size	3	Applicatio	n Dependency	
Disks		Normal	-NA-	SnapCenter_LocalSnapAndSnapVault_Daily_12-01-2019_08	.17.01.9654	Dec/01/2019 11:03:44	106.27 MB		None		1
SVMs		Normal	-NA-	SnapCenter_LocalSnap_Hourly_12-02-2019_06.30.01.3164		Dec/02/2019 09:16:42	74.76 MB		None		
Volumes		Normal	-NA-	SnapCenter_LocalSnapAndSnapVault_Daily_12-02-2019_08	.17.01.9273	Dec/02/2019 11:03:43	17.21 MB		None		
LUNs		Normal	-NA-	SnapCenter_LocalSnap_Hourly_12-02-2019_10.30.01.4510		Dec/02/2019 13:16:42	39.11 MB		None		
Qtrees		Normal	-NA-	SnapCenter_LocalSnap_Hourly_12-02-2019_14.30.01.3366		Dec/02/2019 17:16:42	87.53 MB		None		
Quotas		Normal	-NA-	SnapCenter_LocalSnap_Hourly_12-02-2019_18.30.01.3834		Dec/02/2019 21:16:41	95.67 MB		None		
Junction Paths		Normal	-NA-	SnapCenter_LocalSnap_Hourly_12-02-2019_22.30.01.4925		Dec/03/2019 01:16:41	29.86 MB		None		
		Normal	-NA-	SnapCenter_LocalSnap_Hourly_12-03-2019_02.30.01.5053		Dec/03/2019 05:16:41	43.81 MB		None		
Network	•	Normal	-NA-	SnapCenter_LocalSnap_Hourly_12-03-2019_06.30.01.4088		Dec/03/2019 09:16:40	49.46 MB		None		
Protection	•	Normal	-NA-	SnapCenter_LocalSnapAndSnapVault_Daily_12-03-2019_08		Dec/03/2019 11:03:41	77.14 MB		snapmirro	or	
Events & Jobs	•	Normal	-NA-	SnapCenter_LocalSnap_Hourly_12-03-2019_10.30.01.4554		Dec/03/2019 13:16:40	42.12 MB		None		
Configuration		Normal	-NA-	SnapCenter_LocalSnap_Hourly_12-03-2019_14.30.01.3902		Dec/03/2019 17:16:40	57.42 MB		None		

The following screenshot shows the available backups for the replication target volume hana\_SA1\_data\_mnt00001\_dest at the secondary storage system.

											20.14 ····	
							Type:	All	Q Se	arch all Obje	ts	+
			Volumes									
App	shboard		Volume: SS1_data_mnt00	001_dest				< Back to All volumes	🖍 Edit	Delete	i More Act	ions C Re
1.122	olications & Tiers	۲	Overview Snapshots	Copies Data P	Protection Storage Efficiency Performance							
Stor	rage	•										
No	odes		i More Actions 🏢	Delete C Ref	resh							•
	gregates &	E.	Status 🚎	State 👳	Snapshot Name	177	Date Time	Total S	iize	= Appli	ation Dependen	у
Dis	sks	·	Normal	-NA-	SnapCenter_LocalSnapAndSnapVault_Daily_11-29-2019_08.17.01.8567		Nov/29/2019 11:03:48	113.34	MB	None		
SV	'Ms		Normal	-NA-	SnapCenter_LocalSnapAndSnapVault_Daily_11-30-2019_08.17.01.8590		Nov/30/2019 11:03:46	87.69	MB	None		
Vo	lumes		Normal	-NA-	SnapCenter_LocalSnapAndSnapVault_Daily_12-01-2019_08.17.01.9654		Dec/01/2019 11:03:44	108.67	MB	None		
LU	INs		Normal	-NA-	SnapCenter_LocalSnapAndSnapVault_Daily_12-02-2019_08.17.01.9273		Dec/02/2019 11:03:43	102 M	в	None		
Qti	rees		Busy	-NA-	SnapCenter_LocalSnapAndSnapVault_Daily_12-03-2019_08.17.01.9180		Dec/03/2019 11:03:41	176 KI	3	busy		
Qu	iotas											
Ju	nction Paths											
Net	twork	۲										
Pro	tection	۲								Di	splaying 1 - 5	< 1 >
Eve	ents & Jobs	٠										
Con	nfiguration	×.										

### On-demand database backup at primary storage

1. In the resource view, select the resource and double-click the line to switch to the topology view.

The resource topology view provides an overview of all available backups that have been created using SnapCenter. The top area of this view displays the backup topology, showing the backups on the primary storage (local copies) and, if available, on the off-site backup storage (vault copies).

	AP HANA 💌	SS1 Topology		$\frown$						
	Search databases		Remove Protection	U Back up Now	Modily	Maintenance	0 Details	Configure Databas		
	System	Manage Copies		-						
14	MS1 - Multiple Hosts MDC Single Tenant									
4		15 Backups					ummary C	ard		
	/ 1	0 Clones					Backups	and hadiour		
	SM1	Local copies 5 Backups					20 Snapshot b 1 File-Based t			
	SS1	0 Clones				(	Clones			
		Vault copies								
		Primary Backup(s)								
		search T						Cone	t Restore	
		Backup Name	Count	17				Close	End D	
		SnapCenter_LocalSnap_Hourly_12-03-2019_02.30.01.5053	1					12/03/2019 2:3	0:55 AM	
		SnapCenter_LocalSnap_Hourly_12-02-2019_22.30.01.4925	1					12/02/2019 10:3	0:55 PM	
		SnapCenter_LocalSnap_Hourly_12-02-2019_18.30.01.3834	1					12/02/2019 6:3	0:55 PM	
		SnapCenter_LocalSnap_Hourly_12-02-2019_14.30.01.3366	1					12/02/2019 2:3	0:55 PM	
		SnapCenter_LocalSnap_Hourly_12-02-2019_10.30.01.4510	1					12/02/2019 10:3	0:55 AM	
		SnapCenter_LocalSnapAndSnapVault_Daily_12-02-2019_08.17.01.9273	1					12/02/2019 8:1	7:56 AM	
		SnapCenter_LocalSnap_Hourly_12-02-2019_06.30.01.3164	1					12/02/2019 6:3	0:55 AM	
		SnapCenter_LocalSnap_Hourly_12-02-2019_02.30.01.3555	1					12/02/2019 2:3	0:55 AM	
		SnapCenter_LocalSnap_Hourly_12-01-2019_22.30.01.3859	1					12/01/2019 10:3	0:55 PM	
		SnapCenter_LocalSnap_Hourly_12-01-2019_18.30.01.3834	1					12/01/2019 6:3	0:55 PM	
		SnapCenter_LocalSnap_Hourly_12-01-2019_14.30.01.3255	1					12/01/2019 2:3	0:55 PM	
		SnapCenter_LocalSnap_Hourly_12-01-2019_10.30.01.2508	1					12/01/2019 10:3	0:55 AM	
		SnapCenter_LocalSnapAndSnapVault_Daily_12-01-2019_08.17.01.9654	1					12/01/2019 8:1	7:56 AM	
		SnapCenter_LocalSnap_Hourly_12-01-2019_06.30.01.2968	1					12/01/2019 6:3	0:55 AM	
т	otal 4	SnapCenter LocalSnapAndSnapVault Daily 11-30-2019 08.17.01.8590 Total 15	1					11/30/2019 8:1	7:55 AM	
_										

2. In the top row, select the Back up Now icon to start an on-demand backup. From the drop-down list, select the backup policy LocalSnap and then click Backup to start the on-demand backup.

Create a backup	for the selected reso	urce		
Resource Name	551			
Policy	LocalSnap	+	0	

This starts the backup job. A log of the previous five jobs is shown in the Activity area below the topology view. When the backup is finished, a new entry is shown in the topology view. The backup names follow the same naming convention as the Snapshot name defined in the section "Resource protection configuration."

Backup

Cancel

 $(\mathbf{i})$ 

You must close and reopen the topology view to see the updated backup list.

Sn	hapCenter®			• =	O- L sapcc\scadmin SnapCent	terAdmin 🕻	Sign Ou
	SAP HANA	SS1 Topology					
	Search databases		Remove Protection	Back up Now	Nodity Maintenance Details Con	vigore Database	and Referat
	P System	Manage Copies				In the second second	
	MS1 - Multiple Hosts MDC Single Tenan	t					
	SS2 - HANA 20 SPS4 MDC Single Tenant	16 Backups			Summary Card		
	/ =	0 Clones			22 Backups		
	SM1	Local copies 5 Backups			21 Snapshot based ba		
	551	0 Clones			0 Clones	<u>e</u>	
		Vault copies					
		Primary Backup(s)					
		(search )					t estore 1
		Backup Name	Count	17		Er	nd Date
	r	SnapCenter_LocalSnap_12-03-2019_06.37.50.1491	1		12/07	3/2019 6:38:44	AM 🗖
	-	SnapCenter_LocalSnap_Hourly_12-03-2019_06.30.01.4088	1		12/07	3/2019 6:30:55	AM 🗖
		SnapCenter_LocalSnap_Hourly_12-03-2019_02.30.01.5053	i		12/0	3/2019 2:30:55	AM 🛱
		SnapCenter_LocalSnap_Hourly_12-02-2019_22.30.01.4925	1		12/02/	/2019 10:30:55	PM 🗖
		SnapCenter_LocalSnap_Hourly_12-02-2019_18.30.01.3834	1		12/0	2/2019 6:30:55	PM 🗖
		SnapCenter_LocalSnap_Hourly_12-02-2019_14.30.01.3366	1		12/0	2/2019 2:30:55	PM 🛱
		SnapCenter_LocalSnap_Hourly_12-02-2019_10.30.01.4510	1		12/02/	/2019 10:30:55	AM 🗖
		SnapCenter_LocalSnapAndSnapVault_Daily_12-02-2019_08.17.01.9273	1		12/02	2/2019 8:17:56	AM 🗖
		SnapCenter_LocalSnap_Hourly_12-02-2019_06.30.01.3164	1		12/02	2/2019 6:30:55	AM 🛱
		SnapCenter_LocalSnap_Hourly_12-02-2019_02.30.01.3555	1		12/02	2/2019 2:30:55	AM 🛱
	Total 4	SnapCenter_LocalSnap_Hourly_12-01-2019_22.30.01.3859 Total 16	1		12/01/	/2019 10:30:55	PM 🛱
ivity	y The 5 most recent jobs are displayed	S Completed 🔺 0 Warnings 🗙 0 Failed 🔗 0	Canceled 💿 O Running	(2) 0 Queued			
ute	- es ago Backup of Resource Group 'hana-1	_sapcc_stl_netapp_com_hana_MDC_SS1' with policy 'LocalSnap'				Con	npleted
1000	tes ago Backup of Resource Group 'hana-1	_sapcc_stl_netapp_com_hana_MDC_SS1' with policy 'LocalSnap'				Con	npleted

3. The job details are shown when clicking the job's activity line in the Activity area. You can open a detailed job log by clicking View Logs.

Backup of Resource Group 'hana-1\_sapcc\_stl\_netapp\_com\_hana\_MDC\_SS1' with policy 'LocalSnap'

✓ ▼ Backup of Resource Group 'hana-1\_sapcc\_stl\_netapp\_com\_hana\_MDC\_SS1' with policy 'LocalSnap'

~	Backup				
~	Validate Dataset Parameters				
~	Validate Plugin Parameters				
~	Complete Application Discovery				
~	Initialize Filesystem Plugin				
~	Discover Filesystem Resources				
~	Validate Retention Settings				
~	Quiesce Application				
~	Quiesce Filesystem				
~	Create Snapshot				
~	UnQuiesce Filesystem				
~	UnQuiesce Application				
~	Get Snapshot Details				
~	Get Filesystem Meta Data				
~	Finalize Filesystem Plugin				
~	Collect Autosupport data				
~	Register Backup and Apply Retention				
~	Register Snapshot attributes	-			
Task	Name: Backup Start Time: 12/03/2019 6:37:51 AM End Time	: 12/03/2019 6:39:03 AM			

4. In SAP HANA Studio, the new backup is visible in the backup catalog. The same backup name in SnapCenter is also used in the comment and the EBID field in the backup catalog.

#### On-demand database backups with SnapVault replication

- 1. In the resource view, select the resource and double-click the line to switch to the topology view.
- 2. In the top row, select the Backup Now icon to start an on-demand backup. From the drop-down list, select the backup policy LocalSnapAndSnapVault, then click Backup to start the on-demand backup.

.

111

Backup		
Create a backup	o for the selected resource	
Resource Name	SS1	
Policy	LocalSnapAndSnapVault 🔹	0
	·	

3. The job details are shown when clicking the job's activity line in the Activity area.

# Backup of Resource Group 'hana-1\_sapcc\_stl\_netapp\_com\_hana\_MDC\_SS1' with policy 'LocalSnapAndSnapVault'

~	Quiesce Application	
~	► Quiesce Filesystem	
~	Create Snapshot	
~	UnQuiesce Filesystem	
1	UnQuiesce Application	
~	Get Snapshot Details	
~	Get Filesystem Meta Data	
~	Finalize Filesystem Plugin	
~	Collect Autosupport data	
~	Secondary Update	
~	Register Backup and Apply Retention	
~	Register Snapshot attributes	
~	Application Clean-Up	
V	► Data Collection	
~	Agent Finalize Workflow	
~	( Job 1031 ) SnapVault update	
<b>O</b> Task	Name: ( Job 1031 ) SnapVault update Start Time: 12/04/2019 4:19:55 AM End Time: 12/04/2019 4:20:55 AM	
	View Logs Cancel Job Close	]

4. When the backup is finished, a new entry is shown in the topology view. The backup names follow the same naming convention as the Snapshot name defined in the section "Resource protection configuration."



You must close and reopen the topology view to see the updated backup list.

SAP	HANA 🔽	SS1 Topology							
Se	arch databases		Remove Protection	U Back up Now	 Modify	Maintenance	i Details	Configure Databas	e Refre
胞	System	Manage Copies							
*	MS1 - Multiple Hosts MDC Single Tenant					<u></u>			
*	SS2 - HANA 20 SPS4 MDC Single Tenant	0 Clones					nmary Ca ackups	ard	
	SM1	Local copies 6 Backups					2 Snapshot ba		
	551	O Clones					File-Based ba	ackup 🗸	
		Vault copies				00	iones		
		Primary Backup(s)							
		(search )						Cone	<b>4</b> ¶ Sestore
		Backup Name	Count	17					End Date
		SnapCenter_LocalSnapAndSnapVault_12-04-2019_04.18.57.8527	1					12/04/2019 4:19	9:52 AM 🛱
		SnapCenter_LocalSnap_Hourly_12-04-2019_02.30.01.4636	1					12/04/2019 2:34	0:55 AM 🛱
		SnapCenter_LocalSnap_Hourly_12-03-2019_22.30.01.4836	1				1	2/03/2019 10:3	0:55 PM 🛱
		SnapCenter_LocalSnap_Hourly_12-03-2019_18.30.01.4818	1					12/03/2019 6:3	0:55 PM 🛱
		SnapCenter_LocalSnap_Hourly_12-03-2019_14.30.01.3902	1					12/03/2019 2:3	0:55 PM 🛱
		SnapCenter_LocalSnap_Hourly_12-03-2019_10.30.01.4554	1				1	2/03/2019 10:30	0:55 AM 🛍
		SnapCenter_LocalSnapAndSnapVault_Daily_12-03-2019_08.17.01.9180	1					12/03/2019 8:1	7:56 AM 🛱
		SnapCenter_LocalSnap_Hourly_12-03-2019_06.30.01.4088	1					12/03/2019 6:30	0:55 AM 🛱
		SnapCenter_LocalSnap_Hourly_12-03-2019_02.30.01.5053	1					12/03/2019 2:31	0:55 AM 🛱
		SnapCenter_LocalSnap_Hourly_12-02-2019_22.30.01.4925	1				1	2/02/2019 10:3	0:55 PM 🛱
		SpacCostor LocalSpap, Housely 12 02 2019 19 20 01 2024						10/00/0010 6-0	0-55 DM #

5. By selecting Vault copies, backups at the secondary storage are shown. The name of the replicated backup is identical to the backup name at the primary storage.

	SAP HANA 💌	SS1 Topology						
	Search databases		Remove Protection	U Back up Now	/ Modify	Maintenance Details	Configure Databas	e Refre
	P System	Manage Copies						
	MS1 - Multiple Hosts MDC					Summar	u Card	
	SS2 - HANA 20 SP54 MDC	ingle Tenant 0 Clones				23 Backup	5	
	SM1	Local copies 6 Backups					iot based backups sed backup 🛩	
	551	0 Clones				0 Clones	sed backup 🛩	
_		Vault copies						
		Secondary Vault Backup(s)						
		(search )					Fill Clone	4y Sectors
		Backup Name	Count	17				End I
		SnapCenter_LocalSnapAndSnapVault_12-04-2019_04.18.57.8527	1				12/04/2019	4:19:52 AN
		SnapCenter_LocalSnapAndSnapVault_Daily_12-03-2019_08.17.01.9180	1				12/03/2019	8:17:56 AN
		SnapCenter_LocalSnapAndSnapVault_Daily_12-02-2019_08.17.01.9273	1				12/02/2019	8:17:56 AM
		SnapCenter_LocalSnapAndSnapVault_Daily_12-01-2019_08.17.01.9654	1				12/01/2019	8:17:56 AM
		SnapCenter_LocalSnapAndSnapVault_Daily_11-30-2019_08.17.01.8590	1				11/30/2019	8:17:55 AM
		SnapCenter_LocalSnapAndSnapVault_Daily_11-29-2019_08.17.01.8567	1				11/29/2019	

6. In SAP HANA Studio, the new backup is visible in the backup catalog. The same backup name in SnapCenter is also used in the comment and the EBID field in the backup catalog.

## **Block integrity check**

SAP recommends combining storage-based Snapshot backups with a weekly file-based backup to execute a block integrity check. SnapCenter supports the execution of a block integrity check by using a policy in which file-based backup is selected as the backup type.

When scheduling backups using this policy, SnapCenter creates a standard SAP HANA file backup for the system and tenant databases.

SnapCenter does not display the block integrity check in the same manner as Snapshot copy-based backups. Instead, the summary card shows the number of file-based backups and the status of the previous backup.

12 MS		Manage Copies           15 Backups           0 Clones           Local copies           Vault copies           Yault copies	Remove Protection	Back up Now Modify	Maintenance         Image: Configure Dutabase         Re           Summary Card         22 Backups         20 Snaphot based backups         2 File Based backups v/           Last Backup 11/23/2019 6:00:59 AM         Last Backup 11/23/2019 6:00:59 AM
20         MS           20         SS3           5M         SM	S1 - Multiple Hosts MDC Single Tenant 52 - HANA 20 SPS4 MDC Single Tenant V1	15 Backups 0 Clones Local copies 5 Backups 0 Clones Vault copies			22 Backups 20 Snapshot based backups 2 File Based backups of Last Backup 11/23/2019 6:00:59 AM
SS:	52 - HANA 20 SPS4 MDC Single Tenant V1	0 Clones Local copies 5 Backups 0 Clones Vault copies			22 Backups 20 Snapshot based backups 2 File Based backups of Last Backup 11/23/2019 6:00:59 AM
SM	- W1	0 Clones Local copies 5 Backups 0 Clones Vault copies			22 Backups 20 Snapshot based backups 2 File Based backups v Last Backup 11/23/2019 6:00:59 AM
	262.42	Local copies 5 Backups 0 Clones Vault copies			20 Snapshot based backups 2 File-Based backups ♥ Last Backup 11/23/2019 6:00:59 AM
551	51	S Backups 0 Clones Vault copies			2 File-Based backups ♥ Last Backup 11/23/2019 6:00:59 AM
		0 Clones Vault copies			
		Primary Backup(s)			Backup succeeded
		(search )			File 🐴 Clone Rattors
		Backup Name	Count	1F	End Di
		SnapCenter_LocalSnap_Hourly_11-28-2019_06.30.01.1132	1		11/28/2019 6:30:55 AM
		SnapCenter_LocalSnap_Hourly_11-28-2019_02.30.01.1496	1		11/28/2019 2:30:55 AM
		SnapCenter_LocalSnap_Hourly_11-27-2019_22.30.01.1582	1		11/27/2019 10:30:55 PM
		SnapCenter_LocalSnap_Hourly_11-27-2019_18.30.01.0949	1		11/27/2019 6:30:55 PM
		SnapCenter_LocalSnap_Hourly_11-27-2019_14.30.01.1670	1		11/27/2019 2:30:55 PM
		SnapCenter_LocalSnap_Hourly_11-27-2019_10.30.01.0579	1		11/27/2019 10:30:55 AM
		SnapCenter_LocalSnapAndSnapVault_Daily_11-27-2019_08.17.01.9215	1		11/27/2019 8:17:56 AM
		SnapCenter_LocalSnap_Hourly_11-27-2019_06.30.01.0767	1		11/27/2019 6:30:55 AM
		SnapCenter_LocalSnap_Hourly_11-27-2019_02.30.01.1788	1		11/27/2019 2:30:55 AM
		SnapCenter_LocalSnap_Hourly_11-26-2019_22.30.01.0413	1		11/26/2019 10:30:55 PM
		SnapCenter_LocalSnap_Hourly_11-26-2019_18.30.01.0738	1		11/26/2019 6:30:55 PM
		SnapCenter_LocalSnap_Hourly_11-26-2019_14.30.01.0340	1		11/26/2019 2:30:55 PM
		SnapCenter_LocalSnap_Hourly_11-26-2019_10.30.01.0649	1		11/26/2019 10:30:55 AM
Total 4		SnanCenter LocalSnanAndSnanVault Daily 11-26-2019 08 17 01 8979 Total 15	1		11/26/2019 8:17:56 AM

A block integrity check backup cannot be deleted using the SnapCenter UI, but it can be deleted using PowerShell commands.

PS C:\Users\scadmin> Get-SmBackupReport -Resource SS1 SmBackupId : 9 : 42 SmJobId : 11/19/2019 8:26:32 AM StartDateTime : 11/19/2019 8:27:33 AM EndDateTime Duration : 00:01:00.7652030 CreatedDateTime : 11/19/2019 8:27:24 AM Status : Completed : hana-1\_sapcc\_stl\_netapp\_com\_hana\_MDC\_SS1 ProtectionGroupName SmProtectionGroupId : 1 PolicyName : BlockIntegrityCheck SmPolicyId : 5 : SnapCenter BlockIntegrityCheck 11-19-BackupName 2019 08.26.33.2913 VerificationStatus : NotApplicable VerificationStatuses : SmJobError ВаскирТуре : SCC BACKUP CatalogingStatus : NotApplicable CatalogingStatuses : ReportDataCreatedDateTime : PluginCode : SCC PluginName : hana JobTypeId : 0 JobHost : PS C:\Users\scadmin> Remove-SmBackup -BackupIds 9 Remove-SmBackup Are you sure want to remove the backup(s). [Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): y BackupResult : {} : SMCoreContracts.SMResult Result TotalCount : 0 DisplayCount : 0 Context : Job : SMCoreContracts.SmJob PS C:\Users\scadmin>

The SAP HANA backup catalog shows entries for both the system and the tenant databases. The following figure shows a SnapCenter block integrity check in the backup catalog of the system database.

hdbstudio - System: SYSTEMDB@SS1 Host: hana-1 Instance:	00 Connecte	ed User: SYSTEM System U	sage: Test System	- SAP HAN	A Studio							_	
ile <u>E</u> dit <u>N</u> avigate <u>P</u> roject <u>R</u> un <u>W</u> indow <u>H</u> elp												(manufacture)	
3・圖喻::::::::::::::::::::::::::::::::::::												Quick Ac	cess 🕴 🔡
g Systems 🖾 👘 🗖	🖄 Backup	SYSTEMDB@SS1 (SYSTEM	I) SS1 - HANA20 S	SPS4 MDC Si	ngle Tenant 🔀								-
👔 • 💷 👖 • 📾 🚑 🗢 😫 🗸	A Backup SYSTEMDB@SS1 (SYSTEM) SS1 - HANA20 SPS4 MDC Single Tenant									Lac	t Update:7:38:56 AN		
				reny oc	21 11/ 11/ 14	to or or mod omgio	Tonant				Las	a opuate 1.56.50 Alv	ŵ.   180
> MS1@MS1 (SYSTEM) MS1 - Multiple Hosts		Configuration Backup Ca	talog										
BYSTEMDB@MS1 (SYSTEM) MS1 - Multiple Hosts     Single Host - MDC Multiple Tenants	Backup C	atalog					Backup Details						
> MI@SM1 (SYSTEM) SM1 - HANA20 SPS4 MDC Mult	Databas	se: SYSTEMDB	~				ID:	1574517610777					
> 🔚 SYSTEMDB@SM1 (SYSTEM) SM1 - HANA20 SPS4 MD	1. 24-25-24-44-44						Status:	Successful					
Single Host - MDC Single Tenant	Shov	w Log Backups 🗌 Show I	Delta Backups				Backup Type: Destination Type:	Data Backu File	p				
) I SS1@SS1 (SYSTEM) SS1 - HANA20 SPS4 MDC Single T ) SYSTEMDB@SS1 (SYSTEM) SS1 - HANA20 SPS4 MDC	Status	Started	Duration	Size	Backup Type	Destinatio	Started:		9.6-00-10 AM (	America/Los_Ange	lar)		
Single Host - MDC Single Tenant		Nov 28, 2019 6:30:23	00h 00m 14s	0 B	Data Backup	Snapshot	Finished:			America/Los_Ange			
> 🔚 SS2@SS2 (SYSTEM) SS2 - HANA20SS2 MDC Single Ter		Nov 28, 2019 2:30:23	00h 00m 14s	0 B	Data Backup	Snapshot	Duration:	00h 00m 04					
> 🖺 SYSTEMDB@SS2 (SYSTEM) SS2 - HANA20 SPS4 MDC		Nov 27, 2019 10:30:2	00h 00m 14s		Data Backup	Snapshot	Size	1.47 GB					
		Nov 27, 2019 6:30:23	00h 00m 14s		Data Backup	Snapshot	Throughput:	376.00 MB/	s				
	8	Nov 27, 2019 2:30:24 Nov 27, 2019 10:30:2	00h 00m 14s 00h 00m 14s		Data Backup Data Backup	Snapshot Snapshot	System ID:	P				10	
		Nov 27, 2019 8:17:24	00h 00m 14s		Data Backup	Snapshot	Comment:	SnapCente	r_BlockIntegrit	yCheck_Weekly_1	-23-2019_06.00.	.07.8397	
		Nov 27, 2019 6:30:24	00h 00m 13s		Data Backup	Snapshot		and the second s					
		Nov 27, 2019 2:30:24	00h 00m 13s	0 B	Data Backup	Snapshot	Additional Informa	ation: <ok></ok>					
		Nov 26, 2019 10:30:2	00h 00m 13s		Data Backup	Snapshot							
		Nov 26, 2019 6:30:23	00h 00m 14s		Data Backup	Snapshot	Location:	1 1 10	51 /J ID DOO //		20/		
	8	Nov 26, 2019 2:30:23 Nov 26, 2019 10:30:2	00h 00m 14s 00h 00m 14s		Data Backup Data Backup	Snapshot Snapshot	ECCUTION.	/usr/sap/s	SI/HUBUU/bac	kup/data/SYSTEM	JB/		
		Nov 26, 2019 8:17:24	00h 00m 14s		Data Backup	Snapshot							
		Nov 25, 2019 8:17:24	00h 00m 14s		Data Backup	Snapshot	Host	Service	Size	Name	Source Type	EBID	
		Nov 24, 2019 8:17:24	00h 00m 14s	0 B	Data Backup	Snapshot	hana-1	nameserver		SnapCenter_S	topology		
		Nov 23, 2019 8:17:24	00h 00m 13s		Data Backun	Snanshot	hana-1	nameserver	1.47 GB	SnapCenter_S	volume		
		Nov 23, 2019 6:00:10	00h 00m 04s	1.47 GB	Data Backup	File							
	Propert	ties 🗯 🤨 Error Log										🐷 🍁 🗔	
	Property			Value									

A successful block integrity check creates standard SAP HANA data backup files. SnapCenter uses the backup path that has been configured in the HANA database for file-based data backup operations.

hana-1:/usr/sap/SS1/HDB00/backup/data # ls -al \* DB SS1: total 1710840 drwxr-xr-- 2 ssladm sapsys 4096 Nov 28 10:25 . drwxr-xr-- 4 ssladm sapsys 4096 Nov 19 05:11 .. -rw-r---- 1 ssladm sapsys 155648 Nov 23 08:46 SnapCenter SnapCenter BlockIntegrityCheck Weekly 11-23-2019 06.00.07.8397 databackup 0 1 -rw-r---- 1 ssladm sapsys 83894272 Nov 23 08:46 SnapCenter SnapCenter BlockIntegrityCheck Weekly 11-23-2019 06.00.07.8397 databackup 2 1 -rw-r---- 1 ssladm sapsys 1660952576 Nov 23 08:46 SnapCenter SnapCenter BlockIntegrityCheck Weekly 11-23-2019 06.00.07.8397 databackup 3 1 SYSTEMDB: total 1546340 drwxr-xr-- 2 ssladm sapsys 4096 Nov 28 10:24 . drwxr-xr-- 4 ssladm sapsys 4096 Nov 19 05:11 .. -rw-r---- 1 ssladm sapsys 159744 Nov 23 08:46 SnapCenter SnapCenter BlockIntegrityCheck Weekly 11-23-2019 06.00.07.8397 databackup 0 1 -rw-r---- 1 ssladm sapsys 1577066496 Nov 23 08:46 SnapCenter SnapCenter BlockIntegrityCheck Weekly 11-23-2019 06.00.07.8397 databackup 1 1

## **Restore and recovery**

The following sections describe the restore and recovery workflows of three different scenarios and example configurations.

- Automated restore and recovery:
  - Auto discovered HANA system SS1
  - SAP HANA single host, MDC single tenant system using NFS
- Single-tenant restore and recovery:
  - Auto discovered HANA system SM1
  - · SAP HANA single host, MDC multiple tenant system using NFS
- Restore with manual recovery:
  - Manual configured HANA system SS2
  - $\circ\,$  SAP HANA single host, MDC multiple tenant system using NFS

In the following sections, the differences between SAP HANA single host and multiple hosts and Fibre Channel SAN attached HANA systems are highlighted.

The examples show SAP HANA Studio as a tool to execute manual recovery. You can also use SAP HANA

Cockpit or HANA SQL statements.

#### Automated restore and recovery

With SnapCenter 4.3, automated restore and recovery operations are supported for HANA single container or MDC single tenant systems that have been auto discovered by SnapCenter.

You can execute an automated restore and recovery operation with the following steps:

- 1. Select the backup to be used for the restore operation. The backup can be selected from the following storage options:
  - Primary storage
  - Offsite backup storage (SnapVault target)
- 2. Select the restore type. Select Complete Restore with Volume Revert or without Volume Revert.



The Volume Revert option is only available for restore operations from primary storage and if the HANA database is using NFS as the storage protocol.

- 3. Select the recovery type from the following options:
  - To most recent state
  - Point in time
  - To specific data backup
  - No recovery



The selected recovery type is used for the recovery of the system and the tenant database.

Next, SnapCenter performs the following operations:

- 1. It stops the HANA database.
- 2. It restores the database.

Depending on the selected restore type and the used storage protocol, different operations are executed.

- If NFS and Volume Revert are selected, then SnapCenter unmounts the volume, restores the volume using volume-based SnapRestore on the storage layer, and mounts the volume.
- If NFS is selected and Volume Revert is not selected, SnapCenter restores all files using single-file SnapRestore operations on the storage layer.
- If Fibre Channel SAN is selected, then SnapCenter unmounts the LUN(s), restores the LUN(s) using single file SnapRestore operations on the storage layer, and discovers and mounts the LUN(s).
- 3. It recovers the database:
  - a. It recovers the system database.
  - b. It recovers the tenant database.

Or, for HANA single container systems, the recovery is executed in a single step:

c. It starts the HANA database.



If No Recovery is selected, SnapCenter exits and the recovery operation for the system and the tenant database must be done manually.

This section provides the steps for the automated restore and recovery operation of the auto discovered HANA system SS1 (SAP HANA single host, MDC single tenant system using NFS).

1. Select a backup in SnapCenter to be used for the restore operation.



You can select restore from primary or from offsite backup storage.

napCe	nter®			•	<b>=</b> 9	- L sapcc\s	cadmin Sna	pCenterAdmin	🗊 Sign	n Out
	IANA 🔽	SSI Topology	â	<u>_</u>	1	4	i	÷.		tefres:
and the second			Remove Protection	Back up Now	Modify	Maintenance	Details	Configure Databa	se (R	lefrest
12	System	Manage Copies								
20	MS1 - Multiple Hosts MDC Single Tenant	16 Backups					Summary C	ard		
20	SS2 - HANA 20 SPS4 MDC Single Tenant	0 Clones					23 Backups	aru		
	SM1	Local copies					22 Snapshot bi	ased backups		
	SS1	6 Backups					1 File-Based b			
		0 Clones					0 Clones			
		Vault copies								
		Primary Backup(s)							Restore	e
		search 7						Cone	Restore	
		Backup Name	Count	1₹					End Da	ate
		SnapCenter_LocalSnap_Hourly_12-05-2019_22.30.01.5385	1					12/05/2019 10:	30:55 PM	
		SnapCenter_LocalSnap_Hourly_12-05-2019_18.30.01.5244	1					12/05/2019 6:	30:55 PM	8
		SnapCenter_LocalSnap_Hourly_12-05-2019_14.30.01.6022	1					12/05/2019 2:	30:55 PM	
		SnapCenter_LocalSnap_Hourly_12-05-2019_10.30.01.5450	1				3	12/05/2019 10:	30:56 AM	
		SnapCenter_LocalSnapAndSnapVault_Daily_12-05-2019_08.17.02.0191	1					12/05/2019 8:	17:56 AM	
		SnapCenter_LocalSnap_Hourly_12-05-2019_06.30.01.5487	1					12/05/2019 6:	30:55 AM	
		SnapCenter_LocalSnap_Hourly_12-05-2019_02.30.01.5470	1					12/05/2019 2::	30:55 AM	۳
		SnapCenter_LocalSnap_Hourly_12-04-2019_22.30.01.5182	1				•	12/04/2019 10:	30:55 PM	۳
		SnapCenter_LocalSnap_Hourly_12-04-2019_18.30.01.5249	1					12/04/2019 6:	30:55 PM	Ö
		SnapCenter_LocalSnap_Hourly_12-04-2019_14.30.01.5069	1					12/04/2019 2:	30:55 PM	۵
	4	Epan Contex Local Epan Mounty 12.04.2019 10.20.01 5200						10/04/2010 10-	20-55 114	-

SAP HANA 🔽	SS1 Topology							
Search databases		Remove Protection	L Back up Now	Modify	Maintenance	i Details	Configure Databas	e Refres
System	Manage Copies							
MS1 - Multiple Hosts MDC Single Tenar	16 Backups				3	Summary C	ard	
SS2 - HANA 20 SPS4 MDC Single Tenan	t O Clones				2	22 Backups		
SM1	Local copies					21 Snapshot ba	ased backups	
SS1	5 Backups					1 File-Based b	ackup 🛹	
	0 Clones Vault copies					0 Clones		
	Secondary Vault Backup(s)							-
	search T						Clone	Restore Restore
	Backup Name	Count	17					End D
	SnapCenter_LocalSnapAndSnapVault_Daily_12-05-2019_08.17.02.0191	1					12/05/2019	17:56 AM
	SnapCenter_LocalSnapAndSnapVault_Daily_12-04-2019_08.17.01.9976	1					12/04/2019 8	17:56 AM
	SnapCenter_LocalSnapAndSnapVault_12-04-2019_04.18.57.8527	1					12/04/2019	k:19:52 AM
	SnapCenter_LocalSnapAndSnapVault_Daily_12-03-2019_08.17.01.9180	1					12/03/2019 8	1:17:56 A.M
	SnapCenter_LocalSnapAndSnapVault_Daily_12-02-2019_08.17.01.9273	1					12/02/2019 8	17:56 AM

2. Select the restore scope and type.

The following three screenshots show the restore options for restore from primary with NFS, restore from

secondary with NFS, and restore from primary with Fibre Channel SAN.

The restore type options for restore from primary storage.



The Volume Revert option is only available for restore operations from primary with NFS.

Restore	e from Snap	Center_LocalSnap_Hourly_12-05-2019_22.30.01.5385	×
1 Restor	re scope	Select the restore types	
2 Recov	ery scope	Complete Resource	
3 PreOp	DS	Volume Revert A As part of Complete Resource restore, if a resource contains volumes as Storage Footprint, then the latest Snapshot	1
(4) PostO	ips	copies on such volumes will be deleted permanently. Also, if there are other resources hosted on the same volumes, then it will result in data loss for such resources.	
5 Notific	cation	O Tenant Database	-
6 Summ	hary		
A The r	newer tenants ac	dded on the host after the backup was created cannot be restored and will be lost after restore operation.	
Confi	igure an SMTP Se	erver to send email notifications for Restore jobs by going to <u>Settings&gt;Global Settings&gt;Notification Server Settings</u> .	
		Previous Next	

The restore type options for restore from offsite backup storage.

Restore from Sn	apCenter_LocalSnapAndSnapVault_Daily_12-05-	2019_08.17.02.0191	્ર
Recovery scope     Recovery scope     PreOps	Select the restore types  Complete Resource  Temant Database  Choose archive location		
4 PearOps 3 Notification 8 Summary	hana-primary-sapoc.ttl.netago.com:151_data_mnt00001	hana-backup sappt stillnetapp.comd51,det.*	
	s added on the host after the backup was created cannot be resto P Server to send email notifications for Restore jobs by going to 3	www.energenergenergenergenergenergenergener	hest

The restore type options for restore from primary storage with Fibre Channel SAN.

Restore from Sn	apCenter_LocalSnap_Hourly_12-16-2019_22.35.01.3065
1 Restore scope	Select the restore types
2 Recovery scope	Complete Resource
3 PreOps	Tenant Database
4 PostOps	
5 Notification	
6 Summary	
A The server too and	s added on the host after the backup was created cannot be restored and will be lost after restore operation.
	P Server to send email notifications for Restore jobs by going to <u>Settings-Global Settings-Notification Server Settings</u>
	Previous Next

3. Select Recovery Scope and provide the location for log backup and catalog backup.



SnapCenter uses the default path or the changed paths in the HANA global.ini file to prepopulate the log and catalog backup locations.

Restore from Sna	oCenter LocalSnap	_Hourly_12-05-2019	22.30.01.5385

Restore scope	Recover database files using	
2 Recovery scope	Recover to most recent state	
3 PreOps	Recover to specified data backup     No recovery	
4 PostOps		
5 Notification	Specify log backup locations ① Add	
6 Summary	/mnt/log-backup	
	Specify backup catalog location 1 /mnt/log-backup	
A Recovery options	are applicable to both system database and tenant database.	
🛕 Configure an SMTI	P Server to send email notifications for Restore jobs by going to <u>Settings&gt;Global Settings&gt;Notification Server Settings</u> .	
	Previous Next	20

4. Enter the optional prerestore commands.

Restore from Sna	apCenter_LocalSnap_Hourly_12-05-2019_22.30.01.5385	×
Restore scope	Enter optional commands to run before performing a restore operation 1	
2 Recovery scope	Pre restore command	
3 PreOps		
4 PostOps		
5 Notification		
6 Summary		
A Configure on SMT	P Server to send email notifications for Restore jobs by going to <u>Settings&gt;Global Settings&gt;Notification Server Settings.</u>	
Compute an SMT	- Server to serve emain notineations for Restore Jobs by going to <u>Settings-Global Settings-Rothication Server Settings</u> .	
	Previous	Next

5. Enter the optional post-restore commands.

Restore from Sna	apCenter_LocalSnap_Hourly_12-05-2019_22.30.01.5385	×
Restore scope	Enter optional commands to run after performing a restore operation 🚯	
2 Recovery scope	Post restore command	
3 PreOps		
4 PostOps		
5 Notification		
6 Summary		
A Configure an SMTI	P Server to send email notifications for Restore jobs by going to <u>Settings&gt;Global Settings&gt;Notification Server Settings.</u>	×
	Previous	Next
		a consister

6. Enter the optional email settings.

Restore from Sna	apCenter_LocalSn	ap_Hourly_12-05-2019_22.30.01.5385	×
Restore scope	Provide email sett	ings 🚯	
2 Recovery scope	Email preference	Never •	
3 PreOps	From	Email from	
	То	Email to	
4 PostOps	Subject	Notification	
5 Notification	🔲 Attach Job Report		
6 Summary			
() Summary	-		
		e jobs, an SMTP server must be configured. Continue to the Summary page to save your information otification Server Settings to configure the SMTP server.	n, ×
		Previous	Next

7. To start the restore operation, click Finish.

ackup Name ackup date estore scope ecovery scope og backup locations	SnapCenter_LocalSnap_Hourly_12-05-2019_22.30.01.5385 12/05/2019 10:30:55 PM Complete Resource with Volume Revert Recover to most recent state /mnt/log-backup	
estore scope ecovery scope og backup locations	Complete Resource with Volume Revert Recover to most recent state	
ecovery scope og backup locations	Recover to most recent state	
og backup locations		
	/mnt/log-backup	
ackup catalog location	/mnt/log-backup	
re restore command		
ost restore command		
end email	No	
		nation,
	ost restore command end email fications for Restore jobs, an SM	ost restore command

8. SnapCenter executes the restore and recovery operation. This example shows the job details of the restore and recovery job.

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## Job Details

Restore 'hana-1.sapcc.stl.netapp.com\hana\MDC\SS1'

Restore 'hana-1.sapcc.stl.netapp.com\hana\MDC\SS1'

~	▼ hana-1.sapcc.stl.netapp.com
~	▼ Restore
V	▼ Validate Plugin Parameters
V	▼ Pre Restore Application
V	Stopping HANA instance
~	▼ Filesystem Pre Restore
~	Determining the restore mechanism
~	Deporting file systems and associated entities
~	Restore Filesystem
~	▼ Filesystem Post Restore
V	Building file systems and associated entities
۷.	Recover Application
~	Recovering system database
~	Checking HDB services status
~	Recovering tenant database 'SS1'
~	Starting HANA instance
~	Clear Catalog on Server
~	Application Clean-Up
~	Data Collection
1	Agent Finalize Workflow

			View Logs	Cancel Job	Close
--	--	--	-----------	------------	-------

#### Single-tenant restore and recovery operation

With SnapCenter 4.3, single-tenant restore operations are supported for HANA MDC systems with a single tenant or with multiple tenants that have been auto- discovered by SnapCenter.

You can perform a single-tenant restore and recovery operation with the following steps:

- 1. Stop the tenant to be restored and recovered.
- 2. Restore the tenant with SnapCenter.
  - For a restore from primary storage, SnapCenter executes the following operations:
    - NFS. Storage Single File SnapRestore operations for all files of the tenant database.
    - SAN. Clone and connect the LUN to the database host, and copy all files of the tenant database.
  - For a restore from secondary storage, SnapCenter executes the following operations:
    - NFS. Storage SnapVault Restore operations for all files of the tenant database
    - SAN. Clone and connect the LUN to the database host, and copy all files of the tenant database
- 3. Recover the tenant with HANA Studio, Cockpit, or SQL statement.

This section provides the steps for the restore and recovery operation from the primary storage of the autodiscovered HANA system SM1 (SAP HANA single-host, MDC multiple-tenant system using NFS). From the user input perspective, the workflows are identical for a restore from secondary or a restore in a Fibre Channel SAN setup.

1. Stop the tenant database.

```
smladm@hana-2:/usr/sap/SM1/HDB00> hdbsql -U SYSKEY
Welcome to the SAP HANA Database interactive terminal.
Type: \h for help with commands
        \q to quit
hdbsql=>
hdbsql SYSTEMDB=> alter system stop database tenant2;
0 rows affected (overall time 14.215281 sec; server time 14.212629 sec)
hdbsql SYSTEMDB=>
```

2. Select a backup in SnapCenter to be used for the restore operation.

SA	P HANA 🔽	SM1 Topology							
	Search databases		Remove Protection	L Back up Now	Modify	Maintenance	1 Details	Configure Database	Refre
B	System	Manage Copies							
*	MS1 - Multiple Hosts MDC Single Tenant	12 Backups				Sum	mary Card		
20	SS2 - HANA 20 SPS4 MDC Single Tenant					13 Ba			
	SM1	Local copies					Snapshot based b	ackups	
	SS1						; File-Based backup		
						0 Clo	ines		
		Deine au Deeluur (a)							
		Primary Backup(s)						1	Restore
		search T						Cone	Restore
		Backup Name	Count	47					End Date
		SnapCenter_LocalSnap_Hourly_12-05-2019_22.28.01.2445	1				12	/05/2019 10:28	:55 PM 🛱
		SnapCenter_LocalSnap_Hourly_12-05-2019_18.28.01.1350	1				1	2/05/2019 6:28	:56 PM 🛱
		SnapCenter_LocalSnap_Hourly_12-05-2019_14.28.01.2553	1				1	2/05/2019 2:28	:55 PM 🛱
		SnapCenter_LocalSnap_Hourly_12-05-2019_10.28.01.2412	1				12	/05/2019 10:28	:55 AM 🛱
		SnapCenter_LocalSnap_Hourly_12-05-2019_06.28.01.1628	1				1	2/05/2019 6:28	:55 AM 🛱
		SnapCenter_LocalSnap_Hourly_12-05-2019_02.28.01.1081	1				1	2/05/2019 2:28	:55 AM 🛱
		SnapCenter_LocalSnap_Hourly_12-04-2019_22.28.01.1106	1				12	/04/2019 10:28	:55 PM 🛱
		SnapCenter_LocalSnap_Hourly_12-04-2019_18.28.01.0470	1				1	2/04/2019 6:28	:55 PM 🛱
		SnapCenter_LocalSnap_Hourly_12-04-2019_14.28.01.1969	1				1	2/04/2019 2:28	:56 PM 🛱
		SnapCenter_LocalSnap_Hourly_12-04-2019_10.28.01.0201	1				12	/04/2019 10:28	:55 AM 🛱
		Concenter LocalCone Hoursky 12 04 2010 06 20 01 0050					1.41	7/04/2010 6-20	

3. Select the tenant to be restored.



SnapCenter shows a list of all tenants that are included in the selected backup.

Restore from Sna	pCenter_LocalSnap_Hourly_12-05-2019_22.28.01.2445	×
1 Restore scope	Select the restore types	
2 Recovery scope	Complete Resource	
3 PreOps	Tenant Database      Select tenant database	
4 PostOps		
5 Notification	Select tenant database	
6 Summary	TENANT2	
🛕 Stop the tenant be	fore performing the tenant restore operation.	×
🛕 Configure an SMTF	Server to send email notifications for Restore jobs by going to <u>Settings&gt;Global Settings&gt;Notification Server Settings</u> .	×
	Previous	Next

Single-tenant recovery is not supported with SnapCenter 4.3. No Recovery is preselected and cannot be changed.

Restore from Sn	apCenter_LocalSnap_Hourly_12-05-2019_22.28.01.2445	×
Restore scope	Recover database files using	
2 Recovery scope	<ul> <li>Recover to most recent state</li> <li>Recover to point in time</li> </ul>	
3 PreOps	Recover to specified data backup     Recover to specified data backup     No recovery	
4 PostOps		
5 Notification		
6 Summary		
A Recovery of an mi	ultitenant database container with multiple tenants is not supported	
<b>A</b> Configure an SMT	P Server to send email notifications for Restore jobs by going to <u>Settings&gt;Global Settings&gt;Notification Server Settings</u> .	×
	Previous	Next

4. Enter the optional prerestore commands.

Restore scope	Enter optional commands to run before performing a restore operation 1
2 Recovery scope	Pre restore command
3 PreOps	
4 PostOps	
5 Notification	
6 Summary	
🛕 Configure an SMT	P Server to send email notifications for Restore jobs by going to <u>Settings&gt;Global Settings&gt;Notification Server Settings.</u>
	Previous Next
	TEVIOUS NEAL

5. Enter optional post-restore commands.

Restore from Sn	apCenter_LocalSnap_Hourly_12-05-2019_22.28.01.2445	×
Restore scope	Enter optional commands to run after performing a restore operation 1	
2 Recovery scope	Post restore command	
3 PreOps		
4 PostOps		
5 Notification		
6 Summary		
A Configure an SMT	IP Server to send email notifications for Restore jobs by going to <u>Settings&gt;Global Settings&gt;Notification Server Settings.</u>	×
	Previous	Next

6. Enter the optional email settings.

Restore from Sna	apCenter_LocalSn	ap_Hourly_12-05-2019_22.28.01.2445	×
Restore scope	Provide email set	ings 🕦	
2 Recovery scope	Email preference	Never	
3 PreOps	From	Email from	
PostOps	To Subject	Email to Notification	
5 Notification 6 Summary			
		e jobs, an SMTP server must be configured. Continue to the Summary page to save your information, otification Server Settings to configure the SMTP server.	×
		Previous	Next

7. To start the restore operation, click Finish.

Restore from Sna	apCenter_LocalSnap_Hou	ırly_12-05-2019_22.28.01.2445	×
1 Restore scope	Summary		
2 Recovery scope	Backup Name	SnapCenter_LocalSnap_Hourly_12-05-2019_22.28.01.2445	
	Backup date	12/05/2019 10:28:55 PM	
3 PreOps	Restore scope	Restore tenant database 'TENANT2'	
A PostOps	Recovery scope	No recovery	
	Pre restore command		
5 Notification	Post restore command		
6 Summary	Send email	No	
		SMTP server must be configured. Continue to the Summary page to save your inform Server Settings to configure the SMTP server.	ation, X
		Previous	Finish

The restore operation is executed by SnapCenter. This example shows the job details of the restore job.

## Job Details

÷.

#### Restore 'hana-2.sapcc.stl.netapp.com\hana\MDC\SM1'

- Restore 'hana-2.sapcc.stl.netapp.com\hana\MDC\SM1'
- hana-2.sapcc.stl.netapp.com

¥	<ul> <li>Restore</li> </ul>
~	Validate Plugin Parameters
~	Pre Restore Application
~	Filesystem Pre Restore
~	Restore Filesystem
~	Filesystem Post Restore
~	Recover Application
~	Application Clean-Up
~	Data Collection
~	Agent Finalize Workflow

	· · · · · · · · · · · · · · · · · · ·	
View Logs	Cancel Job	Close

When the tenant restore operation is finished, only the tenant relevant data is restored. On the file system of the HANA database host, the restored data file and the Snapshot backup ID file of the tenant is available.

```
smladm@hana-2:/usr/sap/SM1/HDB00> ls -al /hana/data/SM1/mnt00001/*
-rw-r--r-- 1 smladm sapsys 17 Dec 6 04:01
/hana/data/SM1/mnt00001/nameserver.lck
/hana/data/SM1/mnt00001/hdb00001:
total 3417776

      drwxr-x--- 2 smladm sapsys
      4096 Dec 6 01:14 .

      drwxr-x--- 6 smladm sapsys
      4096 Nov 20 09:35 ..

-rw-r---- 1 smladm sapsys 3758096384 Dec 6 03:59 datavolume 0000.dat
-rw-r---- 1 smladm sapsys 0 Nov 20 08:36
DO NOT TOUCH FILES IN THIS DIRECTORY
-rw-r---- 1 smladm sapsys 36 Nov 20 08:37 landscape.id
/hana/data/SM1/mnt00001/hdb00002.00003:
total 67772
drwxr-xr-- 2 smladm sapsys 4096 Nov 20 08:37 .
drwxr-x--- 6 smladm sapsys 4096 Nov 20 09:35 ..
-rw-r--r-- 1 smladm sapsys 201441280 Dec 6 03:59 datavolume 0000.dat
-rw-r--r-- 1 smladm sapsys 0 Nov 20 08:37
DO NOT TOUCH FILES IN THIS DIRECTORY
/hana/data/SM1/mnt00001/hdb00002.00004:
total 3411836
drwxr-xr-- 2 smladm sapsys 4096 Dec 6 03:57 .
drwxr-x--- 6 smladm sapsys 4096 Nov 20 09:35 ..
-rw-r--r-- 1 smladm sapsys 3758096384 Dec 6 01:14 datavolume 0000.dat
-rw-r--r-- 1 smladm sapsys 0 Nov 20 09:35
DO NOT TOUCH FILES IN THIS DIRECTORY
-rw-r---- 1 smladm sapsys 155648 Dec 6 01:14
snapshot databackup 0 1
/hana/data/SM1/mnt00001/hdb00003.00003:
total 3364216
drwxr-xr-- 2 smladm sapsys 4096 Dec 6 01:14 .
drwxr-x--- 6 smladm sapsys 4096 Nov 20 09:35 ..
-rw-r--r-- 1 smladm sapsys 3758096384 Dec 6 03:59 datavolume 0000.dat
-rw-r--r-- 1 smladm sapsys 0 Nov 20 08:37
DO NOT TOUCH FILES IN THIS DIRECTORY
smladm@hana-2:/usr/sap/SM1/HDB00>
```

8. Start the recovery with HANA Studio.

Market Ma																				
🗂 • 🖾 🕼 ( . ) 🖉 • 🕅 • 🗠	⇔ • ⇔ •													Quick	Access	3   🛸				
9         Systems 23         Image: Control of the systems 23           Image: Control of the system of	- 0	16	🐴 Backup	SYSTEMDB@SS1 (SYSTEM	() SS1 - HANA2	🖄 Ba	kup SYSTEMDB	@SM1 (SYSTEM) SM1 - HA	NA 🛛 🙆 Backup SYSTEMDB@MS1	SYSTEM) MS1	Multi	👛 Backup SY	STEMDB@SS2 (SY	STEM) SS2 - HAN	IA2	- 0				
			🛎 Bacl	kup SYSTEMDB@	SM1 (SYS	TEM) SM	11 - HANA	20 SPS4 MDC Mul	tiple Tenants				Las	t Update:6:15:51	AM 🤗 📗					
	0	Overview	Configuration Backup Ca	atalog																
		Backup C						Backup Details												
	ANA20 SPS4 MDC Mu		Database: SYSTEMDB						ID: Status:	15753689040 Successful	74									
		ر المن ال		tion and Monitoring fanagement	>				Backup Type: Destination Type:	Data Backup Snapshot										
	1 - HANA20 SPS4 M			d Recovery	>	Open Ba	ackup Console		Started:		:28:24 AM (A	merica/Los_Ang	jeles)							
Single Host - MDC Single Tenant		3	Security	100 100 100 100 <b>-</b> 10	>	Back Up	System Databas	se	Finished:	Dec 3, 2019 2:28:38 AM (America/Los_Angeles)										
> III SS2@SS2 (SYSTEM) SS2 - HAN > III SYSTEMDB@SS2 (SYSTEM) SS		🌮 s	Open SQL	Console			Tenant Databas		Duration: Size:	00h 00m 14s 0 B										
	2		😵 s	B	B :	SAP HANA	Modeler	>		Storage Snapsh System Databas		Throughput:	ut: n.a.							
						Add Syster	n with Different User		Recover	Tenant Databas	e	System ID: Comment:	Care Caretar	Level Course 11	lourly 12-03-20	0 02 20 01 1161				
	3	×	Remove		Delete	0 B	Data Backup Data Backup Data Backup		Additional Information	SnapCenter	_Localshap_H	100Hy_12-05-20	19_02.26.01.1161			0				
		1	Log Off					Snapshot Snapshot		): calc										
	4				F5		B Data Backup	Snapshot		- COKA						0				
		ī	Properties		Alt+Enter		Data Backup	Snapshot	Location:	0.411	SM1/mnt000	017								
				Nov 30, 2019 6:29:16	00h 00m 03s		Data Backup Data Backup	Snapshot File	Location	/nana/data/	SIVI I/ mintuuu	01/				0				
			877						~							<u></u>				
													100000	ameserver		Name hdb00001	Source Type volume	SnapC		
											nana-2 n	ameserver	UB	nabuuuur	volume	snapc		_		
																_				
																_				
																_				
																_				
																_				
																_				
		0	Propert	ies 🔀 🤨 Error Log											<b>1</b> ×	- 0				
		5	SYSTEM	DB@SM1 (SYSTEM)	1															
<	3	>	Isanarai	~ Property	,			Value								0				

9. Select the tenant.

		×
Specify tenant database		
/pe filter text		
SM1		
? < <u>Back</u> <u>Next</u> > <u>Finish</u>	Cance	el

10. Select the recovery type.

Recovery of Tenant Database in SM1		_		×		
Specify Recovery Type						
Select a recovery type.						
Recover the database to its most recent state	ត					
Recover the database to its most recent state Recover the database to the following point i						
Date: 2019-12-06 Tim	ne: 01:18:31					
Select Time Zone: (GMT-08:00) Pacific Stand	ard Time				$\sim$	
i System Time Used (GMT): 2019-12-06 09	:18:31					
Recover the database to a specific data backup	որ 🖪					
				А	dvanced	>>
(?)	< <u>B</u> ack	<u>N</u> ext >	<u>F</u> inish		Cance	el

11. Provide the backup catalog location.

Recovery of Tenant Database in SM1		_		×
Locate Backup Catalog				
Specify location of the backup catalog.				
Recover using the backup catalog      Second for the backup catalog				
Search for the backup catalog in the file system only				_
Backup Catalog Location: /mnt/log-backup/DB_TENANT2				
O Recover without the backup catalog				
Backint System Copy				
Backint System Copy				
Source System:				
? < <u>B</u> ack <u>N</u> ext >	<u>F</u> inish		Cance	el 🛛
Stop Database TENANT2@SM1	×			
The database must be offline before recovery can start; the database will be st	opped			
now				
OK Can	el			

Within the backup catalog, the restored backup is highlighted with a green icon. The external backup ID shows the backup name that was previously selected in SnapCenter.

12. Select the entry with the green icon and click Next.

Recovery of Tenant Dat	abase in SM1				<u> 16 -</u>		×
Select a Backup							
Select a backup to recover	the SAP HANA database						
Selected Point in Time							
Database will be recovered	to its most recent state.						
Backups			<i>(</i> ) T		1		
	•		esstul. I	e backup at the top is estimated to have the	shortest recove	ry time.	
Start Time	Location	Backup Prefix	A				
2019-12-05 22:28:24	/hana/data/SM1	SNAPSHOT	•				
2019-12-05 18:28:24	/hana/data/SM1	SNAPSHOT	0				
2019-12-05 14:28:23	/hana/data/SM1	SNAPSHOT	0				
2019-12-05 10:28:24	/hana/data/SM1	SNAPSHOT	0				
2019-12-05 06:28:23	/hana/data/SM1	SNAPSHOT	0				
2019-12-05 02:28:23	/hana/data/SM1	SNAPSHOT	0				
2019-12-04 22:28:24	/hana/data/SM1	SNAPSHOT	0				
2019-12-04 18:28:23	/hana/data/SM1	SNAPSHOT	0				
2019-12-04 14:28:25	/hana/data/SM1	SNAPSHOT	0				
2019-12-04 10:28:24	/hana/data/SM1	SNAPSHOT	0				
					-		
					Refresh	Show	More
Details of Selected Item							
Start Time: 0 2019	9-12-05 22:28:24 Destination 1	Type: SNAPSHOT	Sourc	System: TENANT2@SM1			
iize: 0 B	Backup ID:	1575613704345	Exterr	al Backup ID: SnapCenter_LocalSnap_Hourly	_12-05-2019_22	28.01.24	45
ackup Name: /har	na/data/SM1						
Alternative Location:							
					Che	ck Availa	ability
?				< Back Next >	Finish	Cance	el

13. Provide the log backup location.

Recovery of 1	enant Database in SM1	-		$\times$		
cate Log B	ackups					
ecify location	(s) of log backup files to be used to recover the database.					
(i) Even if n	o log backups were created, a location is still needed to read data that will be used for recovery.					
	kups were written to the file system and subsequently moved, you need to specify their current location. If you do not spe the log backups, the system uses the location where the log backups were first saved. The directory specified will be search			2		
Locations:			Add			
	/mnt/log-backup/DB_TENANT2		Remove A			
			Remov	e		
?)						
0	< <u>B</u> ack <u>N</u> ext > <u>F</u> inish		Cance	el		

14. Select the other settings as required.

Recovery of Tenant Database in SM1	_		×
Other Settings			
Check Availability of Delta and Log Backups			^
You can have the system check whether all required delta and log backups are available at the beginning of the recovery process. If delta missing, they will be listed and the recovery process will stop before any data is changed. If you choose not to perform this check now, it performed but later. This may result in a significant loss of time if the complete recovery must be repeated.			
Check the availability of delta and log backups:			
✓ File System <sup>®</sup>			
Third-Party Backup Tool (Backint)			
Initialize Log Area			
If you do not want to recover log segments residing in the log area, select this option. After the recovery, the log entries will be deleted for	rom the l	og area.	
Initialize Log Area			
Use Delta Backups			
Select this option if you want to perform a recovery using delta backups. If you choose to perform a recovery without delta backups, only be used.	log bacl	cups will	
Use Delta Backups (Recommended)			
Install New License Key			
If you recover the database from a different system, the old license key will no longer be valid You can: - Select a new license key to install now - Install a new license key manually after the database has been recovered			
Install New License Key			
		Browse	
		DIOMSE	
			~
? < <u>B</u> ack <u>Next</u> > <u>F</u> inish		Cance	1

15. Start the tenant recovery operation.

Recovery of Tenant Database in SM1				_		×
Review Recovery Settings						
Review the recovery settings and choose 'Finish	to start the recovery. You can modify the recovery settin	ngs by choosing 'Back	ć.			
Database Information						
Database: Host: Version:	TENANT2@SM1 hana-2 2.00.040.00.1553674765					
Recovery Definition						
Recovery Type:	Snapshot (Point-in-Time Recovery (Until Now))					
Configuration File Handling						
le Caution						
More Information: SAP HANA Administratio	n Guide					
?	< Back	<u>N</u> ext >	<u>F</u> inish		Cance	el

i Database TENANT2@SM1 recovered           1 volumes were recovered           Recovered to Time:         Dec 6, 2019 1:05:14 AM GMT-08:00           Recovered to Log Position:         197371136	Recovery of Tenant Database in SM1 covery Execution Summary				
1 volumes were recovered Recovered to Time: Dec 6, 2019 1:05:14 AM GMT-08:00 Recovered to Log Position: 197371136					
Recovered to Time: Dec 6, 2019 1:05:14 AM GMT-08:00 Recovered to Log Position: 197371136	Database TENANT2@SM	recovered			
Recovered to Log Position: 197371136	1 volumes were recovered				
	Recovered to Time:	Dec 6, 2019 1:05:14 AM GMT-08:00			
	Recovered to Log Position:	197371136			
Close					

#### Restore with manual recovery

To restore and recover an SAP HANA MDC single-tenant system using SAP HANA Studio and SnapCenter, complete the following steps:

- 1. Prepare the restore and recovery process with SAP HANA Studio:
  - a. Select Recover System Database and confirm shutdown of the SAP HANA system.
  - b. Select the recovery type and the log backup location.
  - c. The list of data backups is shown. Select Backup to see the external backup ID.
- 2. Perform the restore process with SnapCenter:
  - a. In the topology view of the resource, select Local Copies to restore from primary storage or Vault Copies if you want to restore from an off-site backup storage.
  - b. Select the SnapCenter backup that matches the external backup ID or comment field from SAP HANA Studio.
  - c. Start the restore process.



If a volume-based restore from primary storage is chosen, the data volumes must be unmounted from all SAP HANA database hosts before the restore and mounted again after the restore process is finished.



In an SAP HANA multiple-host setup with FC, the unmount and mount operations are executed by the SAP HANA name server as part of the shutdown and startup process of the database.

- 3. Run the recovery process for the system database with SAP HANA Studio:
  - a. Click Refresh from the backup list and select the available backup for recovery (indicated with a green icon).
  - b. Start the recovery process. After the recovery process is finished, the system database is started.
- 4. Run the recovery process for the tenant database with SAP HANA Studio:
  - a. Select Recover Tenant Database and select the tenant to be recovered.
  - b. Select the recovery type and the log backup location.

A list of data backups displays. Because the data volume has already been restored, the tenant backup is indicated as available (in green).

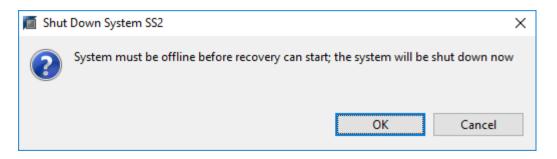
c. Select this backup and start the recovery process. After the recovery process is finished, the tenant database is started automatically.

The following section describes the steps of the restore and recovery operations of the manually configured HANA system SS2 (SAP HANA single host, MDC multiple tenant system using NFS).

1. In SAP HANA Studio, select the Recover System Database option to start the recovery of the system database.

	gate Project Run Window Help . [실] ▼ 친 ▼ ♡> ◇ ▼ ↔ ▼								Quick Access	010		
										B		
o Systems 🔀	- 0							SYSTEMDB@SM1		- 0		
> 陆 MS1@N	B v B v B v B v B v B v B v B v B v B v		STEMDB@SS1 (SYSTEM) SS1 - HANA20 SPS4 MDC Single Tenant hana-1 00 200.040.00.1553674765 (fa/hana2sp04)					Last Update: Dec 10, 2019 3:41:32 AM 🤣   🔟 Interval: 🗵 👻 Seconds   🞚	<b>a</b>   6			
	MDB@MS1 (SYSTEM) MS1 - Multiple Hosts	Processes Diagno	Processes Diagnosis Files Emergency Information									
	t - MDC Multiple Tenants M1 (SYSTEM) SM1 - HANA20 SPS4 MDC Mult	Host: <all></all>	v 31	¢.								
	MDB@SM1 (SYSTEM) SM1 - HANA20 SP54 MD		^	<u>^</u>				and the second se		_		
	t - MDC Single Tenant	Active Host hana-1		Description HDB Compileserver	Process ID 384		Start Time Dec 10, 2019 6:34:00 AM	Elapsed Time				
	51 (SYSTEM) SS1 - HANA20 SPS4 MDC Single T MDB@SS1 (SYSTEM) SS1 - HANA20 SPS4 MDC		hdbdaemon	HDB Daemon	32375		Dec 10, 2019 6:33:52 AM					
	t - MDC Single Tenant		hdbindexserver	HDB Indexserver-SS1		Running	Dec 10, 2019 6:34:01 AM	0:07:31				
> PS SS2@SS	2 (SYSTEM) SS2 - HANA20SS2 MDC Single Ter		hdbnameserver	HDB Nameserver	32393		Dec 10, 2019 6:33:53 AM					
> 🔚 SYSTEM	DB@SS2 (SYSTEM) SC2 . HANA 20 SDC4 MDC			HDB Preprocessor HDB Web Dispatcher	387		Dec 10, 2019 6:34:00 AM Dec 10, 2019 6:34:16 AM					
	Configuration and Monitori		, xsengine	HDB XSEngine-SS1			Dec 10, 2019 6:34:01 AM					
	Backup and Recovery		* 11	kup Console								
	Security		Back Up System Database									
		Back Up Tenant Database										
	0 Open SQL Console	Recover System Database										
	SAP HANA Modeler			enant Database								
	Add System with Different L	lser										
	X Remove	Delete										
	Log Off											
	Refresh	F5										
	Properties	Alt+Enter										
		Properties 🔀	(9) Error Log						<b>⊡</b> ⊽	-		
		SYSTEMDB@S										
		Isonarsi V										

2. Click OK to shut down the SAP HANA database.



The SAP HANA system shuts down and the recovery wizard is started.

3. Select the recovery type and click Next.

Recovery of SYSTEMDB@SS2	_		×
Specify Recovery Type			
Select a recovery type.			
Recover the database to its most recent state			
Recover the database to the following point in time			
Date: 2019-12-10 Time: 03:43:03			
Select Time Zone: (GMT-08:00) Pacific Standard Time		$\sim$	
i System Time Used (GMT): 2019-12-10 11:43:03			
Recover the database to a specific data backup			
		Advance	d >>
? < <u>B</u> ack <u>N</u> ext > <u>F</u> inish	h	Canc	el

4. Provide the location of the backup catalog and click Next.

Recovery of SYSTEMDB@SS2	_		×
Locate Backup Catalog			
Specify location of the backup catalog.			
Recover using the backup catalog			
Search for the backup catalog in the file system only			
Backup Catalog Location: /mnt/log-backup/SYSTEMDB			
<ul> <li>Recover without the backup catalog</li> </ul>			
Backint System Copy			
Backint System Copy			
Source System:			
	sh	Canc	al
(?) < <u>Back</u> <u>Next &gt;</u> <u>Fini</u>	sn	Canc	el

5. A list of available backups displays based on the content of the backup catalog. Choose the required backup and note the external backup ID: in our example, the most recent backup.

Recovery of SYSTEMDB	@SS2				93 <u>1</u> 39	
elect a Backup						
To recover this snapsho	t, it must be available in the	data area.				
ackups		backup catalog as succ	essful. The backup at	the top is estimated to have	the shortest recover	y time,
Start Time	Location	Backup Prefix	Available			
2019-12-10 02:05:08	/hana/data/SS2	SNAPSHOT	0			
2019-12-09 22:05:08	/hana/data/SS2	SNAPSHOT	0			
2019-12-09 18:05:08	/hana/data/SS2	SNAPSHOT	0			
2019-12-09 14:05:08	/hana/data/SS2	SNAPSHOT	0			
2019-12-09 10:05:08	/hana/data/SS2	SNAPSHOT	0			
2019-12-09 06:05:08	/hana/data/SS2	SNAPSHOT	0			
2019-12-09 02:05:08	/hana/data/SS2	SNAPSHOT	0			
2019-12-08 22:05:07	/hana/data/SS2	SNAPSHOT	0			
2019-12-08 18:05:08	/hana/data/SS2	SNAPSHOT	0			
2019-12-08 14:05:08	/hana/data/SS2	SNAPSHOT	0			
					P	P
	or recover this snapshot, it must be available in the data area.	Show Mo				
ze: 0 B	Backup ID:				urly_12-10-2019_02.	0 <mark>5.01.375</mark> 7
					Cher	:k Availabil
3			< <u>B</u>	ack <u>N</u> ext >	Finish	Cancel

6. Unmount all data volumes.

umount /hana/data/SS2/mnt00001



For an SAP HANA multiple host system with NFS, all data volumes on each host must be unmounted.

(i)

In an SAP HANA multiple-host setup with FC, the unmount operation is executed by the SAP HANA name server as a part of the shutdown process.

7. From the SnapCenter GUI, select the resource topology view and select the backup that should be restored; in our example, the most recent primary backup. Click the Restore icon to start the restore.

I Sr	napCe	enter®			٥	≅ 9-	L sapcc\scadm	in SnapCent	erAdmin	🖡 Sign Out
	SAP I	HANA 🔽	SS2 - HANA 20 SPS4 MDC Single Tenant Topology							
> II	Sei	arch databases			Remove Protection	Back up Now	Modify	Naintenance	i Details	Refresh
,	12	System	Manage Copies							
	20	MS1 - Multiple Hosts MDC Single Tenant					C	en Crud		
	20	SS2 - HANA 20 SPS4 MDC Single Tenant	0 Clones					ary Card		
1		SM1	Local copies				14 Back	ups oshot based backu	ne	
		SS1	Local copies					-Based backups 🗸		
							0 Clone	25		
2			Primary Backup(s)						8	
- \			(search V)						Cione	Restore Di
			Backup Name	Count	17					End Date
			SnapCenter_LocalSnap_Hourly_12-10-2019_02.05.01.3757	1				12/10	)/2019 2:05	23 AM 🛱
			SnapCenter_LocalSnap_Hourly_12-09-2019_22.05.01.3848	1				12/09/	2019 10:05	:23 PM 🛱
			SnapCenter_LocalSnap_Hourly_12-09-2019_18.05.01.2909	1				12/09	9/2019 6:05	:23 PM 🛱
			SnapCenter_LocalSnap_Hourly_12-09-2019_14.05.01.3300	1				12/09	9/2019 2:05	:23 PM 🛱
			SnapCenter_LocalSnap_Hourly_12-09-2019_10.05.01.3143	1				12/09/	2019 10:05	:23 AM 🛱
			SnapCenter_LocalSnap_Hourly_12-09-2019_06.05.01.6648	1				12/09	9/2019 6:05	23 AM 🛱
			SnapCenter_LocalSnap_Hourly_12-09-2019_02.05.01.2792	1				12/09	9/2019 2:05	22 AM 🛱
			SnapCenter_LocalSnap_Hourly_12-08-2019_22.05.01.1815	1				12/08/	2019 10:05	:22 PM 🛱
			SnapCenter_LocalSnap_Hourly_12-08-2019_18.05.01.2784	1				12/08	3/2019 6:05	:23 PM 🛱
			SnapCenter_LocalSnap_Hourly_12-08-2019_14.05.01.2938	1					3/2019 2:05	
	Total	4	SpanConter LocalSpan Hourty 12:09:2019:10:05:01:2270 Total 12					10/00/	2010 10-05	
tivit		The 5 most recent jobs are displayed r-43.sapc.stl.netapp.com/8146/PluginCreatorRes	tere (Disciplination Constant Configuration Control of Completed 🔺 0 Warnings 🔀 0 Failed 🥝 0 Cance	eled 🜔 0 Running	O Queue	d			_	

The SnapCenter restore wizard starts.

8. Select the restore type Complete Resource or File Level.

Select Complete Resource to use a volume-based restore.

Restore from Sr	napCenter_LocalSnap_Hourly_12-10-2019_02.05.01.3757	×
1 Restore scope	Select the restore types	
2 PreOps	Complete Resource	
3 PostOps	File Level 1	
4 Notification		
5 Summary		
A Configure an SM	TP Server to send email notifications for Restore jobs by going to <u>Settings&gt;Global Settings&gt;Notification Server Settings.</u>	X
	Previous	Next

9. Select File Level and All to use a single-file SnapRestore operation for all files.

Restore from Sn	apCenter_LocalSnap_Hourly_12-10-20	19_02.05.0	1.3757	×
1 Restore scope	Select the restore types			
2 PreOps	Complete Resource ()			
3 PostOps	• File Level 1			
(4) Notification	Select files to restore			
5 Summary	Volume/Qtree	All	File Path	
	Ana-primary.sapcc.stl.netapp.com:/vol/SS		Provide one or more file paths separated by comma	
🛕 Configure an SMT	P Server to send email notifications for Restore jobs l	by going to Se	ettings>Global Settings>Notification Server Settings.	×
			Previous	ext



For a file-level restore of a SAP HANA multiple host system, select all the volumes.

🗖 OnCommand System Manager 🗙 🛛 💋 Login	×	SnapCenter × +				-	
← → C ▲ Not secure   snapcenter-43.sapcc.	stl.netapp.com:8146/Plu	iginCreatorInventoryProtect/ProtectIndex?ResourceT	ype=null&Hos	st=null&PluginName=hana		☆	00
	Destare from Co	apCenter_LocalSnap_Hourly_12-10-20	0.07.15.0	1 1 4 2 5	x		
	1 Restore scope	Select the restore types	19_07.13.0	1.1433			
The second s	2 PreOps	Complete Resource 🚯					
	3 PostOps	• File Level 1					
	(4) Notification	Select files to restore					
	5 Summary	Volume/Qtree	All	File Path			
		hana-primary.sapcc.stl.netapp.com:/vol/M     hana-primary.sapcc.stl.netapp.com:/vol/M		Provide one or more file paths separated by comma Provide one or more file paths separated by comma			
	A Configure an SMT	IP Server to send email notifications for Restore jobs l	by going to Se	ttings>Global Settings>Notification Server Settings.	×		
				Previous			

10. (Optional) Specify the commands that should be executed from the SAP HANA plug-in running on the central HANA plug-in host. Click Next.

Restore from Sr	napCenter_LocalSnap_Hourly_12-10-2019_02.05.01.3757	×
1 Restore scope	Enter optional commands to run before performing a restore operation 🚯	
2 PreOps	Pre restore command	
3 PostOps		
4 Notification	Unmount command	
5 Summary		
🛕 Configure an SM	TP Server to send email notifications for Restore jobs by going to <u>Settings&gt;Global Settings&gt;Notification Server Settings.</u>	×
	Previous	Next

11. Specify the optional commands and click Next.

Restore from Sn	hapCenter_LocalSnap_Hourly_12-10-2019_02.05.01.3757	×
1 Restore scope	Enter optional commands to run after performing a restore operation 🚯	
2 PreOps	Mount command	
3 PostOps	1	
(4) Notification	Post restore command	
5 Summary		
🛕 Configure an SM	TP Server to send email notifications for Restore jobs by going to <u>Settings&gt;Global Settings&gt;Notification Server Settings</u> .	×
	Previous	lext

12. Specify the notification settings so that SnapCenter can send a status email and job log. Click Next.

Restore from Sr	hapCenter_LocalSi	nap_Hourly_12-10-2019_02.05.01.3757	×
Restore scope	Provide email set	tings 🕦	
2 PreOps	Email preference	Never •	
3 PostOps	From	Email from	
	То	Email to	
4 Notification	Subject	Notification	
5 Summary	📄 Attach Job Report		
A If you want to so	nd notifications for Post	ore jobs, an SMTP server must be configured. Continue to the Summary page to save your informatio	n
		Notification Server Settings to configure the SMTP server.	X
		Previous	Next

13. Review the summary and click Finish to start the restore.

Restore from Sr	napCenter_LocalSnap_Ho	urly_12-10-2019_02.05.01.3757	×
Restore scope	Summary		
2 PreOps	Backup Name	SnapCenter_LocalSnap_Hourly_12-10-2019_02.05.01.3757	
	Backup date	12/10/2019 2:05:23 AM	
3 PostOps	Restore scope	Complete Resource	
A Notification	Pre restore command		
	Unmount command		
5 Summary	Mount command		
	Post restore command		
	Send email	No	
		n SMTP server must be configured. Continue to the Summary page to save your info n Server Settings to configure the SMTP server.	rmation,
		Previo	ous Finish

14. The restore job starts, and the job log can be displayed by double-clicking the log line in the activity pane.

## Job Details

· ·	SnapCenter-43.sapcc.stl.netapp.com	
,	▼ Restore	
1	Validate Plugin Parameters	
1	Pre Restore Application	
1	► File or Volume Restore	
1	Recover Application	
•	Clear Catalog on Server	
1	Application Clean-Up	
	► Data Collection	
	Agent Finalize Workflow	
	ame: Agent Finalize Workflow Start Time: 12/10/2019 3:47:30 AM End Time: 12/10/2019 3:47:35 AM	

×

15. Wait until the restore process completes. On each database host, mount all data volumes. In our example, only one volume must be remounted on the database host.

mount /hana/data/SP1/mnt00001

16. Go to SAP HANA Studio and click Refresh to update the list of available backups. The backup that was restored with SnapCenter is shown with a green icon in the list of backups. Select the backup and click Next.

Recovery of SYSTEMDB	@SS2				8 <u>1</u>	18		×
Select a Backup								
Select a backup to recover	the SAP HANA database							
Selected Point in Time								
Database will be recovered	to its most recent state							
Backups								
and a second	ps that were recorded in the	backup catalog as succ	essful. The backup	at the top is estimated to have	the shortest re	coverv	time.	
Start Time	Location	Backup Prefix	Available				000650	_
2019-12-10 02:05:08	/hana/data/SS2	SNAPSHOT	•					
2019-12-09 22:05:08	/hana/data/SS2	SNAPSHOT	0					
2019-12-09 18:05:08	/hana/data/SS2	SNAPSHOT	0					
2019-12-09 14:05:08	/hana/data/SS2	SNAPSHOT	8					
2019-12-09 10:05:08	/hana/data/SS2	SNAPSHOT	0					
2019-12-09 06:05:08	/hana/data/SS2	SNAPSHOT	0					
2019-12-09 02:05:08	/hana/data/SS2	SNAPSHOT	0					
2019-12-08 22:05:07	/hana/data/SS2	SNAPSHOT	0					
2019-12-08 18:05:08	/hana/data/SS2	SNAPSHOT	0					
2019-12-08 14:05:08	/hana/data/SS2	SNAPSHOT	0					
					- P			
					Ref	resh	Show N	Aore
Details of Selected Item								
Start Time: 0 2019	9-12-10 02:05:08 Destination	Type: SNAPSHOT	Source System:	SYSTEMDB@SS2				
ize: 🚺 0 B	Backup ID:	1575972308584	External Backup	D: SnapCenter_LocalSnap_H	ourly_12-10-201	19_02.0	5.01.375	7
la <mark>ck</mark> up Name: /har	na/data/SS2				1165			
Alternative Location:								
					-			3999
						Check	Availat	alit
(?)			<	Back Next >	Finish		Cancel	
0			1					_

17. Provide the location of the log backups. Click Next.

Recovery of S	SYSTEMDB@SS2				_		×
Locate Log B	ackups						
Specify location	(s) of log backup files to be used to re	cover the databa	se.				
(i) Even if n	o log backups were created, a location	is still needed t	o read data that will b	be used for re	covery.		
you do not s	ckups were written to the file system an pecify an alternative location for the lo he directory specified will be searched	g backups, the					
Locations:						Add	
	/mnt/log-backup/SYSTEMDB					Remove A	AII
						Remove	2
?		< <u>B</u> ack	<u>N</u> ext >	<u>F</u> inish		Cance	I

18. Select other settings as required. Make sure Use Delta Backups is not selected. Click Next.

Recovery of SYSTEMDB@SS2					×
)ther Settings					
Check Availability of Delta and Log Backups					
You can have the system check whether all required process. If delta or log backups are missing, they will changed. If you choose not to perform this check no loss of time if the complete recovery must be repeate	be listed and the recov w, it will still be perforn	ery process will	stop before any dat	a is	
Check the availability of delta and log backups:					
File System 🛙					
Third-Party Backup Tool (Backint)					
Initialize Log Area					
If you do not want to recover log segments residing will be deleted from the log area.	in the log area, select t	his option. After	r the recovery, the lo	og entries	
🗌 Initialize Log Area 🏮					
Use Delta Backups					
Select this option if you want to perform a recovery u delta backups, only log backups will be used.	using delta backups. If y	ou choose to p	erform a recovery w	ithout	
Use Delta Backups (Recommended)					
Install New License Key					
If you recover the database from a different system, t You can: - Select a new license key to install now - Install a new license key manually after the databas		10 longer be val	id		
Install New License Key					
				Browse	
			111	Trevenues	
٢		New	<b>F</b> _11	6	
$\bigcirc$	< <u>B</u> ack	<u>N</u> ext >	Einish	Cance	1

19. Review the recovery settings and click Finish.

view Recovery Settings	
view the recovery settings and cl tings by choosing 'Back'.	hoose 'Finish' to start the recovery. You can modify the recovery
atabase Information	
Database:	SYSTEMDB@SS2
Host:	hana-3
Version:	2.00.040.00.1553674765
ecovery Definition	
Recovery Type:	Snapshot (Point-in-Time Recovery (Until Now))
🚯 Caution	
	ase from a storage snapshot invalidates all the tenant databases. After you recover the recover all the tenant databases.
onfiguration File Handling	
Caution	
	onfiguration changes, you may need to make the changes manually in the target system Administration Guide
To recover customer-specific co	

20. The recovery process starts. Wait until the recovery of the system database completes.

Recovery of SYSTEMDB@SS2		—		$\times$
tecovery Execution Summ	nary			
i Database SYSTEMDB@SS	2 recovered			
1 volumes were recovered				
🚯 Caution				
	abase from a storage snapshot invalidates all the tenant databases. Afte I to recover all the tenant databases.	r you rec	over the	
Recovered to Time:	Dec 10, 2019 3:42:40 AM GMT-08:00			
Recovered to Log Position:	74714880			
?			<u>C</u> lose	

21. In SAP HANA Studio, select the entry for the system database and start Backup Recovery - Recover Tenant Database.

🔟 hdbstudio - System: SYS	TEMDB@SS1 Host: hana-1 Instance	: 00 - SAP HANA Studio							- D X
File Edit Navigate Proje	ect Run Window Help								
📬 🕶 🖼 🕼 🗄 🛃 🕶 {	{i • \$\$ <b>\$</b> • \$ •								Quick Access 🛛 😰 🛛 🕄
o Systems 🔀	- 0	🖄 Backup SYSTEMDB	B@SM1 (SYSTEM)	SM1 - HANA20 SP54	MDC Multipl	le Tenants	SYSTEMDB@SS1	😫 🚺 SYSTEMDB@	DSM1 C
Image: Constraint of the second sec		Version: 2.00.040.00 Processes Diagnosis F	0.1553674765 (fa/f	hana2sp04)	HANA20	SPS4 I	1DC Single Tena	Nt hana-100	Last Update: Dec 10, 2019 4:27:18 AM 🤣 📋 Interval: 5 💌 Seconds   🕞   🗓
> 👪 SM1@SM1 (SYSTEM	M) SM1 - HANA20 SPS4 MDC Mult		v 34						
<ul> <li>&gt; B SYSTEMDB@SM1 (SYSTEM) SM1 - HANA20 SP54 MDC</li> <li>&gt; Single Host - MDC Single Tenant</li> <li>&gt; B SSI@SS1 (SYSTEM) SS1 - HANA20 SP54 MDC Single T</li> <li>&gt; GVSTEMDB@SS1 (SYSTEM) SS1 - HANA20 SP54 MDC</li> </ul>		Active Host Pro hana-1 hd	lbcompileserver Ibdaemon	Description HDB Compileserver HDB Daemon HDB Indexserver-SS1	384 32375	Running Running	Start Time Dec 10, 2019 6:34:00 AM Dec 10, 2019 6:33:52 AM Dec 10, 2019 6:34:01 AM	0:53:25	
Single Host - MDC Sin S2@SS2 (SYSTEM)	ngle Tenant I) SS2 - HANA20SS2 MDC Single Ter			HDB Nameserver	32393		Dec 10, 2019 6:33:53 AM		
> 🕃 SYSTEMDB@SS2 (S	SYSTEMA CC2 HANADA COCA MOC	😑 hana-1 hd		HDB Preprocessor	387		Dec 10, 2019 6:34:00 AM		
	Configuration and Monit	-		HDB Web Dispatcher HDB XSEngine-SS1			Dec 10, 2019 6:34:16 AM Dec 10, 2019 6:34:01 AM		
	Backup and Recovery		> Open Ba	ckup Console					
	Security		> Back Up	System Database					
100	Open SQL Console		14	Tenant Database					
	SAP HANA Modeler		×	System Database	_				
	Add System with Differen	ut liser	Recover	Tenant Database					
	X Remove	Delete							
	Log Off	Delete							
	Refresh	F5							
	Properties	Alt+Enter							
	riopenies	Bit Citta							
		🗖 Properties 🛛 🤨	) Error Log						
		SYSTEMDB@SS2	(SYSTEM)						
<	>	lioneral y	Property				Value		

22. Select the tenant to recover and click Next.

Recovery of Tenant Database in SS2	_		×
Specify tenant database			
/pe filter text			
✓ SS2			
	١	Cance	el

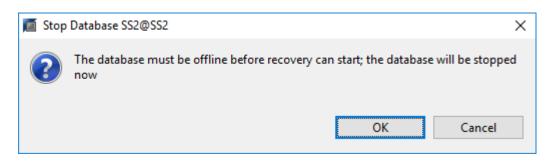
23. Specify the recovery type and click Next.

Recovery of Tenant Database in SS2	-		×			
Specify Recovery Type						
Select a recovery type.						
Recover the database to its most recent state <sup>1</sup>						
<ul> <li>Recover the database to its most recent state</li> <li>Recover the database to the following point in ti</li> </ul>	me 🛙					
Date: 2019-12-10 Time:	04:27:22					
Select Time Zone: (GMT-08:00) Pacific Standard	Time				$\sim$	
i System Time Used (GMT): 2019-12-10 12:27:	22					
Recover the database to a specific data backup	3					
				A	Advanced	>>
?	< <u>B</u> ack	<u>N</u> ext >	<u>F</u> inish		Cance	el
_						

24. Confirm the backup catalog location and click Next.

Recovery of Tenant Databas	e in SS2				<u>(110)</u>		×
ocate Backup Catalog							
Specify location of the backup	catalog.						
Recover using the backup of	atalog						
Search for the backup cardinal	atalog in the file	system only					
Backup Catalog Locatio	n: /mnt/log-b	ackup/DB_SS2					
○ Recover without the backu	o catalog						
Backint System Copy							
Backint System Copy							
Source System:							
٩				1		-	
?		< <u>B</u> ack	<u>N</u> ext >	Einish		Cance	els

25. Confirm that the tenant database is offline. Click OK to continue.



26. Because the restore of the data volume has occurred before the recovery of the system database, the tenant backup is immediately available. Select the backup highlighted in green and click Next.

Recovery of Tenant Data	abase in SS2				<u>(6.8</u> 4)		×
elect a Backup							
Select a backup to recover	the SAP HANA database						
Selected Point in Time							
Database will be recovered	to its most recent state.						
Backups							
The overview shows backup	ps that were recorded in the <mark>l</mark>	backup <mark>cata</mark> log as succ	essful. The backup	at the top is estimated to have	e the shortest recov	ery time	•
Start Time	Location	Backup Prefix	Available				
2019-12-10 02:05:08	/hana/data/SS2	SNAPSHOT	•				
2019-12-09 22:05:08	/hana/data/SS2	SNAPSHOT	0				
2019-12-09 18:05:08	/hana/data/SS2	SNAPSHOT	0				
2019-12-09 14:05:08	/hana/data/SS2	SNAPSHOT	8				
2019-12-09 10:05:08	/hana/data/SS2	SNAPSHOT	8				
2019-12-09 06:05:08	/hana/data/SS2	SNAPSHOT	8				
2019-12-09 02:05:08	/hana/data/SS2	SNAPSHOT	8				
2019-12-08 22:05:07	/hana/data/SS2	SNAPSHOT	8				
2019-12-08 18:05:08	/hana/data/SS2	SNAPSHOT	0				
2019-12-08 14:05:08	/hana/data/SS2	SNAPSHOT	0				
					Refresh	Show	(Moi
					Kenesi	JHOW	WOI
etails of Selected Item							
	-12-10 02:05:08 Destination		Source System:				
ize: 0 B	Backup ID:	1575972308585	External Backup	ID: SnapCenter_LocalSnap_H	ourly_12-10-2019_0	2.05.01.3	757
	ia/data/SS2						
Iternative Location:							
					Ch	eck Avail	abilit
~							
(?)				Back Next >	Finish	Cance	16 1

27. Confirm the log backup location and click Next.

Recovery of <sup>1</sup>	Tenant Database in SS2			_		×
Locate Log B	ackups					
Specify location	(s) of log backup files to be used	to recover the o	latabase.			
lf the log ba location. If y	to log backups were created, a lo ckups were written to the file syst ou do not specify an alternative l re first saved. The directory specit	tem and subseque location for the l	uently moved, you n og backups, the syst	eed to specify thei	r current	ie log
	/mnt/log-backup/DB_SS2				Remove	All
					Remov	
					_	
?		< <u>B</u> ack	<u>N</u> ext >	<u>F</u> inish	Canc	el

28. Select other settings as required. Make sure Use Delta Backups is not selected. Click Next.

Recovery of Tenant Database in SS2	_		×						
Other Settings	Other Settings								
Check Availability of Delta and Log Backups You can have the system check whether all required delta and log backups are available at the b recovery process. If delta or log backups are missing, they will be listed and the recovery proces			î						
data is changed. If you choose not to perform this check now, it will still be performed but later significant loss of time if the complete recovery must be repeated.									
Check the availability of delta and log backups:									
<ul> <li>✓ File System <sup>®</sup></li> <li>☐ Third-Party Backup Tool (Backint)</li> </ul>									
Initialize Log Area If you do not want to recover log segments residing in the log area, select this option. After the entries will be deleted from the log area.	recovery,	the log							
Use Delta Backups									
Select this option if you want to perform a recovery using delta backups. If you choose to perfo without delta backups, only log backups will be used.	rm a recov	/ery							
Install New License Key									
If you recover the database from a different system, the old license key will no longer be valid You can: - Select a new license key to install now - Install a new license key manually after the database has been recovered Install New License Key									
		Browse	E.						
			~						
? < <u>Back</u> <u>Next</u> > <u>Finis</u>	h	Cancel							

29. Review the recovery settings and start the recovery process of the tenant database by clicking Finish.

		>	
eview Recovery Settings			
Review the recovery settings and cho ecovery settings by choosing 'Back'.	oose 'Finish' to start the recovery. You can modify the		
Database Information			
Database:	SS2@SS2		
Host:	hana-3		
Version:	2.00.040.00.1553674765		
Recovery Definition			
Recovery Type:	Snapshot (Point-in-Time Recovery (Until Now))		
Configuration File Handling			
🚯 Caution			
More Information: SAP HANA Ad	Iministration Guide		
More Information: SAP HANA Ad	Iministration Guide		
More Information: SAP HANA Ad	Iministration Guide		

30. Wait until the recovery has finished and the tenant database is started.

Recovery of Tenant Database	_		×	
Recovery Execution Sumr	Recovery Execution Summary			
i Database SS2@SS2 recov	ered			
2 volumes were recovered				
Recovered to Time:	Dec 10, 2019 3:42:41 AM GMT-08:00			
Recovered to Log Position:	251544768			
			-	
?			<u>C</u> lose	2

The SAP HANA system is up and running.



For an SAP HANA MDC system with multiple tenants, you must repeat steps 20–29 for each tenant.

## Advanced configuration and tuning

This section describes configuration and tuning options that customers may use to adapt the SnapCenter setup to their specific needs. Not all the settings may apply for all customer scenarios.

#### Enable secure communication to HANA database

If the HANA databases are configured with secure communication, the hdbsql command that is executed by SnapCenter must use additional command-line options. This can be achieved by using a wrapper script which calls hdbsql with the required options.



There are various options to configure the SSL communication. In the following examples, the simplest client configuration is described using the command line option, where no server certificate validation is done. If certificate validation on server and/or client side is required, different hdbsql command line options are needed, and you must configure the PSE environment accordingly as described in the SAP HANA Security Guide.

Instead of configuring the hdbsql executable in the hana.properties files, the wrapper script is added.

For a central HANA plug-in host on the SnapCenter Windows server, you must add the following content in C:\Program Files\NetApp\SnapCenter\Snapcenter Plug-in Creator\etc\hana.properties.

HANA HDBSQL CMD=C:\\Program Files\\sap\\hdbclient\\hdbsql-ssl.cmd

The wrapper script hdbsql-ssl.cmd calls hdbsql.exe with the required command-line options.

```
@echo off
"C:\Program Files\sap\hdbclient\hdbsql.exe" -e -ssltrustcert %*
```



The -e - ssltrustcert hdbsql command-line option also works for HANA systems where SSL is not enabled. This option can therefore also be used with a central HANA plug-in host, where not all HANA systems have SSL enabled or disabled.

If the HANA plug-in is deployed on individual HANA database hosts, the configuration must be done on each Linux host accordingly.

HANA HDBSQL CMD = /usr/sap/SM1/HDB12/exe/hdbsqls

The wrapper script hdbsqls calls hdbsql with the required command-line options.

```
#/bin/bash
/usr/sap/SM1/HDB12/exe/hdbsql -e -ssltrustcert $*
```

#### Disable auto discovery on the HANA plug-in host

To disable autodiscovery on the HANA plug-in host, complete the following steps:

- 1. On the SnapCenter Server, open PowerShell. Connect to the SnapCenter Server by running the Open-SmConnection command and specify the username and password in the opening login window.
- 2. To disable auto discovery, run the Set- SmConfigSettings command.

For a HANA host hana-2, the command is as follows:

PS C:\Users\administrator.SAPCC> Set-SmConfigSettings -Agent -Hostname hana-2 -configSettings @{"DISABLE\_AUTO\_DISCOVERY"="true"} Name Value ---- -----DISABLE\_AUTO\_DISCOVERY true PS C:\Users\administrator.SAPCC>

3. Verify the configuration by running the Get- SmConfigSettings command.

```
PS C:\Users\administrator.SAPCC> Get-SmConfigSettings -Agent -Hostname
hana-2 -key all
Key: CUSTOMPLUGINS OPERATION TIMEOUT IN MSEC
                                                       Value: 3600000
Details: Plug-in API operation Timeout
Key: CUSTOMPLUGINS HOSTAGENT TO SERVER TIMEOUT IN SEC Value: 1800
Details: Web Service API Timeout
Key: CUSTOMPLUGINS ALLOWED CMDS
                                                        Value: *;
Details: Allowed Host OS Commands
Key: DISABLE AUTO DISCOVERY
                                                        Value: true
Details:
Key: PORT
                                                        Value: 8145
Details: Port for server communication
PS C:\Users\administrator.SAPCC>
```

The configuration is written to the agent configuration file on the host and is still available after a plug-in upgrade with SnapCenter.

```
hana-2:/opt/NetApp/snapcenter/scc/etc # cat
/opt/NetApp/snapcenter/scc/etc/agent.properties | grep DISCOVERY
DISABLE_AUTO_DISCOVERY = true
hana-2:/opt/NetApp/snapcenter/scc/etc #
```

#### Deactivate automated log backup housekeeping

Log backup housekeeping is enabled by default and can be disabled on the HANA plug-in host level. There are two options to change these settings.

#### Edit the hana.property file

Including the parameter LOG\_CLEANUP\_DISABLE = Y in the hana.property configuration file disables the log backup housekeeping for all resources using this SAP HANA plug-in host as communication host:

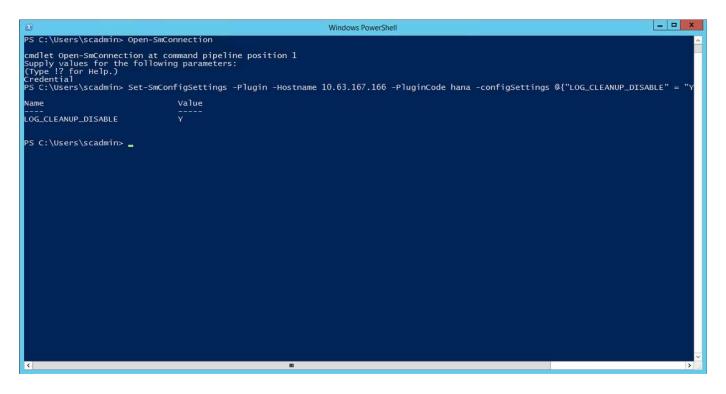
• For the Hdbsql communication host on Windows, the hana.property file is located at C:\Program Files\NetApp\SnapCenter\Snapcenter Plug-in Creator\etc.

• For the Hdbsql communication host on Linux, the hana.property file is located at /opt/NetApp/snapcenter/scc/etc.

#### Use the PowerShell command

A second option to configure these settings is using a SnapCenter PowerShell command.

- 1. On the SnapCenter server, open a PowerShell. Connect to the SnapCenter server using the command Open- SmConnection and specify user name and password in the opening login window.
- 2. With the command Set- SmConfigSettings -Plugin HostName <pluginhostname> -PluginCode hana - configSettings @{"LOG\_CLEANUP\_DISABLE" = "Y"}, the changes are configured for the SAP HANA plug-in host <pluginhostname> specified by the IP or host name (see the following figure).



#### Disable warning when running SAP HANA plug-in on a virtual environment

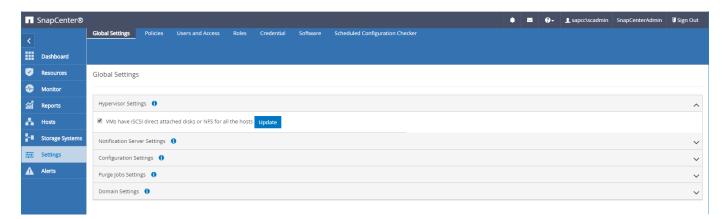
SnapCenter detects if the SAP HANA plug-in is installed on a virtualized environment. This could be a VMware environment or a SnapCenter installation at a public cloud provider. In this case, SnapCenter displays a warning to configure the hypervisor, as shown in the following figure.

	SnapCenter®							٠	<b>2</b> 0-	sapcc\scadmin	SnapCenterAdmin	🖡 Sign Out
<		Managed Hosts	Disks Shares	Initiator Groups	iSCSI Session							
	Dashboard	Search by Name	V							Add		More
V	Resources	Name Name		1	Туре	System	Plug-in		Version	n Overall Stat	JS	
-	Monitor	SnapCenter-	-43.sapcc.stl.netapp.cc	om	Windows	Stand-alone	Microsoft Windows Server, SAP HANA		4.3	🔴 Configu	re VMware plug-in 🚺	
âĨ	Reports											
A	Hosts											
-	Storage Systems											
==	Settings											
	Alerts											

It is possible to suppress this warning globally. In this case, SnapCenter is not aware of virtualized environments and, therefore, does not show these warnings.

To configure SnapCenter to suppress this warning, the following configuration must be applied:

- 1. From the Settings tab, select Global Settings.
- 2. For the hypervisor settings, select VMs Have iSCSI Direct Attached Disks or NFS For All the Hosts and update the settings.



### Change scheduling frequency of backup synchronization with off-site backup storage

As described in the section "Retention management of backups at the secondary storage," retention management of data backups to an off-site backup storage is handled by ONTAP. SnapCenter periodically checks if ONTAP has deleted backups at the off-site backup storage by running a cleanup job with a weekly default schedule.

The SnapCenter cleanup job deletes backups in the SnapCenter repository as well as in the SAP HANA backup catalog if any deleted backups at the off-site backup storage have been identified.

The cleanup job also executes the housekeeping of SAP HANA log backups.

Until this scheduled cleanup has finished, SAP HANA and SnapCenter might still show backups that have already been deleted from the off-site backup storage.



This might result in additional log backups that are kept, even if the corresponding storagebased Snapshot backups on the off-site backup storage have already been deleted.

The following sections describe two ways to avoid this temporary discrepancy.

#### Manual refresh on resource level

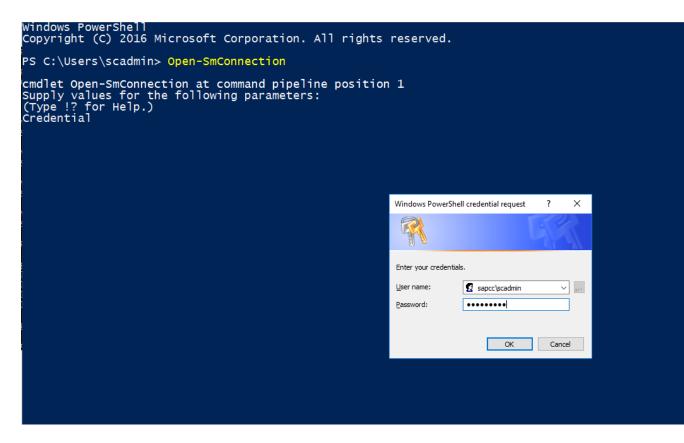
In the topology view of a resource, SnapCenter displays the backups on the off-site backup storage when selecting the secondary backups, as shown in the following screenshot. SnapCenter executes a cleanup operation with the Refresh icon to synchronize the backups for this resource.

SAP HANA 🔽	SS1 Topology							
Search databases		Remove Protection	U Back up Now	Modify	Maintenance	i Details	Configure Database	
Ne System	Manage Copies							
AMS1 - Multiple Hosts MDC Single Tenant						a) 5		
SS2 - HANA 20 SPS4 MDC Single Tenant	17 Backups					Summary C	ard	
SM1	0 Clones				1	25 Backups		
551	Local copies 6 Backups					23 Snapshot b 2 File-Based		
331	0 Clones					0 Clones	Jackaps +	
	Vault copies							
	Primary Backup(s)							
	search Y						Correct Correct	- 4 Sect
	Backup Name	Count	17					End
	SnapCenter_LocalSnapAndSnapVault_Daily_11-25-2019_08.17.01.8577	1					11/25/2019 8:17:5	55 A
	SnapCenter_LocalSnap_Hourly_11-25-2019_06.30.00.9717	1					11/25/2019 6:30:5	55 A
	SnapCenter_LocalSnap_Hourly_11-25-2019_02.30.01.0154	1					11/25/2019 2:30:5	54 A
	SnapCenter_LocalSnap_Hourly_11-24-2019_22.30.00.9349	1					11/24/2019 10:30:5	54 F
	SnapCenter_LocalSnap_Hourly_11-24-2019_18.30.00.8786	1					11/24/2019 6:30:5	54 F
	SnapCenter_LocalSnap_Hourly_11-24-2019_14.30.01.0183	1					11/24/2019 2:30:5	54 P
	SnapCenter_LocalSnap_Hourly_11-24-2019_10.30.01.0657	1					11/24/2019 10:30:5	;4 A
	SnapCenter_LocalSnapAndSnapVault_Daily_11-24-2019_08.17.01.8649	1					11/24/2019 8:17:5	5 A
	SnapCenter_LocalSnap_Hourly_11-24-2019_06.30.01.0029	1					11/24/2019 6:30:5	j4 A
	SnapCenter_LocalSnap_Hourly_11-24-2019_02.30.00.8752	1					11/24/2019 2:30:5	j4 A
	SnapCenter_LocalSnap_Hourly_11-23-2019_22.30.00.9248	1					11/23/2019 10:30:5	55 F
	SnapCenter_LocalSnap_Hourly_11-23-2019_18.30.00.8705	1					11/23/2019 6:30:5	54 F
	SnapCenter_LocalSnap_Hourly_11-23-2019_14.30.01.0051	1					11/23/2019 2:30:5	54 F
	SnapCenter_LocalSnap_Hourly_11-23-2019_10.30.00.9363	1					11/23/2019 10:30:5	
Total 4	Total 17						** 100 100 40 0 10 1	-

#### Change the frequency of the SnapCenter cleanup job

SnapCenter executes the cleanup job <code>SnapCenter\_RemoveSecondaryBackup</code> by default for all resources on a weekly basis using the Windows task scheduling mechanism. This can be changed using a SnapCenter PowerShell cmdlet.

- 1. Start a PowerShell command window on the SnapCenter Server.
- 2. Open the connection to the SnapCenter Server and enter the SnapCenter administrator credentials in the login window.



3. To change the schedule from a weekly to a daily basis, use the cmdlet Set- SmSchedule.

PS C:\Users\scadmin> S	Se	t-SmSchedule -ScheduleInformation
@{"ScheduleType"="Dail	ly	";"StartTime"="03:45 AM";"DaysInterval"=
"1"} -TaskName SnapCer	nt	er_RemoveSecondaryBackup
TaskName	:	SnapCenter_RemoveSecondaryBackup
Hosts	:	{ }
StartTime	:	11/25/2019 3:45:00 AM
DaysoftheMonth	:	
MonthsofTheYear	:	
DaysInterval	:	1
DaysOfTheWeek	:	
AllowDefaults	:	False
ReplaceJobIfExist	:	False
UserName	:	
Password	:	
SchedulerType	:	Daily
RepeatTask_Every_Hour	:	
IntervalDuration	:	
EndTime	:	
LocalScheduler	:	False
АррТуре	:	False
AuthMode	:	
SchedulerSQLInstance	:	SMCoreContracts.SmObject
MonthlyFrequency	:	
Hour	:	0
Minute	:	0
NodeName	:	
ScheduleID	:	0
RepeatTask_Every_Mins	:	
CronExpression	:	
CronOffsetInMinutes	:	
StrStartTime	:	
StrEndTime	:	
PS C:\Users\scadmin> (	Ch	eck the configuration using the Windows Task
Scheduler.		

4. You can check the job properties in Windows task scheduler.

Task Scheduler					-		
<u>File Action View H</u> elp							
🔶 🔿 📧 🛛 🖬							
() Task Scheduler (Local)	Name	Status	Triggers	Next Run Time	Last Run Tin ^	A	ctions
✓ Contract Task Scheduler Library	CreateExplorerShellUnelevatedTask		When the task is created or modified		11/18/2019 :	T	ask Sche 🔺
<ul> <li>Microsoft</li> <li>Windows</li> </ul>	GoogleUpdateTaskMachineCore		Multiple triggers defined	11/26/2019 3:30:37 AM	11/25/2019 :	-	Creat
> Windows	GoogleUpdateTaskMachineUA		At 3:30 AM every day - After triggered, repeat every 1 hour for a duration of 1 day.	11/25/2019 9:30:37 AM			Creat
> MvSQL	SnapCenter_AlertCleanUp		At 11:59 PM every day	11/25/2019 11:59:00 PM	11/24/2019		-
y nysqr	Image: SnapCenter_ComputeStorageSavings	Ready	At 12:00 AM every day	11/26/2019 12:00:00 AM	11/25/2019		Impor
	Image: SnapCenter_ConfigCheck_SnapCenterServer_SnapCen	Ready	At 11:59 PM every Sunday of every week, starting 11/18/2019	12/1/2019 11:59:00 PM	11/24/2019		a Displa
	SnapCenter_RemoveSecondaryBackup		At 3:45 AM every day	11/26/2019 3:45:00 AM	11/30/1999		👌 Disabl
	B SnapCenter_RG-1_POLICY-4_Hourly	Ready	At 6:30 AM on 11/19/2019 - After triggered, repeat every 04:00:00 indefinitely.	11/25/2019 10:30:00 AM	11/25/2019 €		New F
	One State Conter_RG-1_POLICY-5_Weekly	Ready	At 6:00 AM every Saturday of every week, starting 11/19/2019	11/30/2019 6:00:00 AM			
	Image: Book of the second s		At 8:17 AM every day	11/26/2019 8:17:00 AM			View 🕨
	B SnapCenter_RG-2_POLICY-4_Hourly		At 6:28 AM on 11/20/2019 - After triggered, repeat every 04:00:00 indefinitely.	11/25/2019 10:28:00 AM		C	Refresh
	Image: State St		At 6:28 AM every Saturday of every week, starting 11/20/2019	11/30/2019 6:28:00 AM			Help
	SnapCenter_RG-3_POLICY-4_Hourly		At 2:05 AM on 11/21/2019 - After triggered, repeat every 04:00:00 indefinitely.	11/25/2019 10:05:00 AM			
	SnapCenter_RG-3_POLICY-5_Weekly		At 2:05 AM every Saturday of every week, starting 11/21/2019	11/30/2019 2:05:00 AM			elected It 🔺
	SnapCenter RG-4 POLICY-4 Hourly	Readv	At 3:15 AM on 11/25/2019 - After triggered. repeat every 04:00:00 indefinitely.	11/25/2019 11:15:00 AM	11/25/2019 . *		Run
						1.8	End End
	General Triggers Actions Conditions Setting		/			1	Disable
	Name: SnapCenter_RemoveSecondaryBack	cup					Export
	Location: \					e	Prope
	Author:					8	🕻 Delete
	Description:						Help
							Thep
	Security options						
	When running the task, use the following user a NT AUTHORITY\SYSTEM	count:					
	<ul> <li>Run only when user is logged on</li> </ul>						
	Run whether user is logged on or not						
	Do not store password. The task will on	have ac	tess to local resources		~		
	los autors a				×		

# Where to find additional information and version history

To learn more about the information that is described in this document, review the following documents and/or websites:

SnapCenter Resources Page

https://www.netapp.com/us/documentation/snapcenter-software.aspx

SnapCenter Software Documentation

https://docs.netapp.com/us-en/snapcenter/index.html

• TR-4667: Automating SAP System Copies Using the SnapCenter

Automating SAP System Copies Using the SnapCenter

• TR-4719: SAP HANA System Replication, Backup and Recovery with SnapCenter

SAP HANA System Replication, Backup and Recovery with SnapCenter

• TR-4018: Integrating NetApp ONTAP Systems with SAP Landscape Management

https://www.netapp.com/pdf.html?item=/media/17195-tr4018pdf.pdf

• TR-4646: SAP HANA Disaster Recovery with Storage Replication

https://www.netapp.com/pdf.html?item=/media/8584-tr4646pdf.pdf

## Version history

Version	Date	Document version history
Version 1.0	July 2017	<ul> <li>Initial release.</li> </ul>
Version 1.1	September 2017	<ul><li>Added the section "Advanced Configuration and Tuning."</li><li>Minor corrections.</li></ul>
Version 2.0	March 2018	<ul> <li>Updates to cover SnapCenter 4.0: New data volume resource Improved Single File SnapRestore operation</li> </ul>
Version 3.0	January 2020	<ul> <li>Added the section "SnapCenter Concepts and Best Practices."</li> <li>Updates to cover SnapCenter 4.3: Automatic discovery Automated restore and recovery Support of HANA MDC multiple tenants Single-tenant restore operation</li> </ul>
Version 3.1	July 2020	• Minor updates and corrections: NFSv4 support with SnapCenter 4.3.1 Configuration of SSL communication Central plug-in deployment for Linux on IBM Power
Version 3.2	November 2020	<ul> <li>Added the required database user privileges for HANA 2.0 SPS5.</li> </ul>
Version 3.3	May 2021	<ul><li> Updated the SSL hdbsql configuration section.</li><li> Added Linux LVM support.</li></ul>
Version 3.4	August 2021	<ul> <li>Added the disable auto discovery configuration description.</li> </ul>

Version	Date	Document version history
Version 3.5	February 2022	<ul> <li>Minor updates to cover SnapCenter 4.6 and auto discovery support for HANA System Replication-enabled HANA systems.</li> </ul>

# SAP HANA data protection and high availability with SnapCenter, SnapMirror active sync and VMware Metro Storage Cluster

SAP HANA data protection and high availability with SnapCenter, SnapMirror active sync and VMware Metro Storage Cluster

This document provides best practices for data protection with SnapCenter in a VMware environment combined with SnapMirror active sync as a high availability solution for the HANA storage resources.

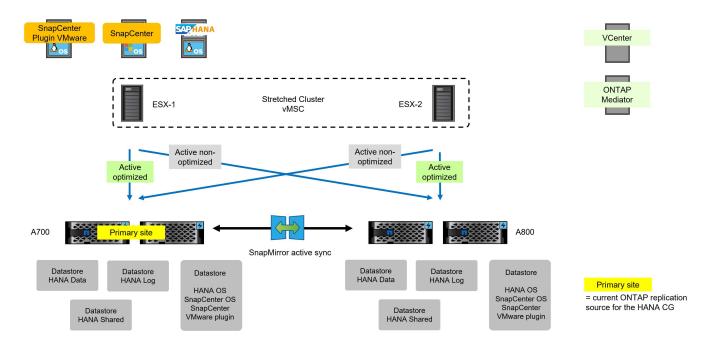
Author: Nils Bauer, NetApp

#### Scope of this document

The document is not intended to be a step-by-step description of how to setup the complete environment but will cover concepts and relevant details related to:

- · Setup of SAP HANA systems with VMware VMFS
- SnapMirror active sync configuration for SAP HANA
- SnapCenter configuration for HANA on VMware with VMFS
- SnapCenter configuration for SnapMirror active sync
- SnapCenter operations with HANA on VMware and SnapMirror active sync

We will focus on a VMware Metro Storage Cluster (vMSC) configuration using a uniform access setup of SnapMirror active sync as shown in the figure below, but we will also briefly touch bare metal as well as non-uniform access configurations.



# **Overview SAP HANA high availability**

This chapter provides an overview of high availability options for SAP HANA comparing replication on application layer with storage replication.

## SAP HANA system replication (HSR)

SAP HANA system replication offers an operation mode in which the data is replicated synchronously, preloaded into memory and continuously updated at the secondary host. This mode enables very low RTO values, approximately 1 minute or less, but it also requires a dedicated server that is only used to receive the replication data from the source system. Because of the low failover time, SAP HANA system replication is also often used for near-zero-downtime maintenance operations, such as HANA software upgrades. Linux Pacemaker cluster solutions are typically used to automate failover operations.

In case of any failure at the primary site, storage, host or complete site, the HANA system automatically fails over to the secondary site controlled by the Linux Pacemaker cluster.

For a full description of all configuration options and replication scenarios, see SAP HANA System Replication | SAP Help Portal.

(1)	x Pacemaker cluster	
	<ul> <li>A system replication</li> <li>Storage, host or site failure:         <ul> <li>Automated failover of HANA syste to secondary node</li> <li>RPO=0, RTO&lt;1min</li> </ul> </li> </ul>	m
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Data Log Shared	Data Log Shared	

#### NetApp SnapMirror active sync

SnapMirror active sync enables business services to continue operating even through a complete site failure, supporting applications to fail over transparently using a secondary copy. There is no manual intervention or custom scripting required to trigger a failover with SnapMirror active sync. SnapMirror active sync is supported on AFF clusters, All-Flash SAN Array (ASA) clusters, and C-Series (AFF or ASA). SnapMirror active sync protects applications with iSCSI or FCP LUNs.

Beginning with ONTAP 9.15.1, SnapMirror active sync supports a symmetric active/active capability. Symmetric active/active enable read and write I/O operations from both copies of a protected LUN with bidirectional synchronous replication so that both LUN copies can serve I/O operations locally.

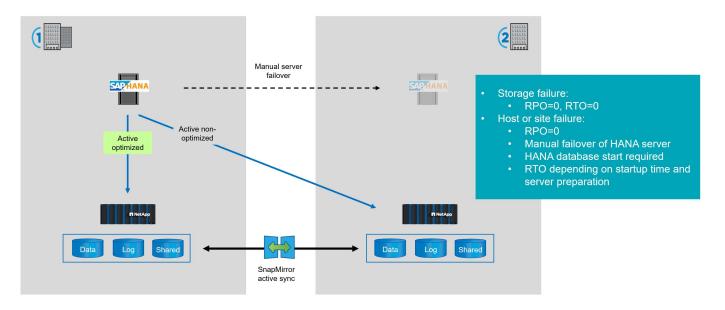
More details can be found at SnapMirror active sync overview in ONTAP.

#### HANA bare metal

When running SAP HANA on a bare metal server, you can use SnapMirror active sync to provide a high available storage solution. The data is replicated synchronously therefore providing an RPO=0.

In case of a storage failure, the HANA system will transparently access the mirrored copy at the secondary site using the second FCP path providing an RTO=0.

In case of a host or complete site failure, a new server at the secondary site needs to be provided to access the data from the failed host. This would typically be a test or QA system of the same size as production which will now be shut down and be used to run the production system. After the LUNs at the secondary site are connected to the new host, the HANA database needs to be started. The total RTO therefore depends on the time needed to provision the host and the startup time of the HANA database.

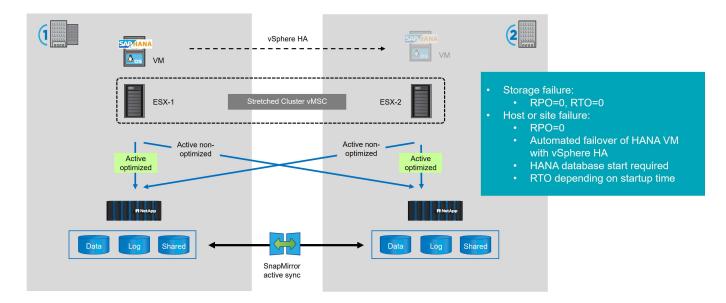


### vSphere Metro Storage Cluster (vMSC)

When running SAP HANA in a VMware environment using FCP attached datastores you can use SnapMirror active sync to build a VMware Metro Storage Cluster. In such a setup the datastores used by the HANA system are replicated synchronously to the secondary site.

In case of a storage failure, the ESX host will automatically access the mirrored copy at the secondary site providing an RTO=0.

In case of a host or complete site failure, vSphere HA is used to start the HANA VM at the secondary ESX host. When the HANA VM is running, the HANA database needs to be started. The total RTO therefore mainly depends on the startup time of the HANA database.



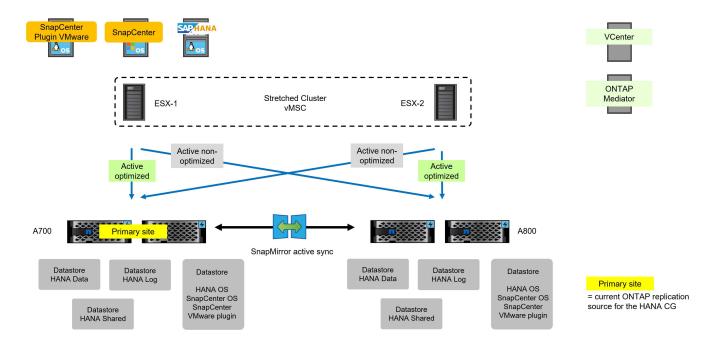
## Solution comparison

The following table provides a summary of the key characteristics of the solutions described above.

	HANA System Replication	SnapMirror active sync – bare metal	SnapMirror active sync – Vmware vMSC
RPO with any failure	RPO=0 Synchronous replication		
RTO with storage failure	RTO < 1min	RTO=0 Transparent storage failover	
RTO with site or host failure	RTO < 1min	RTO: Depending on the time required for server preparation and HANA database startup.	RTO: Depending on the time required for HANA database startup.
Failover automation	Yes, automated failover to secondary HSR host controlled by pacemaker cluster.	Yes, for storage failure No, for host or site failure (Provisioning of host, connect storage resources, HANA database start)	Yes, for storage failure Yes, for host or site failure (Failover of VM to other site automated with vSphere HA, HANA database start)
Dedicated server at secondary site required	Yes, required to preload data into memory and enable fast failover w/o database startup.	No, server is only required in case of failover. Typically, the server used for QA would then be used for production.	No, Resources at ESX host are only required in case of a failover. Typically, QA resources would then be used for production.

## Example configuration overview

In the lab setup, we are using a uniform access configuration, where both ESX hosts have access to both storage clusters. Within the next sections we describe the uniform access configuration but also highlight the differences for a non-uniform setup.



## Software versions

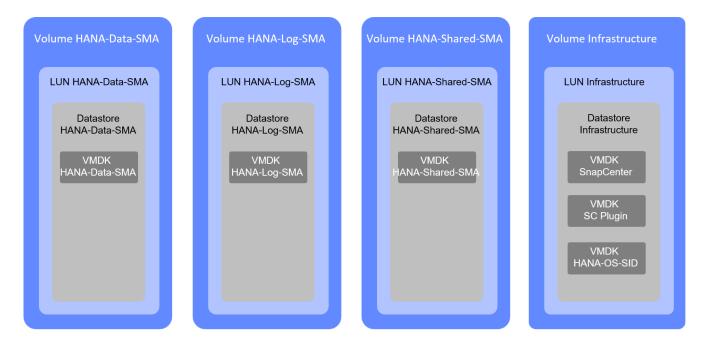
Software	Version
ONTAP	A700: 9.15.1P7, A800: 9.16.1RC1
vSphere client	8.0.3
ESXi	8.0.3
SnapCenter plugin for vSphere	6.0.1
Linux OS	SLES for SAP 15 SP5
SAP HANA	2.0 SPS8
SnapCenter	6.0.1

## HANA system provisioning and installation

This chapter describes the installation and configuration of the SAP HANA system specific to a VMware setup using VMFS. Additional generic best practices can be found at SAP HANA on NetApp AFF Systems with Fibre Channel Protocol.

## Storage configuration

The figure below shows the storage and datastore configuration for the HANA system. You must configure a dedicated volume, LUN, datastore for each filesystem of the HANA system. Datastores must not be shared across multiple HANA systems or other workloads.



All three LUNs of the HANA system (hana\_data\_SMA, hana\_log\_SAM and hana\_shared\_SMA) as well as the LUN for the OS images and SnapCenter components have been provisioned at the A700 storage cluster.



All volumes of the HANA system must be provisioned in the same SVM. In the SnapMirror active sync configuration described later, we will create a consistency group across all three HANA volumes, which requires that the volumes are in the same SVM. The infrastructure volume will be in a different consistency group and could therefore be in a different SVM.

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SHBOARD	LUNS	5						
IGHTS	+ Add						Q Search 🛓 Down	nload 💿 Show/hide 🛩 🔄 Fit
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rview		۹	Q bluexpdr	Q	>	> >	>	
umes Is	~	vvolPE-1724163990635	svm200_bluexpdr_a700s	vvol_FCoE_2	4 MiB	0	0	
ve namespaces	~	vvoIPE-1724163990633	svm200_bluexpdr_a700s	vvol_FCoE_1	4 MiB	0	0	
sistency groups	~	DraaS_qa_lun1	svm200_bluexpdr_a700s	DraaS_qa_lun1	200 GiB	0	0	
age VMs	~	DRaas_qa_lun2	svm200_bluexpdr_a700s	DRaas_qa_lun2	100 GiB	0	0	
	~	<ul> <li>Infrastructure</li> </ul>	svm200_bluexpdr_a700s	Infrastructure	2 TiB	50	0.31	0
WORK ^	~	hana_data_SMA	svm200_bluexpdr_a700s	hana_data_SMA	300 GiB	0	0.24	
iew net ports	~	hana_log_SMA	svm200_bluexpdr_a700s	hana_log_SMA	158 GiB	0	0.24	
orts	~	hana_shared_SMA	svm200_bluexpdr_a700s	hana_shared_SMA	210 GiB	1	0.16	0
NTS & JOBS 🗸		hana_test_lun	svm200_bluexpdr_a700s	hana_test_lun	1 TiB	0	0.39	
ECTION ~								
TS ~								
STER ~								
IEK -								

An initiator group must be configured, and the LUNs above must be mapped to the ESX-1 host, which is in close proximity to the A700 storage system in our lab setup.

## **Datastore provisioning**

We created three datastores for the HANA system using the three LUNs we have provisioned before. In addition, we created an infrastructure datastore using the infrastructure LUN.

😑 vSphere Client 🛛 Q Search in all environm	ients	C	오 Administrator@VSPHERE.LOCAL ~ (	☺   ଡ~
<ul> <li></li></ul>	hana_data_SMA         : ACTIONS           Summary         Monitor         Configure         Permissions         Files         Hosts         VI	мs		
<ul> <li></li></ul>	Details     Image: space state sta	Cepacity and Usage Last updated at 6:57 AM Storage 98.33 GB free 201.42 GB used 299.75 GB capacity VIEW STATS REFRESH	Related Objects II	٢

## VM provisioning and OS installation

In our lab setup we deployed a new VM and placed the VMDK for the Linux OS in the infrastructure datastore.

## VM disk configuration

Three new disks have been added to the HANA VM, each disk within one of the datastores which have been created for the HANA system.

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( () () () () () () () () () () () () () (	🗇 nana-1	Edit Settings   han			×			
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<ul> <li>Datacenter_87</li> <li>(II) Cluster_87_1</li> <li>(II) 10.193.39.118</li> </ul>	Quick Filter	> CPU	<u> </u>					
10.193.39.120		> Memory	GB ~					
ស៊ី hana-1 ស៊ី scv-6.0.1.6246801-241029_0224		> Hard disk 1		E.				
SnapCenter4HANA		✓ Hard disk 2	200 <u>GB ×</u>	E.				
		Maximum Size	298.33 GB					
		VM storage policy	Datastore Default ~					
		Туре	Thick Provision Lazy Zeroed					
		Sharing	No sharing 🗸					
		Disk File	[hana_data_SMA] hana-1/hana-1.vmdk					
		Disk Mode	Dependent v					
		Virtual Device Node	SCSI controller 0 < SCSI(0:1) Hard disk 2 <					
	Manage Columns	> Hard disk 3	120 GB ~	÷		ltems per page	e 35 🗸 4 items	
✓ Recent Tasks Alarms		> Hard disk 4	150 GB ~	÷				
Task Name Y Target Y	Status			CANCEL	Time 🔻	Server	т	
Manage Columns All V More Tasks							0 item	ns

## VM parameter setting

The parameter disk.EnableUUID must be added and set to TRUE . The parameter is required by SnapCenter. If not set the SnapCenter "Discover virtual resource" operation will fail.

The VM must be stopped before parameter can be added.

$\equiv$ vSphere Client $\mathbb{Q}$ Search in all env	ironments		Iministrator@VSPHERE.LOCAL ~	?~
< <sub>5</sub>	Edit Settings hana-1		×	
	Virtual Hardware VM Options Advanced Paran	neters	1	
<ul> <li>         tme-rhev02.rtp.openenglab.netapp         Internet Datacenter_87         Internet Cluster_87_1         Internet 10.193.39.118     </li> </ul>	Advanced Configuration Parameters Modify or add configuration parameters as needed for e Empty values will be removed (supported on ESXI 6.0 a	experimental features or as instructed by technical support. nd later).	<b>ge</b> III Ipdated: 1/17/25, 5:23 AM	ŵ
,10.193.39.120 命 hana-1 爺 sev-6.0.1.6246801-241029	Attribute         Value           disk.EnableUUID         TRUE	ADD	O MHz used	
🔂 SnapCenter4HANA	Attribute	T Value T	O MB used	
	nvram	hana-1.nvram	lige	
1	svga.present	TRUE	720 GB used	
	hpet0.present	TRUE		
	RemoteDisplay.maxConnections	-1	STATS	
	sched.cpu.latencySensitivity	normal	STATS	
	tools.guest.desktop.autolock	TRUE	ind Objects	
	vmxstats.filename	hana-1.scoreboard	ted Objects <sup>11</sup>	
	numa.autosize.cookie	80012	er	
	numa.autosize.vcpu.maxPerVirtualNode	8	<u>Cluster 87 1</u>	
	cpuid.coresPerSocket.cookie	8	10.193.39.118 /orks	
	sched.swap.derivedName	/vmfs/volumes/677ec7a8	VM Network Ige	
11	pciBridge1.present	TRUE	nana data SMA	
Recent Tasks Alarms				
Task Name Target		CANCEL	↓ Y Completion Time Y	Serve
Power Off virtual machi 🗿 <u>hana-1</u> ne			25, 5:23:13 01/17/2025, 5:23:24 AM	tme- tp.or b.net
Manage Columns All v More Tasks				

The functionality can be checked with the command below.

```
hana-1:~ # sg_inq /dev/sdd
standard INQUIRY:
PQual=0 PDT=0 RMB=0 LU_CONG=0 hot_pluggable=0 version=0x06 [SPC-4]
[AERC=0] [TrmTsk=] NormACA=0 HiSUP=0 Resp_data_format=2
SCCS=0 ACC=0 TPGS=0 3PC=0 Protect=0 [BQue=0]
EncServ=0 MultiP=0 [MChngr=0] [ACKREQQ=0] Addr16=0
[RelAdr=0] WBus16=1 Sync=1 [Linked=0] [TranDis=0] CmdQue=1
length=36 (0x24) Peripheral device type: disk
Vendor identification: VMware
Product identification: Virtual disk
Product revision level: 2.0
Unit serial number: 6000c293fecf25ac6bc457af67fe1f54
```

## File system preparation at Linux host

#### Creation of xfs filesystem on new disks

The device names of new the new disks can be checked with the command below.

```
hana-1:/install # lsblk
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS
sda 8:0 0 250G 0 disk
-sda1 8:1 0 256M 0 part /boot/efi
└─sda2 8:2 0 82G 0 part
-system-root 254:0 0 60G 0 lvm /root
/var
/usr/local
 /tmp
 /srv
 /opt
 /home
 /boot/grub2/x86++ ++64-efi
 /boot/grub2/i386-pc
 /.snapshots
/
-system-swap 254:1 0 2G 0 lvm SWAP
sdb 8:16 0 200G 0 disk
sdc 8:32 0 120G 0 disk
sdd 8:48 0 150G 0 disk
sr0 11:0 1 1024M 0 rom
hana-1:/install #
```

An xfs file system has been created on each of the three new disks.

hana-1:/install # mkfs.xfs /dev/sdb meta-data=/dev/sdb isize=512 agcount=4, agsize=7864320 blks sectsz=512 attr=2, projid32bit=1 crc=1 finobt=1, sparse=1, rmapbt=0 reflink=0 bigtime=0 inobtcount=0 data = bsize=4096 blocks=31457280, imaxpct=25 sunit=0 swidth=0 blks naming =version 2 bsize=4096 ascii-ci=0, ftype=1 log =internal log bsize=4096 blocks=15360, version=2 sectsz=512 sunit=0 blks, lazy-count=1 realtime =none extsz=4096 blocks=0, rtextents=0

hana-1:/install # mkfs.xfs /dev/sdc meta-data=/dev/sdc isize=512 agcount=4, agsize=7864320 blks sectsz=512 attr=2, projid32bit=1 crc=1 finobt=1, sparse=1, rmapbt=0 reflink=0 bigtime=0 inobtcount=0 data = bsize=4096 blocks=31457280, imaxpct=25 sunit=0 swidth=0 blks naming =version 2 bsize=4096 ascii-ci=0, ftype=1 log =internal log bsize=4096 blocks=15360, version=2 sectsz=512 sunit=0 blks, lazy-count=1 realtime =none extsz=4096 blocks=0, rtextents=0

```
hana-1:/install # mkfs.xfs /dev/sdd
meta-data=/dev/sdd isize=512 agcount=4, agsize=9830400 blks
sectsz=512 attr=2, projid32bit=1
crc=1 finobt=1, sparse=1, rmapbt=0
reflink=0 bigtime=0 inobtcount=0
data = bsize=4096 blocks=39321600, imaxpct=25
sunit=0 swidth=0 blks
naming =version 2 bsize=4096 ascii-ci=0, ftype=1
log =internal log bsize=4096 blocks=19200, version=2
sectsz=512 sunit=0 blks, lazy-count=1
realtime =none extsz=4096 blocks=0, rtextents=0
hana-1:/install #
```

**Creation of mount points** 

```
hana-1:/ # mkdir -p /hana/data/SMA/mnt00001
hana-1:/ # mkdir -p /hana/log/SMA/mnt00001
hana-1:/ # mkdir -p /hana/shared
hana-1:/ # chmod -R 777 /hana/log/SMA
hana-1:/ # chmod -R 777 /hana/data/SMA
hana-1:/ # chmod -R 777 /hana/data/SMA
```

## Configuration of /etc/fstab

```
hana-1:/install # cat /etc/fstab
/dev/system/root / btrfs defaults 0 0
/dev/system/root /var btrfs subvol=/@/var 0 0
/dev/system/root /usr/local btrfs subvol=/@/usr/local 0 0
/dev/system/root /tmp btrfs subvol=/@/tmp 0 0
/dev/system/root /srv btrfs subvol=/@/srv 0 0
/dev/system/root /root btrfs subvol=/@/root 0 0
/dev/system/root /opt btrfs subvol=/@/opt 0 0
/dev/system/root /home btrfs subvol=/@/home 0 0
/dev/system/root /boot/grub2/x86 64-efi btrfs subvol=/@/boot/grub2/x86 64-
efi 0 0
/dev/system/root /boot/grub2/i386-pc btrfs subvol=/@/boot/grub2/i386-pc 0
0
/dev/system/swap swap swap defaults 0 0
/dev/system/root /.snapshots btrfs subvol=/@/.snapshots 0 0
UUID=2E8C-48E1 /boot/efi vfat utf8 0 2
/dev/sdb /hana/data/SMA/mnt00001 xfs relatime, inode64 0 0
/dev/sdc /hana/log/SMA/mnt00001 xfs relatime, inode64 0 0
/dev/sdd /hana/shared xfs defaults 0 0
hana-1:/install #
hana-1:/install # df -h
Filesystem Size Used Avail Use% Mounted on
devtmpfs 4.0M 8.0K 4.0M 1% /dev
tmpfs 49G 4.0K 49G 1% /dev/shm
tmpfs 13G 26M 13G 1% /run
tmpfs 4.0M 0 4.0M 0% /sys/fs/cgroup
/dev/mapper/system-root 60G 35G 25G 58% /
/dev/mapper/system-root 60G 35G 25G 58% /.snapshots
/dev/mapper/system-root 60G 35G 25G 58% /boot/grub2/i386-pc
/dev/mapper/system-root 60G 35G 25G 58% /boot/grub2/x86 64-efi
/dev/mapper/system-root 60G 35G 25G 58% /home
/dev/mapper/system-root 60G 35G 25G 58% /opt
/dev/mapper/system-root 60G 35G 25G 58% /srv
/dev/mapper/system-root 60G 35G 25G 58% /tmp
/dev/mapper/system-root 60G 35G 25G 58% /usr/local
/dev/mapper/system-root 60G 35G 25G 58% /var
/dev/mapper/system-root 60G 35G 25G 58% /root
/dev/sda1 253M 5.1M 247M 3% /boot/efi
tmpfs 6.3G 56K 6.3G 1% /run/user/0
/dev/sdb 200G 237M 200G 1% /hana/data/SMA/mnt00001
/dev/sdc 120G 155M 120G 1% /hana/log/SMA/mnt00001
/dev/sdd 150G 186M 150G 1% /hana/shared
hana-1:/install #
```

## **HANA** installation

The HANA installation can now be executed.



With the described configuration the /usr/sap/SMA directory will be on the OS VMDK. If /usr/sap/SMA should be stored in the shared VMDK, the hana shared disk could be partitioned to provide another file system for /usr/sap/SMA.

## Userstore key for SnapCenter

A user store for a system database user must be created, which should be used by SnapCenter. The HANA instance number must be set accordingly for communication port. In our setup instance number "00" is used.

A more detailed description can be found at SnapCenter resource-specific configuration for SAP HANA database backups

```
smaadm@hana-1:/usr/sap/SMA/HDB00> hdbuserstore set SMAKEY hana-1:30013
SNAPCENTER <password>
Operation succeed.
```

The connectivity can be checked with the command below.

```
smaadm@hana-1:/usr/sap/SMA/HDB00> hdbsql -U SMAKEY
Welcome to the SAP HANA Database interactive terminal.
Type: \h for help with commands
\q to quit
hdbsql SYSTEMDB=> exit
smaadm@hana-1:/usr/sap/SMA/HDB00
```

## SnapMirror active sync configuration

This article covers the configuration steps required for this solution.

## **Pre-requisites**

Storage clusters and relevant SVMs must be peered.

ONTAP mediator must be available and configured at both storage clusters.

DASHBOARD Overview   INSIGNT <ul> <li>InterCluster settings</li> <li>Network interfaces</li> &lt;</ul>	≡ <b>I</b> ONTAP Sy	rstem Manager	Search actions, objects, and pages Q Q
STORAGE A Intercluster settings   STORAGE Network interfaces   Overview Methanemegazes   Consistery groups Baskassons   Consistery groups Storage VMs   Ties Cluster peers   NTWORK Cluster peers   Overview Methanemegazes   Consistery groups Protect oolung   NTWORK Protect oolung   NTWORK Protect oolung   Overview Protect oolung   Bitement ports Methator @   Consistery Protect oolung   Baskassons Protect oolung   Consistery Protect oolung   Storage VMs Protect oolung   Consistery Protect oolung   Baskassons Protect oolung   Baskassons Protect oolung   Consistery Protect oolung   Baskassons Protect oolung   Bask	DASHBOARD	Overview	
Verview Verview   Vorview   Vorview   Vorview   Vorview   NTWORK   Overview   NtWorks   Overview   NtWorks   Overview   NtWorks   Overview   Desites   Overview   Desites   Ntworks   Overview   Desites   Ntworks   Overview   Desites   Ntworks   Desites   Overview   Desites   Desites   Desites   Overview   Desites    Desites   Desites <td>INSIGHTS</td> <td>&lt; Intercluster settings</td> <td>Protected data →</td>	INSIGHTS	< Intercluster settings	Protected data →
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LNA: Image: Backward of the size volumes aren't protected.   NMMe namespaces Image: Backward of the size volumes aren't protected.   Storage VMs Image: Backward of the size volumes aren't protected.   Ters Cluster peers   Coverview Image: Backward of the size volumes aren't protected.   Coverview Image: Backward of the size volumes aren't protected.   Retwork * Mediator *   Ters s. Jobs * Mediator *   Ters s. Jobs * Mediator *   Ters volumes do for protection if you   Image: Backward of the size volumes for protection if you   Retwork * Storage VM peers   Forter torm of the size volumes for the size volumes for the applications hosted across ONTAP enabled platforms. Use NetApp SnapCenter for application-consistent   Retwork * Protect software simplifies backup, restore, and done management for the applications hosted across ONTAP enabled platforms. Use NetApp SnapCenter for application-consistent   Retwork * Protect software simplifies backup, restore, and done management for the applications hosted across ONTAP enabled platforms. Use NetApp SnapCenter for application-consistent   Notifies * Protect software simplifies backup, restore, and done management for the applications hosted across ONTAP enabled platforms. Use NetApp SnapCenter for application-consistent   Notifies * Protect software simplifies backup, restore, and done management for the applications hosted across ONTAP enabled platforms. Use NetApp SnapCenter for application-consistent   Notifies * Protect software simplifies backup, restore, and done management for the applications hosted across ONTAP enabl		International	21 of the 62 volumes aren't protected.
Initializing groups   Sorage VMs   Ters   Cluster peers   NETWORK   Overview   Ehemet ports   Fc ports   Mediator ()   PROTECTION   PROTECTION   Relationships   Sorage VM peers   Fress   Storage VMs   Overview   Relationships   Storage VM peers   Storage VMs   Storage VMs		IP2.168.100.101	
Storage VMs   Tiers   Cluster peers   NETWORK   Overview   Ethemet ports   Rc ports   Mediator ()   Potect for business   Potect for business   Potect volumes   Potect volumes for protection if you   Diverview   Etwents as Jobs volumes   Potect volumes for protection if you   Devriew   Relationships   Rolationships   Storage VM peers   Storage VM peers   Protect volumes   Storage VM peers   Protect storage VMs			49 of the 62 volumes aren't protected.
Tiers Cluster peers i   NEWORK Present custers NAME   Overview   Ethernet ports   FC ports   Events & JOBS   Nediator ()   Mediator ()   Overview   Back up volumes to cloud   Image: State st			
Overview Overview   Ethernet ports   K ports   K ports   EVENTS & JOBS ~   PROTECTION ^   Overview   Relationships   Storage VM peers   Frester Storage VMs      Protect software simplifies backup, restore, and done management for the applications hosted across ONTAP enabled platforms. Use NetApp SnapCenter for application-consistent protection.		Cluster peers :	66 of the 66 volumes aren't backed up to cloud.
FC ports       Mediator ①       Image: Construction Operation of the applications hosted across ONTAP enabled platforms. Use NetApp SnapCenter for application-consistent         EVENTS & JOBS ~       Image: Construction of the applications hosted across ONTAP enabled platforms. Use NetApp SnapCenter for application-consistent         PROTECTION ^       Overview       Overview <td></td> <td></td> <td>0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%</td>			0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
EVENTS & JOBS 105.180.07   EVENTS & JOBS 105.180.07   PROTECTION Instance   Overview Instance   Relationships Storage VM peers   Instance Instance   SNI initiator groups Instance	Ethernet ports	Madiatan O	Protect volumes Back up volumes to cloud Protect for business continuity
PROTECTION     Image: status     Image:		10.61.180.97	Late you calant onerfife volumes for protection if you Late you select which volumes you want to be backed Late you protect a consistency group with a sero
Overview         Storage VM peers         Overview		✓ tme-a800	
Relationships Storage VM peers : HOSTS A PEERD STORAGE VMS SAN initiator groups			() NetApp SnapCenter software simplifies backup, restore, and clone management for the applications hosted across ONTAP enabled platforms. Use NetApp SnapCenter for application-consistent
SAN initiator groups	Relationships	Storage VM peers	protection.
NVMe subsystem			✓ Local policy settings ③
CLUSTER			
Overview Cloud object stores ③	Overview		✓ Cloud object stores ③
Hardware Settings			
Disks Cloud Backup Service () Status: () Not configured	-		✓ Cloud Backup Service ⑦ Status: ⑦ Not configured

■ ONTAP Sy	rstem Manager		Search actions, objects, and pages Q		?	↔ 8				
DASHBOARD	Storage VM peers Protection ov	torage VM peers Protection overview								
INSIGHTS	+ Peer storage VMs	Q Search @ Show/hide 🗸	⊤ Filter							
STORAGE ^	Storage VM	Peered cluster	Peered storage VM	Status	Applications using this peer					
Overview	svm200_bluexpdr_a700s	tme-a800	svm200_bluexpdr_a800	Peered	SnapMirror					
Volumes										

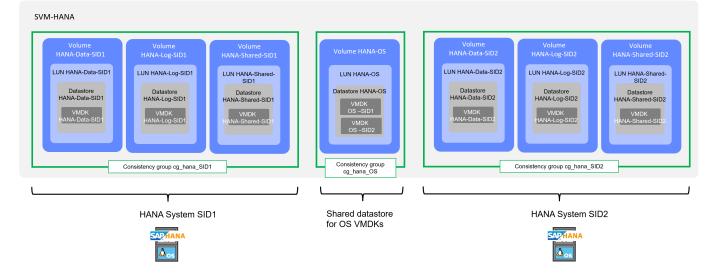
## Storage layout and consistency group configuration

In the ONTAP documentation SnapMirror active sync overview in ONTAP the concept of consistency groups with SnapMirror active sync is described as followed:

A consistency group is a collection of FlexVol volumes that provide a consistency guarantee for the application workload that must be protected for business continuity.

The purpose of a consistency group is to take simultaneous snapshot images of multiple volumes, thus ensuring crash-consistent copies of a collection of volumes at a point in time. A consistency group ensures all volumes of a dataset are quiesced and then snapped at precisely the same point in time. This provides a dataconsistent restore point across volumes supporting the dataset. A consistency group thereby maintains dependent write-order consistency. If you decide to protect applications for business continuity, the group of volumes corresponding to this application must be added to a consistency group so a data protection relationship is established between a source and a destination consistency group. The source and destination consistency must contain the same number and type of volumes.

For the replication of HANA systems, the consistency group must include all volumes used by the individual HANA system (data, log and shared). Volumes which should be part of a consistency group must be stored in the same SVM. Operating system images can be stored in a separate volume with its own consistency group. The figure below illustrates a configuration example with two HANA systems.



## Initiator group configuration

In our lab setup we created an initiator group including both storage SVMs which are used for the SnapMirror active sync replication. In the SnapMirror active sync configuration described later, we will define that the initiator group will be part of the replication.

Using the proximity settings, we defined which ESX host is close to which storage cluster. In our case the A700 is close to ESX-1 and the A800 is close to ESX-2.

	stem Manager		Searc	h actions, objects, and pages:	Q	? ↔ 8
ASHBOARD	SAN initiator groups					
ISIGHTS	+ Add to initiator group $\sim$					Q Search 😇 Filter
rorAGE ^	<ul> <li>Name</li> <li>Q</li> </ul>	cluster_87_1 All SAN initiator g				🖉 Edit 🝈 Delete
Marins Mar namespaces inhistency groups orage VMs sets EFWORK ^ verview Verview	Cluster, 87, 1           Datacenter, 86, FCP           draas, jgp, essi116,           essi, 118           essi, 120           orky 95aa30c2-6123-464b-a784-24cc4           bbC1664b, datacenter-3, Juna, Jog, SAA           obt/664b, datacenter-3, Juna, Jog, SAA           obt/664b, datacenter-3, Juna, Jog, SAA           obt/664b, datacenter-3, Juna, Shared, 5           MA           obt/64b, datacenter-3, Juna, Shared, 5           datacenter-3, Juna, Shared, 5           datacenter, 86, JFCP           tracenter, 86, JFCP           tracenter, 86, JFCP           tracenter, 86, JF	Overview         Hierarchy         Mapped           STORACE VM sym200_bluespdr_a700s         ************************************	NPLCARE TO CLUSTER tme-a800	NEPLO OK	ATCH STATUS	
N initiator groups	vvol-igroup-1	<ul> <li>Initiators</li> </ul>				
vMe subsystem	€ 1 →	Name 10.00.00.10.96:17.04.669 10.00.00.10.96:17.04.669 10.00.00.10.96:47.04.663 10.00.00.10.96:40.95.7f 10.00.00.10.96:40.95.80	ESX-1		In proximity to svm200_bluespdr_s700s svm200_bluespdr_s700s svm200_bluespdr_s800 svm200_bluespdr_s800	

ONTAP Sy	rstem Manager		Search actions, c	bjects, and pages	٩			? ↔
DASHBOARD	SAN initiator groups							
INSIGHTS	+ Add to initiator group $\checkmark$							Q Search 📼 Fi
STORAGE ^	Name	cluster_87_1 All SAN initiator groups						🖉 Edit  🗎 Delete
olumes	cluster_87_1	Overview Hierarchy Mapped LUNs						
/Ns /Me namespaces	Datacenter_86_FCP			GROUP TYPE				
insistency groups	draas_igp_esxi116_	Name		initiator group				
torage VMs	esxi_118	<ul> <li>duster_87_1</li> </ul>	Replic					
ers	esxi_120	essi_118	REPLICATE svm200	D TO SVM )_bluexpdr_a800		REPLICATED TO CLUSTER tme-a800	REPLICATION STATUS OK	
Verview	otv_96aaa0c2-6123-464b-a784-24cc4 b0cf646_datacenter-3_hana_log_SMA	esxi_120	∧ Init	iators				
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ents & Jobs 🗸 🗸	otv_Datacenter_86_FCP			10:00:00:10:9b:17:	-	⊙ ок ⊘ ок		svm200_bluexpdr
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OSTS ^	vvol-igroup-1			10:00:00:10:9b:40:	-	⊘ ок		svm200_bluexpdr
/Me subsystem								
LUSTER ~			Mappe	H LUNs				
			Name					ID
			hana_	data_SMA				1
			hana_	og_SMA				2
			hana_	shared_SMA				3
			hana_1	test_lun				4
	$\leftarrow$ 1 $\rightarrow$							
	< 1 3							

(i)

In a non-uniform access setup, the initiator group at the primary storage cluster (A700) must only include the initiators of the ESX-1 host, since there is no SAN connection to ESX-2. In addition, you need to configure another initiator group at the second storage cluster (A800) which only include the initiators of the ESX-2 host. Proximity configuration and initiator group replication is not required.

## Configure protection with ONTAP system manager

	ystem Manager					Search act	tions, objects,	, and pages					?	$\diamond$	8
DASHBOARD	Overview														
DASHBOARD INSIGHTS STORAGE ^ Overview UNVer namespaces LUNs Constory groups Storage VMs Tiers: NETWORK ~ EVENTS & JOBS ~ PROTECTION ^ Relationships HOSTS ^ SAN initiator groups NVMe subsystem CLUSTER ~	<ul> <li>Intercluster settings</li> <li>Network interfaces</li> <li>Process</li> <li>Process</li></ul>	•	SnapMirror SnapMirror Back up to O% Prote Lets you se protect ent ① Netap ~ Local ~ Local	rotection opies (local or remote (local or remote os 20% cloud cloud t volumes t specific volum	30% 30% are simplifies ba 35 ③ 5 ③	ockup, restore, ar	nd clone manag	Lets you se destination	L,	olumes you w	100% 66 of the 66 volum 100%	es aren't protected. ses aren't protected. ses aren't backed up to cloud. Protect for business continuity Lets you protect a consistent protection. ascCenter for application-consistent protection.	ero recovery ti	→	

#### Consistency group and initiator group replication

A new consistency group must be created, and all three LUNs of the HANA system must be added to the consistency group.

"Replicate initiator group" has been enabled. The imitator group will then stay in-sync independent where changes are made.



In a non-uniform access setup, the initiator group must not be replicated, since a separate initiator group must be configured at the second storage cluster.

By clicking on proximity settings, you can review the configuration done before in the initiator group setup.

ONTAP System Manager	Search action	ns, objects, and pages Q		? ↔ 8
DASHBOARD	Protect Consistency gro	oup	×	
STORAGE ~	Proximity settings	×	Destination	
EVENTS & JOBS V	Initiator	Initiator in proximity to	Destination	
PROTECTION ^	Initiator group: cluster_87_1 Mapped LUNs: 3		✓ Refresh	
Overview Relationships	10:00:00:10:9b:17:04:69	Source 🗸	~	
HOSTS	10:00:00:10:9b:17:04:6a	Source 👻		
SAN initiator groups NVMe subsystem	10:00:00:10:9b:40:b9:7f	Destination 🗸		
CLUSTER Y	10:00:00:10:9b:40:b9:80	Destination ~		
			urra: dest	
			nime.	
		Cancel Save	ļ	
_				

The destination storage cluster must be configured and "initialize relationship" must be enabled.

#### Synchronisation

At the A700 storage cluster (source), the new relationship is now listed.

AGE ^		ystem Manager	Search actions, objects, and pages Q	<b>?</b> ↔
Ref       No         Searc       Searc         Searc </th <th>BOARD</th> <th>Relationships</th> <th></th> <th></th>	BOARD	Relationships		
R       Image: Since       Destinant       Destinant       Destinant       Destinant       Destinant       Destinant         R       Since       Destinant       Destinant <td>ITS</td> <td>Local destinations Local sources</td> <td></td> <td></td>	ITS	Local destinations Local sources		
source     bounce     bounce     predyrgen       source     source     source     source     source				Q Search 🛓 Download @ Show/hide 💙 후 Filter
immigration     immi		Source	Destination	Policy type
ky groups     * sm2002 bleepdr 3700 krole / me_1     sm2002 bleepdr 3700 krole / me_1     Andriconous       Max     * sm2002 bleepdr 3700 krole / me_1     sm2002 bleepdr 3700 krole / me_1     Andriconous       Ka     * sm2002 bleepdr 3700 krole / me_2     sm2002 bleepdr 3700 krole / me_2     Andriconous       Ka     * sm2002 bleepdr 3700 krole / me_2     sm2002 bleepdr 3700 krole / me_2     Andriconous       Ka     * sm2002 bleepdr 3700 krole / me_2     sm2002 bleepdr 3700 krole / me_2     Andriconous       Ka     * sm2002 bleepdr 3700 krole / me_2     sm2002 bleepdr 3700 krole / me_2     Andriconous       Ka     * sm2002 bleepdr 3700 krole / me_2     sm2002 bleepdr 3700 krole / me_2     Andriconous       * sm2002 bleepdr 3700 krole / me_2     * sm2002 bleepdr 3700 krole / me_2     Andriconous       * sm2002 bleepdr 3700 krole / me_2     * sm2002 bleepdr 3700 krole / me_2     Andriconous       * sm2002 bleepdr 3700 krole / me_2     * sm2002 bleepdr 3700 krole / me_2     Andriconous       * sm2002 bleepdr 3700 krole / me_2     * sm2002 bleepdr 3700 krole / me_2     Andriconous       * sm2002 bleepdr 3700 krole / me_2     * sm2002 bleepdr 3700 krole / me_2     Andriconous       * sm2002 bleepdr 3700 krole / me_2     * sm2002 bleepdr 3700 krole / me_2     Andriconous       * sm2002 bleepdr 3700 krole / me_2     * sm2002 bleepdr 3700 krole / me_2     Sm2002 bleepdr 3700 krole / me_2 <t< td=""><td>macr.2005</td><td><ul> <li>svm200_bluexpdr_a700ssudev1</li> </ul></td><td>svm200_bluexpdr_a800:sudev1_dest</td><td>Asynchronous</td></t<>	macr.2005	<ul> <li>svm200_bluexpdr_a700ssudev1</li> </ul>	svm200_bluexpdr_a800:sudev1_dest	Asynchronous
RK     *     *     mc20_bluepdr_3700x/clmme_2     smc20_bluepdr_3800x/clmme_2.dest     Apm/chronous       14.100     *     *     smc20_bluepdr_3700x/clmme_2.dest     Apm/chronous       1100     *     *     smc20_bluepdr_3700x/clmme_2.dest     Apm/chronous       1100     *     smc20_bluepdr_3700x/clmme_vncl_1     Apm/chronous       1100     *     smc20_bluepdr_3700x/clmme_vncl_1     Apm/chronous       1100     *     smc20_bluepdr_3700x/clmme_vncl_1     Apm/chronous       1100     *     smc20_bluepdr_3700x/clmme_vncl_1     Apm/chronous       1100     *     *     Apm/chronous     Apm/chronous       1100     *     *     *     Apm/chronous     Apm/chronous       1100     *     *     *     *     Apm/chronous       1100     *     *     *     *     *       1100     *     *     *     *     *       1100     *     *     *     *     *       1100     *     *     *     *     *       1100     *     *     *     *     *       1100     *     *     *     *     *       1100     *     *     *     *     *		<ul> <li>svm200_bluexpdr_a700s.vvol_nvme_1</li> </ul>	svm200_bluexpdr_a800tvol_vvol_rvme_1_dest	Asynchronous
RK        sm200_bluepdr_3700s/VME_FC_SCV_NEW       sm200_bluepdr_3800s/VME_FC_SCV_NEW,dest_1       Approx         A: J0S        sm200_bluepdr_3700s/VULME_FC_SCV_NEW       sm200_bluepdr_3800s/VULME_FC_FLUGIN_PRI_dest       Approx         TION        sm200_bluepdr_3700s/VULME_FC_SCV_NEW       sm200_bluepdr_3800s/vul_ME_FC_FLUGIN_PRI_dest       Approx         sm200_bluepdr_3700s/VULME_FC_SCV_NEW       sm200_bluepdr_3800s/vul_ME_FC_SCV_NEW_/SME_FC_FLUGIN_PRI_dest       Approx         sm200_bluepdr_3700s/VULME_FC_SCV_NEW       sm200_bluepdr_3800s/vul_mme_1_dest       Approx         sm200_bluepdr_3800s/vul_mme_1_dest       sm200_bluepdr_3800s/vul_mme_1_dest       Approx         sm100s_bluepdr_3700s/vul_gl_gl_ma_sma       sm200_bluepdr_3800s/vul_mme_1_dest       Sm100s nuepdr_3800s/vul_mme_1_dest	Ms	<ul> <li>svm200_bluexpdr_a700s:DraaS_qa_lun1</li> </ul>	svm200_bluexpdr_a800:DraaS_qa_lun1_dest	Asynchronous
Image: Source of the section of th		<ul> <li>svm200_bluexpdr_a700s:vvol_nvme_2</li> </ul>	svm200_bluexpdr_a800.vol_vvol_nvme_2_dest	Asynchronous
************************************	rk ~	<ul> <li>svm200_bluexpdr_a700s:NVME_FC_SCV_NEW</li> </ul>	svm200_bluexpdr_a800:NVME_FC_SCV_NEW_dest_1	Asynchronous
ipp <ul> <li>sym200_bluespit_s800vvo[.mme_1_dest</li> <li>sym20_bluespit_s800vvo[.mme_1_dest</li> <li>sym20_bluespit_s800vvo[.mme_1_dest</li></ul>	& JOBS ~	svm200_bluexpdr_a700s:VOLUME_NVME_FC_PLUGIN_PRI	svm200_bluexpdr_a800.vol_VOLUME_NVME_FC_PLUGIN_PRI_dest	Asynchronous
htps: * smr200_bluespdr_s700s/cg/cg_hana_sma Synchronous synchron	TION ^	<ul> <li>svm200_bluexpdr_a700s:nvme_vvol_1</li> </ul>	svm200_bluexpdr_a800:wol_nvme_1_dest	Asynchronous
*         ** smr200_bluespid_a700/c/g/g.g.hana_sma         smr200_bluespid_a800/c/g/g.g.hana_sma         Smr200_bluespid_a800/c/g.g.hana_sma           tor groups         ** smr200_bluespid_a800/c/g.g.g.hana_sma         smr200_bluespid_a800/c/g.g.hana_sma         Smr200_bluespid_a800/c/g.g.hana_sma		Marcar 200 blance de 200 marca avail 2	and 0.00 bit see the e000 continuous of all as	Annakaran
tot Bonbs autor Onethol'a Look (d'Taua'rest Sautor Onethol'a cost (d' d'aua'rest Sautor Onethol'a Look (d' Taua'rest		<ul> <li>svm200_bluexpdr_a700s;/cg/cg_hana_sma</li> </ul>	svm200_bluexpdr_a800:/cg/cg_hana_sma	Synchronous
		<ul> <li>svm2o0_biuexpdr_ar/ous/cg/cg_nana_test</li> </ul>	svmzou_piuexpar_aoou/cg/cg_nana_test	Synchronous
R ~	R ~			
			Showing 1 - 9 of 9 Relationships	$\leftarrow$ 1 $\rightarrow$

At the A800 storage cluster (destination), the new relationship and the status of the replication is listed.

						ch actions, objects, and pages 💦 🔇 🔇
verview	Relationships					
JNs						
/Me namespaces	Local destinations Local sources					
onsistency groups						
hares	🔘 Protect 🗸					Q ± Ш
ltrees	Source	Destination	Protection policy	Relationship health	State	Lag 🚯
uotas orage VMs	<ul> <li>svm200_bluexpdr_a700s:sudev1</li> </ul>	svm200_bluexpdr_a800:sudev1_dest	Asynchronous	Healthy	<ul> <li>Mirrored</li> </ul>	57 minutes, 7 seconds
ers	<ul> <li>svm200_bluexpdr_a700s:vvol_nvme_1</li> </ul>	svm200_bluexpdr_a800svol_vvol_nvme_1_dest	Asynchronous	Healthy	Mirrored	57 minutes, 7 seconds
rtwork ^	<ul> <li>svm200_bluexpdr_a700s:Draa5_qa_lun1</li> </ul>	svm200_bluexpdr_a800:Draa5_qa_lun1_dest	Asynchronous	Healthy	@ Mirrored	57 minutes, 7 seconds
Iverview	<ul> <li>svm200_bluexpdr_a700s:vvol_nvme_2</li> </ul>	svm200_bluexpdr_a800:vol_vvol_nvme_2_dest	Asynchronous	Healthy	<ul> <li>Mirrored</li> </ul>	57 minutes, 7 seconds
chernet ports	<ul> <li>svm200_bluexpdr_a700s:NVME_FC_SCV_NEW</li> </ul>	svm200_bluexpdr_a800:NVME_FC_SCV_NEW_dest_1	Asynchronous	Healthy	<ul> <li>Mirrored</li> </ul>	57 minutes, 7 seconds
ents & Jobs 🗸 🗸	svm200_bluexpdr_a700s:VOLUME_NVME_FC_PL	UGIN_PRI svm200_bluexpdr_a800.vol_VOLUME_NVME_FC_PLUGIN_PRI_de st	Asynchronous	Healthy	Mirrored	57 minutes, 7 seconds
otection ^	<ul> <li>svm200_bluexpdr_a700s:nvme_vvol_1</li> </ul>	svm200_bluexpdr_a800:vvol_nvme_1_dest	MirrorAndVault	Healthy	Mirrored	141 days, 20 hours, 5 minutes and 4 second
verview	sum200 bluerodr a700sruma usol 2	rum200. bluavadr. a800saval. numa. 2. dart	MirrorAprib/ault	C Lissible	Quement	141 days 23 bours 12 minutes and 7-secon
elationships	<ul> <li>svm200_bluexpdr_a700s;/cg/cg_hana_sma</li> </ul>	svm200_bluexpdr_a800;/cg/cg_hana_sma	AutomatedFailOverDuplex	Healthy	C Synchronizing	
AN initiator groups	<ul> <li>svm200_bluexpdr_a700s;/cg/cg_hana_test</li> </ul>	svm200_bluexpdr_a800;/cg/cg_hana_test	AutomatedFailOverDuplex	Healthy	⊙ In sync	-
VMe subsystem						
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ster ^						
verview						
ardware						
ettings						
lisks						

## Infrastructure datastore

The datastore, where the OS images of the HANA system, SnapCenter and the vSphere plugin is stored is replicated in the same way as described for the HANA database datastores.

## Primary site

SnapMirror active sync behaviour is symmetric, with one important exception - primary site configuration.

SnapMirror active sync will consider one site the "source" and the other the "destination". This implies a oneway replication relationship, but this does not apply to IO behaviour. Replication is bidirectional and symmetric and IO response times are the same on either side of the mirror.

If the replication link is lost, the LUN paths on the source copy will continue to serve data while the LUN paths on the destination copy will become unavailable until replication is reestablished and SnapMirror re-enters a synchronous state. The paths will then resume serving data.

The effect of designating one cluster as a source simply controls which cluster survives as a read-write storage system if the replication link is lost.

The primary site is detected by SnapCenter and used to execute backup, restore and cloning operations.



Keep in mind, that source and destination is not tied to the SVM or storage cluster but can be different for each replication relationship.

	AP Sy	stem Manager	Search actions, objects, and pages	e Q	? 🔿
		Relationships			
SHBOARD		Local destinations Local sources			
SIGHTS					
ORAGE	~			Q Search 🛓 Do	wnload 💿 Show/hide 🗙 🖙 Filter
TWORK	~	Source	Destination		Policy type
ENTS & JOBS	~	<ul> <li>svm200_bluexpdr_a700s:NVME_FC_SCV_NEW</li> </ul>	svm200_bluexpdr_a800:	NVME_FC_SCV_NEW_dest_1	Asynchronous
OTECTION	^	<ul> <li>svm200_bluexpdr_a700s:VOLUME_NVME_FC_PLUGIN_PRI</li> </ul>	svm200_bluexpdr_a800:	vol_VOLUME_NVME_FC_PLUGIN_PRI_dest	Asynchronous
erview		vm200_bluexpdr_a700s:nvme_vvol_1	svm200_bluexpdr_a800:	vvol_nvme_1_dest	Asynchronous
ationships		<ul> <li>svm200_bluexpdr_a700s:nvme_vvol_2</li> </ul>	svm200_bluexpdr_a800:	vvol_nvme_2_dest	Asynchronous
STS	^	> svm200_bluexpdr_a700s:/cg/cg_hana_sma	svm200_bluexpdr_a800;	/cg/cg_hana_sma	Synchronous
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		n tme-a700-clus consister/ciaoup cg_hana_sma	tme-a800     CONSISTENCY GROUP     cg_hana_sma		
		O 10.61.180.97 Mediator		Ø	

## **SnapCenter configuration**

As stated at the beginning of the document, the purpose of the document is to provide best practices for a HANA environment using VMware with VMFS and SnapMirror active sync. We will only cover details and important steps relevant for this specific solution and will not explain the general SnapCenter concepts. These concepts and other additional information on SnapCenter can be found at:

TR-4614: SAP HANA backup and recovery with SnapCenter

TR-4719: SAP HANA System Replication - Backup and Recovery with SnapCenter

TR-4667: Automating SAP HANA System Copy and Clone Operations with SnapCenter

## **Pre-requisites**

In general, SnapMirror active sync should be setup before the protected resources are added to SnapCenter. If backups have been created before the setup of SnapMirror active sync, they will only exist at the original primary storage and will not be replicated afterwards.

### SnapCenter HANA resource must be auto discovered

Resources which are configured with VMware VMFS or resources protected with SnapMirror active sync must be auto discovered by SnapCenter to allow specific operations required for these configurations.

Since HANA non-data volumes are always manual configured resources in SnapCenter, they are not supported by SnapCenter out of the box. We will discuss options and workarounds for non-data volumes later in this document.

SAP HANA multiple host systems must be configured using a central HANA plugin and are therefore manual configured resources by default. Such HANA systems are not supported by SnapCenter, when using VMware VMFS or SnapMirror active sync.

### SnapCenter for VMware vSphere plugin

The SnapCenter for VMware vSphere plugin must be deployed in the VMware environment.

### Management IP address on SVM hosting the volumes

Even though clusters will be added to SnapCenter, the SVMs hosting the source and destination volumes must have a management IP address configured.

## **REST APIs for storage communication**

Management and monitoring of SnapMirror active sync requires REST API access. Therefore, SnapCenter must be configured to use REST APIs for storage communications. The parameter "IsRestEnabledForStorageConnection" in the configuration file C:\Program Files\NetApp\SMCore\SMCoreServiceHost.dll.config must be set to true.

<add key="IsRestEnabledForStorageConnection" value="true">

l · · · ・ 个 🧯 > This PC	→ Local Disk (C:) → Program Files → NetApp	SMCore > CONFIG Fi	le	
Ouick access	Name	Date modified	Туре	🖌 Size
Desktop 🖈	App.config	11/8/2024 5:34 AM	CONFIG File	6 KB
Downloads	SMCoreServiceHost.dll.config	1/17/2025 1:59 AM	CONFIG File	5 KB
Contraction and the second	SmJobLauncher.dll.config	11/8/2024 5:35 AM	CONFIG File	1 KB
Documents 🖈	SmJobsHelper.dll.config	11/8/2024 5:36 AM	CONFIG File	1 KB
Fictures 🕺	SnapDrive.Nsf.Common.Configuration.dll	11/8/2024 5:35 AM	CONFIG File	3 KB
This PC	SnapDrive.Nsf.Common.Infrastructure.dll	11/8/2024 5:35 AM	CONFIG File	1 KB
3D Objects	SnapDrive.Nsf.Common.Logging.dll.config	11/8/2024 5:35 AM	CONFIG File	з кв
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Documents	SnapDrive.Nsf.Core.Storage.dll.config	11/8/2024 5:35 AM	CONFIG File	3 KB
Downloads	SnapDrive.Nsf.ServiceProviders.dll.config	11/8/2024 5:35 AM	CONFIG File	3 KB
Music	VMWareProxy.dll.config	11/8/2024 5:35 AM	CONFIG File	1 KB
Fictures	🗋 web.config	11/8/2024 5:44 AM	CONFIG File	1 KB
Videos				

After the parameter change the SnapCenter SMCore Service must be restarted.

ile <u>A</u> ction <u>V</u> iew	Help							
•	a 🗟 🔣 📰 🕨 🖩 🛛 🕨							
Services (Local)	Services (Local)	-						
	SnapCenter SMCore Service	Name	Description	Status	Startup Type	Log On As		
	127.1	Security Accounts Manager	The startup	Running	Automatic	Local System		
	Stop the service	Sensor Data Service	Delivers dat	1.2211.221	Disabled	Local System		
	Restart the service	Sensor Monitoring Service	Monitors va		Manual (Trigg	Local Service		
		Sensor Service	A service for _		Manual (Trigg	Local System		
	Description:	Server	Supports file	Running	Automatic (Tri	Local System		
	SnapCenter service for	Shared PC Account Manager	Manages pr	00000000	Disabled	Local System		
	communicating with host.	Shell Hardware Detection	Provides not.	Running	Automatic	Local System		
		Smart Card	Manages ac	9	Manual (Trigg_	Local Service		
		Smart Card Device Enumerat	-		Disabled	Local System		
		Smart Card Removal Policy	Allows the s		Manual	Local System		
		SnapCenter SMCore Service	SnapCenter_	Running	Automatic	Local System		
		SNMP Trap	Receives tra	-	Manual	Local Service		
		Software Protection	Enables the _		Automatic (De	Network Se		
		Special Administration Cons	Allows admi		Manual	Local System		
		Spot Verifier	Verifies pote		Manual (Trigg_	Local System		
		SSDP Discovery	Discovers ne_		Disabled	Local Service		
		State Repository Service	Provides req_	Running	Automatic	Local System		
		Still Image Acquisition Events	Launches ap.,		Manual	Local System		
		Storage Service	Provides ena_	Running	Automatic (De.,	Local System		
		Storage Tiers Management	Optimizes th_		Manual	Local System		
		SysMain	Maintains a	Running	Automatic	Local System		
		System Event Notification S	Monitors sy	Running	Automatic	Local System		
		System Events Broker	Coordinates	Running	Automatic (Tri	Local System		
		System Guard Runtime Mon_	Monitors an_	<u></u>	Manual (Trigg_	Local System		
		A Task Scheduler	Enables a us	Running	Automatic	Local System		
		TCP/IP NetBIOS Helper	Provides sup	Running	Manual (Trigg	Local Service		
		Telephony	Provides Tel		Manual	Network Se		
		C. Themes	Provides use_	Running	Automatic	Local System		
		Time Broker	Coordinates _	Running	Manual (Trigg	Local Service		
		Couch Keyboard and Handw	Enables Tou	Running	Automatic (Tri	Local System		

## Add storage systems

Storage systems can be added after REST API is enabled for SnapCenter. It is required to add both storage clusters, not the individual SVM's.

NetApp Snap										
	ONTAP	Storage Azure NetApp Files								
Dashboard	Туре	ONTAP Clusters •	Search by Name						New Delete	SnapGath
Resources	ONTA	P Storage Connections							New Leicte	srapgao
Monitor		Name		IE IP		User Name	Platform	Controller License		
Reports		tme-a700s-clus.rtp.openenglab.n	<u>ietapp.com</u>	10.1	93.39.81	admin	AFF	0		
		tme-a800-01-02-cm.rtp.openeng	lab.netapp.com	10.1	93.39.129	admin	AFF	0		
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Dashboard Resources Monitor Reports	ONTAP Type ONTA	Storage         Azure NetApp Files           ONTAP SVMs         •           P Storage Connections         •           Name         •	Search by Name	J <u>È</u> IP				Platform	Now Diters	SnapGa
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Dashboard Resources Monitor Reports Hosts	ONTAP Type ONTA	Storage Axure NetApp Files ONTAP SVMs	Search by Name			tme-a800-01-02-cm.rtp.openenglab.netapp.com tme-a800-01-02-cm.rtp.openenglab.netapp.com tme-a800-01-02-cm.rtp.openenglab.netapp.com tme-a800-01-02-cm.rtp.openenglab.netapp.com		Platform AFF AFF AFF AFF AFF	Controller License	SnapGat
Dashboard Resources Monitor Reports Hosts Storage Systems		Storage Axure NetApp Files ONTAP SVMs    ONTAP SVMs	Search by Name		0.193.39.178	tme-a800-01-02-cm.rtp.openenglab.netapp.com tme-a800-01-02-cm.rtp.openenglab.netapp.com tme-a800-01-02-cm.rtp.openenglab.netapp.com tme-a800-01-02-cm.rtp.openenglab.netapp.com tme-a700s-clus.rtp.openenglab.netapp.com		Platform AFF AFF AFF AFF	Controller License	SnapGat
Resources	ONTAP Type ONTA	Storage Axure NetApp Files ONTAP SVMs	Search by Name			tme-a800-01-02-cm.rtp.openenglab.netapp.com tme-a800-01-02-cm.rtp.openenglab.netapp.com tme-a800-01-02-cm.rtp.openenglab.netapp.com tme-a800-01-02-cm.rtp.openenglab.netapp.com		Platform AFF AFF AFF AFF AFF	Controller License	SnapGat

### Add host – SnapCenter for VMware vSphere plugin

If a resource in SnapCenter is running in a virtualized VMware environment, SnapCenter leverages the SnapCenter plugin for VMware vSphere to extend the SnapCenter backup, restore and cloning workflows with the required steps on the VMware layer.

Before the host can be added in SnapCenter the SnapCenter plugin for VMware vSphere must be deployed within the VMware environment.



Credentials must be set during host add workflow, where vSphere can be selected as a host type.

ΠN	etApp SnapCenter®		٠	2	0.	🧘 scadmin	SnapCenterAdmin	🗊 Sign Out
>	Managed Hosts							×
	Search by Name	Add Host						
		Host Type vSphere • 0						
•	Name IL	Host Name Host Name or IP						
á	tme-a300-efs01-02-d1	Credentials None - +						
A.								
34		Submit Cancel						
#								
▲		A Prechecks and remote installation of plug-ins cannot be performed using the credential that is set to 'None'. Plug-ins must be manually installed and plug-in services should be up and running.						×

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>	Managed Hosts						Þ
	Search by Name	Host Details					
		Host Name tme-a300-efs01-02-d1	Alerts				
•	Name         I≟           hana-1	Host IP 10.193.39.112	No Alerts				
<b>111</b>	tme-a300-efs01-02-d1	Overall Status 🗶 Running					
A.		Host Type vSphere					
łe.		System Stand-alone					
÷:		Credentials vsphere - +					
A		Push Server Credentials					
		vCenter Host 10.193.67.87					
		vCenter Port 443					
		vCenter User administrator@vsphere.local					
		Plug-ins SnapCenter Plug-in 6.0.1 for VMware vSphere					
		VMware vSphere					
		Submit Cancel Reset					

No additional configuration required at the SnapCenter for vSphere plugin itself.

## Add host - HANA system

(;

(;

No specific requirements. Plugin deployment and auto discovery is done as usual.

With the auto discovery process SnapCenter detects that the HANA resource is running virtualized with VMFS/VMDKs. SnapCenter also detects the SnapMirror active sync setup and identifies the current primary site.

After resource auto discovery the current primary site is shown in the storage footprint section of the resource view. The detection which storage system is master is based on the output of the ONTAP command, which is used by SnapCenter.

```
volume show -vserver <vs> -volume <vol> -fields smbc-consensus,is-smbc-
master
```

n Ne	tApp Sn	napCenter®					٠		0-	👤 scadmi	n SnapCenterAdmin	🖡 Sign Out
>	SAP HANA	A 💌										×
	Search o	databases										
<b>V</b>	17 les	System	Details for selected resource									
		SMA	Туре		Multitenant Database Container							
ណ៍			HANA System Name		SMA							
			SID		SMA							
Å			Tenant Databases		SMA							
-			Plug-in Host		hana-1							
			HDB Secure User Store Key		SMAKEY							
			HDBSQL OS User		smaadm							
A			Log backup location		/usr/sap/SMA/HDB00/backup/log							
			Backup catalog location		/usr/sap/SMA/HDB00/backup/log							
			System Replication		None							
			Plug-in name		SAP HANA							
			Last backup		01/29/2025 3:14:18 AM (Completed)							
			Resource Groups		hana-1_hana_MDC_SMA							
			Policy		SM-AS-Policy							
			Discovery Type		Auto							
			Storage Footprint									
			SVM	Volume		Junction Path		ш	JN/Qtre	e		
			10.193.39.178	hana_data_	5MA			ha	ana_dat	a_SMA		

## **Policy configuration**

The policy used for the resource protected with SnapMirror active sync must be configured using SnapMirror replication even though SnapCenter does not trigger any SnapMirror update operations.

Modify SAF	P HANA Backup	o Policy								$\times$
1 Name		Select secondary replic	ation options 🚯							
2 Policy type		Update SnapMirror afte	er creating a local Snapsh	iot copy.						
3 Snapshot		Update SnapVault after	creating a local Snapsho	it copy.						
4 Replication	and backup	Secondary policy labe	Hourly	•	0					
5 Summary		Error retry count	3							
<b>NetApp</b> SnapCente						۵ ب	<b>@• ⊥</b> sc	admin SnapCen	iterAdmin	🗊 Sign Out
< SAP	bal Settings <b>Policies</b> Users an	nd Access Roles Credential Software								
Dashboard Resources	arch by Name						Modify	Copy	i Details	Delete
		E Scope	Schedule Type	Snapshot	Backu	p		Replication		
M Reports	SM-AS-Policy	Data Backup	Hourly	Copies to keep : 7 copies				SnapMirror		
Hosts										
- Storage Systems										
Settings										
Alerts										

## HANA resource protection configuration

No specific requirements. Resource protection configuration is done as usual.

## **SnapCenter backup operations**

With each backup operation, SnapCenter executes the discovery on the VMware side as well as the detection of the primary site. If there is a storage failover, SnapCenter will

detect the new primary site as soon as a backup has been executed for the resource.

## Topology view

Within the topology view, SnapCenter shows the backups of both source and destination storage clusters.

🗖 Ne	tApp SnapCenter®			• =	② - ▲ scadmin SnapCenterAdr	nin 🛛 🗊 Sign Out
>	SAP HANA 👻	SMA Topology				
	Search databases		*** <b>`</b>	s 🌶	Վ () ≕	
	Li P System SMA	Manage Copies 3 Backups 0 Clones 0 Clones Local copies 3 Backups 0 Clones Mirror copies	Bachup to Object Store Remore Protection	Backup Now Modify	Materianiz         Ditable         Configure D           Summary Card         6         Backups         6           6         Backups         6         Simphot baside backups           0         File Based backups         0         Clones           0         Snapshots Locked         0         Snapshots Locked	
A		Primary Backup(s)           search         Image: Constraint of the search of the se	Snapshot Lock Expiration	Count 1		End Date
		SnapCenter_SM-AS-Pollcy_Hourly_01-29-2025_03.00.44.5500 SnapCenter_SM-AS-Pollcy_Hourly_01-29-2025_02.10.00.0284		1		125 3:01:57 AM 🛱

n Ne	t <b>App</b> Sna	pCenter®				• •	😯 🗶 scar	dmin SnapCenterAdmin	🗊 Sign Out
>	SAP HANA	•	SMA Topology						
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<ul><li>✓</li><li>♦</li></ul>	EP	System	Manage Copies	Backup to Object Store Remove Protection	Back up Now	Modily	Maintenance	Details Configure Databa:	ie Refresh
ай			3 Backups 0 Clones Mirror copies				Summ 6 Backu	ary Card ps	
소 24			Local copies				0 File-E	oshot based backups Based backups 🕄	
æ							0 Clones 0 Snapsl	s hots Locked	
A			Secondary Mirror Backup(s)						
			search T					Cone	4 Restore
			Backup Name	Snapshot Lock Expiration		Count			End Date
			SnapCenter_SM-AS-Policy_Hourly_01-29-2025_03.13.06.0256			1		01/29/2025	3:14:18 AM 🛱
			SnapCenter_SM-AS-Policy_Hourly_01-29-2025_03.00.44.5500			1		01/29/2025	3:01:57 AM 🛱
			SnapCenter_SM-AS-Policy_Hourly_01-29-2025_02.10.00.0284			1		01/29/2025	2:11:26 AM 🛱

By clicking on the count number at the secondary storage, the current relationship and replication direction is shown. The source is always the current primary site. After a storage failover the primary site will change, and the display is adapted accordingly. All backups have always the same relationship dependent which storage system is currently the primary site.

BackupCount
a_data_SMA_dest 1

## Snapshots at storage systems

The Snapshot backups that have been created by SnapCenter are available at both HANA data volumes at both storage systems. ONTAP creates additional Snapshots on the consistency group level, which are available at all other HANA volumes as well.

The figure below shows the Snapshots of the HANA data volume at the A700 cluster.

■ ONTAP Sy	rstem Manager	Search actions, objects, and pages Q	? ↔ (
DASHBOARD	Volumes		
INSIGHTS	More		Q Search 🖙 Filter
STORAGE ^	Name	hana data SMA All Volumes	🖉 Edit 🚦 More
Overview	Q hana	Haha_data_SIVIA All volumes	🖉 Edit : More
Volumes	hana_data_SMA	Overview Snapshot copies SnapMirror Back up to cloud	
LUNs NVMe namespaces	hana_shared_SMA		
Consistency groups	hana_log_SMA	+ Add	Q Search @ Show/hide ➤ = Filter
Storage VMs	hana_test_lun	Name Snapshot copy creation ti	ime Snapshot restore size 🕕
Tiers		SnapCenter_SM-AS-Policy_Hourly_01-29-2025_03.13.06.0256 Jan/29/2025 6:13 AM	3.26 GiB
NETWORK ^		snapmirrorCG.066356b3-5506-11ef-bcf8-d039ea0503a4_2163612411.2025-01-29_110638 Jan/29/2025 6:06 AM	3.29 GiB
Overview Ethernet ports		SnapCenter_SM-AS-Policy_Hourly_01-29-2025_03.00.44.5500 Jan/29/2025 6:01 AM	3.28 GiB
FC ports		snapmirrorCG.1ab89ec7-5506-11ef-a3fb-00a098e22473_2154262914.2025-01-29_055923 Jan/29/2025 5:59 AM	3.28 GiB
EVENTS & JOBS V		SnapCenter_SM-AS-Policy_Hourly_01-29-2025_02.10.00.0284 Jan/29/2025 5:10 AM	3.28 GiB
PROTECTION ^		snapmirrorCG.1ab89ec7-5506-11ef-a3fb-00a098e22473_2154262914.2025-01-29_041600 Jan/29/2025 4:16 AM	3.26 GiB
Overview		snapmirrorCG.1ab89ec7-5506-11ef-a3fb-00a098e22473_2154262914.2025-01-29_011600 Jan/29/2025 1:16 AM	3.25 GiB
Relationships		snapmirror.1ab89ec7-5506-11ef-a3fb-00a098e22473_2154262914.2025-01-24_152850 Jan/24/2025 10:28 AM	3.16 GiB
HOSTS ^			
SAN initiator groups			
NVMe subsystem			
CLUSTER ~			
		Showing 1 - 8 of 8 Snapshot Copies	$\leftarrow$ 1 $\rightarrow$
	$\leftarrow$ 1 $\rightarrow$		

The figure below shows the Snapshots of the HANA data volume at the A800 cluster.

	ONTAP System Manager   tme-a800		Q Search actions, objects, and pages	• • •
Dashboard	← Back to Volumes			
Insights	vol_hana_data $$			
Storage ^	vol_nana_uata			
Overview	Overview Snapshots SnapMirror Back up to cloud Security	File system Quota Reports		Edit : More
Volumes				
LUNS	+ Add		Q	
NVMe namespaces	T Add		4	ш <del>т</del>
Consistency groups	Name	Snapshot creation time	Snapshot restore size 👔	
Shares	SnapCenter_SM-AS-Policy_Hourly_01-29-2025_03.13.06.0256	Jan/29/2025 6:13 AM	3.07 GiB	
Qtrees Quotas	snapmirrorCG.066356b3-5506-11ef-bcf8-d039ea0503a4_2163612411.2025-01-29_110638	Jan/29/2025 6:06 AM	3.06 GiB	
Storage VMs	SnapCenter_SM-AS-Policy_Hourly_01-29-2025_03.00.44.5500	Jan/29/2025 6:01 AM	3.05 GiB	
Tiers	snapmirrorCG.1ab89ec7-5506-11ef-a3fb-00a098e22473_2154262914.2025-01-29_055923	Jan/29/2025 5:59 AM	3.05 GiB	
Network ^	SnapCenter_SM-AS-Policy_Hourly_01-29-2025_02.10.00.0284	Jan/29/2025 5:10 AM	3.06 GiB	
Overview	snapmirrorCG.1ab89ec7-5506-11ef-a3fb-00a098e22473_2154262914.2025-01-29_041600	Jan/29/2025 4:16 AM	3.05 GiB	
Ethernet ports FC ports	snapmirrorCG.1ab89ec7-5506-11ef-a3fb-00a098e22473_2154262914.2025-01-29_011600	Jan/29/2025 1:16 AM	3.04 GiB	
Events & jobs	snapmirror.1ab89ec7-5506-11ef-a3fb-00a098e22473_2154262914.2025-01-24_152850	Jan/24/2025 10:28 AM	3.01 GiB	
	snapmirror.1ab89ec7-5506-11ef-a3fb-00a098e22473_2154262914.2025-01-24_152849	Jan/24/2025 10:28 AM	3.01 GiB	
Protection ^				
Overview				
Relationships				
Hosts ~			1 - 9 of 9 << < 1	> >>
Cluster ~				

## **SnapCenter restore and recovery**

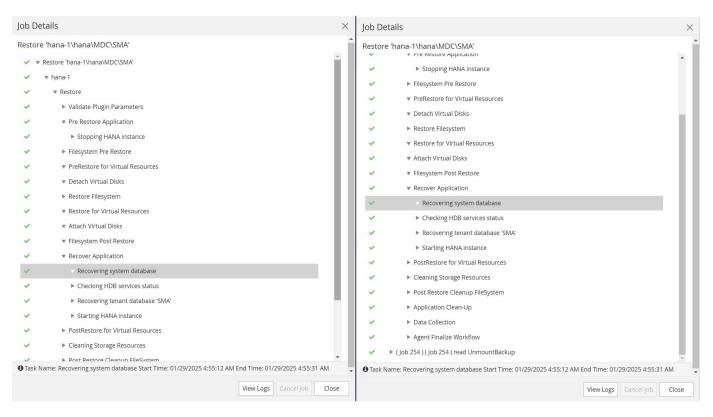
With virtual resources stored on VMFS/VMDK's a SnapCenter restore operation is always done by a clone, mount, copy operation.

- 1. SnapCenter creates a volume clone based on the selected Snapshot
- 2. SnapCenter mounts the LUN in the cloned volume as a new datastore to the ESX host

- 3. SnapCenter adds the VMDK within the datastore as a new disk to the HANA VM
- 4. SnapCenter mounts the new disk to the Linux OS
- 5. SnapCenter copies the data from the new disk back to the original location
- 6. When the copy operation is finished all above resource are removed again
- 7. The HANA recovery is done as usual

The overall runtime of the restore operation is therefore dependent on the database size and the throughput of the FC connection between the storage clusters and the ESX hosts.

In addition, when a resource is configured with SnapMirror active sync the SnapCenter restore operation can only be selected at the current primary site.



While the restore and recovery operation is running, you can see a new cloned volume, which has been created at the current primary site.

	P Sys	stem Ma	nager	Search action	s, objects, and page	ıs Q				?	
DASHBOARD		Volun	nes								
INSIGHTS		More						Q Sea	rch 🛓 Down	load @ Show/hide >	← Filt
STORAGE	^		Name	Storage VM ≑	Status	Capacity		IOPS	Latency (ms)	Throughput (MB/s)	Protection
Overview			Q hana	Q blue	( 💙	>		>	>	>	(All)
/olumes .UNs		~	hana_data_SMA	svm200_bluexpdr_a700s	🕑 Online	5.84 GiB used	298 GiB available	10	0.13	0.51	000
WMe namespaces		~	hana_data_SMA_Clone_0129250507433563	svm200_bluexpdr_a700s	🕑 Online	3.26 GiB used	320 GiB 301 GiB available	75	0.11	3.67	000
onsistency groups torage VMs		~	hana_shared_SMA	svm200_bluexpdr_a700s	🕑 Online	16 GiB used	215 GiB 188 GiB available	10	0.12	0.41	000
iers	~	~	hana_log_SMA	svm200_bluexpdr_a700s	🕑 Online	4.1 GiB used	163 GIB 150 GiB available	10	0.10	0.35	000
VENTS & JOBS		~	hana_test_lun	svm200_bluexpdr_a700s	<ul> <li>Online</li> </ul>	58.9 MiB used	1.03 TiB 1.03 TiB available	12	0.27	1.31	000
ROTECTION	~										
IOSTS	~										
LUSTER	~										

At the HANA Linux host, you can see a new disk, which got mounted to the host. When the restore operation is done the disk, datastore and volumes will be removed again by SnapCenter.

```
hana-1:~ # df -h
Filesystem Size Used Avail Use% Mounted on
devtmpfs 4.0M 8.0K 4.0M 1% /dev
tmpfs 49G 4.0K 49G 1% /dev/shm
tmpfs 13G 58M 13G 1% /run
tmpfs 4.0M 0 4.0M 0% /sys/fs/cgroup
/dev/mapper/system-root 60G 36G 24G 60% /
/dev/mapper/system-root 60G 36G 24G 60% /.snapshots
/dev/mapper/system-root 60G 36G 24G 60% /boot/grub2/i386-pc
/dev/mapper/system-root 60G 36G 24G 60% /home
/dev/mapper/system-root 60G 36G 24G 60% /boot/grub2/x86 64-efi
/dev/mapper/system-root 60G 36G 24G 60% /opt
/dev/mapper/system-root 60G 36G 24G 60% /srv
/dev/mapper/system-root 60G 36G 24G 60% /usr/local
/dev/mapper/system-root 60G 36G 24G 60% /tmp
/dev/mapper/system-root 60G 36G 24G 60% /root
/dev/mapper/system-root 60G 36G 24G 60% /var
/dev/sdb 200G 8.0G 192G 4% /hana/data/SMA/mnt00001
/dev/sdc 120G 7.0G 113G 6% /hana/log/SMA/mnt00001
/dev/sda1 253M 5.1M 247M 3% /boot/efi
/dev/sdd 150G 28G 123G 19% /hana/shared
tmpfs 6.3G 48K 6.3G 1% /run/user/467
tmpfs 6.3G 28K 6.3G 1% /run/user/0
/dev/sde 200G 8.0G 192G 4%
/var/opt/snapcenter/scu/clones/hana data SMAmnt00001 255 scu clone 1
hana-1:~ #
```

## SAP System refresh operation

Cloning operations can be executed at the primary site or the secondary storage.

The cloned volume will not be part of the HANA consistency group and will not be replicated with SnapMirror active sync.

Detailed information on the system refresh workflows can be found at: TR-4667: Automating SAP HANA System Copy and Clone Operations with SnapCenter

## SnapCenter non-data volumes

When resources are configured manually in SnapCenter and are not auto discovered, SnapCenter is not aware of VMware and SnapMirror active sync. Therefore, they are not supported natively by SnapCenter.

For non-data volumes like HANA shared, backup and restore operations could still be done using SnapCenter

when considering additional manual steps.

## Failure of the storage system configured in SnapCenter

If a failure of the storage system configured in SnapCenter occurs, SnapCenter will not automatically switch to the other storage system. The non-data volume resource must be adapted manually so that the mirrored copy of the volume is used for backup and restore operations.

🗖 Ne	<b>tApp</b> Sn	apCenter®						••	👤 scadmir	n SnapCenterAdmin	🗊 Sign Out
>	SAP HANA	•									
	Search d	databases									
•	ШP	Name	Details for selected resource								
	20	SMA-shared	Туре		Non-Data Volume						
ណី			Resource Name		SMA-shared						
A			Associated SID		SMA						
			Plug-In Host		hana-1						
10 - E			Plug-in name		SAP HANA						
÷=			Last backup		01/30/2025 1:45:51 AM (Completed)						
A			Resource Groups		hana-1_hana_NonDataVolume_SMA_SMA	shared					
4			Policy		LocalSnap						
			Discovery Type		Manual						
			Storage Footprint								
			SVM	Volume		Junction Path		LUN/Qtr	ree		
			svm200_bluexpdr_a700s	hana_shared_	_SMA			hana_sh	nared_SMA		

#### **Backup operations**

Even though SnapCenter is not aware of the SnapMirror active sync configuration for the HANA shared volume, Snapshot are replicated to both sites.

■ ONTAP S	ystem N	lanager	Search actions, objects, and pages Q			?	$\leftrightarrow$
DASHBOARD	Volu	imes					
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STORAGE ^		Name	hana shared SMA All Volumes			0.515	More
Overview		Q hana	hana_shared_swia All volumes			Ø Edit	: More
Volumes		hana_data_SMA	Overview Snapshot copies SnapMirror Back up to cloud				
LUNs NVMe namespaces		hana_shared_SMA					
Consistency groups		hana_log_SMA	+ Add		Q Search	@ Show/hide 💙	≡ Filter
Storage VMs		hana_test_lun	Name Sn	napshot copy creation time S	Snapshot restore size 🏮		
Tiers			SnapCenter_LocalSnap_Hourly_01-30-2025_01.45.31.3354 Jan	an/30/2025 4:45 AM 1	15.6 GiB		
NETWORK ~			SnapCenter_LocalSnap_Hourly_01-30-2025_01.45.22.2981 Jar	an/30/2025 4:45 AM 1	15.6 GiB		
EVENTS & JOBS 🛛 🗸			snapmirrorCG.1ab89ec7-5506-11ef-a3fb-00a098e22473_2154262914.2025-01-30_041615 Jar	an/30/2025 4:16 AM 1	15.6 GiB		
PROTECTION ^			snapmirrorCG.1ab89ec7-5506-11ef-a3fb-00a098e22473_2154262914.2025-01-30_011600 Jar	an/30/2025 1:16 AM 1	15.4 GiB		
Overview			snapmirrorCG.066356b3-5506-11ef-bcf8-d039ea0503a4_2163612411.2025-01-29_163439 Jar	an/29/2025 11:34 AM 1	16 GiB		
Relationships			snapmirrorCG.066356b3-5506-11ef-bcf8-d039ea0503a4_2163612411.2025-01-29_110638 Jar	an/29/2025 6:06 AM 1	15.9 GiB		
			snapmirror.1ab89ec7-5506-11ef-a3fb-00a098e22473_2154262915.2025-01-24_152850 Jar	an/24/2025 10:28 AM 1	14.2 GiB		
CLUSTER ^							
Overview							_
Hardware Settings							

■ NetApp	ONTAP System Manager   tme-a800		Q Search actions, objects, and pages	○ ② ↔
Dashboard	← Back to Volumes			
Insights	vol hana share $\checkmark$			
Storage ^	Overview Snapshots SnapMirror Back up to cloud Security	File system Quota Reports		🖉 Edit 🚦 More
Overview Volumes	Overview Snapshots Snapivilitor Back up to cloud Security	rie system Quota Reports		C EUR : MORE
LUNs				
NVMe namespaces	+ Add			Q 🛄 =
Consistency groups	Name	Snapshot creation time	Snapshot restore size 🍈	
Shares	SnapCenter_LocalSnap_Hourly_01-30-2025_01.45.31.3354	Jan/30/2025 4:45 AM	16.2 GiB	
Qtrees Quotas	SnapCenter_LocalSnap_Hourly_01-30-2025_01.45.22.2981	Jan/30/2025 4:45 AM	16.2 GiB	
Storage VMs	snapmirrorCG.1ab89ec7-5506-11ef-a3fb-00a098e22473_2154262914.2025-01-30_041615	Jan/30/2025 4:16 AM	16.1 GiB	
Tiers	snapmirrorCG.1ab89ec7-5506-11ef-a3fb-00a098e22473_2154262914.2025-01-30_011600	Jan/30/2025 1:16 AM	16 GiB	
Network 🗸	snapmirrorCG.066356b3-5506-11ef-bcf8-d039ea0503a4_2163612411.2025-01-29_163439	Jan/29/2025 11:34 AM	15.7 GiB	
Events & jobs 🛛 🗸	snapmirrorCG.066356b3-5506-11ef-bcf8-d039ea0503a4_2163612411.2025-01-29_110638	Jan/29/2025 6:06 AM	15.8 GiB	
Protection ~	snapmirror.1ab89ec7-5506-11ef-a3fb-00a098e22473_2154262915.2025-01-24_152850	Jan/24/2025 10:28 AM	14.1 GiB	
Hosts ~	snapmirror.1ab89ec7-5506-11ef-a3fb-00a098e22473_2154262915.2025-01-24_152849	Jan/24/2025 10:28 AM	14.1 GiB	
Cluster ~				

## **Restore operation**

In case of a restore, SnapCenter would just execute a volume restore w/o any VMware specific steps. Normally you would need to unmount the HANA shared volume at the Linux host, disconnect the datastore then do the volume restore, connect the datastore again and then mount the file system at the Linux host. As a manual operation you could stop the HANA VM, restore the HANA shared volume with SnapCenter and then restart the VM again.

## **Failover scenarios**

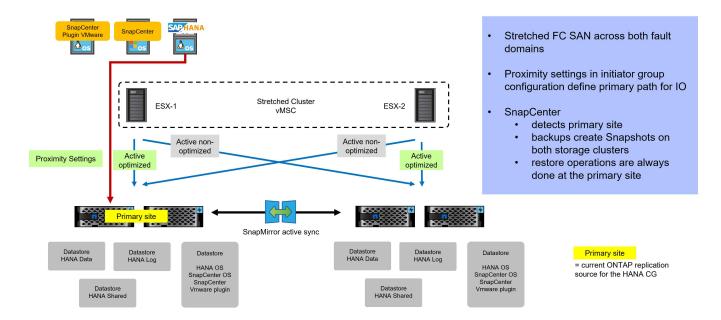
This article will highlight the failover scenarios for this solution.

## Uniform access setup

In a uniform access configuration, the fibre channel SAN is stretched across both sites. The ESX hosts at both sites could access both copies of the data sets. During normal operation, the ESX host running the HANA system is accessing the local copy of the data based on proximity settings in the initiator group configuration. Each ESX host has an active optimized path to the local copy and an active non-optimized path to the mirrored copy.

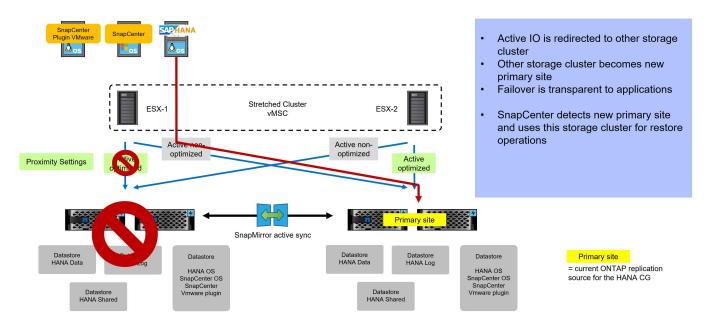
## Normal operation

During normal operation the HANA system reads and writes from/to the local copy based on the active optimized path from ESX host ESX-1. With each backup operation, SnapCenter detects the current primary site for the replication relationship and executes the backup operations against the primary site. The Snapshots are replicated to the mirrored copy and are available at both sites. A SnapCenter restore operation would be executed at the primary site.



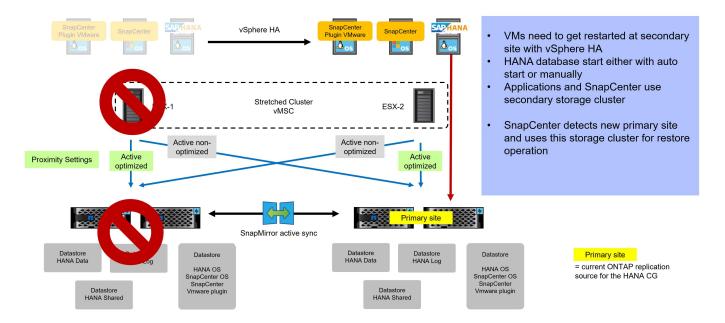
## Storage failure

If the storage system at site 1 fails, the HANA systems access the mirrored copy at site 2 and continues operation. The primary site switches to the secondary site and SnapCenter now executes backup and restore operations at the new primary site.



#### Site failure

In case of a site failure, the HANA VM as well as SnapCenter and the SnapCenter for VMware plugin VM will fail over to the ESX host at the secondary site using vSphere HA. The HANA database needs to get started and will then access the mirrored copy at the second site. The primary site switches to the secondary site and SnapCenter now executes backup and restore operations at the new primary site.

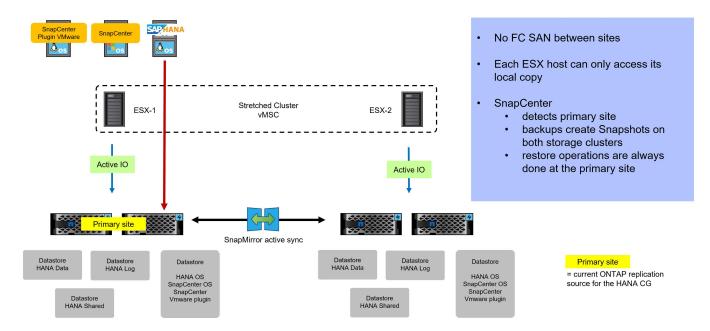


## Non-uniform access setup

In a non-uniform access configuration, the fibre channel SAN is not stretched across both sites. Each ESX host at each site can only access the local copy of the data sets.

### Normal operation

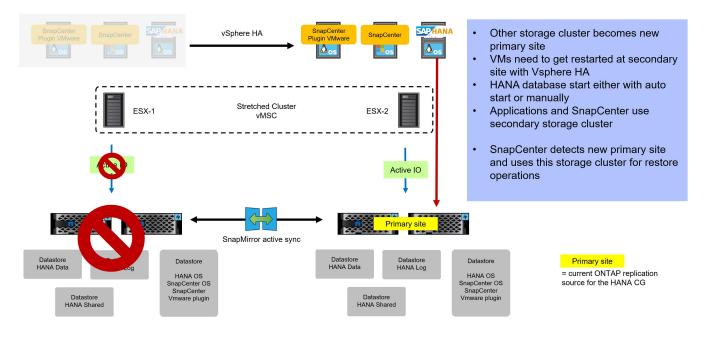
During normal operation the HANA system reads and writes from/to the local copy. With each backup operation, SnapCenter detects the current primary site for the replication relationship and executes the backup operations against the primary site. The Snapshots are replicated to the mirrored copy and are available at both sites. A SnapCenter restore operation would be executed at the primary site.



## Storage failure

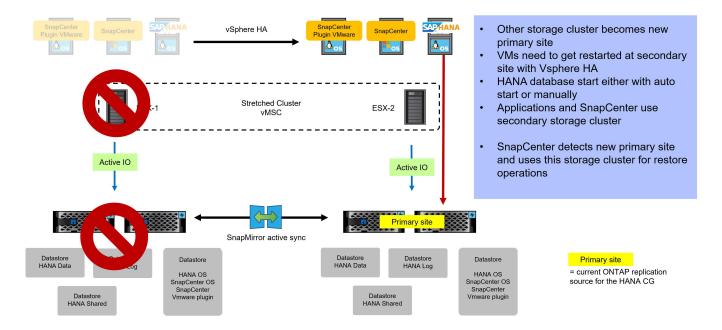
In case of a storage failure, the HANA VM as well as SnapCenter and the SnapCenter for VMware plugin VM will fail over to the ESX host at the secondary site using vSphere HA. The HANA database needs to get started and will then access the mirrored copy at the second site. The primary site switches to the secondary site and

SnapCenter now executes backup and restore operations at the new primary site.



#### Site failure

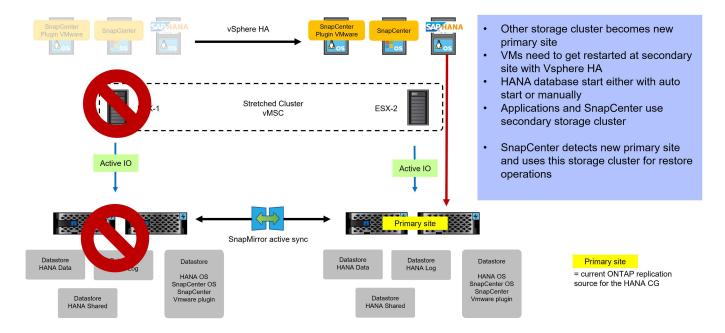
Same as storage failure.



#### Relocation of HANA VM or primary site

If the HANA VM is relocated to the other ESX host and the primary site of the storage remains the same, a restore operation with SnapCenter will fail. Since SnapCenter uses the primary site to execute restore operations, the clone will be created at the left side, while the HANA VM runs on the right side. Since there is no data path between the sites, SnapCenter will not be copy the data.

As a workaround you need to make sure, that the relocation of VM and primary side is done together, or you need to failover the primary site before the restore operation with SnapCenter.



## Additional information and version history

This article provides links to additional resources relevant to this solution.

SnapCenter:

TR-4614: SAP HANA backup and recovery with SnapCenter

TR-4719: SAP HANA System Replication - Backup and Recovery with SnapCenter

TR-4667: Automating SAP HANA System Copy and Clone Operations with SnapCenter

SnapCenter Software documentation

SnapMirror active sync:

SnapMirror active sync overview in ONTAP

NetApp ONTAP with NetApp SnapMirror active sync with VMware vSphere Metro Storage Cluster (vMSC).

VMware vSphere Metro Storage Cluster with SnapMirror active sync

VMware vSphere Metro Storage Cluster (vMSC)

Version history:

Version	Date	Comment
Version 1.0	March 2025	Initial version

# SAP HANA data protection with SnapCenter with VMware VMFS and NetApp ASA systems

## SAP HANA data protection with SnapCenter with VMware VMFS and NetApp ASA systems

This document outlines the best practices for data protection using SnapCenter for HANA systems running on VMware with datastores using VMFS and LUNs stored on NetApp ASA systems.

Author: Nils Bauer, NetApp

## Scope of this document

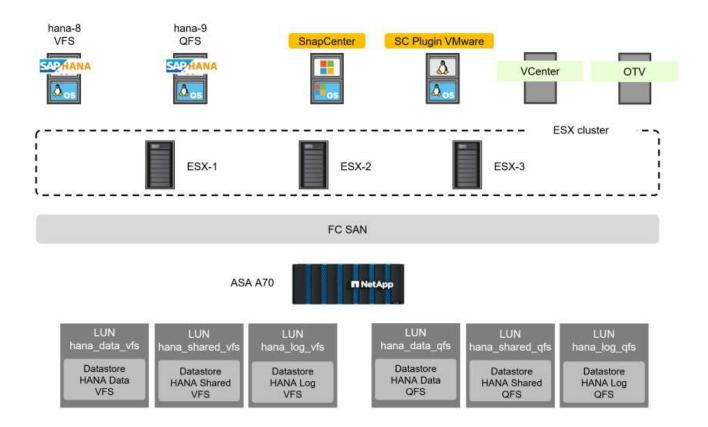
It does not serve as a step-by-step guide for configuring the entire environment but focuses on details specific to SnapCenter and HANA on VMFS, including:

- · Setting up SAP HANA systems with VMware VMFS
- Specific SnapCenter configurations for HANA on VMware with VMFS
- · SnapCenter backup, restore, and recovery operations for HANA on VMware with VMFS
- SnapCenter SAP System Refresh operations for HANA on VMware with VMFS

For further information and detailed configuration instructions, refer to the documents listed in the "Additional Information" chapter.

## Lab setup used for this document

The figure below presents a high-level overview of the lab setup utilized. Two single-host HANA MDC systems are used to demonstrate the various operations. The HANA system VFS is designated for executing backup, restore, and recovery operations, while the HANA system QFS serves as the target system for SAP System Refresh operations. The SnapCenter plug-in for VMware is essential for enabling SnapCenter to manage HANA resources configured with VMware VMFS. Although ONTAP tools for VMware were used to provision the storage units for the HANA systems, they are not a mandatory component.



### Software versions

Software	Version
ONTAP	ASA A70 ONTAP 9.16.1
vSphere client	8.0.3
ESXi	8.0.3
SnapCenter plugin for vSphere	6.1.0
ONTAP tools for VMware vSphere	10.4
Linux OS	SLES for SAP 15 SP6
SAP HANA	2.0 SPS8
SnapCenter	6.1P1

## HANA system provisioning and installation

This chapter describes the installation and configuration of the SAP HANA system specific to a VMware setup using VMFS. Additional generic best practices can be found at SAP HANA on NetApp ASA Systems with Fibre Channel Protocol.

## Storage configuration

To meet the storage performance KPIs defined by SAP for production HANA systems, dedicated LUNs and datastores must be configured for the data and log filesystems of the HANA system. Datastores must not be shared among multiple HANA systems or other workloads.

ONTAP tools for VMware (OTV) has been used to provision the three datastores for the HANA system VFS.

- hana\_data\_VFS
- hana\_log\_VFS
- hana\_shared\_VFS



The datastore for the HANA shared filesystem can also be shared across multiple HANA systems.

vSphere Client	Q Search in all envir	onments									C & Administrator@SAPCC.V	/CENTER ~ 🕲 🤅
		<	SAPCC	ACTIONS								
8 8	2		Summary Monit	or Configure Pe	ermissions	Hosts & Clusters VMs	Datastores	Networks Update:	5			
<ul> <li>Vernterê sapec stin</li> <li>SAPCC</li> <li>datastorel</li> <li>datastorel (1)</li> <li>datastorel (2)</li> <li>Datastore (2)</li> <li>Datastore (2)</li> <li>Datastore A40</li> <li>hana_data_UY</li> <li>hana_shared_</li> <li>OS_Image</li> </ul>	50 10 15 5			Hosts: 3 Virtual Machines: 38 Clusters: 1 Networks: 8 Datastores: 10		H	Capacity and Last updated at 9 CPU 9.26 GHz used Memory 375.09 GB used Storage		162 GH 2.0 3 TE 6.1		∷ assigned	đ
			Custom Attributes				VIEW STATS			ASSIGN		
				j) No custom attribut	tes assigned	1						
	larms						Quant					
k Name 🔻		Y Status		Details		Initiator T	Gueued For	Start Time 🔱 🕇	Completion Time <b>T</b>	Server		
Process VMFS datastor 🗍 <u>10.63.167.6</u> ⊘ Co updates		ompleted			System	4 ms	05/19/2025, 9:20:23 AM	05/19/2025, 9:20:23 AM	vcenter8.sapcc.stl.netapp.com	2		
Process VMFS datastor 10.63.167.4 O Completed		mpleted	sted		System	5 ms	05/19/2025, 9:20:23 AM	05/19/2025, 9:20:23 AM	vcenter8.sapcc.stl.netapp.com	2		
ate VMFS datastore	10.63.167.14	(Co				SAPCC.VCENTER\Administrat	10 ms	05/19/2025, 9:20:22	05/19/2025. 9:20:23	vcenter8.sapcc.stl.netapp.com		

## At the storage system three LUNs have been created by OTV.

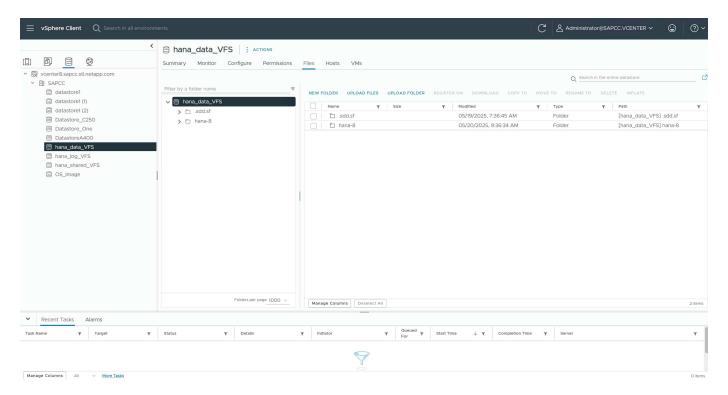
■ NetApp	ONTAP System Manager   A70-S	NPCC						Q Search actions, objects, and pages	) 🕯	0 <>	0	
Dashboard	Storage											
Insights	The basic unit of storage is a LUN (for SCSI hosts) or NVMe namespace (for NVMe). You can add LUN or NVMe namespace storage units based on your data center configuration. More 🖸											
Storage												
Hosts	19		<b>68.6</b> тів			19		0				
Network ^	Storage units	Storage units		Available		Online	Offline					
Overview	+ Add									x ± m	-	
Ethernet ports										~		
FC ports	Name		Consistency group	Capacity	Data reduction	Host mapping	IOPS	Latency (ms)	Through	put (MB/s)		
Events & jobs 🛛 👻	✓ hana_data_VFS			100 GiB	8.75 to 1	otv_host-44_e3d7e9d4-46	if3-4fda 0	0	0			
Protection ~	✓ hana_log_VFS			100 GiB	8.69 to 1	otv_host-44_e3d7e9d4-46	13-4fda 0	0	0			
Cluster ~	✓ hana_shared_VFS		£	100 GiB	3.13 to 1	otv_host-44_e3d7e9d4-46	f3-4fda 0	0	0			

## VM disk configuration

Three new disks (VMDK) must be added to the HANA VM. Each disk within one of the datastores which have been created before as illustrated in the picture below.

LUN	LUN	LUN
hana_data_VFS	hana_log_VFS	hana_shared_VFS
Datastore	Datastore	Datastore
hana_data_VFS	hana_log_VFS	hana_shared_VFS
VMDK for	VMDK for	VMDK for
HANA data	HANA log	HANA shared

vSphere Client Q Search In all environments				C 2ª	Administrator@SAPCC.VCENTER > ② ⑦ >
	Summary Monitor Confi	Edit Settings har	ia-8	×	
<ul> <li></li></ul>	Guest OS	Maximum Size	1.4 TB	PCI Devices	Related Objects
<ul> <li>bana-8</li> <li>Deitmar</li> </ul>		VM storage policy	Datastore Default ~		Cluster
Discovered virtual machine     Infrastructure		Туре	Thin Provision		Host
<ul> <li>SnapCenter HANA</li> <li>hana-1</li> </ul>		Sharing	No sharing v	(i) No PCI devices	Resource pool <u>ASAr2</u> Networks
ක් hana-11 ක් hana-2	en suse	Disk File	[Datastore_One] asa_hana01/asa_hana01.vmdk		DPortGroup-NES     ExtAccess     Storage
ළූ hana-3 ඕ hana-4 ඔා hana-5	LAUNCH REMOTE CONSOLE	Disk Mode	Dependent ~		Datastore_One
武 nana-5 武 hana-7 武 Nils-Jumpbox		Virtual Device Node	SCSI controller 0         SCSI(0:0) Hard disk 1            95         GB	EDIT	
∰ SnapCenter ∰ SnapCenter-Beta → ဤ VCLS	Tags	Maximum Size	98.34 G8	Storage Policies	
		VM storage policy	Datastore Default ~	VM Storage Policies VM Storage Policy Compliance	
	$\bigcirc$	Location	hana_data_VFS v	Last Checked Date	
	No tags assigned	Disk Provisioning	Thin Provision V	VM Replication Groups	
		Sharing	No sharing v		
Recent Tasks Alarms		Disk Mode	SCSI controller 0 v SCSI(0:1) New Hard disk v	1	
Task Name ¥ Target ¥ Sta	tus 🍸 Details	Virtual Device Node			Ψ.
Power On virtual machi @ <u>hana-8</u>	Completed		CANCEL	8.sapcc.stl.netapp.com	
Initialize powering On 📑 <u>SAPCC</u> 😔	Completed	SAPCC.VCEN or	VTER\Administrat 7 ms 05/19/2025; 9:41:32 05/19/2025; 9:41:32 AM AM	vcenter8.sapcc.stl.netapp.com	
Rename virtual machine 👘 asa hana01 🔗	Completed Reconfigu	ring Virtual Mac SAPCC.VCEN	ATER\Administrat 7 ms 05/19/2025, 9:41:22 05/19/2025, 9:41:23	vcenter8.sapcc.stl.netapp.com	Alama



When the three disk have been added to the VM, they can be listed at the OS level.

```
hana-8:~ # lsblk
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS
sda 8:0 0 100G 0 disk
-sdal 8:1 0 256M 0 part /boot/efi
 -sda2 8:2 0 82G 0 part
 -system-root 254:0 0 60G 0 lvm /root
 /var
 /usr/local
 /tmp
 /srv
 /opt
 /home
 /boot/grub2/x86++ ++64-efi
 /boot/grub2/i386-pc
 /.snapshots
 /
-system-swap 254:1 0 2G 0 lvm [SWAP]
sdb 8:16 0 95G 0 disk
sdc 8:32 0 95G 0 disk
sdd 8:48 0 95G 0 disk
sr0 11:0 1 17.1G 0 rom
```

## VM parameter disk.EnableUUID

This parameter must be set accordingly, otherwise SnapCenter database auto discovery will fail.

- 1. Shutdown VM
- 2. Add new parameter "disk.EnableUUID" and set to "TRUE"
- 3. Start VM

	nents				C	Administrator@SAPCC.VCENTER ~	© ~
• • • • • • • • • • • • • • • • • • •	hana-8     Summary Mor	Edit Settings hana-8	<b>2</b> 1	×			
<ul> <li>         ✓ I sapcc.stinetapp.com     </li> <li>         ✓ ASAr2     </li> <li>         Ø hana-8     </li> </ul>	Guest OS	pclBridge5.pciSlotNumber pclBridge6.pciSlotNumber pclBridge7.pciSlotNumber	22		5:32 AM	PCI Devices	٢
		scsi0:0.redo	24		used		
හී hana-1 කී hana-11 කී hana-2		vmware.tools.requiredversion migrate.hostLogState	12448 none		ied	(j) No PCI devices	
හි hana-3 හී hana-4 ඔ hana-5 ගී hana-7	LAUNCH REMO	i migrate.migrationId i migrate.hostLog i scsiO:1.redo	1687185440178702834 asa_hana01-52af231b.hlo		used	EDIT	
<ul> <li>Niis-Jumpbox</li> <li>SnapCenter</li> <li>SnapCenter-Beta</li> </ul>	Related Object	scsi0:2.redo scsi0:3.redo					
> Er vals	Cluster ([]) <u>Cluster</u> Host	i disk.EnableUUID guestinfo.vmtools.buildNumber guestinfo.vmtools.description	24276846 open-vm-tools 12.5.0 buil	_			
	ID.63.167.6 Resource pool ASAr2 Networks	guestinfo.vmtools.versionNumber guestinfo.vmtools.versionString	12448 12.5.0		3	No notes assigned	
✓ Recent Tasks Alarms	DPortGroup     ExtAccess	guestinfo.vmware.components.available guestinfo.appInfo	none {"version":"1", "updateCou				
Task Name         T         Target         T           ONTAP tools Discover hosts         Structure space still netapp.com         T         T	Status			CANCEL	Time <b>T</b> 15, 5:29:44	Server vcenter8.sapcc.stl.netaop.com	Y

## File system preparation at Linux host

Creation of xfs filesystem on new disks

An xfs file system has been created on each of the three new disks.

```
hana-8:~ # mkfs.xfs /dev/sdb
meta-data=/dev/sdb isize=512 agcount=4, agsize=6225920 blks
= sectsz=512 attr=2, projid32bit=1
= crc=1 finobt=1, sparse=1, rmapbt=1
= reflink=1 bigtime=1 inobtcount=0 nrext64=0
data = bsize=4096 blocks=24903680, imaxpct=25
= sunit=0 swidth=0 blks
naming =version 2 bsize=4096 ascii-ci=0, ftype=1
log =internal log bsize=4096 blocks=16384, version=2
= sectsz=512 sunit=0 blks, lazy-count=1
realtime =none extsz=4096 blocks=0, rtextents=0
Discarding blocks...Done.
hana-8:~ # mkfs.xfs /dev/sdc
meta-data=/dev/sdc isize=512 agcount=4, agsize=6225920 blks
= sectsz=512 attr=2, projid32bit=1
= crc=1 finobt=1, sparse=1, rmapbt=1
```

= reflink=1 bigtime=1 inobtcount=0 nrext64=0
data = bsize=4096 blocks=24903680, imaxpct=25

= sectsz=512 sunit=0 blks, lazy-count=1

naming =version 2 bsize=4096 ascii-ci=0, ftype=1

realtime =none extsz=4096 blocks=0, rtextents=0

= reflink=1 bigtime=1 inobtcount=0 nrext64=0
data = bsize=4096 blocks=24903680, imaxpct=25

= sectsz=512 sunit=0 blks, lazy-count=1

naming =version 2 bsize=4096 ascii-ci=0, ftype=1

realtime =none extsz=4096 blocks=0, rtextents=0

log =internal log bsize=4096 blocks=16384, version=2

log =internal log bsize=4096 blocks=16384, version=2

meta-data=/dev/sdd isize=512 agcount=4, agsize=6225920 blks

= sunit=0 swidth=0 blks

Discarding blocks...Done.

= sunit=0 swidth=0 blks

Discarding blocks...Done.

hana-8:~ #

Creation of mount points

hana-8:~ # mkfs.xfs /dev/sdd

= sectsz=512 attr=2, projid32bit=1
= crc=1 finobt=1, sparse=1, rmapbt=1

```
hana-8:/ # mkdir -p /hana/data/VFS/mnt00001
hana-8:/ # mkdir -p /hana/log/VFS/mnt00001
hana-8:/ # mkdir -p /hana/shared
hana-8:/ # chmod -R 777 /hana/log/SMA
hana-8:/ # chmod -R 777 /hana/data/SMA
hana-8:/ # chmod -R 777 /hana/shared
```

#### Configuration of /etc/fstab

```
hana-8:/ # cat /etc/fstab
/dev/system/root / btrfs defaults 0 0
/dev/system/root /var btrfs subvol=/@/var 0 0
/dev/system/root /usr/local btrfs subvol=/@/usr/local 0 0
/dev/system/root /tmp btrfs subvol=/@/tmp 0 0
/dev/system/root /srv btrfs subvol=/@/srv 0 0
/dev/system/root /root btrfs subvol=/@/root 0 0
/dev/system/root /opt btrfs subvol=/@/opt 0 0
/dev/system/root /home btrfs subvol=/@/home 0 0
/dev/system/root /boot/grub2/x86++ ++64-efi btrfs
subvol=/@/boot/grub2/x86++ ++64-efi 0 0
/dev/system/root /boot/grub2/i386-pc btrfs subvol=/@/boot/grub2/i386-pc 0
0
/dev/system/swap swap swap defaults 0 0
/dev/system/root /.snapshots btrfs subvol=/@/.snapshots 0 0
UUID=FB79-24DC /boot/efi vfat utf8 0 2
### SAPCC share
192.168.175.86:/sapcc share /mnt/sapcc-share nfs
rw,vers=3,hard,timeo=600,rsize=1048576,wsize=1048576,intr,noatime,nolock 0
0
/dev/sdb /hana/data/VFS/mnt00001 xfs relatime, inode64 0 0
/dev/sdc /hana/log/VFS/mnt00001 xfs relatime, inode64 0 0
/dev/sdd /hana/shared xfs defaults 0 0
hana-8:/#
hana-8:/ # df -h
Filesystem Size Used Avail Use% Mounted on
/dev/mapper/system-root 60G 4.4G 54G 8% /
devtmpfs 4.0M 0 4.0M 0% /dev
tmpfs 49G 0 49G 0% /dev/shm
efivarfs 256K 57K 195K 23% /sys/firmware/efi/efivars
tmpfs 13G 18M 13G 1% /run
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-tmpfiles-setup-dev-
early.service
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-sysctl.service
```

```
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-tmpfiles-setup-dev.service
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-vconsole-setup.service
/dev/mapper/system-root 60G 4.4G 54G 8% /.snapshots
/dev/mapper/system-root 60G 4.4G 54G 8% /boot/grub2/i386-pc
/dev/mapper/system-root 60G 4.4G 54G 8% /boot/grub2/x86++ ++64-efi
/dev/mapper/system-root 60G 4.4G 54G 8% /home
/dev/mapper/system-root 60G 4.4G 54G 8% /opt
/dev/mapper/system-root 60G 4.4G 54G 8% /srv
/dev/mapper/system-root 60G 4.4G 54G 8% /tmp
/dev/mapper/system-root 60G 4.4G 54G 8% /usr/local
/dev/mapper/system-root 60G 4.4G 54G 8% /var
/dev/sda1 253M 5.9M 247M 3% /boot/efi
/dev/mapper/system-root 60G 4.4G 54G 8% /root
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-tmpfiles-setup.service
tmpfs 6.3G 72K 6.3G 1% /run/user/464
tmpfs 1.0M 0 1.0M 0% /run/credentials/getty@tty1.service
tmpfs 6.3G 52K 6.3G 1% /run/user/0
192.168.175.86:/sapcc share 1.4T 840G 586G 59% /mnt/sapcc-share
/dev/sdb 95G 1.9G 94G 2% /hana/data/VFS/mnt00001
/dev/sdc 95G 1.9G 94G 2% /hana/log/VFS/mnt00001
/dev/sdd 95G 1.9G 94G 2% /hana/shared
hana-8:/ #
```

## **HANA** installation

The HANA installation can now be executed.



With the described configuration the /usr/sap/VFS directory will be on the OS VMDK. If /usr/sap/VFS should be stored in the shared VMDK, the hana shared disk could be partitioned to provide another file system for /usr/sap/VFS.

## **HANA** configuration

## Configure SnapCenter database user

A user store for a system database user must be created, which should be used by SnapCenter.

🗖 bdbstudio - /S	ecurity/Users/SNAPCENTER System: SYSTEMD8@VFS Host: hana-E	Unstance: 45 Connected II	ker: SYSTEM System Usage:	Test System - SAP HAN	A Studio								- 🗆 X
	e Search Run Window Help	instance. 45 connected o	ser. statuw system osage.	lest system - ser ment	A Studio								U A
	a v {a · to co · co · let												Q 🔡 隊
₽ Systems ×	🖺 • 🛅 🐘 • 🔤 🛜 🕴 👝 🗖	SYSTEMDB@SS2	SYSTEMDB@SS2	SYSTEMDB@SS	SYSTEMDB@SS2	👪 SMA@SMA	💃 "SYSTEMDB@V	× 😽 SYSTEMDB@VFS	SYSTEMDB@V	🖄 Backup SYST	🐁 SYSTEMDB@SS	**14	- 0
	vare FC and SM-as ^	SYSTEMDB@VFS (SYSTE	EM) VFS hana-8 45										🕞 🆕 O 🤄
	MA (SYSTEM) SMA												
	DB@SMA (SYSTEM) SMA	i User 'SNAPCENTER'	changed										÷
	single tanant 2.05P57 1.(SYSTEM) SS1 - MDC single tenan	User User Parameters											
	1 (SYSTEM) SS1 - MDC single tenan DB@SS1 (SYSTEM) SS1 - MDC single tenant												
✓ → SS1 Repair		SNAPCENTER											
	1 (SYSTEM) SS1 Repair Tenant	Disable ODBC/JD	and a										
✓ → SS2 HSR harden bare bare bare bare bare bare bare bare	ina-3 -> hana-4	Disable ODBC/ID	JBC access										
	2 (SYSTEM) SS2 - HSR Source System	Authentication											
	2 (SYSTEM) SS2 - HSR Target System	Password				SAML	SAP Logon Ticket						
	DB@SS2 (SYSTEM) SS2 - HSR Source System	Password*:	8	Confirm*:									
	DB@SS2 (SYSTEM) SS2 - HSR Target System	Force password o	change on next logon: O Ye	s 💿 No									
VFS - Vmw	INF VMDK DB@VFS (SYSTEM) VFS	Kerberos				X509	SAP Assertion Tic	ket					
Back		External ID*:											
> Catal													
> 🧁 Provi		Valid From:	May 19, 2025, 10:40:01 AM	GMT-04:00 💿 🧱	Valid Until: Jan	1, 2026, 10:39:40 AM GM	1T-05:00 💿 🔞						
🗸 🗁 Secur		6	8										
👸 Se		Session Client:											
👻 👬 Us													
	SAPDBCTRL		m Privileges Object Privilege	es Analytic Privileges	Application Privileges P	rivileges on Users							
	SNAPCENTER	÷ X						Y 28 -	Details				
	SYS SYSTEM	System Privilege		Grantor									
	XSSQLCC_AUTO_USER_3094F258A8978F7A7558E080D94C8500	🖙 BACKUP ADMI		SYSTEM									
	XSSQLCC_AUTO_USER_5E2492DBCDEDAE8BF85A0EA2741D230	See CATALOG REAL		SYSTEM									
	XSSQLCC AUTO USER D5D3B0C4F06A793778E0D4198763EC5	DATABASE BAC DATABASE REC		SYSTEM SYSTEM									
ġ.	_SYS_ADVISOR	CATABASE REC	LOVERY OPERATOR	SYSTEM									
	_SYS_AFL												
	_SYS_DATA_ANONYMIZATION												
	_SYS_EPM												
	_SYS_PLAN_STABILITY SYS_REPO												
	SYS_REPO SYS_SQL_ANALYZER												
	SYS STATISTICS												
	SYS TABLE REPLICAS												
	SYS_TASK												
	_SYS_WORKLOAD_REPLAY												
> 🙌 Re													
	S (SYSTEM) VFS												
> I SYSTEMDB	@CPI (SYSTEM) CPI HANA Cockpit												
(	, v												
	,												

#### Configure hdb userstore key

A user store key must be created for the user vfsadm. The HANA instance number must be set accordingly for communication the port. In our setup instance number "45" is used.

```
vfsadm@hana-8:/usr/sap/VFS/HDB45> hdbuserstore SET VFSKEY hana-8:34513
SNAPCENTER <password>
Retroactive report: Operation succeed.
```

Check access with:

```
vfsadm@hana-8:/usr/sap/VFS/HDB45> hdbsql -U VFSKEY
Welcome to the SAP HANA Database interactive terminal.
Type: \h for help with commands
\q to quit
hdbsql SYSTEMDB=> exit
vfsadm@hana-8:/usr/sap/VFS/HDB45>
```

## **SnapCenter configuration**

## **Pre-requisites**

#### SnapCenter HANA resource must be auto discovered

Resources configured with VMware VMFS must be auto discovered by SnapCenter to enable specific operations required for these configurations.

Since HANA non-data volumes are always manually configured resources in SnapCenter, they are not supported by SnapCenter with VMFS.

SAP HANA multiple host systems must be configured using a central HANA plugin and are therefore manually configured by default. Such systems are also not supported by SnapCenter when using VMware VMFS.

#### SnapCenter for VMWare vSphere plugin

The SnapCenter for VMware vSphere plugin must be deployed in the VMware environment.

#### Storage SVM management IP

Storage SVMs hosting the LUN's must have a management interface configured, otherwise the SVMs will not be listed in SnapCenter when adding storage with the "add cluster" option and auto discovery operation will fail.

## Job Details

Discover resources for host 'hana-8.sapcc.stl.netapp.com'

× v Discover resources for host 'hana-8.sapcc.stl.netapp.com'

<ul> <li>Thana-0.5apec.5d.netapp.com</li> </ul>	c.stl.netapp.con	hana-8.sapcc.stl.netapp.	tl.netapp	occ.s	8.sa	hana-	v	×
---	------------------	--------------------------	-----------	-------	------	-------	---	---

×	Discover
~	Complete Application Discovery
~	Discover Filesystem Resources
×	Discover Virtual Resources
~	Discover_OnFailure

😳 Failure in virtual resources discovery: [Failed to resolve the storage associated with the VMware virtual disks	
5000c2964ec4375910dc9953d9f870ca]	

View Logs

Cancel Job Close

×

NetApp SnapC	Center®				♠ ⊠ Q•	L sapcc\scadr	nin SnapCenterAdmin 🖡 Sign Ou
	ONTAP	Storage Azure NetApp Files					
Dashboard	Туре [	ONTAP SVMs    Search by Name					Here Defete SnupGather
Resources	ONTA	P Storage Connections					
Monitor		Name	J≟ IP	Cluster Name	User Name	Platform	Controller License
Reports		<u>svm1</u>	10.63.167.55	10.63.167.54		ASA	*
Hosts		hana		10.63.150.245		AFF	×
<ul> <li>Hosts</li> </ul>		hana-backup	10.63.150.246	10.63.150.245		AFF	×
Storage Systems		hana-cloud-dr		10.1.2.175		FSx	Not applicable
		hana-dr	10.63.150.247	10.63.150.245		AFF	~
Settings							

#### VM disk parameter

The parameter must be set as described in chapter "VM parameter disk.EnableUUID", otherwise SnapCenter database auto discovery will fail.

Configure Databa	se	×
Plug-in host	hana-8.sapcc.stl.netapp.com	
HDBSQL OS User	vfsadm	
HDB Secure User Store Key	VFSKEY	0
'/dev/sdb', Rea	ng storage details: [Failed to retrieve the unit serial number for the devi ison: 'SCSI inquiry falled. Check if the disk.EnableUUID parameter is set // configuration file.'.]	
	Cancel	ок

#### Configure SnapCenter to use REST APIs for storage communication

SnapCenter must be configured to use REST APIs for storage communications. Otherwise, the create Snapshot operation will fail with the error message shown below.

## Job Details

Backup of Resource Group 'hana-8\_sapcc\_stl\_netapp\_com\_hana\_MDC\_VFS' with policy 'LocalSnap'

× • Backup of Resource Group 'hana-8\_sapcc\_stl\_netapp\_com\_hana\_MDC\_VFS' with policy 'LocalSnap'

▼ hana-8.sapcc.stl.netapp.com
▼ Backup
Validate Dataset Parameters
Validate Plugin Parameters
Complete Application Discovery
Initialize Filesystem Plugin
Discover Filesystem Resources
Discover Virtual Resources
Populate storage details
Validate Retention Settings
Quiesce Application
Quiesce Filesystem
Create Snapshot
Backup_OnFailure

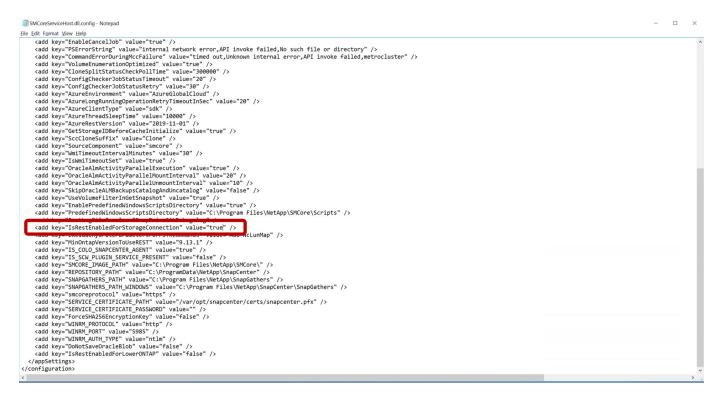
SCC-STORAGE-02002: Creating Snapshot copy [SnapCenter\_hana-8\_LocalSnap\_Hourly\_05-20-2025\_10.33.58.2195] on storage resource [svm1:hana\_data\_VFS] failed with error [Snapshot operation failed. [400]: POST, DELETE, and PATCH requests on the snapshot session endpoint are not supported on this platform.]

View Logs	Cancel Job	Close
-----------	------------	-------

The parameter "IsRestEnabledForStorageConnection" in the configuration file C:\Program Files\NetApp\SMCore\SMCoreServiceHost.dll.config must be set to "true".

<add key="IsRestEnabledForStorageConnection" value="true" />

 $\times$ 



After the change has been made, SnapCenter SMCore Service must be stopped and started.

Services (Local)	Services (Local)											
Construction of the second second	SnapCenter SMCore Service	Name	Description	Status	Startup Type	Log On As						
	Shipcenter Shicere Service	Remote Procedure Call (RPC)	The RPCSS	Running	Automatic	Network S						
	Stop the service	Remote Procedure Call (RP	In Windows	Running	Manual	Network S						
	Restart the service	Remote Registry	Enables rem		Automatic (T	Local Service						
		Resultant Set of Policy Provi			Manual	Local Syste						
	Description:	Routing and Remote Access	Offers routi		Disabled	Local Syste						
	SnapCenter service for	RPC Endpoint Mapper	Resolves RP	Running	Automatic	Network S						
	communicating with host.	Secondary Logon	Enables star	Kunning	Manual	Local Syste						
		Secure Socket Tunneling Pr	Provides su		Manual	Local System						
		Security Accounts Manager		Providence	Automatic	Local Syste						
		Security Accounts Manager Sensor Data Service	The startup Delivers dat	Running	Manual (Trig	Local System						
			Monitors va		Manual (Trig	Local System						
		Sensor Monitoring Service Sensor Service				2.000 00000000						
			A service fo	<b>2</b> 7032700	Manual (Trig	Local Syste						
		Server	Supports fil	Running	Automatic	Local Syste						
		Shell Hardware Detection	Provides no	Running	Automatic	Local Syste						
		G Smart Card	Manages ac	0.02	Disabled	Local Service						
		Smart Card Device Enumera		Running	Manual (Trig	Local Syste						
		Smart Card Removal Policy	Allows the s	-	Manual	Local Syste						
		SnapCenter SMCore Service	SnapCenter	Running	Automatic	Local Syste						
		SNMP Trap	Receives tra		Manual	Local Service						
		Software Protection	Enables the		Automatic (D	Network S						
		Special Administration Con	Allows adm		Manual	Local Syste						
		Spot Verifier	Verifies pote	120000-000	Manual (Trig	Local Syste						
		SSDP Discovery	Discovers n	Running	Manual	Local Service						
		State Repository Service	Provides re	Running	Manual	Local Syste						
		Still Image Acquisition Events	Launches a		Manual	Local Syste	-					

## Add VMware Plugin to SnapCenter

Before the host can be added in SnapCenter the SnapCenter plugin for VMware vSphere must be deployed within the VMware environment. See also Deploy SnapCenter Plug-in for VMware vSphere.



Credentials must be set during host add workflow, where vSphere can be selected as a host type.

ΠN	etApp	SnapCenter®				٠	≅ 0·	▲ sapcc\scadmin	SnapCenterAdmin	🖡 Sign Oi	ut
>		aged Hosts									
	Sea	arch by Name	Host Details								
			Host Name	scv-vmw.sapcc.stl.netapp.com	Alerts						
•		Name 11	Host IP	10.63.167.24							
<u>شا</u>		hana-1.sapcc.stl.netapp.com hana-2.sapcc.stl.netapp.com	Overall Status	Running	No Alerts						
		hana-3.sapcc.stl.netapp.com	Host Type								
Α.		hana-4.sapcc.stl.netapp.com									
÷٩		hana-7.sapcc.stl.netapp.com	System	Stand-alone							
部		hana-8.sapcc.stl.netapp.com	Credentials	SCV-sapcc •							
▲		scv-vmw.sapcc.stl.netapp.com SnapCenter.sapcc.stl.netapp.com	Push Server Credentials								
			vCenter Host								
			vCenter Port	443							
			vCenter User	administrator@sapcc.vcenter							
			Plug-ins	SnapCenter Plug-in 6.1.0 for VMware vSphere							
				VMware vSphere							
			Submit Cancel	Reset							

## Add HANA host

(i)

No specific requirements. Plugin deployment and auto discovery is done as usual.

Manget Horse         Name         Order System         <							
Name	Search	bu Nama					
P source		by Name D					
Image:		Name IL	Туре	System	Plug-in	Version	Add Remove Refresh More -
https://sancestingtabencom     Linx 0     Sandalone     SAP HAAA LUNK     6.1     P. Rinning       https://sancestingtabencom     Linx 0     Sandalone     SAP HAAA LUNK     6.1     P. Rinning       sorage System     https://sancestingtabencom     Linx 0     Sandalone     SAP HAAA LUNK     6.1     P. Rinning       sorage System     https://sancestingtabencom     Linx 0     Sandalone     SAP HAAA LUNK     6.1     P. Rinning       sotage System     https://sancestingtabencom     Linx 0     Sandalone     SAP HAAA LUNK     6.1     P. Rinning       sotage System     https://sancestingtabencom     Linx 0     Sandalone     SAP HAAA LUNK     6.1     P. Rinning       sotage System     https://sancestingtabencom     Linx 0     Sandalone     SAP HAAA LUNK     6.1     P. Rinning       sotage System     https://sancestingtabencom     Linx 0     Sandalone     SAP HAAA LUNK     6.1     P. Rinning		hana-1.sapcc.stl.netapp.com		Stand-alone	SAP HANA, UNIX	6.1	Running
a hank-laser     b hank-laser     b hank-laser     b hank-laser     6.1     e Runnig       b hank-laser     b hank-laser <td< td=""><td></td><td>hana-2.sapcc.stl.netapp.com</td><td>Linux ()</td><td>Stand-alone</td><td>SAP HANA, UNIX</td><td>6.1</td><td>Running</td></td<>		hana-2.sapcc.stl.netapp.com	Linux ()	Stand-alone	SAP HANA, UNIX	6.1	Running
Setting:     https://sancedimetespectrom     Linux 0     Sand alone     SAP HAVA, UNIX     6.1     Rinning       https://sancedimetespectrom     https://sancedimetespectrom     Linux 0     Sand alone     SAP HAVA, UNIX     6.1     Rinning       A Merts		hana-3.sapcc.stl.netapp.com	Linux 🚯	Stand-alone	SAP HANA, UNIX	6.1	Running
Arers     https://sancestingtaben.com     Linux 0     Stand-alone     SAP HANA, LNIX     6.1        Running        Image: Instanting Sancestingtaben.com     Linux 0     Stand-alone     Sancestingtaben.com     6.1        Running		hana-4.sapcc.stl.netapp.com	Linux ()	Stand-alone	SAP HANA, UNIX	6.1	Running
han-8_sepc_stinetsp.com Linux  Stand-alone Installing plug-in		hana-7.sapcc.stl.netapp.com	Linux 🚯	Stand-alone	SAP HANA, UNIX	6.1	Running
Sovermexsapecstilnetaee.com võphere Stand-alone VMware.võphere 6.1 ® Running		hana-8.sapcc.stl.netapp.com	Linux 🚯				
		scv-vmw.sapcc.stl.netapp.com	vSphere	Stand-alone	VMware vSphere	6.1	Running
			hana-Lasoccatinetapo.com       hana-Lasoccatinetapo.com       hana-Lasoccatinetapo.com       hana-Lasoccatinetapo.com       hana-Lasoccatinetapo.com       hana-Lasoccatinetapo.com       hana-Lasoccatinetapo.com	hana-Lancostinetapp.com     Linux 0       hana-Lancostinetapp.com     Linux 0	hana-1.sacc-stinetapp.com         Linux 0         Stand-alone           hana-2.sacc-stinetapp.com         Linux 0         Stand-alone           hana-3.sacc-stinetapp.com         Linux 0         Stand-alone           hana-4.sacc-stinetapp.com         Linux 0         Stand-alone           hana-4.sacc-stinetapp.com         Linux 0         Stand-alone           hana-5.sacc-stinetapp.com         Linux 0         Stand-alone           hana-5.sacc-stinetapp.com         Linux 0         Stand-alone	Nave 1_searcestIntelencom         Linux 0         Stand alone         SAP HANA_LNUX           Image 1_searcestIntelencom         Linux 0         Stand alone         SAP HANA_LNUX	Num         Linx         Standahor         Standahor

With the auto discovery process SnapCenter detects that the HANA resource is running virtualized with VMFS.

n Ne	<b>tApp</b> Sr	napCenter®						٠	Ø•	▲ sapcc\scadmin	SnapCenterAdmin	🖡 Sign Out
>	SAP HAN	A 🔽										>
	Search	databases										
•	El	System	Details for selected resource	e								
	8	Q51	Туре			Multitenant Database 0	Container					
<i>.</i>		SM1	HANA System Name			VFS						
		SS1	SID			VFS						
A		SS2	Tenant Databases			VFS						
10 B		SS2	Plug-in Host			hana-8.sapcc.stl.netapp	o.com					
=			HDB Secure User Store Key			VFSKEY						
A		VFS	HDBSQL OS User			vfsadm						
			Log backup location			/usr/sap/VFS/HDB45/ba	ackup/log					
			Backup catalog location			/usr/sap/VFS/HDB45/ba	ackup/log					
			System Replication			None						
			Plug-in name			SAP HANA						
			Last backup			None						
			Resource Groups			None						
			Policy			None						
			Discovery Type			Auto						
			Storage Footprint									
			SVM		Volume		Junction Path		LUI	N/Qtree		
			svm1						har	na_data_VFS		
	Total 6											
Activit	y Tł	ne 5 most recent jobs are displayed		🔗 5 Completed	🙆 0 Warnings	🗙 0 Failed 🛛 🙆 0 0	Tanceled 📀 0 Running 🗐 0 Queued					^

## Policy and resource protection configuration

Nothing specific to VMware with VMFS.

## **Backup operations**

Nothing specific to VMware with VMFS.

## Job Details

~

hana-8.sapcc.stl.netapp.com

Backup of Resource Group 'hana-8\_sapcc\_stl\_ne.....na\_MDC\_VFS' with policy 'LocalSnap'

✓ ▼ Backup of Resource Group 'hana-8\_sapcc\_stl\_netapp\_com\_hana\_MDC\_VFS' with policy 'LocalSnap'

	550	
~	Backup	
4	Validate Dataset Parameters	
~	Validate Plugin Parameters	
4	Complete Application Discovery	
~	Initialize Filesystem Plugin	
4	Discover Filesystem Resources	
~	Discover Virtual Resources	
~	Populate storage details	
~	Validate Retention Settings	
~	Quiesce Application	
~	Quiesce Filesystem	
~	Create Snapshot	
4	UnQuiesce Filesystem	
~	UnQuiesce Application	
~	Get Snapshot Details	
4	Get Filesystem Metadata	
~	Get Virtualization Metadata	
~	Finalize Filesystem Plugin	
4	Collect Autosupport data	
~	Register Backup and Apply Retention	

- Register Snapshot attributes
- Application Clean-Up
- Data Collection

1

Agent Finalize Workflow

Task Name: Backup Start Time: 05/21/2025 10:29:05 PM End Time: 05/21/2025 10:30:38 PM

SAP HANA 👻							
Search databases		4007	÷ 0	a a		-	
				Modify Maintenance	1 Details	Configure Database	
🗄 🎮 System	Manage Copies						
QS1							
SM1	12 Backups			Summary Card			
SS1	o clones		1.	2 Backups			
552	Local copies			12 Snapshot based backups			
SS2				0 File-Based backups () () Clones			
VFS				0 Snapshots Locked			
	Primary Backup(s)						
	search T					Clone	4
	Backup Name	Snapshot Lock Expiration	Count				
	Backup Name SnapCenter_hana-8_LocalSnap_Hourly_05-22-2025_06.29.00.3706	Snapshot Lock Expiration	Count 1			05/22/2025 6:3	
		Snapshot Lock Expiration				05/22/2025 6:3	30:1
	SnapCenter_hana-8_LocalSnap_Hourly_05-22-2025_06.29.00.3706	Snapshot Lock Expiration	1				30:1 30:1
	SnapCenter, hana-8_LocalSnap_Hourly_05-22-2025_06.29.00.3706 SnapCenter_hana-8_LocalSnap_Hourly_05-22-2025_02.29.00.3541	Snapshot Lock Expiration	1 1			05/22/2025 2:3	30:1 30:1 30:1
	SnapCenter, han-8_LocalSnap_Hourly_05-22-2025_06.29.00.3706 SnapCenter, han-8_LocalSnap_Hourly_05-22-2025_02.29.00.3541 SnapCenter, han-8_LocalSnap_Hourly_05-21-2025_22.29.03.2699	Snapshot Lock Expiration	1 1 1			05/22/2025 2:3 05/21/2025 10:3	30:1 30:1 30:1 30:1
	SnapCenter, hana-8_LocalSnap, Hourly_05-22-2025_06.29.00.3706 SnapCenter, hana-8_LocalSnap, Hourly_05-22-2025_02.29.00.3541 SnapCenter_hana-8_LocalSnap, Hourly_05-21-2025_22.29.03.2699 SnapCenter_hana-8_LocalSnap, Hourly_05-21-2025_18.29.00.3956	Snapshot Lock Expiration	1 1 1 1 1			05/22/2025 2:3 05/21/2025 10:3 05/21/2025 6:3	30:1 30:1 30:1 30:1
	SnapCenter_hane-8_LocalSnap_Hourly_05-22-2025_06.29.00.3706 SnapCenter_hane-8_LocalSnap_Hourly_05-22-2025_02.29.00.3541 SnapCenter_hane-8_LocalSnap_Hourly_05-21-2025_22.29.03.2699 SnapCenter_hane-8_LocalSnap_Hourly_05-21-2025_18.29.00.3956 SnapCenter_hane-8_LocalSnap_Hourly_05-21-2025_14.29.00.3956	Snapshot Look Expiration	1 1 1 1 1 1 1 1			05/22/2025 2:3 05/21/2025 10:3 05/21/2025 6:3 05/21/2025 2:3	30:1 30:1 30:1 30:1 30:1
	SnapCenter_hane-8_LocalSnap_Hourly_05-22:2025_06.25:00.3706 SnapCenter_hane-8_LocalSnap_Hourly_05-22:2025_02.29:00.3541 SnapCenter_hane-8_LocalSnap_Hourly_05-21:2025_22:22:00.3269 SnapCenter_hane-8_LocalSnap_Hourly_05-21:2025_18:29:00.3956 SnapCenter_hane-8_LocalSnap_Hourly_05-21:2025_14:29:00.3966 SnapCenter_hane-8_LocalSnap_Hourly_05-21:2025_10.29:00.3581	Snapshot Lock Expiration	1 1 1 1 1 1 1			05/22/2025 2:3 05/21/2025 10:3 05/21/2025 6:3 05/21/2025 2:3 05/21/2025 10:3	30:1 30:1 30:1 30:1 30:1 30:1
	SnapCenter_hane-8_LocalSnap_Hourly_05-22-2025_06.23:00.3706           SnapCenter_hane-8_LocalSnap_Hourly_05-21-2025_02.23:00.3561           SnapCenter_hane-8_LocalSnap_Hourly_05-21-2025_18.29:00.3966           SnapCenter_hane-8_LocalSnap_Hourly_05-21-2025_18.29:00.3966           SnapCenter_hane-8_LocalSnap_Hourly_05-21-2025_10.29:00.3861           SnapCenter_hane-8_LocalSnap_Hourly_05-21-2025_10.29:00.3861           SnapCenter_hane-8_LocalSnap_Hourly_05-21-2025_10.29:00.3861	Snapshot Look Expiration				05/22/2025 2:3 05/21/2025 10:3 05/21/2025 6:3 05/21/2025 2:3 05/21/2025 10:3 05/21/2025 6:3	30:1 30:1 30:1 30:1 30:1 30:1 30:1
	SnapCenter_hane-8_LocalSnap_Hourly_05-22-2025_06.23.00.3706           SnapCenter_hane-8_LocalSnap_Hourly_05-22-2025_02.23.00.3541           SnapCenter_hane-8_LocalSnap_Hourly_05-21-2025_18.29.00.3956           SnapCenter_hane-8_LocalSnap_Hourly_05-21-2025_18.29.00.3956           SnapCenter_hane-8_LocalSnap_Hourly_05-21-2025_14.29.00.3966           SnapCenter_hane-8_LocalSnap_Hourly_05-21-2025_14.29.00.3966           SnapCenter_hane-8_LocalSnap_Hourly_05-21-2025_14.29.00.3960           SnapCenter_hane-8_LocalSnap_Hourly_05-21-2025_14.29.00.3900           SnapCenter_hane-8_LocalSnap_Hourly_05-21-2025_02.29.00.3910	Snapshot Look Expiration	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			05/22/2025 2:3 05/21/2025 10:3 05/21/2025 6:3 05/21/2025 10:3 05/21/2025 10:3 05/21/2025 6:3 05/21/2025 6:3	30:1 30:1 30:1 30:1 30:1 30:1 30:1 30:1
	SnapCenter_hame_&_LocalSnap_Hourly_05-22-2025_06.29.00.3706           SnapCenter_hame_&_LocalSnap_Hourly_05-22-2025_02.29.00.3541           SnapCenter_hame_&_LocalSnap_Hourly_05-21-2025_12.29.00.3969           SnapCenter_hame_&_LocalSnap_Hourly_05-21-2025_14.29.00.3966           SnapCenter_hame_&_LocalSnap_Hourly_05-21-2025_14.29.00.3966           SnapCenter_hame_&_LocalSnap_Hourly_05-21-2025_14.29.00.3966           SnapCenter_hame_&_LocalSnap_Hourly_05-21-2025_02.29.00.3981           SnapCenter_hame_&_LocalSnap_Hourly_05-21-2025_02.29.00.3950           SnapCenter_hame_&_LocalSnap_Hourly_05-21-2025_02.29.00.3951           SnapCenter_hame_&_LocalSnap_Hourly_05-21-2025_02.29.00.3951	Snapshot Look Expiration				05/22/2025 2:3 05/21/2025 10:3 05/21/2025 6:3 05/21/2025 2:3 05/21/2025 10:3 05/21/2025 6:3 05/21/2025 2:3 05/21/2025 2:3	30:1 30:1 30:1 30:1 30:1 30:1 30:1 30:1

SnapCenter creates a consistency group (CG) and adds the storage unit hana\_data\_VFS to the CG. Snapshots are created at CG level.

■ NetApp	ONTAP Syste	m Manager   A70-SA	PCC					Q Search actions, objects, and pages	) 🖬	0	<>	θ
Dashboard	Storage											
Insights	The basic unit	of storage is a LUN (for S	CSI hosts) or NVMe namespace (for	NVMe). You can add LUN or NVMe	namespace storage units based of	on your data center configuration. M	lore 🖸					
Storage												
Hosts		19		68.5 тів		⊘ 19		⊘ ⊗				
Network ^		Storage units		Available		Online		Offline				
Overview Ethernet ports	+ Add									q ±	Ш	Ŧ
FC ports		Name	Consistency group	Capacity	Data reduction	Host mapping	IOPS	Latency (ms)	Throug	hput (MB/	s)	
Events & jobs 🛛 👻	~	hana_data_VFS	sc20250520_110422_689	100 GiB	1 to 1	otv_host-44_e3d7e9d4-46f3-4	lfda 1	0.07	0			
Protection ^	~	hana_log_VFS		100 GiB	1.19 to 1	otv_host-44_e3d7e9d4-46f3-4	lfda 4	0.23	0.41			
Overview Consistency groups	~	hana_shared_VFS	-	100 GiB	2.8 to 1	otv_host-44_e3d7e9d4-46f3-4	lfda 6	0.23	0.43			

■ NetApp	ONTAP System Manager   A70-SAPCC			Q Search actions, objects, and pages	) # 0 * 0
Dashboard	← Back to consistency groups				
Insights	sc20250520_11 ~				
Storage					
Hosts	Overview Snapshots Replication				🖉 Edit 🗄 More
Network ^					
Overview	Storage VM svm1	Storage units		Application type VMware	
Ethernet ports					
FC ports					
Events & jobs 🛛 🛩	Protection				Show uninitialized
Protection ^					
Overview	Snapshots		Replication		
Consistency groups	😥 None		10 None		
Policies					
Replication					
Cluster ~	Storage units				
	Delete X Remove from consistency group				Ŧ
	Name	Capacity	Host mapping		
	hana_data_VFS	100 GiB	otv_host-44_e3d7e9d4-46f3-4fda-aba3-00c1be	4c0fcf +2	

NetApp	ONTAP System Manager   A70-SAPCC		Q Search actions, objects, and pages	¥1 😧	<>
Dashboard	← Back to consistency groups				
nsights itorage	sc20250520_110422 ~				
osts	Overview Snapshots Replication			🖉 Edit	More
ietwork ~	+ Add Policy -			م	
rotection	Name	Created	SnapMirror label		
Overview	SnapCenter_hana-8_LocalSnap_Hourly_05-20-2025_11.03.44.3420	May/20/2025 11:10 AM			
Consistency groups	SnapCenter_hana-8_LocalSnap_Hourly_05-20-2025_14.29.00.3840	May/20/2025 2:36 PM			
olicies eplication	SnapCenter_hana-8_LocalSnap_Hourly_05-20-2025_18.29.00.3611	May/20/2025 6:36 PM			
uster ~	SnapCenter_hana-8_LocalSnap_Hourly_05-20-2025_2229.00.3896	May/20/2025 10:36 PM			
	SnapCenter_hana-8_LocalSnap_Hourly_05-21-2025_02.29.00.3515	May/21/2025 2:36 AM			
	SnapCenter_hana-8_LocalSnap_Hourly_05-21-2025_06/29.00.3960	May/21/2025 6:36 AM			
	SnapCenter_hana-8_LocalSnap_Hourly_05-21-2025_10.29.00.3581	May/21/2025 10:36 AM			
	SnapCenter_hana-8_LocalSnap_Hourly_05-21-2025_14.29.00.3696	May/21/2025 2:36 PM			
	SnapCenter_hana-8_LocalSnap_Hourly_05-21-2025_18.29.00.3956	May/21/2025 6:36 PM			
	SnapCenter_hana-8_LocalSnap_Hourly_05-21-2025_2229.03.2699	May/21/2025 10:36 PM			
	SnapCenter_hana-8_LocalSnap_Hourly_05-22-2025_02.29.00.3541	May/22/2025 2:36 AM			
	SnapCenter_hana-8_LocalSnap_Hourly_05-22-2025_06/29.00.3706	May/22/2025 6:36 AM			

## **Restore and recovery operations**

With virtual resources stored on VMFS/VMDK's SnapCenter restore operations are always done by a clone, mount, copy operation.

- 1. SnapCenter creates a storage clone based on the selected Snapshot
- 2. SnapCenter mounts the LUN as a new datastore to the ESX host
- 3. SnapCenter adds the VMDK within the datastore as a new disk to the HANA VM
- 4. SnapCenter mounts the new disk to the Linux OS
- 5. SnapCenter copies the data from the new disk back to the original location

- 6. When the copy operation is finished all above resource are removed again
- 7. SnapCenter executes recovery of the HANA system database
- 8. SnapCenter executes recovery of the HANA tenant database

The overall runtime of the restore operation is dependent on the database size and the throughput of the FC connection between the storage clusters and the ESX hosts. In our lab setup with an initial HANA installation the runtime has been around 12 minutes.

Restore from Sn	apCenter_hana-8_LocalSnap_Hourly_05-22-2025_06.29.00.3706	×
1 Restore scope	Select the restore types	
2 Recovery scope	Complete Resource ()	
3 PreOps	O Tenant Database	
4 PostOps		
5 Notification		
6 Summary		
Restore scope	apCenter_hana-8_LocalSnap_Hourly_05-22-2025_06.29.00.3706 Recover database files using	×
Restore scope	Recover database files using	
2 Recovery scope	<ul> <li>Recover to most recent state</li> <li>Recover to point in time</li> </ul>	
3 PreOps	Recover to specified data backup	
4 PostOps	O No recovery 1	
5 Notification	Specify log backup locations ()	
	Specify log backup locations ①	
5 Notification 6 Summary		
	Add	

While the restore and recovery operation is running, you can see a new cloned storage unit.

≡ <b>⊓</b> Net	App	ONTAP System Manager   A70-SA	PCC							Q Search actions, objects, and pages	) er (		θ
Dashboard		Storage											
Insights		The basic unit of storage is a LUN (for S	CSI hosts) or NVMe namespace (for NVMe).	You can add LUN or NVMe namespace stora	ge units based on yo	ur data center configur	ation. More 🖸						
Storage													
Hosts		20		68.6 тів			<u></u> 2	0		0			
Network	~	Storage units		Available			On	line		Offline			
Events & jobs	×	+ Add									Q	± 00	Ŧ
Protection	Ý	Name		Consistency group	Capacity	Dat	a reduction	Host mapping	IOPS	Latency (ms)	Throughput	(MB/s)	
Cluster	ř	<ul> <li>hana_data_VFS</li> </ul>		sc20250520_110422_689	100 GiB	1.0	to 1	otv_host-44_e3d7e9d4	46f3-4fda 0	0	0		
		hana_data_VFS_Clone_	0522250947396031		100 GiB	1 to	1	otv_host-57_e3d7e9d4	46f3-4fdi -		-		
		✓ hana_log_VFS			100 GiB	1.19	to 1	otv_host-44_e3d7e9d4	46f3-4fd: 0	0	0		
		hana_shared_VFS			100 GiB	2.3	to 1	otv_host-44_e3d7e9d4	46f3-4fdi 0	0	0		

The new LUN (datastore) based on the cloned storage unit gets attached to the ESX cluster.

vSphere Client Q Search in all environments				C	Administrator@SAPCC.VCENTER ~	୭ ~
<	hana_data_VFS(sc-202505220948073	(386) ACTIONS				
0 P = 0	Summary Monitor Configure Permissions Files					
<ul> <li>✓ (Q) vcenter8.sapcc.stl.netapp.com</li> <li>✓ (E) SAPCC</li> <li>(E) datastore1</li> <li>(E) datastore1 (1)</li> </ul>	Filter by a folder name v	NEW FOLDER UPLOAD FILES U     Name      T		LOAD COPY TO MOVE TO RENAME TO DELETE Y Type Y		2 T
datastore1 (2)	> 🗀 .sdd.sf	Sdd.sf		5, 7:36:45 AM Folder	[hana_data_VFS(sc-20250522094807386)].sdd.sf	÷
Datastore_C250     Datastore_One	> 🗅 hana-8	□   □ hana-8	05/22/202	25, 9:48:25 AM Folder	[hana_data_VFS(sc-20250522094807386)] hana-8	
<ul> <li>☐ DataStoreAA00</li> <li>☐ hang_data_VFS</li> <li>☐ hang_data_VFS</li> <li>☐ hang_state_VFS</li> <li>☐ hang_stated_VFS</li> <li>☐ os_image</li> </ul>	Peiersprace 1000 v	Manage Columns Deselect All			2	ltems
					2	
Recent Tasks     Alarms						
Task Name Y Target Y Status		T Gueued T	Start Time $\downarrow$ $\psi$ Completion Time	a T Server	-	т
Reconfigure virtual mac @ <u>hana-8</u>	mpleted SAPCC.v	VCENTER\Administrat 7 ms	05/22/2025, 9:48:25 05/22/2025, 9 AM AM	9:48:26 vcenter8.sapcc.stl.netapp.com		
		VCENTER\Administrat 5 ms	05/22/2025, 9:48:15 05/22/2025, 9 AM AM	9:48:21 vcenter8.sapcc.stl.netapp.com		
Besignature unresolved 10 63 167.6 O Co Manage Columns All V More Tasks	moleted SAPCC \	\/CENTER\∆riministrat4 ms	05/22/2025 9:48:05 05/22/2025 9	9:48:05 vcenter8 sance stillnetann.com	6	5 items

The VMDK within the datastore gets mapped to the target HANA VM and mounted to the HANA system.

```
hana-8:~ \# df -h
Filesystem Size Used Avail Use% Mounted on
/dev/mapper/system-root 60G 5.3G 54G 9% /
devtmpfs 4.0M 8.0K 4.0M 1% /dev
tmpfs 49G 0 49G 0% /dev/shm
efivarfs 256K 57K 195K 23% /sys/firmware/efi/efivars
tmpfs 13G 26M 13G 1% /run
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-tmpfiles-setup-dev-
early.service
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-sysctl.service
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-sysusers.service
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-tmpfiles-setup-dev.service
/dev/mapper/system-root 60G 5.3G 54G 9% /.snapshots
/dev/mapper/system-root 60G 5.3G 54G 9% /boot/grub2/i386-pc
/dev/mapper/system-root 60G 5.3G 54G 9% /boot/grub2/x86++ ++64-efi
/dev/mapper/system-root 60G 5.3G 54G 9% /home
/dev/mapper/system-root 60G 5.3G 54G 9% /opt
/dev/mapper/system-root 60G 5.3G 54G 9% /root
/dev/mapper/system-root 60G 5.3G 54G 9% /srv
/dev/mapper/system-root 60G 5.3G 54G 9% /usr/local
/dev/mapper/system-root 60G 5.3G 54G 9% /tmp
/dev/mapper/system-root 60G 5.3G 54G 9% /var
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-vconsole-setup.service
/dev/sdc 95G 8.9G 87G 10% /hana/log/VFS/mnt00001
/dev/sdb 95G 7.6G 88G 8% /hana/data/VFS/mnt00001
/dev/sdd 95G 15G 81G 16% /hana/shared
/dev/sda1 253M 5.9M 247M 3% /boot/efi
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-tmpfiles-setup.service
192.168.175.86:/sapcc share 1.4T 858G 568G 61% /mnt/sapcc-share
tmpfs 6.3G 72K 6.3G 1% /run/user/464
tmpfs 1.0M 0 1.0M 0% /run/credentials/getty@tty1.service
tmpfs 6.3G 52K 6.3G 1% /run/user/0
/dev/sde 95G 9.2G 86G 10%
/var/opt/snapcenter/scu/clones/hana data VFS mnt00001 142592 scu clone 1
hana-8:~ #
```

## Job Details

Restore 'hana-8.sapcc.stl.netapp.com\hana\MDC\VFS'

~	# hana-8.sapcc.stl.netapp.com
~	* Restore
~	Validate Plugin Parameters
	Pre Restore Application
~	▼ Stopping HANA Instance
~	▼ Filesystem Pre Restore
~	PreRestore for Virtual Resources
~	Detach Virtual Disks
~	Restore Filesystem
~	Restore for Virtual Resources
1	Attach Virtual Disks
1	Filesystem Post Restore
1	Recover Application
~	PostRestore for Virtual Resources
~	Cleaning Storage Resources
4	Post Restore Cleanup FileSystem
~	Application Clean-Up
~	Data Collection
~	Agent Finalize Workflow
~	▶ ( Job 142596 ) ( Job 142596 ) read UnmountBackup
Task	Name: Recover Application Start Time: 05/22/2025 9:56:13 AM End Time: 05/22/2025 9:58:15 AM

## **SAP System Refresh**

Detailed information on SAP System Refresh operations using SnapCenter can be found at TR-4667: Automating SAP HANA System Copy and Clone Operations with SnapCenter.

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The second HANA system QFS has been provisioned in the same way as described in chapter "HANA system provisioning and installation".

## Prerequisites

The current version of SnapCenter (6.1P1) has some limitations which are planned to get fixed with next releases.

- 1. It is required to restart the spl process after each "clone create" and "clone delete" workflows using the command "systemctl restart spl" at the target HANA host.
- 2. The HANA VMs used as source and target of the SAP system refresh operation must run on the same ESX host.

#### Workflow summary

Before the first SAP System Refresh operation can be executed, the target HANA system must be installed, and the host must be added to SnapCenter. Then the HANA system must be shut down and the HANA data disk must be unmounted from host.

## SnapCenter clone create workflow

- 1. Create storage clone
- 2. Configure host mapping for storage clone
- 3. Attach storage clone (datastore) to ESX host
- 4. Add new disk from datastore to target HANA VM
- 5. Mount disk to HANA VM OS
- 6. Recover HANA system using post-script

## Runtime: 12 minutes



Compared to the restore operation, the runtime of the clone operation is independent from the size of the HANA database. The runtime of step 1-5 will be similar also for very large databases. Recovery will of course take longer for larger HANA systems.

## SnapCenter clone delete workflow

- 1. Shutdown HANA system using pre-script
- 2. Unmount disk from HANA VM OS
- 3. Remove disk from HANA VM
- 4. Remove datastore from ESX host
- 5. Delete storge clone

Runtime: 11 minutes

## SnapCenter clone create workflow

The clone create workflow is started by selecting the desired Snapshot and by clicking on the clone button.

SAP HAI	SnapCenter®	VFS Topology		• =	
Search	h databases			💼 o 🧪	🔧 🕕 🚍
12 PM	System		Backup to Object S	itore Remove Protection Back up Now Modify	Maintenance Details Configure Database I
A	QFS	Manage Copies			
		12 Backups		Su	mmary Card
8	QS1	0 Clones		13 Baci	
	SM1	Local copies			apshot based backups
	SS1				e-Based backup 🗸
	S52			0 Clor	es
	SS2			0 Snaj	oshots Locked
	VFS				
		Primary Backup(s)			
		search Y			Clone From Backup
		alaman U			Cone Restor
		Backup Name	Snapshot Lock Expiration	Count	Er
		SnapCenter_hana-8_LocalSnap_Hourly_06-16-2025_06.29.00.4157		1	06/16/2025 6:30:29
		SnapCenter_hana-8_LocalSnap_Hourly_06-16-2025_02.29.00.4072		1	06/16/2025 2:30:28
		SnapCenter_hana-8_LocalSnap_Hourly_06-15-2025_22.29.00.4010		1	06/15/2025 10:30:30
		SnapCenter_hana-8_LocalSnap_Hourly_06-15-2025_18.29.00.3828		1	06/15/2025 6:30:28
		SnapCenter_hana-8_LocalSnap_Hourly_06-15-2025_14.29.00.3772		1	06/15/2025 2:30:28
		SnapCenter_hana-8_LocalSnap_Hourly_06-15-2025_14.29.00.3772 SnapCenter_hana-8_LocalSnap_Hourly_06-15-2025_10.29.00.4143		1	
					06/15/2025 10:30:28
		SnapCenter_hana-8_LocalSnap_Hourly_06-15-2025_10.29.00.4143		1	06/15/2025 10:30:28 06/15/2025 6:30:28
		SnapCenter_hana & LocalSnap_Hourly_06-15-2025_10.29.00.4143 SnapCenter_hana & LocalSnap_Hourly_06-15-2025_06.29.00.3640		1	06/15/2025 2:30:28 06/15/2025 1:30:28 06/15/2025 6:30:28 06/15/2025 2:30:34 06/14/2025 1:030:28
		SnapCenter, hana-8_LocalSnap_Hourly_06-15-2025_10.29.00.4143 SnapCenter_hana-8_LocalSnap_Hourly_06-15-2025_06.29.00.3640 SnapCenter_hana-8_LocalSnap_Hourly_06-15-2025_02.29.03.3879		1 1 1	06/15/2025 10:30:28 06/15/2025 6:30:28 06/15/2025 2:30:34
		SnapCenter, Jhan-& LocalSnap, Hourly, 06-15-2025, 10.29.00.4143 SnapCenter, Jhan-& LocalSnap, Hourly, 06-15-2025, 96:29.00.340 SnapCenter, Jhan-& LocalSnap, Hourly, 06-16-2025, 202.30.3379 SnapCenter, Jhan-& LocalSnap, Hourly, 06-14-2025, 22.29.00.3826		1 1 1 1 1	06/15/2025 10:30:28 06/15/2025 6:30:28 06/15/2025 2:30:34 06/15/2025 2:30:34

The target host and SID must be provided.

Clone From Ba	×			
1 Location	Select the host to	create the clone		
2 Settings	Plug-in host	hana-9.sapcc.stl.netapp.com	- 0	
3 Scripts	Target Clone SID	QFS	0	
4 Notification				
5 Summary				

ckup		
LUN Map Setting	32	
Igroup protocol	FCP	
	Select Mixed	
	FCP	
	ISCSI	
	LUN Map Setting	LUN Map Settings Igroup protocol FCP Select Mixed

In our example we are using a post-script to execute the recovery at the target host.

Clone From Ba	ackup
1 Location	The following commands will run on the Plug-in Host: hana-9.sapcc.stl.netapp.com
2 Settings	Enter optional commands to run before performing a clone operation 1
3 Scripts	Pre clone command
4 Notification	h.
5 Summary	Enter optional commands to run after performing a clone operation 🚯
	/mnt/sapcc-share/SAP-System-Refresh/sc-system-refresh.sh Post clone command

×

When the workflow is started SnapCenter creates a cloned storage unit based on the selected Snapshot.

■ NetApp	ONTAP System Manager   A70-SAPCC					Q Search actions, objects, and pages	) * 0 * 6
Dashboard Insights	Storage The basic unit of storage is a LUN (for SCSI hosts) or NVMe namespace (for NVMe). You	a can add LUN or NVMe namespace stora	ge units based on your data center	r configuration. More			
Storage Hosts Network ~	22 Storage units	68.5 TIB Available		Online		O Offline	
Events & jobs Protection	+ Add	Consistency group	Capacity	Data reduction	Host mapping IOPS	Latency (ms)	Q ≟ III = Throughput (MB/s)
Cluster ~	✓ hana_data_QFS	-	100 GiB	5.46 to 1	otv_host-44_e3d7e9d4-46f3-4fdz 4	0.11	0.39
	✓ hana_data_VFS	sc20250520_110422_689	100 GIB	1 to 1	otv_host-44_e3d7e9d4-46f3-4fdi 5	0.12	0.39
	hana_data_VFS_Clone_06172507005037511     hana_log_QFS		100 GiB	1 to 1 4.1 to 1	otv_host-57_e3d7e9d4-46f3-4fdi 23	0.11	0.39
	hana_log_VFS	-	100 GIB	1.22 to 1	otv_host-44_e3d7e9d4-46f3-4fda 8	0.12	0.40
	hana_shared_QFS		100 GiB	2.81 to 1	otv_host-44_e3d7e9d4-46f3-4fda 5	0.11	0.39
	hana_shared_VFS		100 GiB	1.69 to 1	otv_host-44_e3d7e9d4-46f3-4fdz 5	0.13	0.39

SnapCenter then attaches the LUN (datastore) to the ESX host, on which the target HANA VM is running.

vSphere Client Q Search in all environments		C & Administrator@SAPCC.VCENTER ~ ③
	( 10.63.167.6 : ACTIONS	
B, E Ø	Summary Monitor Configure Permissions VMs Datastores Networks Updates	
vcenter8.sapcc.stl.netapp.com		
B SAPCC	Quick Filter v Entervalue	
✓ []] Cluster	Name         ↑         Status         Type         Datastore Cluster         Capacity         Free	
10.63.167.14	□         III         datastorel (2)         ✓         Norm         VMFS 6         766 GB         764 58 GB	
10.63.167.4		
<ul> <li>10.63.167.6</li> <li>ASAr2</li> </ul>	□ III	
> @ Deitmar	I II Datastore One V Norm NFS 3 2.85 TB 1.22 TB	
O InrastructurePool     O SnapCenter HANA	□ II B DatastoreA400	
<ul> <li>✓ SnapCenter HANA</li> <li> <sup>™</sup> hana-1     </li> </ul>	al [# ] hana_data_OFS	
健 hana-11 健 hana-2	al	
jp hana-2 ∰ hana-3	al	
🔯 hana-4	□         II         □         hana data VES/sc-2025061         ✓ Norm         VMFS 6         99.75 GB         90.94 GB           7077015334)         al	
∰ hana-5 ∰ hana-7	□ I II	
📅 hana-8	□ III 🗎 hana log VFS	
₫ hana-9 ₫ Nils-Jumpbox	I II I hana shared QFS VNOrm VMFS 6 99.75 GB 87 GB	
SnapCenter	□ #	
SnapCenter-Beta	al	
scv-6.1.0.6246937-250221_0406		
	Manage Columns Export Destlect All	litems per page 35 $ \sim $ 12
Recent Tasks Alarms		
Jame Y Target Y Sta	atus Y Details Y Initiator Y Queved Y Start Time J Y Completion Time Y Server	
	Par	

The VMDK within the new datastore is then added to the HANA VM.

<b>vSphere Client</b> Q Search in all environm	nents					C	Administrator@SAPCC.VCENTE	ir ~ 🖸 😳	0 0 ~
	Summary Mor	Edit Settings   hana	a-9			×			
✓	Guest OS	Virtual Hardware VM Option	Advanced Paramete	rs	ADD NEW DEVICE ~	7:27 AM	# PCI Devices		Ø
<ul> <li>□ 10.63.167.14</li> <li>□ 10.63.167.4</li> <li>□ 10.63.167.6</li> <li>&gt; ⊘ ASAr2</li> </ul>		> CPU > Memory	<u>8 ~</u> (1) 64	✓ GB ∨		used			
>      O Deitmar     O InrastructurePool     O SnapCenter HANA		Hard disks     Hard disk 1	5 total   480 GB	GB ~	I	æd	(i) No PCI devices		
යි hana-1 ගී hana-11 ගී hana-2 ගී hana-3	LAUNCH REMO	Hard disk 2     Hard disk 3	95 95	GB ~ GB ~	1	used			
හි hana-4 යු hana-5 සී hana-7		<ul> <li>Hard disk 4</li> <li>Hard disk 5</li> </ul>	95 95		1		EDIT		
값 hana-8 값 hana-9 값 Nils-Jumpbox 값 SnapCenter	Related Objec Cluster (I) <u>Cluster</u>	Maximum Size	99.75 GB				** Notes		
团 SnapCenter-Beta 团 scv-6.1.0.6246937-250221_0406	Host 10.63.167.6 Resource pool SnapCente Networks	VM storage policy Type	Datastore Default ~				No notes assigned		
	DPortGrou     ExtAccess     Storage     Datastore	Sharing Disk File	No sharing ~	50617070115334)] hana-8/hana-8.vm	dk		NO HOLES assigned		
Recent Tasks     Alarms	B hana data B hana data				CANCEL				
	Status	▼ Details	T Initiator	T For T St	art Time ↓ ¥ Cor	npletion Time 🔻	Server		Ŧ
Manage Columns All V More Tasks									0 items

SnapCenter then configures and mounts the new disk at the HANA Linux system.

```
hana-9:/mnt/sapcc-share/SAP-System-Refresh # df -h
Filesystem Size Used Avail Use% Mounted on
/dev/mapper/system-root 60G 5.2G 52G 10% /
devtmpfs 4.0M 4.0K 4.0M 1% /dev
tmpfs 49G 0 49G 0% /dev/shm
efivarfs 256K 57K 195K 23% /sys/firmware/efi/efivars
tmpfs 13G 26M 13G 1% /run
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-tmpfiles-setup-dev-
early.service
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-sysctl.service
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-sysusers.service
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-tmpfiles-setup-dev.service
/dev/mapper/system-root 60G 5.2G 52G 10% /.snapshots
/dev/mapper/system-root 60G 5.2G 52G 10% /boot/grub2/i386-pc
/dev/mapper/system-root 60G 5.2G 52G 10% /boot/grub2/x86++ ++64-efi
/dev/mapper/system-root 60G 5.2G 52G 10% /home
/dev/mapper/system-root 60G 5.2G 52G 10% /opt
/dev/mapper/system-root 60G 5.2G 52G 10% /srv
/dev/mapper/system-root 60G 5.2G 52G 10% /root
/dev/mapper/system-root 60G 5.2G 52G 10% /tmp
/dev/mapper/system-root 60G 5.2G 52G 10% /usr/local
/dev/mapper/system-root 60G 5.2G 52G 10% /var
```

```
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-vconsole-setup.service
/dev/sdc 95G 8.9G 87G 10% /hana/log/QFS/mnt00001
/dev/sdd 95G 14G 82G 14% /hana/shared
/dev/sda1 253M 5.9M 247M 3% /boot/efi
tmpfs 1.0M 0 1.0M 0% /run/credentials/systemd-tmpfiles-setup.service
192.168.175.86:/sapcc++ ++share 1.4T 858G 568G 61% /mnt/sapcc-share
tmpfs 6.3G 72K 6.3G 1% /run/user/464
tmpfs 1.0M 0 1.0M 0% /run/credentials/getty@tty1.service
tmpfs 6.3G 52K 6.3G 1% /run/user/0
/dev/sde 95G 9.2G 86G 10% /hana/data/QFS/mnt00001
tmpfs 6.3G 56K 6.3G 1% /run/user/1001
hana-9:/mnt/sapcc-share/SAP-System-Refresh #
hana-9:/mnt/sapcc-share/SAP-System-Refresh # cat /etc/fstab
/dev/system/root / btrfs defaults 0 0
/dev/system/root /var btrfs subvol=/@/var 0 0
/dev/system/root /usr/local btrfs subvol=/@/usr/local 0 0
/dev/system/root /tmp btrfs subvol=/@/tmp 0 0
/dev/system/root /srv btrfs subvol=/@/srv 0 0
/dev/system/root /root btrfs subvol=/@/root 0 0
/dev/system/root /opt btrfs subvol=/@/opt 0 0
/dev/system/root /home btrfs subvol=/@/home 0 0
/dev/system/root /boot/grub2/x86++ ++64-efi btrfs
subvol=/@/boot/grub2/x86++ ++64-efi 0 0
/dev/system/root /boot/grub2/i386-pc btrfs subvol=/@/boot/grub2/i386-pc 0
0
/dev/system/swap swap swap defaults 0 0
/dev/system/root /.snapshots btrfs subvol=/@/.snapshots 0 0
UUID=FB79-24DC /boot/efi vfat utf8 0 2
192.168.175.86:/sapcc++ ++share /mnt/sapcc-share nfs
rw,vers=3,hard,timeo=600,rsize=1048576,wsize=1048576,intr,noatime,nolock 0
0
#/dev/sdb /hana/data/QFS/mnt00001 xfs relatime, inode64 0 0
/dev/sdc /hana/log/QFS/mnt00001 xfs relatime, inode64 0 0
/dev/sdd /hana/shared xfs defaults 0 0
# The following entry has been added by NetApp (SnapCenter Plug-in for
UNIX)
/dev/sde /hana/data/QFS/mnt00001 xfs
rw, relatime, attr2, inode64, logbufs=8, logbsize=32k, noquota 0 0
hana-9:/mnt/sapcc-share/SAP-System-Refresh #
```

The following screenshot shows the job steps executed by SnapCenter.

Job	Details	$\times$
Clon	e from backup 'SnapCenter_hana-8_LocalSnap_Hourly_06-17-2025_10.29.00.4260' Clone from backup 'SnapCenter_hana-8_LocalSnap_Hourly_06-17-2025_10.29.00.4260' * hana-9.sapcc.stl.netapp.com	Î
* * * * * *	<ul> <li>Clone</li> <li>Application Pre Clone</li> <li>Storage Clone</li> <li>Can Execute Clone Virtual or RDM disks</li> <li>Clone Virtual or RDM disks</li> <li>Unmount Filesystem</li> </ul>	
* * * * * * * *	<ul> <li>Mount Filesystem</li> <li>Performing rescan of devices</li> <li>Building clone for data file systems and associated entities</li> <li>Application Post Clone</li> <li>Register Clone Metadata</li> <li>Clean-up Snapshot entries on Server</li> <li>Application Clean-Up</li> <li>Data Collection</li> <li>Agent Finalize Workflow</li> </ul>	
() Tas	sk Name: Mount Filesystem Start Time: 06/17/2025 11:02:42 AM End Time: 06/17/2025 11:10:17 AM	se

As mentioned in the "Pre-requisites" section, the SnapCenter spl service at the HANA host must be restarted using the command "systemctl restart spl" to initiate proper cleanup. This must be done when the job has finished.

When the clone workflow is finished, the auto discovery can be started by clicking on the resource QFS. When the auto discovery process is finished the new storage footprint is listed in the details view of the resource.

🗖 Ne	<b>tApp</b> Sr	napCenter®					٠	≥ 6	• sapcc\scadmin	SnapCenterAdmin	🛿 Sign Out
>	SAP HANA	N 💌									×
	Search	databases									
•	EP	System	Details for selected resource	è							
		QS1	Туре		Multitenant Database Container						
<i>1</i> 11		QFS	HANA System Name		QFS						
A		SM1	SID		QFS						
		SS1	Tenant Databases		QFS						
10 J		551	Plug-In Host		hana-9.sapcc.stl.netapp.com						
<b>#</b>			HDB Secure User Store Key		QFSKEY						
A		552	HDBSQL OS User		qfsadm						
-		VFS	Log backup location		/usr/sap/QFS/HDB45/backup/log						
			Backup catalog location		/usr/sap/QFS/HDB45/backup/log						
			System Replication		None						
			Plug-in name		SAP HANA						
			Last backup		None						
			Resource Groups		None						
			Policy		None						
			Discovery Type		Auto						
			Backup Name			Hourly_06-17-2025_10.29.00.4260					
			Backup Name of Clone		SnapCenter_hana-8_LocalSnap_l	-lourly_06-17-2025_10.29.00.4260					
			Storage Footprint								
			SVM	Volume		Junction Path			LUN/Qtree		
			svm1						hana_data_VFS_Clone_	06172511013515617	
	Total 7										
Activit	y Th	e 5 most recent jobs are displayed		S Completed 💧 1 Warning	X 1 Failed O Canceled	📀 0 Running 🏼 🗐 0 Queued					^

## SnapCenter clone delete workflow

The clone delete workflow is started by selecting the clone at the source HANA resource and by clicking on the delete button.

n Net	<b>tApp</b> Si	napCenter®									٠	<b>⊠ (}</b> •	<b>⊥</b> sapcc\se	admin Sna	apCenterAdmin	🗊 Sign Out
>	SAP HAN	A 🔽	VFS Topology													
	Search	databases							May	_				•	-	
0									Backup to Object Store	Remove Protection	Back up Now	Modify	Maintenance	i Details	Configure Database	e Refresh
	1E Im	System	Manage Co	pies												
۲	8	Q\$1		12 Backups									Summary	Card		
	1	QFS SM1		1 Clone									13 Backups			
*		SS1	l	ocal copies									12 Snapshot ba	sed backups		
÷۹.,		SS2											1 File-Based b	ackup 🛩		
÷=		552											0 Snapshots L	ocked		
A		VFS														
	Total 7		Primary Clo search Clone SID QFS	Clone Host hana-9.sapcc.stl.netapp.com		Clone Name hana-8_sapcc_stl_netapp_ 17-2025_10.27.55	_com_hana_MDC_V	/FS_clone_1	146515_MDC_VFS	06-	06/	: 17/2025 11:01:	Start Date		06/17/2025 11	End date
Activity	V Tł	ne 5 most recent jobs are displayed cc.stl.netapp.com:8146/PluginCreatorInvent	tan Destact /Dest	3 Completed	ed 🔼 1 Wa	arning 🗙 1 Failed	Ø 0 Canceled	0 Rur	nning (D) 0 Q	ueued						^

In our example we are using a pre-script to shutdown the target HANA database.

*i* Cloned volume will be deleted. SnapCenter backups and HANA backup catalog must be deleted manually.

Enter commands to execute before clone deletion

Pre clone delete :

/mnt/sapcc-share/SAP-System-Refresh/sc-system-refresh.sh shutdown

The selected clone(s) will be permanently deleted. If the selected clone contains other resource(s) it will also be deleted.

If the cloned databases are protected then the protection needs to be removed to delete the clone.

Do you want to proceed?

□ Force Delete

The following screenshot shows the job steps executed by SnapCenter.

## Job Details

Deleting clone 'hana-8\_sapcc\_stl\_netapp\_com\_h.....S\_clone\_\_146534\_MDC\_VFS\_06-17-2025\_10.27.55'

Deleting clone 'hana-8\_sapcc\_stl\_netapp\_com\_hana\_MDC\_VFS\_clone\_\_146534\_MDC\_VFS\_06-17-2025\_10.27.55'

~	hana-9.sapcc.stl.netapp.com
~	▼ Delete Clone
~	Validate Plugin Parameters
4	Application Clone Delete
~	Delete Pre Clone Commands
~	<ul> <li>Unmount Filesystem</li> </ul>
~	Deporting cloned file systems and associated entities
~	Performing rescan of devices
~	Deleting Virtual Resources
4	▼ Delete Storage Clone
~	Unregister Clone Metadata
~	🔻 Filesystem Clone Metadata Cleanup
~	Performing rescan of devices
~	Agent Finalize Workflow
🕽 Ta	ask Name: Application Clone Delete Start Time: 06/17/2025 1:36:24 PM End Time: 06/17/2025 1:37:02 PM

As mentioned in the "Pre-requisites" section, the SnapCenter spl service at the HANA host must be restarted using the command "systemctl restart spl" to initiate proper cleanup.

View Logs

Cancel Job

Close

## Additional information and version history

HANA best practices:

• SAP HANA on NetApp ASA Systems with Fibre Channel Protocol.

X

SnapCenter:

- TR-4614: SAP HANA backup and recovery with SnapCenter
- TR-4719: SAP HANA System Replication Backup and Recovery with SnapCenter
- TR-4667: Automating SAP HANA System Copy and Clone Operations with SnapCenter
- SAP HANA data protection and high availability with SnapCenter, SnapMirror active sync and VMware Metro Storage Cluster
- SnapCenter Software documentation

Version history:

Version	Date	Comment
Version 1.0	07/2025	Initial version

# BlueXP Backup and Recovery for SAP HANA - Cloud Object storage as backup destination

## BlueXP Backup and Recovery for SAP HANA - Cloud Object storage as backup destination

This technical report provides best practices for SAP HANA data protection using NetApp BlueXP Backup nad Recovery for Application. This document covers concepts, configuration recommendations, and operation workflows, including configuration, backup operations, and restore operations.

## Overview

This document describes how to setup and configure SAP HANA for data protection from on-premises to cloud based object stores with NetApp BlueXP. It covers the BlueXP backup and recovery part of the solution. This solution is an enhancement of the on-premises SAP HANA backup solution using NetApp Snap Center and provides a cost-efficient way for long-term archiving of SAP HANA backups to cloud based object storage and offers optional tiering of object storage to archival storage like AWS Glacier/Deep Glacier, Microsoft Azure Blob Archive, and GCP Archive Storage.

The setup and configuration of the on-premises SAP HANA backup and recovery solution is described in TR-4614: SAP HANA backup and recovery with SnapCenter (netapp.com).

This TR only describes how to enhance the on-premises SnapCenter based SAP HANA backup and recovery solution with BlueXP backup and recovery for SAP HANA using AWS S3 object storage as example. The setup and configuration using Microsoft Azure and GCP object storage instead of AWS S3 is similar, but is not described within this document.

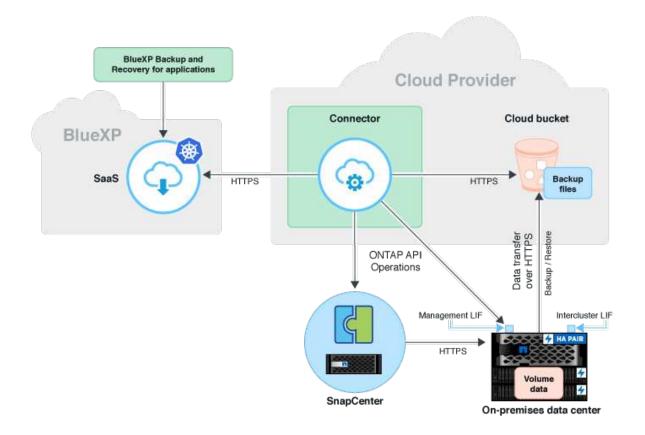
## BlueXP Backup and Recovery architecture

BlueXP backup and recovery is a SaaS solution that provides data protection capabilities for applications running on NetApp on-premises Storage to the cloud. It offers efficient, application consistent, policy-based protection of SAP HANA using NetApp storage. In addition, BlueXP backup and recovery provides centralized control and oversight, while delegating the ability for users to manage application-specific backup and restore operations.

BlueXP backup and recovery runs as SaaS within NetApp BlueXP and leverages the framework and UI. The BlueXP working environment framework is used to configure and manage the credentials for NetApp ONTAP based on-premises storage and the NetApp SnapCenter Server.

A BlueXP connector needs to be deployed within the customer virtual network. A connection between the onpremises environment and the cloud environment is required such as an site to site VPN connection. The communication between the NetApp SaaS components and the customer environment is exclusively done via the connector. The connector is executing the storage operations by using the ONTAP and SnapCenter management APIs.

The data transfer between the on-premises storage and the cloud bucket is end-to-end protected with AES 256-bit encryption at rest, TLS/HTTPS encryption in flight, and customer-managed key (CMK) support. The backed-up data can be stored in an immutable and indelible WORM state. The only way to access the data from the object storage is to restore it to NetApp ONTAP based storage including NetApp CVO.



## Overview of installation and configuration steps

The required installation and configuration steps can be split in three areas. Prerequisite is that the SAP HANA backup configuration has been configured at NetApp Snap Center. For setting up Snap Center for SAP HANA in the first place refer to SnapCenter configuration (netapp.com).

1. Installation and configuration of NetApp BlueXP components.

Needs to be done once during the initial setup of the data protection solution.

2. Preparation steps at NetApp SnapCenter.

Needs to be done for each SAP HANA database, which should be protected.

3. Configuration steps in BlueXP backup and recovery.

Needs to be done for each SAP HANA database, which should be protected.

#### Installation and configuration of NetApp BlueXP Hybrid Application Backup

The installation and configuration of the NetApp BlueXP components are described in Protect your onpremises applications data | NetApp Documentation.

- 1. Sign-up to BlueXP and setup NetApp account at https://bluexp.netapp.com/.
- 2. Deploy BlueXP connector in your environment. Description is available at Learn about Connectors | NetApp Documentation.
- 3. Add/buy a Cloud Backup license at BlueXP: https://docs.netapp.com/us-en/cloud-manager-backup-restore/ task-licensing-cloud-backup.html.
- 4. Create working environment for NetApp on-premises environment and your cloud destination in BlueXP by adding your on-premises storage.
- 5. Create a new object store relationship for the on-premises storage into an AWS S3 bucket.
- 6. Configure SAP HANA system resource at SnapCenter.
- 7. Add Snap Center to your working environment.
- 8. Create a policy for your environment.
- 9. Protect you SAP HANA System.

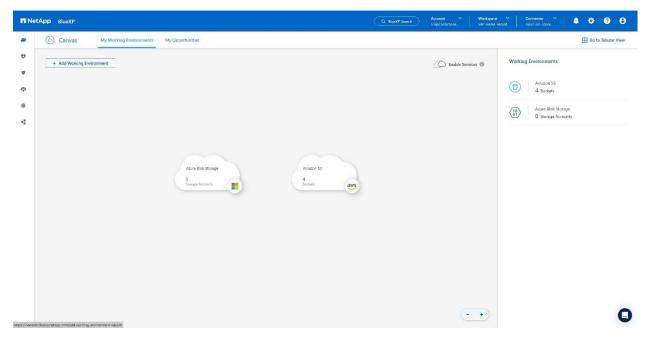
## Configuring BlueXP Backup and Recovery for SAP HANA

This section describes how to setup the working environment, how to configure SnapCenter, and how to configure and activate SAP HANA backup within BlueXP.

## Create working environment for BlueXP

Add the on-premises storage system to you work environment.

- 1. At the left menu choose Storage  $\rightarrow$  Canvas  $\rightarrow$  My Working Environment.
- 2. Press + Add Working Environment.



## 3. Choose On-Premises.

III Ne	tApp BlueXP			Q BlueXP Search	) Account 🌱 War SnapCenterServi. SAP-	kapasce Y Connector Y HANA-Hybrid sapsc-cm-conne.	<b>≜ ⇔ ⊗ ⊖</b>
	Add Working Environment		Ch	oose a Location			×
e							
w			aws	6			
¢							
۲		Microsoft Azure	Amazon Web Services	Google Cloud Platform	On-Premises		
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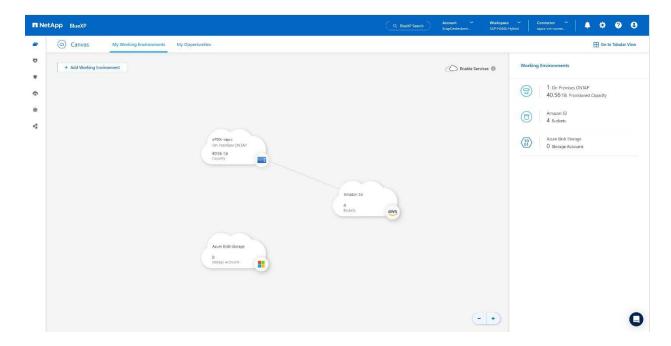
4. Choose Discover On-Premises ONTAP.

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5. Add the IP address of the ONTAP cluster and the password and press **Discover**.

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6. The ONTAP cluster is now available.



## Create a relationship between the on-premises storage system and an object storage bucket

The relationship between the on-premises storage and the S3 bucket is done by creating a backup for a volume or by activating a backup of an application. If an existing site-to-site VPN shall be used for transferring the data from on-premises to S3, a volume backup needs to be used for creating the relationship between the on-premises storage and S3 bucket as VPC endpoints need to be used.

At creation of this documentation the application backup workflow doesn't offer to choose VPC endpoints to access S3 buckets.

Refer to Gateway endpoints for Amazon S3 - Amazon Virtual Private Cloud how to setup VPC endpoints for S3 within your VPC.

To create a first volume backup, perform the following steps:

1. Navigate via **Protection** to **Backup and recovery** and choose **Volumes**.

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2. Press the Activate Backup button.

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		Simple & intuitive Hybrid Multicle No backup er doud regentise regards. Simply tick the button above and follow the instructions AVE, Azure, GCP er Stora	Volumes ONTAP to Combines incremental, block-level operation with	

3. Choose the desired on-premises storage system and click Activate Backup.

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4. Choose Backup.

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8	Activate backup and recovery 🚯 Introduction 🕃 Selicit volumes. 🚯 Define backup strategy 🙆 Review	×
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5. Choose a volume which is stored at the same SVM as your SAP HANA data files and press **Next**. In this example the volume for /hana/shared has been chosen.

Activ	ate backup and recovery	Y		Select volumes	3 Define backup strategy	Review			>
						Volumes			
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6. **Continue**, if an existing policy exists.

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	SS1 data mint00001 dest © Ce	hana-backop	OF	FireWol		6.67 Gill		Nor-Snaplock		Unity		

7. Check the **Backup Option** and choose your desired Backup Provider. In this example AWS. Keep the option checked for already existing policies.

Uncheck options you do not want to use.

lueXP		Q. Blusse Search Account "Workspace" Connector " 🍋 🔅 🥐 🤂
Activate backup and recovery	⊘ Introduction ⊘ Select volumes. ⊘ Define backup strategy ④ Review	×
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8. Create a new bucket or choose an existing one. Provide your AWS account settings, the regio, your access key, and the secret key. Press **Next**.

III Ne	tApp BlueXP			Q BueldP Serrich SnapCentarSer	Workspace         Connector            Workspace         September         september	<b>4</b> 9 0 0
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		Encryption Define	nd by Provider settings	$\sim$		
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			Provinue			

9. Choose the correct IPspace of your on-premises storage system, select **Privat Endpoint Configuration** and choose the VPC endpoint for the S3. Press **Next**.

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10. Review your configuration and press **Activate Backup**.

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				Providuit	Activata Backup						

11. The backup has been successfully initiated.

III Ne	etApp BlueXP		Q. BluestP Search         Account         Werkspace         Connector           SimpCenserSer.         Wanspace-1         Segre-con-connector	് <b>№ ≎ 0 ⊖</b>
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		Simple & intuitive Hybrid Multicloud No backup or cloud expense required. Simply clear the button above and follow the instructions NVS, Asure, GCP or StrangtGI		
		() Successfully initiated unified backup	×	

#### Configure the SAP HANA system resource at SnapCenter

1. Check, if the SVM (hana in this example) where your SAP HANA system is stored has been added via the cluster. If only the SVM has been added, add the cluster.

NetApp Snap	oCenter®	1				•	🛛 😧 🕹 sapce\s	admin SnapCenterAdmin 🔋 Sign Out
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2. Define a schedule policy with either daily, weekly, or monthly schedule type.

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t The schedules are triggered in the SnapCenter Server time xone.	Start date Expires on Repeat every	63/24/2023 01:00 am (1) 63/15/2024 09:52 am (1) 1 (2) days							

3. Add the new policy to your SAP HANA system and assign a daily schedule.

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,	15.00	System	Manage Copies					
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			SnapCenter_LocalSnap_Hourly_03-23-20 23_19.00.01.5084	LocalSnap	Hourly: Repeat every 4 hours	/ x		
			SnapCenter_LocalSnap_Hourly_03-23-20 23 15.00.02.4395	LocalSnap-OnDemand	None	To schedule operations select a policy that has the appropriate schedule associated, or modify the selected policy to allow schedules.		
			SnapCenter_Policy4CBA_Dally_03-23-202 3_11.57.36.5415	LocalSnapAndSnapVault	Daily: Repeat every 1 days	/ x		
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4. Once configured new backups with this policy will be available after the policy has been executed according to the schedule defined.

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÷			Vault copies						0 Clones			
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			SnapCenter_LocalSnap_Hourly_03-24-2023_03.00.01.5889	1							03/24/2023 3	01:02 AM 🛱
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#### Adding SnapCenter to the BlueXP Working Environment

- 1. At the left menu choose **Protection**  $\rightarrow$  **Backup and recovery**  $\rightarrow$  **Applications**.
- 2. Choose Hybrid from the pulldown menu.

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	KApp         BlocXP <ul></ul>	Hybrid A Hybrid Ociol Native Oc	Q Buoto Search       Account supported       Workspace of all statuting of a	
				0

3. Choose **SnapCenter Servers** at the Settings menu.

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4. Register the SnapCenter Server.

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Ŷ									
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									0

5. Add the SnapCenter Server credentials.

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6. The SnapCenter Servers has been added and data will discovered.

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7. Once the discovery job has been finished the SAP HANA system will be available.

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## Creating a Backup Policy for Application Backup

1. Choose **Policies** within the settings menu.

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Daily: 366 Primary Not Active •••			5 Year Daily LTR	daily	Dally: 1830	Primary	Not Active			
			1 Year Daily LTR	daily	Daily: 366	Primary	Not Active			

3. Provide the policy name, desired SnapMirror label, choose your desired options, and press **Create**.

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# Protecting the SAP HANA database with Cloud Backup for Applications

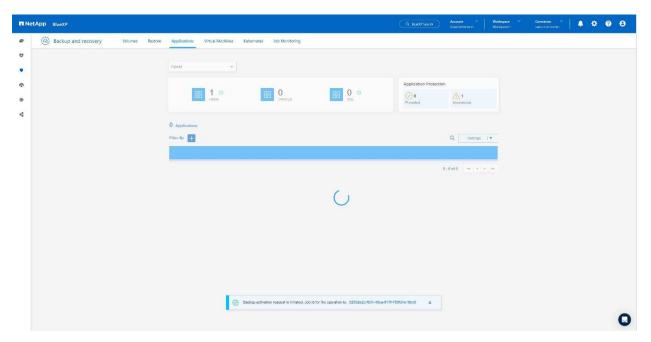
1. Choose **Activate Backup** for the SAP HANA system.

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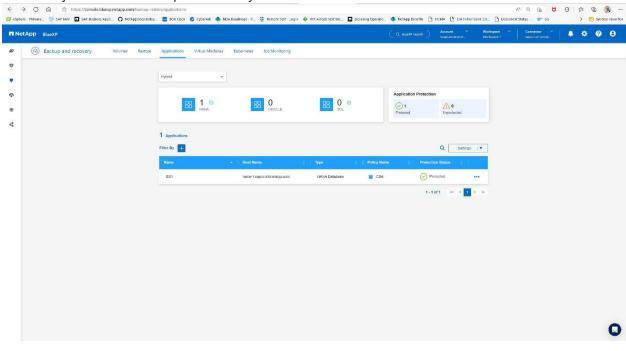
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3. As the storage system and the connector have configured upfront the backup will be activated.



4. Once the job has been completed the System will be listed.



5. After some time the backups will be listed at the detail view of the SAP HANA System. A daily backup will be listed the next day.

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In some environments it might the necessary to remove any existing schedule settings of the snapmirror source. To do so execute the following command at the source ONTAP system: *snapmirror modify -destination -path <hana-cloud-svm>:<SID\_data\_mnt00001>\_copy -schedule ""*.

# Restoring SAP HANA BlueXP Backup

A restore from of the backup can only be done to an on-premises NetApp ONTAP based storage system or NetApp CVO within the cloud. A restore can be done by doing the following steps:

- 1. In BlueXP UI, click **Protection > Backup and recovery > Applications** and choose Hybrid.
- 2. In the **Filter By** field, select the filter **Type** and from the drop-down select **HANA**.
- 3. Click **View Details** corresponding to the database that you want to restore.

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4. Select the desired backup and choose Storage Export.

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#### 5. Provide the desired options:

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	Provident Next					

- a. For NAS environment, specify the FQDN or IP address of the host to which the volumes restored from object store are to be exported.
- b. For SAN environment, specify the initiators of the host to which LUNs of the volumes restored from object store are to be mapped.
- 6. If the snapshot is in archival storage, select the priority to restore your data from the archival storage.
- 7. If there is not enough space on the source storage or the source storage is down, select **Change storage location**.
- 8. If you select **Change storage location**, you can append a suffix to the destination volume. If you have not selected the checkbox, then by default **\_restore** is appended to the destination volume. Click **Next**.
- 9. If you selected Change Storage Location, specify the alternate storage location details where the data restored from the object store will be stored in the Storage mapping page and click **Next**.
- 10. Review the details and click **Restore**.

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This operation does only the storage export of the restored backup for the given host. You must manually mount the filesystem at the host and bring up the database. After utilizing the volume, the storage Administrator can delete the volume from the ONTAP cluster.

## **Additional Information and Version History**

This section lists where to find additional information and shows the version history.

#### Where to find additional information

To learn more about the information that is described in this document, review the following documents and/or websites:

- NetApp BlueXP backup and recovery Product Documentation Protect your on-premises applications data | NetApp Documentation
- SAP HANA backup and recovery with SnapCenter

#### Version history

Version	Date	Document version history
Version 1.0	March 2024	Initial version

Refer to the Interoperability Matrix Tool (IMT) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

# SAP HANA System Replication Backup and Recovery with SnapCenter

# TR-4719: SAP HANA System Replication - Backup and Recovery with SnapCenter

SAP HANA System Replication is commonly used as a high-availability or disasterrecovery solution for SAP HANA databases. SAP HANA System Replication provides different operating modes that you can use depending on the use case or availability requirements.

Author: Nils Bauer, NetApp

There are two primary use cases that can be combined:

- High availability with a recovery point objective (RPO) of zero and a minimal recovery time objective (RTO) using a dedicated secondary SAP HANA host.
- Disaster recovery over a large distance. The secondary SAP HANA host can also be used for development or testing during normal operation.

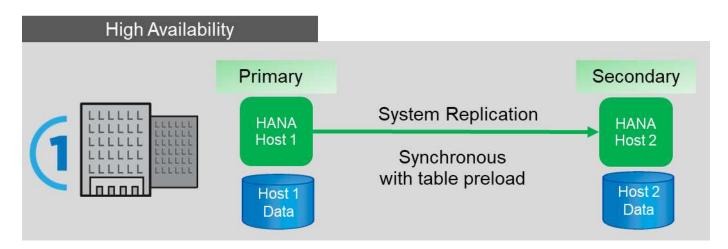
### High availability with an RPO of zero and a minimal RTO

System Replication is configured with synchronous replication using tables preloaded into memory at the secondary SAP HANA host. This high-availability solution can be used to address hardware or software failures and also to reduce planned downtime during SAP HANA software upgrades (near- zero downtime operations).

Failover operations are often automated by using third-party cluster software or with a one-click workflow with SAP Landscape Management software.

From a backup requirement perspective, you must be able to create backups independent of which SAP HANA host is primary or secondary. A shared backup infrastructure is used to restore any backup, regardless of which host the backup has been created on.

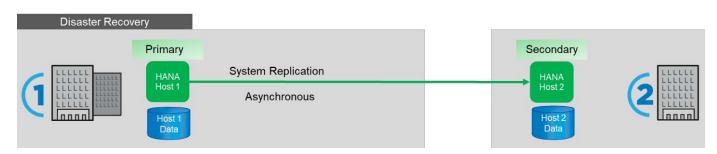
The rest of this document focuses on backup operations with SAP System Replication configured as a highavailability solution.



#### Disaster recovery over a large distance

System replication can be configured with asynchronous replication with no table preloaded into memory at the secondary host. This solution is used to address data center failures, and failover operations are typically performed manually.

Regarding backup requirements, you must be able to create backups during normal operation in data center 1 and during disaster recovery in data center 2. A separate backup infrastructure is available in data centers 1 and 2, and backup operations are activated as a part of disaster failover. The backup infrastructure is typically not shared, and a restore operation of a backup that was created at the other data center is not possible.



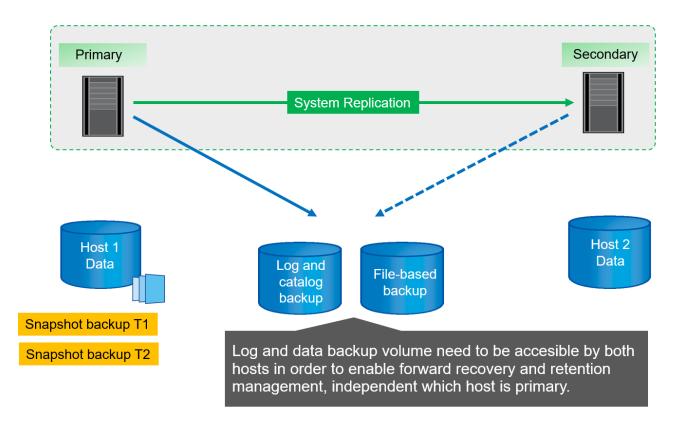
## Storage Snapshot backups and SAP System Replication

Backup operations are always performed at the primary SAP HANA host. The required SQL commands for the backup operation cannot be performed at the secondary SAP HANA host.

For SAP HANA backup operations, the primary and secondary SAP HANA hosts are a single entity. They share the same SAP HANA backup catalog and they use backups for restore and recovery, regardless of whether the backup was created at the primary or secondary SAP HANA host.

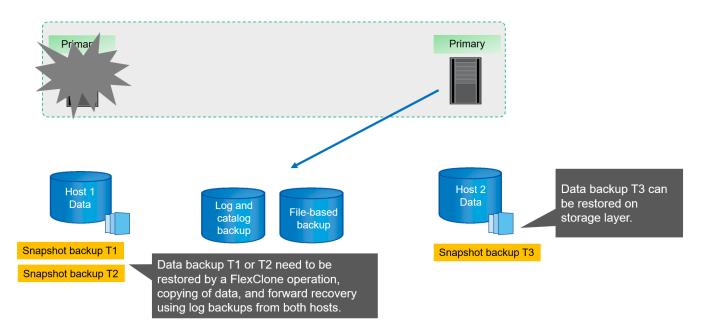
The ability to use any backup for restore and to do forward recovery using log backups from both hosts requires a shared log backup location that is accessible from both hosts. NetApp recommends that you use a shared storage volume. However, you should also separate the log backup destination into subdirectories within the shared volume.

Each SAP HANA host has its own storage volume. When you use a storage-based Snapshot to perform a backup, a database- consistent Snapshot is created on the primary SAP HANA host's storage volume.



When a failover to host 2 is performed, host 2 becomes the primary host, the backups are executed at host 2, and Snapshot backups are created at the storage volume of host 2.

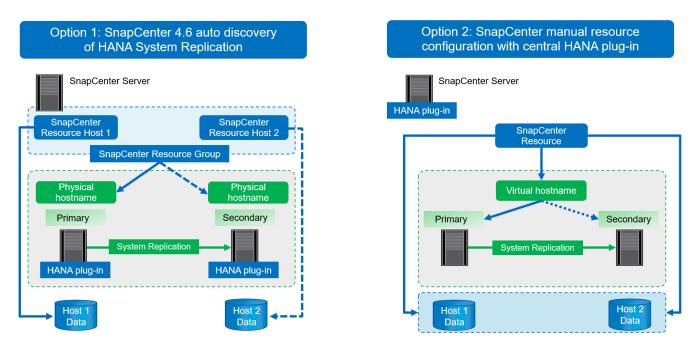
The backup created at host 2 can be restored directly at the storage layer. If you must use a backup created at host 1, then the backup must be copied from the host 1 storage volume to the host 2 storage volume. Forward recovery uses the log backups from both hosts.



## SnapCenter configuration options for SAP System Replication

There are two options for configuring data protection with NetApp SnapCenter software in an SAP HANA System Replication environment:

- A SnapCenter resource group including both SAP HANA hosts and auto discovery with SnapCenter version 4.6 or higher.
- A single SnapCenter resource for both SAP HANA hosts using a virtual IP address.



Starting with SnapCenter 4.6, SnapCenter supports auto-discovery of HANA systems configured in a HANA System Replication relationship. Each host is configured using its physical IP address (host name) and its individual data volume on the storage layer. The two Snapcenter resources are combined in a resource group, and SnapCenter automatically identifies which host is primary or secondary and executes the required backup operations accordingly. Retention management for Snapshot and file-based backups created by SnapCenter is performed across both hosts to ensure that old backups also get deleted at the current secondary host.

With a single-resource configuration for both SAP HANA hosts, the single SnapCenter resource is configured using the virtual IP address of the SAP HANA System Replication hosts. Both data volumes of the SAP HANA hosts are included in the SnapCenter resource. Because it is a single SnapCenter resource, retention management for Snapshot and file-based backups created by SnapCenter works independent of which host is currently primary or secondary. This options is possible with all SnapCenter releases.

	Resource group with SnapCenter 4.6	Single SnapCenter resource and virtual IP address
Backup operation (Snapshot and file-based)	Automatic identification of primary host in resource group	Automatically use virtual IP address
Retention management (Snapshot and file-based)	Automatically executed across both hosts	Automatically use single resource
Backup capacity requirements	Backups are only created at primary host volume	Backups are always created at both hosts volumes. The backup of the second host is only crash consistent and cannot be used to do a roll forward.

The following table summarizes the key differences of the two configuration options.

	Resource group with SnapCenter 4.6	Single SnapCenter resource and virtual IP address
Restore operation	Backups from current active host are available for restore operation	Pre-backup script required to identify which backups are valid and can be used for restore
Recovery operation	All recovery options available, same as for any auto-discovered resource	Manual recovery required

In general, NetApp recommends using the resource group configuration option with SnapCenter 4.6 to protect HANA systems with enabled HANA System Replication. Using a single SnapCenter resource configuration is only required if the SnapCenter operation approach is based on a central plug-in host and the HANA plug-in is not deployed on the HANA database hosts.

The two options are discussed in detail in the following sections.

(†)

## SnapCenter 4.6 configuration using a resource group

SnapCenter 4.6 supports auto discovery for HANA systems configured with HANA System Replication. SnapCenter 4.6 includes the logic to identify primary and secondary HANA hosts during backup operations and also handles retention management across both HANA hosts. In addition, automated restore and recovery is now also available for HANA System Replication environments.

#### SnapCenter 4.6 configuration of HANA System Replication environments

The following figure shows the lab setup used for this chapter. Two HANA hosts, hana-3 and hana-4, were configured with HANA System Replication.

A database user "SnapCenter" was created for the HANA system database with the required privileges to execute backup and recovery operations (see SAP HANA Backup and Recovery with SnapCenter). A HANA user store key must be configured at both hosts using the above database user.

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ss2adm@hana- 3: / > hdbuserstore set SS2KEY hana- 3:33313 SNAPCENTER
<password>
```

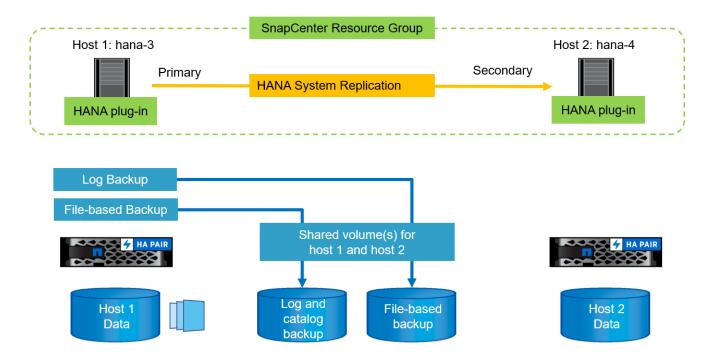
```
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<password>
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From a high-level perspective, you must perform the following steps to set up HANA System Replication within SnapCenter.

- 1. Install the HANA plugin on the primary and secondary host. Autodiscovery is executed and the HANA System Replication status is detected for each primary or secondary host.
- 2. Execute SnapCenter configure database and provide the hdbuserstore key. Further autodiscovery

operations are executed.

3. Create a resource group, including both hosts and configure protection.



After you have installed the SnapCenter HANA plug-in on both HANA hosts, the HANA systems are shown in the SnapCenter resource view in the same way as other autodiscovered resources. Starting with SnapCenter 4.6, an additional column is displayed that shows the status of HANA system replication (enabled/disabled, primary/secondary).

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	SAP HANA	·								
Dashboard	View Mu	ltitenant Database Container 👻 🤇 Se	earch databases						Refresh Resources Add SAP HA	NA Database New Resource Gro
Resources	TE - Im	System	System ID (SID)	Tenant Databases	Replication	Plug-in Host	Resource Groups	Policies	Last backup	Overall Status
🚱 Monitor	8	552	552	552	Enabled (Primary)	hana-3.sapcc.stl.netapp.c om				Not protected
Reports	8	552	552	552	Enabled	hana-4.sapcc.stl.netapp.c				Not protected
Hosts					(Secondary)	om				
Storage System	æ									
\Xi Settings										
A Alerte										

By clicking the resource, SnapCenter requests the HANA user store key for the HANA system.

Configure Databa	se		3
Plug-in host	hana-3.sapcc.stl.netapp.com		
HDBSQL OS User	ss2adm		
HDB Secure User Store Key	SS2KEY		0
		Cancel	өк

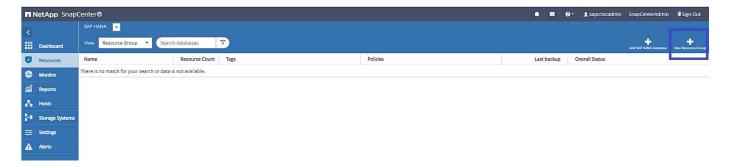
Additional autodiscovery steps are executed, and SnapCenter show the resource details. With SnapCenter 4.6, the system replication status and the secondary server are listed in this view.

SAP HAN	NA -	Resource - Details				
Search	n databases					
12 <b>Im</b>	System	Details for selected resource				
8	SS2	Туре	Multitenant Database Cont	ainer		
	SS2	HANA System Name	552			
		SID	S52			
		Tenant Databases	552			
		Plug-in Host	hana-3.sapcc.stl.netapp.co	m		
		HDB Secure User Store Key	S52KEY			
		HDBSQL OS User	ss2adm			
		Log backup location	/mnt/backup/552			
		Backup catalog location	/mnt/backup/SS2			
		System Replication	Enabled (Primary)			
		Secondary Servers	hana-4			
		plug-in name	SAP HANA			
		Last backup	None			
		Resource Groups	None			
		Policy	None			
		Discovery Type	Auto			
		Storage Footprint				
		SVM	Volume	Junction Path	LUN/Qtree	
		hana-primary.sapcc.stl.netapp.com	SS2_data_mnt00001	/SS2_data_mnt00001		
Terrig						
Total 2						

After performing the same steps for the second HANA resource, the autodiscovery process is complete and both HANA resources are configured in SnapCenter.

e	SAP HANA										
Dashboard	View Mult	itenant Database Container 👻 Search dat	tabases 🛛 🏹						Refresh Resources	AGO SAP HANA (	acabase New Resource Gri
Resources	15 las	System	System ID (SID)	Tenant Databases	Replication	Plug-in Host	Resource Groups	Policies	Last t	ackup	Overall Status
Monitor		552	552	552	Enabled (Primary)	hana-3.sapcc.stl.netapp.c om				1	lot protected
Reports		552	552	552	Enabled (Secondary)	hana-4.sapcc.stl.netapp.c om				1	lot protected
Hosts	-				10000000						
Storage Systems											
Ξ Settings											
Alerts											

For HANA System Replication- enabled systems, you must configure a SnapCenter resource group, including both HANA resources.



NetApp recommends using a custom name format for the Snapshot name, which should include the hostname, the policy, and the schedule.

	tApp S	SnapCenter®		
>	SAP HAI	NA 💌	New Resource Group	
	Searc	h databases	To configure an SMTP Server to send email notifications for scheduled or on-demand jobs, go to Settings-Global Settings-Notification Server Settings.	
0	17 lm	System		
		552	1         2         3         4         5         6           Name         Resources         Application Settings         Policies         Notification         Summary	
<b>a</b>		552	Name Resources Application Settings Policies Notification Summary	
A			Provide a name and tags for the resource group	
80			Name SS2 - HANA System Replication 0	
-			Tags 0	
A			Use custom name format for Snapshot copy ScustomText * SHostName * SPolicy * SScheduleType *	
			SnapCenter	

You must add both HANA hosts to the resource group.

ΠNe	etApp S	napCenter®	
>	SAP HAN	IA 🔽	New Resource Group
	Search	1 databases	
U	17 jan	System	
۲		552	Name Resources Application Settings Policies Notification Summary
<b>M</b>		552	Add resources to resource group
Å			Host Resource Type
80			All All
			Available Resources Selected Resources
#			search available resources
▲			S52 (hana-3 : MDC) S52 (hana-4 : MDC)

Policies and schedules are configured for the resource group.



The retention defined in the policy is used across both HANA hosts. If, for example, a retention of 10 is defined in the policy, the sum of backups of both hosts is used as a criteria for backup deletion. SnapCenter deletes the oldest backup independently if it has been created at the current primary or secondary host.

II Ne	tApp SnapCenter®		
>	SAP HANA 💌	New Resource Group	
	Search databases		
U	Name		
٠	There is no match for your search or data is not available.	Name Resources Application Settings Policies Notification Summary	
<b>a</b>		Select one or more policies and configure schedules	
÷		LocalSnap - + 0	
80		✓ LocalSnap BlockIntegrityCheck S	
#		Policy IE Applied Schedules Configure Schedules	
		LocalSnap Hourly: Repeat every 1 hours 🖌 🗙	
		Total 1	

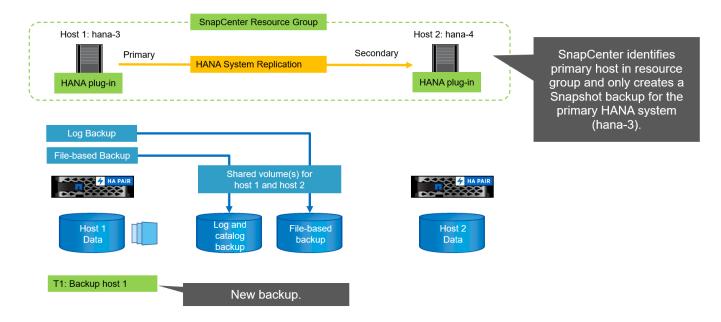
The resource group configuration is now finished and backups can be executed.

n Ne	tApp SnapCenter®					- L sapcc\scat	dmin SnapC	enterAdmin	🖡 Sign Out
	SAP HANA 💌	SS2 - HANA System Replication De	tails						×
	Search databases	Search				Modily Resource Group	US Back up Now	Maintenance	Delete
,	Name	Resource Name	Туре	Host					
)	SS2 - HANA System Replication	552	MultipleContainers	hana-3.sapcc.stl.netapp.com					
		552	MultipleContainers	hana-4.sapcc.stl.netapp.com					
Ň									

	SAP HANA	-									
Dashboard	View Mult	itenant Database Container 👻 🛛 Si	earch databases						Refresh Resources	AM SAPHAN	A Database New Resource Gro
Resources	12 14	System	System ID (SID)	Tenant Databases	Replication	Plug-in Host	Resource Groups	Policies	Las	t backup	Overall Status
Monitor		SS2	552	SS2	Enabled (Primary)	hana-3.sapcc.stl.netapp.c om	SS2 - HANA System Repli cation	LocalSnap			Backup not run
Reports		552	552	552	Enabled (Secondary)	hana-4.sapcc.stl.netapp.c		LocalSnap			Backup not run
Hosts	-				(secondary)	om	cation				
Storage System	5										
E Settings											
Alerts											

#### **Snapshot backup operations**

When a backup operation of the resource group is executed, SnapCenter identifies which host is primary and only triggers a backup at the primary host. This means, only the data volume of the primary host will be snapshotted. In our example, hana-3 is the current primary host and a backup is executed at this host.



The SnapCenter job log shows the identification operation and the execution of the backup at the current primary host hana-3.

Job D	etails	×
Backu	ip of Resource Group 'SS2 - HANA System Replication' with policy 'LocalSnap'	
~ * 1	Backup of Resource Group 'SS2 - HANA System Replication' with policy 'LocalSnap'	*
	<ul> <li>Refresh HANA replication resources on host(s): hana-3.sapcc.stl.netapp.com, hana- ipcc.stl.netapp.com</li> </ul>	- 11
~	▼ hana-3.sapcc.stl.netapp.com	
~	Backup	
~	Validate Dataset Parameters	
~	Validate Plugin Parameters	- 11
~	Complete Application Discovery	- 11
~	Initialize Filesystem Plugin	- 11
~	Discover Filesystem Resources	- 11
~	Validate Retention Settings	
~	Quiesce Application	
~	Quiesce Filesystem	
4	Create Snapshot	- 11
~	UnQuiesce Filesystem	- 11
~	UnQuiesce Application	- 11
~	Get Snapshot Details	- 11
~	Get Filesystem Meta Data	- 11
~	Finalize Filesystem Plugin	- 11
~	Collect Autosupport data	
~	Register Backup and Apply Retention	
~	Register Snapshot attributes	
~	Application Clean-Up	
() Task	Name: Backup Start Time: 12/13/2021 8:35:33 AM End Time:	
	View Logs Cancel Job	Close
	(	

A Snapshot backup has now been created at the primary HANA resource. The hostname included in the backup name shows hana-3.

n Ne	tApp SnapCenter®			•	-	9-	L sapcc\scadm	nin SnapCenterAdmin	🛙 Sign Out
>	SAP HANA	SS2 - HANA System Replication X	SS2 Topology						×
	Search databases	search					Preset	i tat	, <del>Refrecti</del>
U	Name	Resource Name	Manage Copies						
-	SS2 - HANA System Replication	552	1 Backup				Sum	mary Card	
<b>a</b> i		552	0 Clones					ckup	
٨			Local copies					Snapshot based backup	
								File-Based backups	
łe.							0 Ck	ones	
*			Primary Backup(s)						
A			search 🛛					-	ti II Neme Deve
			Backup Name Count	1F					End Date
			SnapCenter_hana-3_LocalSnap_Hourly_12-13-2021_08.35.30.7075 1					12/13/2021 8	:36:32 AM 🗖

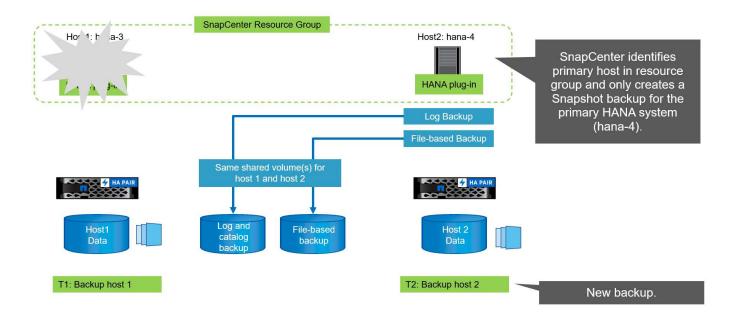
The same Snapshot backup is also visible in the HANA backup catalog.

<u>E</u> ile <u>E</u> dit <u>N</u> avigate Segrch <u>B</u> un <u>W</u> indow <u>H</u> elp													
🔁 • 📾 🖏 • 취 • 💝 🗢 • 아 • 🖬 🖻													Q 181
👍 Systems 🛛 🛛 📴 🕶 🖉 🕶 🖾 🥵 🖇 🖓 🖬	SYSTER	MDB@SS2 👫 SYSTEM	IDB@SS2 🖄	Backup SYS	TEMDB@SS2 (S	(STEM) SS2 - HSR Source System 🛛							0
> 🗁 FC5 - SAN with Linux LVM	🖄 Backu	up SYSTEMDB@SS2 (SYSTE	vl) SS2 - HSR Sour	ce System								Last Update:8:39:16 AM	s
> GSI - System Refresh Target > GSII - MDC multiple tenants - 2.05PS5	Overview	Configuration Backup Ca	talog										
SS1 - MDC single tenant - 2.05PS5	Backup	Catalog					Backup Details						
[6] §S\$1@\$S\$1 (\$YSTEM) \$S1 - MDC single tenant - 2.05P55     [6] \$VSTEM0B@\$S1 (\$YSTEM) \$S1 - MDC single tenant - 2.05P55     [6] \$S1 Repair System     [6] \$S1 Repair System     [6] \$S1 Repair Stanz3 -> banz3 ->     [6] \$S1 Repair Stanz3 -> banz4		ise: SYSTEMDB w Log Backups 🔲 Show I	∼ Delta Backups				ID: Status: Backup Type: Destination Type:	163940255 Successful Data Back Snapshot	100.00				
<ul> <li>SS2 HSK nana-3 -&gt; nana-4</li> <li>SS2@SS2 (SYSTEM) SS2 - HSR Source System</li> </ul>	Status	Started	Duration	Size	Backup Type	Destinatio	Started:		1 8:35:57 AM	(America/Indiana	apolis)		
Tigs SS2@SS2 (SYSTEM) SS2 - HSR Target System     Tigs SYSTEMOBOSS2 (SYSTEM) SS2 - HSR Sauce System     SYSTEMDB@SS2 (SYSTEM) SS2 - HSR Target System	8	Dec 13, 2021 8:35:57 Dec 13, 2021 7:04:58	00h 00m 15s 00h 00m 04s		Data Backup Data Backup	Snapshot File	Finished: Duration: Size Throughput: System ID: Comment: Additional Information	00h 00m 1 1.76 GB n.a. SnapCent	55	(America/Indiana calSnap_Hourly_1;	polis) 2-13-2021_08.35.30	).7075	~ ~
								/hana/dat		001/ te Name B hdb00001	Source Type volume	EBID SnapC	~ ~

If a takeover operation is executed, further SnapCenter backups now identify the former secondary host (hana-4) as primary, and the backup operation is executed at hana-4. Again, only the data volume of the new primary host (hana-4) is snapshotted.



The SnapCenter identification logic only covers scenarios in which the HANA hosts are in a primary-secondary relation or when one of the HANA hosts is offline.



The SnapCenter job log shows the identification operation and the execution of the backup at the current primary host hana-4.

Job D	etails	×
Backu	p of Resource Group 'SS2 - HANA System Replication' with policy 'LocalSnap'	
√ ¥ 8	Backup of Resource Group 'SS2 - HANA System Replication' with policy 'LocalSnap'	
×	<ul> <li>Refresh HANA replication resources on host(s): hana-3.sapcc.stl.netapp.com, hana- pcc.stl.netapp.com</li> </ul>	- 11
	▼ hana-4.sapcc.stl.netapp.com	- 11
~	Backup	
~	Validate Dataset Parameters	- 11
~	Validate Plugin Parameters	- 11
~	Complete Application Discovery	- 11
~	Initialize Filesystem Plugin	- 11
~	Discover Filesystem Resources	- 11
~	Validate Retention Settings	- 11
~	Quiesce Application	- 11
~	Quiesce Filesystem	- 11
~	Create Snapshot	- 11
~	UnQuiesce Filesystem	- 11
~	UnQuiesce Application	- 11
~	Get Snapshot Details	- 11
~	Get Filesystem Meta Data	- 11
~	Finalize Filesystem Plugin	
1	Collect Autosupport data	
~	Register Backup and Apply Retention	- 11
~	Register Snapshot attributes	
~	► Application Clean-Up	
() Task	Name: Backup Start Time: 12/13/2021 8:56:44 AM End Time:	
	View Logs Cancel Job	Close

A Snapshot backup has now been created at the primary HANA resource. The hostname included in the backup name shows hana-4.

II Ne	etApp SnapCenter®				٠	0 · 1 sa	pcc\scadmin	SnapCenterAdmin	🛿 Sign Out
> 	SAP HANA Search databases	SS2 - HANA System Replication X	SS2 Topology						× ≓
U	System	Resource Name	Manage Copies						
⊗ ≤	SS2 - HAVIA System Replication	552 552	C Clones Local copies					p shot based backup lased backups ()	
## •			Primary Backup(s) Search   Backup Name SnapCenter_hana-4_LocalSnap_Hourly_12-13-2021_08 56.42.1331	Count 1	47				figure 2 End Date

The same Snapshot backup is also visible in the HANA backup catalog.

M hdbstudio - System: SYSTEMDB@SS2 Host: hana-4 Instance: 33 Cons	ected User: S	SYSTEM System Usage: Tes	t System - SAP HA	ANA Studio											143		×	
Eile Edit Navigate Search Bun Window Help																		
🗂 • 🗐 临 [ 出 • 罚 • 🗢 🗢 •   📑																9 1	2 5	
Yoo Systems 😥 📲 ▾ 🗐 🔛 ▾ 💷 🛃 🗒 😫 " 🗖	SYSTEM	ADB@SS2 👫 SYSTEM	DB@SS2 🖉	Backup SYS	TEMDB@SS2 (S	(STEM) SS2 - HSR Sou	urce System	SYSTEM	DB@SS2 🛛 👛 B	Backup S	VSTEMDB@	SS2 (SYSTEM	l) SS2 - HSR Targe	et System 🛯			- 0	
> 🗁 FC5 - SAN with Linux LVM	🙆 Backup SYSTEMDB@SS2 (SYSTEM) SS2 - HSR Target System																	
	Overview Configuration Backup Catalog																	
V (b) 551 - MDC single teams - 2.05955         ·           · [b] 551055 (SYSTEM 51 - MDC single teams - 2.05955         ·           · [b] 551055 (SYSTEM 51 - MDC single teams - 2.05955         ·           · [b] 551055 (SYSTEM 51 - MDC single teams - 2.05955         ·           · [b] 551055 (SystEm 51 - MDC single teams - 2.05955         ·           · [b] 551055 (SystEm 51 - MDC single teams - 2.05955         ·           · [b] 551055 (SystEm 51 - MES - System 7         ·           · [b] 552055 (SYSTEM 52 - HSF Single System 7         ·           · [b] 552055 (SYSTEM 52 - HSF Single System 7         ·           · [b] 552055 (SYSTEM 52 - HSF Single System 7         ·           · [b] 5520552 (SYSTEM 52 - HSF Single System 7         ·           · [b] 5520552 (SYSTEM 52 - HSF Single System 7         ·	Backup (		Backup Details															
	Database: SYSTEMDB								ID: Status: Backup Type: Destination Type:	2	1639403827309 Successful Data Backup Snapshot							
	Status	Started	Duration	n Size	Backup Type	Destinatio			Started:	Dec 13, 2021 8:57:07 AM (Ame				/Indianapolis)				
		Dec 13, 2021 8:57:07	00h 00m 15s		Data Backup	Snapshot		Finished: Dec 13, 2021 8					M (America/Indianapolis)					
		Dec 13, 2021 8:50:40 Dec 13, 2021 8:43:45	00h 00m 14s 00h 00m 04s		Data Backup	Snapshot			Duration:	C								
) (a statewidewssz (statewi) ssz - Hak larget system	8	Dec 13, 2021 0:4549 Dec 13, 2021 7:04:58			Data Backup Data Backup	File File			Size	1.69 GB								
									Throughput: System ID:	n.a.								
									Supervision Concernence			enter_hana-4_LocalSnap_Hourly_12-13-2021_08.56.42.1331					0	
									Additional Inform	nation:	oni koko 🔿							
									Location:	/hana/data/SS2/mmt00001/					~ ~			
									Host ^ hana-4	Servie	ce eserver		name hdb00001	Source Type volume	EBID SnapC			

#### Block-integrity check operations with file-based backups

SnapCenter 4.6 uses the same logic as described for Snapshot backup operations for block-integrity check operations with file-based backups. SnapCenter identifies the current primary HANA host and executes the file-based backup for this host. Retention management is also performed across both hosts, so the oldest backup is deleted regardless of which host is currently the primary.

#### SnapVault replication

To allow transparent backup operations without manual interaction in case of a takeover and independent of which HANA host is currently the primary host, you must configure a SnapVault relationship for the data volumes of both hosts. SnapCenter executes a SnapVault update operation for the current primary host with each backup run.

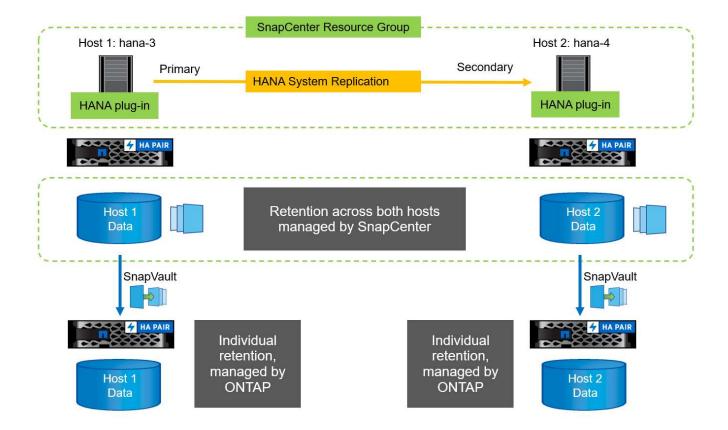


If a takeover to the secondary host is not performed for a long time, the number of changed blocks for the first SnapVault update at the secondary host will be high.

Since the retention management at the SnapVault target is managed outside of SnapCenter by ONTAP, the retention can't be handled across both HANA hosts. Therefore backups that have been created before a takeover are not deleted with backup operations at the former secondary. These backups remain until the former primary becomes primary again. So that these backups do not block the retention management of log backups, they must deleted manually either at the SnapVault target or within the HANA backup catalog.



A cleanup of all SnapVault Snapshot copies is not possible, because one Snapshot copy is blocked as a synchronization point. If the latest Snapshot copy needs to be deleted as well, the SnapVault replication relationship must be deleted. In this case, NetApp recommends deleting the backups in the HANA backup catalog to unblock log backup retention management.



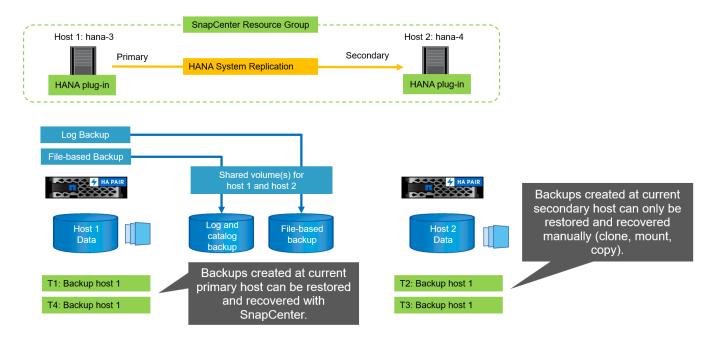
#### **Retention management**

SnapCenter 4.6 manages retention for Snapshot backups, block-integrity check operations, HANA backup catalog entries, and log backups (if not disabled) across both HANA hosts, so it doesn't matter which host is currently primary or secondary. Backups (data and log) and entries in the HANA catalog are deleted based on the defined retention, regardless of whether a delete operation is necessary on the current primary or secondary host. In other words, no manual interaction is required if a takeover operation is performed and/or the replication is configured in the other direction.

If SnapVault replication is part of the data protection strategy, manual interaction is required for specific scenarios, as described in the section SnapVault Replication

#### **Restore and recovery**

The following figure depicts a scenario in which multiple takeovers have been executed and Snapshot backups have been created at both sites. With the current status, the host hana-3 is the primary host and the latest backup is T4, which has been created at host hana-3. If you need to perform a restore and recovery operation, the backups T1 and T4 are available for restore and recovery in SnapCenter. The backups, which have been created at host hana-4 (T2, T3), can't be restored using SnapCenter. These backups must be copied manually to the data volume of hana-3 for recovery.



Restore and recovery operations for a SnapCenter 4.6 resource group configuration are identical to an autodiscovered non-System Replication setup. All options for restore and automated recovery are available. For further details, see the technical report TR-4614: SAP HANA Backup and Recovery with SnapCenter.

A restore operation from a backup that was created at the other host is described in the section Restore and Recovery from a Backup Created at the Other Host.

## SnapCenter configuration with a single resource

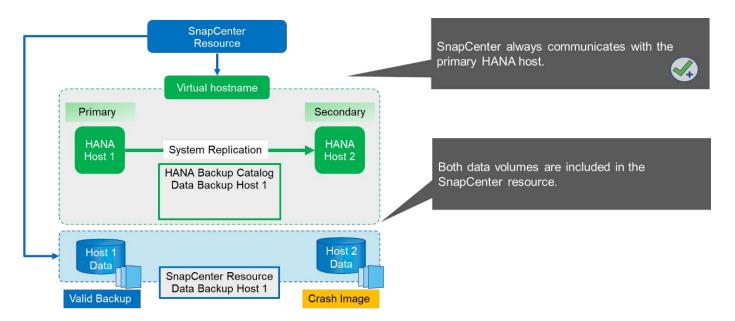
A SnapCenter resource is configured with the virtual IP address (host name) of the HANA System Replication environment. With this approach, SnapCenter always communicates with the primary host, regardless of whether host 1 or host 2 is primary. The data volumes of both SAP HANA hosts are included in the SnapCenter resource.



We assume that the virtual IP address is always bound to the primary SAP HANA host. The failover of the virtual IP address is performed outside SnapCenter as part of the HANA System Replication failover workflow.

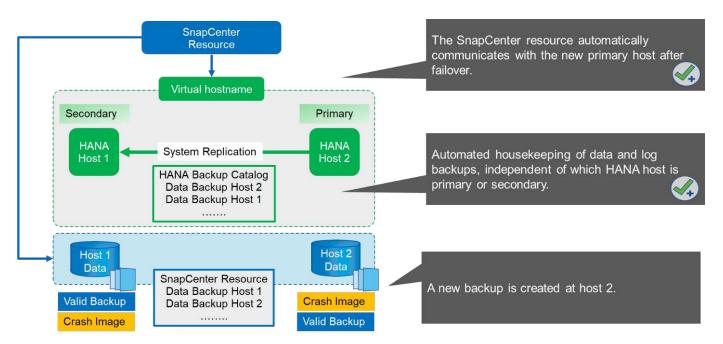
When a backup is executed with host 1 as the primary host, a database-consistent Snapshot backup is created at the data volume of host 1. Because the data volume of host 2 is part of the SnapCenter resource, another Snapshot copy is created for this volume. This Snapshot copy is not database consistent; rather, it is just a crash image of the secondary host.

The SAP HANA backup catalog and the SnapCenter resource includes the backup created at host 1.



The following figure shows the backup operation after failover to host 2 and replication from host 2 to host 1. SnapCenter automatically communicates with host 2 by using the virtual IP address configured in the SnapCenter resource. Backups are now created at host 2. Two Snapshot copies are created by SnapCenter: a database-consistent backup at the data volume at host 2 and a crash image Snapshot copy at the data volume at host 1. The SAP HANA backup catalog and the SnapCenter resource now include the backup created at host 1 and the backup created at host 2.

Housekeeping of data and log backups is based on the defined SnapCenter retention policy, and backups are deleted regardless of which host is primary or secondary.

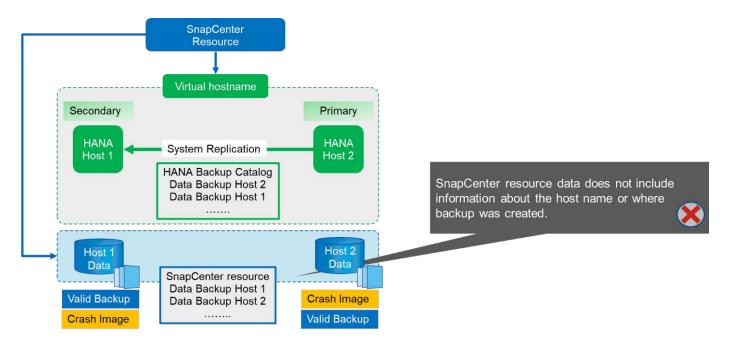


As discussed in the section Storage Snapshot Backups and SAP System Replication, a restore operation with storage-based Snapshot backups is different, depending on which backup must be restored. It is important to identify which host the backup was created at to determine if the restore can be performed at the local storage volume, or if the restore must be performed at the other host's storage volume.

With single-resource SnapCenter configuration, SnapCenter is not aware of where the backup was created. Therefore, NetApp recommends that you add a prebackup script to the SnapCenter backup workflow to

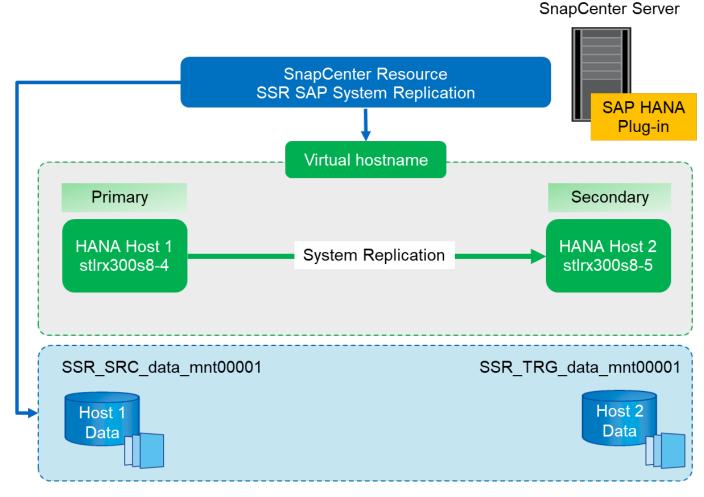
identify which host is currently the primary SAP HANA host.

The following figure depicts identification of the backup host.



#### **SnapCenter configuration**

The following figure shows the lab setup and an overview of the required SnapCenter configuration.



To perform backup operations regardless of which SAP HANA host is primary and even when one host is down, the SnapCenter SAP HANA plug-in must be deployed on a central plug-in host. In our lab setup, we used the SnapCenter server as a central plug-in host, and we deployed the SAP HANA plug-in on the SnapCenter server.

A user was created in the HANA database to perform backup operations. A user store key was configured at the SnapCenter server on which the SAP HANA plug-in was installed. The user store key includes the virtual IP address of the SAP HANA System Replication hosts (ssr-vip).

hdbuserstore.exe -u SYSTEM set SSRKEY ssr-vip:31013 SNAPCENTER <password>

You can find more information about SAP HANA plug-in deployment options and user store configuration in the technical report TR-4614: SAP HANA Backup and Recovery with SnapCenter.

In SnapCenter, the resource is configured as shown in the following figure using the user store key, configured before, and the SnapCenter server as the hdbsql communication host.

Add SAP HANA Da	itabase			,					
1 Name	Provide Resource Det	ails							
2 Storage Footprint 3 Summary	Resource Type	<ul> <li>Single Container</li> <li>Multitenant Database Container (MDC) - Single Tenant</li> <li>Non-data Volumes</li> </ul>							
	HANA System Name SID	SSR - SAP System Replication SSR							
	Tenant Database HDBSQL Client Host	SSR SC30-V2.sapcc.stl.netapp.com SSRKEY							
	HDB Secure User Store Keys								
	HDBSQL OS User	SYSTEM		0					
			Previous	Next					

The data volumes of both SAP HANA hosts are included in the storage footprint configuration, as the following figure shows.

Add SAP HANA Da	tabase		×
1 Name	Provide Storage Footprint Details		
2 Storage Footprint	Storage Systems for storage footprint hana		
3 Resource Settings			
4 Summary	Modify hana		×
	Select one or more volumes and if required their associ	ated Qtrees and LUNs	
	Volume Name	LUNs or Qtrees	
	SSR_TRG_data_mnt00001	Default is 'None' or type to find	
	SSR_SRC_data_mnt00001	Default is 'None' or type to find	
			Save
		Pre	evious Next

As discussed before, SnapCenter is not aware of where the backup was created. NetApp therefore recommends that you add a pre- backup script in the SnapCenter backup workflow to identify which host is currently the primary SAP HANA host. You can perform this identification using a SQL statement that is added to the backup workflow, as the following figure shows.

Select host from "SYS".M\_DATABASE

sr	napCenter®		🌲 🜌 😔 🛛 sapcetscadmin SnapCenterAdmin 🖉 Si	iign Out
>	SAP HANA 💌	SSR - SAP System Replication T X	Multitenant Database Container - Protect	×
	Search databases			i Decails
	System           FP1 MDC single tenant SAN           H23 MDC single tenant SAN           NF2 MDC single tenant NF5 multiple           SP1 MDC single tenant NF5           SSR - SAP System Replication	Manage Copies Primary Backup(s) search Backup Name 5napCenter_LocalSnap_06-27-2018_07.12.2 5.1232 SnapCenter_LocalSnap_06-27-2018_07.08.4 9.2081	Commands to be executed before and after creating Snapshot copies	A
Activit	Total 5 The 5 most recent jobs are displayed	Total 2	Pre UnQuiesce Previous Previous	Next

#### SnapCenter backup operation

Backup operations are now executed as usual. Housekeeping of data and log backups is performed independent of which SAP HANA host is primary or secondary.

The backup job logs include the output of the SQL statement, which allows you to identify the SAP HANA host where the backup was created.

The following figure shows the backup job log with host 1 as the primary host.

Dashboard		Job			
Resources	Source	Log Level			
Monitor	SC30-V2.sapcc.stl.netapp.com hana_34790.log	OTHER	Coloraction constraint constraints for the constraint of the constraints by the constraints by the constraint of the constraints by the constraints of the constraints by the constraint	•	
Reports	SC30-V2.sapcc.stl.netapp.com hana_34790.log	OTHER	2018-06-27107:12:36.00035-0-600 TRACE [pool-4-thread-1310] 127 com.netapp.snapcreator.agent.nextgen.operationmanager.OperationManagerimpl -Getting status for optic*cv03844-66-271-365605070:913		
Hosts Storage Systems	SC30-V2.sapcc.stl.netapp.com hana_34790.log	INFO	2018-06-2710711236.0000670-0400 INFO (pool-6-bread-115) 86 com.netapp.snapcreator.workflow.notifier.impl.jobStatusNotifierimpl -SCC-00226: Successfully updated job status for jobid [34790] on SnapCenter-Server.	s	
<ul> <li>Storage Systems</li> </ul>	SC30-V2.sapcc.stl.netapp.com hana_34790.log	OTHER	2018-06-27107:12:36.0000545-04:00 TRACE [pool-4-thread-1309] 127 com.netapp.snapcreator.agent.nextgen.operationmanager.OperationManagerImpl -Getting status for		
0-V2.sapcc.stl.ne	scao-v2.sspc.ssl.netapp.com hana_34790.log OTH	R "0	1019-06-27T0712:36.0000545-04:00 TRACE [pool-4 thread-1309] 262 com.netapp.snapcreator.workflow.Task - Command [echo SELECT HOS c:\Program Ellactapholdschen/hdbsql*-U SSRXEY] finished with exit code: [0] stdout: [ Welcome to the SAP HANA Database interactive ter q to qui HOST *strx30088-4*]. row selected (overall time 7379 Usec; server time 318 Usec) ] stderr: [] 2018-6-27T071236.000054-5*-0.00 TRACE [pool-4thread-1809] 122 com.netapp.apacetart workflow.atLiskull-command [echo SELECT HOST *ROM *SYS*-M_LDATABASE*   - Command -	rminal.	
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0-V2.sapcc.stl.ne	SC30-V2.sapcc.sti.netapp.com hana_34790.log SC30-V2.sapcc.sti.netapp.com hana_34790.log	R "C \c	C:\Program Ellakasababdeling hdbsql* -U SSRKEY] finished with exit code: [0] stdout: [Welcome to the SAP HANA Database interactive ter q to qui HOST *strx3008.4*]. row selected (overall time 7379 Usec; server time 318 Usec) ] stdeut: [Welcome to the SAP HANA Database interactive ter comments and the server time 318 Usec) ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database]. The server time 31	rminal.	
80-V2.sapcc.stl.ne	SC30-Y2.sspcc.stl.netapp.com hana_34790.log	R "C	CNProgram: Elackambelbeliantholbsql*-U SSRKEY] finished with exit code: [0] stidout: [ Welcome to the SAP HANA Database interactive terr q to quil HOST "stirx300s8-4" it row selected (overall time 7379 usec; server time 318 usec) ] stiderr: [] 2018-06-2710/11285.000055-01400 TRACE [pool-4thread-1809] 127 com.netapp.snapcreator.worlflow.ukl.faskUbi-Command (echo SELECT HOST FROM "SYS", M_DATABASE" ] "CuProgram FileAtaphabdechribtbach" USSRKEY] finished with exit code: [0] stident; [Welcome to the SAP HANA Database interactive terminal. Type: h for help with commands to to an tHOST "stirk300b64" it row selected (overall time 7379 usec server time 318 usec) ] atder: [] 2018-06-2710/11285.000055-01400 [Bog Geod-dread-1809 256 com.netapp.snapceator.worlflow.task.dexcuting Pre-application quiese command [echo SELECT HOST FROM	rminal.	
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30-V2.sapcc.stl.ne	SC39-V2.sapcc.stl.netapp.com hana_34790.log SC39-V2.sapcc.stl.netapp.com hana_34790.log SC39-V2.sapcc.stl.netapp.com hana_34790.log SC39-V2.sapcc.stl.netapp.com hana_34790.log	R "C VC NFO NFO NFO	CLProgram Ellastanbabbblan, hdbsql" -U SSRKEY] finished with exit code: [0] stdout: [Welcome to the SAP HANA Database interactive fer q to qui HOST "strx3008.4"]. row selected (overall time 7379 Usec; server time 318 Usec) ] stdeut: [Welcome to the SAP HANA Database interactive fer q to qui HOST "strx3008.4"]. row selected (overall time 7379 Usec; server time 318 Usec) ] stdeut: [Welcome to the SAP HANA Database interactive term and the starbabbblentholes. The starbabbblentholes and the stocker [U] stdeut: [Welcome to the SAP HANA Database interactive terminal; Type: U for help with commands is to qui HOST "strx3008.4"]. row selected (overall time 7379 Usec; server time 318 Usec] ] stdeut: [Welcome to the SAP HANA Database interactive terminal; Type: U for help with commands is to qui HOST "strx3008.4%]. row selected (overall time 7379 Usec; server time 318 Usec] ] stdeut: [Welcome to SAP HANA Database interactive terminal; Type: U for help with commands is to qui HOST "strx3008.4%]. row selected (overall time 7379 Usec; server time 318 Usec] ] stdeut: [] 2018-66-2770711236.000545-0400 INFO [pool-4-dread-1309] 256 com.netapp.snapcreator.workflowtask-dxecuting Pre-application quiesce completed successfully 2018-66-2770711236.000545-0400 INFO [pool-4-dread-1309] 256 com.netapp.snapcreator.workflowtask-dxecuting Pre-application quiesce completed successfully 2018-66-2770711236.000545-0400 INFO [pool-4-dread-1309] 256 com.netapp.snapcreator.workflowtask-dxecuting Pre-application quiesce completed successfully 2018-66-2770711236.000545-0400 INFO [pool-4-dread-1309] 256 com.netapp.snapcreator.workflowtask-command [echo SELECT HOST FROM "scrxthub"] 2018-66-2770711236.000545-0400 INFO [pool-4-dread-1309] 252 com.netapp.snapcreator.workflowtask-command [echo SELECT HOST FROM "scrxthub"] 2018-66-2770711236.000545-0400 INFO [pool-4-dread-1309] 252 com.netapp.snapcreator.workflowtask-command [echo SELECT HOST FROM "scrxthub"] 2018-66-277071236.000545-0400 INFO [pool-4-dread-1309] 252 com.netapp.snapcreator.workflowtask-	rminal.	
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80-V2.sapcc.stl.ne	SC39-V2.sepccstl.netapp.com hana_34790.log SC39-V2.sepccstl.netapp.com hana_34790.log SC39-V2.sepccstl.netapp.com hana_34790.log SC39-V2.sepccstl.netapp.com hana_34790.log SC39-V2.sepccstl.netapp.com hana_34790.log SC39-V2.sepccstl.netapp.com hana_34790.log	R COTHER COTHER NIFO	<ul> <li>CNProgram Ellasta sphabeling hidbsql" -U SSREV] finished with exit code: [0] stdout: [Welcome to the SAP HANA Database Interactive terr et o gui HOST "stirx30068-4"]</li> <li>2018-06-2770712:85.0000545-04.00 TMCE [pool-4tmed-1309] 122 com.netapp.anapcreator.workflow.sll.studies learner: betminal. Type: hi for help with commands in to gui HOST "stirx30068-4"]</li> <li>2018-06-2770712:85.0000545-04.00 TMCE [pool-4tmed-1309] 122 com.netapp.anapcreator.workflow.sll.studies learner: betminal. Type: hi for help with commands in to gui HOST "stirx300685-04.00 TMCE [pool-4tmed-1309] 256 com.netapp.anapcreator.workflow.sll.studies learner: betminal. Type: hi for help with commands in to gui HOST "stirx300055-04.00 TMCE [pool-4tmed-1309] 256 com.netapp.anapcreator.workflow.tak-structure for application quiesce complexed successfully 2018-06-27707112-36.0000545-04.00 TMCE [gool-4tmed-1309] 256 com.netapp.anapcreator.workflow.tak-structure for application quiesce complexed successfully 2018-06-27707112-36.0000545-04.00 TMCE [gool-4tmed-1309] 256 com.netapp.anapcreator.workflow.tak-structure for the policition quiesce complexed successfully 2018-06-27707112-36.0000545-04.00 TMCE [gool-4tmed-1309] 256 com.netapp.anapcreator.workflow.tak-command [etch SELECT HOST FROM "SN". "Application quiesce complexed successfully 2018-06-2770712-36.0000545-04.00 TMCE [gool-4tmed-1309] 252 com.netapp.anapcreator.workflow.tak-command [etch SELECT HOST FROM "SN". "Application quiesce complexed successfully 2018-06-2770712-36.0000545-04.00 TMCE [gool-4tmed-1309] 252 com.netapp.anapcreator.workflow.tak-command [etch SELECT HOST FROM "SN". "Application quiesce complexed successfully 2018-06-2770712-36.0000545-04.00 TMCE [gool-4tmed-1309] 252 com.netapp.anapcreator.workflow.tak-command [etch SELECT HOST FROM "SN". "Application quiesce complexed successfully 2018-06-2770712-38.0000545-04.00 TMCE [gool-4tmed-1309] 252 com.netapp.anapcreator.workflow.tak-command [etch SELECT HOST FROM "SN". "Application quiesce complexed succes</li></ul>	rminal.	

This figure shows the backup job log with host 2 as the primary host.

Dashboard	Log t	Job	Vilgen Scient - Pilgen Scient - Rest
Resources Monitor	Source anapmanagemen_personag	Control Log Level	x Nestade Nestade Sector Sect
sapcc.stl.netapp	.com hana_34799.log OTHER	"c\Pr	06-27107:45:53.0000174-04:00 TRACE [pool-4-thread-1347] 262 com.netapp.snapcreator.workflow.Task -Command [echo SELECT HOST FROM "SYS": "M_DATABASE" ogram Electrophothelian (hdbsql" -U SSRKEY] finished with exit code: [O] stdout: [ Welcome to the SAP HANA Database interactive terminal. Type: \h for help with co qui HOST "stdrx300s8-5" ) row selected (overall time 5613 usec; server time 202 usec) ] stderr: []
Storage Systems	SnapManagerWeb_34799.log	INFO	2018-06-27707:45:53.3148036-04:00 INPC SnapManagetWeb,34759 PID=(2324) TID=(61) Enter Update(obStatus
Settings	SnapManagerWeb_34799.log	INFO	2018-05-27107-45:53.2678816-04:00 INFO SnapManagerWeb_34759 PID=(2324) TID=(61) Exit JobManagerProvider: Update(obStatus
	SnapManagerWeb_34799.log	INFO	2018-06-27107;45:33.236(524-04:00 INFO SnapManagerWeb_34759 PID=[2324] TID=[61] Exit Update(obStatus
	SnapManagerWeb_34799.log	INFO	2018-05-27107/45:53.1897658-04:00 INFO SnapManagerWeb_34799 PID=[2324] TID=[61] Enter JobManagerProwder: Update]obStatus
	Sasattapasarttab. 24780 Jan	1950	1018 OF 17TH DUCKS 1887609 OF 01 UKO CALAD VALUES 21158 BOD (1)318 THINKI CALAD DUCKS HILL.
	SC30-V2.sapcc.stl.netapp.com hana_34799.log	OTHER	2018-06-22707/45:53.0000174-04:00 TRACE [pool-4thread-1347] 242 com.netspp.snapcreator.workflow.Task-Command [echo SELECT HOST FROM 'SYS':"M_DATABASE"   "CP/Pogram Filestaphtholentholsage" J SSINEY] finished with extr cortex (D) student: [V Mecome to the SAP H4AA Database interactive terminal. Type: Uh for help with commands type out HOST 'sin30505-51' in vesterot (Avoid 100 SU usec) server targe 202 usec) 1 server to T
	SC30-V2.sapcc.stl.netapp.com hana_34799.log	INFO	2018-06-27107:45:33.0000174-04:00 INFO (pool-4-thread-1348) 145 com.netapp.snapcreator.workflow.task.Quiesce -Application Quiesce for plugin : hana
	SC30-V2.sapcc.stl.netapp.com hana_34799.log	INFO	2018-05-27107:45:53.0000174-04:00 INFO [bool-4-thread-1348] 145 com.netapp.snapcreator.workflow.task.Quiesce -log level minus
	5C30-V2.sapcc.stl.netapp.com hana_34799.log	INFO	2018-05-27107:45:33.0000174-04:00 INFO [pool-4-thread-1348] 145 com.netapp.snapcreator.workflow.task.Quiesce -Application Quiesce
	SC30-V2.sapcc.stl.netapp.com hana_34799.log	INFO	2018-06-27107:45:53.0000174-04:00 INFO [pool-3-thread-243] 145 com.netapp.snapcreator.workflow.task.Quiesce-Skipping Quiesce: False
	5C30-V2.sapcc.stl.netapp.com hana_34799.log	INFO	2018-06-27107/45:53.0000174-04:00 INFO [pool-3-thread-243] 145 com.netapp.snapcreator.workflow.task.Quiesce -Quiesce skip check
	SC30-V2.sapcc.stl.netapp.com hana_34799.log	INFO	2018-06-27707/45/53.000174-04:00 INFO [pool-4-thread-1947] 145 com.netapp.snapcreator.workflow.task.PreAppQuiesceCmd -Pre Application Quiesce commands finished successfully
	SC30-V2.sapcc.stl.netapp.com hana_34799.log	INFO	2018-06-27107:45:53.0000174-04:00 INPO [pool-4-thread-1347] 256 com.netapp.snapcreator.workflow.Task -Pre application quiesce completed successfully
	SC30-V2.sapcc.stl.netapp.com hana_34799.log	OTHER	2018-06-27107/x5/33.000174-04:00 TAACE [pool-athread-1347] 127 com.netapp.snapcreator agent.nexgen.operationmanager.OperationManagerimpi -Getting status for oplid=d7e4d902-abc9-4576-9ftid=de51684f375f
	SC30-V2.sapcc.stl.netapp.com hana_34799.log	OTHER	2018-05-271074553,0000174-04:00 TRACE [pool-4-thread-1347] 127 com.netapp.snapcreator agent.nextgen.operationmanager.OperationManagerImpl -getOperationResult] - Getting result for opid=d7e4d502-abc54-57te-51ad-de5165al37bf

The following figure shows the SAP HANA backup catalog in SAP HANA Studio. When the SAP HANA database is online, the SAP HANA host where the backup was created is visible in SAP HANA Studio.

**(** 

The SAP HANA backup catalog on the file system, which is used during a restore and recovery operation, does not include the host name where the backup was created. The only way to identify the host when the database is down is to combine the backup catalog entries with the backup.log file of both SAP HANA hosts.

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<ul> <li>EP1 - MDC Single tenant - SAN</li> <li>E H23-Multiple-Partitions</li> </ul>	Overview			0   com									
👂 🗁 NF2 - MDC Single Tenant - Multiple H							Backup Details						
P01 - Single Container - NFS     @ QP1 - MDC Single Tenant - NFS     @ SP1 - MDC Single Tenant - NFS     @ SP1 - MDC Single Tenant - NFS     @ SSR-SAP-System-Replication     [] SSR%SSR (SYSTEM) SSR Source Sys	2.1						ID:	1529595390505					
	Databas	e: SYSTEMDB	*				Status:	Successful					
		v Log Backups 🗌 Show 🛙	Delta Backups				Backup Type: Destination Type:	Data Backup Snapshot					
SSR@SSR (SYSTEM) SSR Target Sys	Status	Started	Duration	Size	Backup Type	Destinatio	Started:	Jun 21, 2018 11:36:30 AM	(America/New_York)				
A SYSTEMDB@SSR (SYSTEM) SSR So		Jun 21, 2018 11:36:3	00h 00m 06s		Data Backup	Snapshot	Finished:	Jun 21, 2018 11:36:37 AM	(America/New_)	(ork)			
🕙 Backup	8	Jun 21, 2018 11:34:4	00h 00m 06s	1.47 GB	Data Backup	Snapshot	Duration: Size:	00h 00m 06s 1.47 GB					
D Content							Size: Throughput:	1.47 GB n.a.					
<ul> <li>Provisioning</li> <li>Security</li> </ul>							System ID:						
SYSTEMDB@SSR (SYSTEM) SSR Ta							Comment:	SnapCenter_LocalSnap_0	6-21-2018_11.36				
Backup										<u> </u>			
Description Content							Additional Information:	<ok></ok>					
<ul> <li>Provisioning</li> <li>Security</li> </ul>												Ŷ	
B Q01 (SYSTEM) Single Container - NFS							Location:	/hana/data/SSR/mnt000	01/			0	
								L					
							COLORADO COLORADO COLORADO	010 TV	Name	Source Type			
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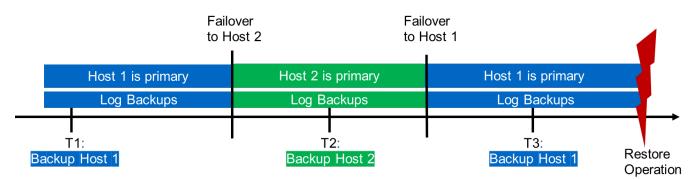
#### **Restore and recovery**

As discussed before, you must be able to identify where the selected backup was created to define the required restore operation. If the SAP HANA database is still online, you can use SAP HANA Studio to identify the host at which the backup was created. If the database is offline, the information is only available in the SnapCenter backup job log.

The following figure illustrates the different restore operations depending on the selected backup.

If a restore operation must be performed after timestamp T3 and host 1 is the primary, you can restore the backup created at T1 or T3 by using SnapCenter. These Snapshot backups are available at the storage volume attached to host 1.

If you need to restore using the backup created at host 2 (T2), which is a Snapshot copy at the storage volume of host 2, the backup needs to be made available to host 1. You can make this backup available by creating a NetApp FlexClone copy from the backup, mounting the FlexClone copy to host 1, and copying the data to the original location.



Restore Operation With	
Backup T1	SnapCenter
Backup T2	Create FlexClone from "Backup host 2", mount and copy
Backup T3	SnapCenter

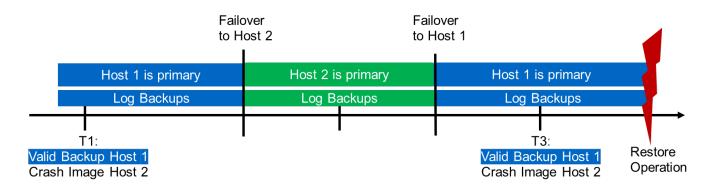
With a single SnapCenter resource configuration, Snapshot copies are created at both storage volumes of both SAP HANA System Replication hosts. Only the Snapshot backup that is created at the storage volume of the primary SAP HANA host is valid to use for forward recovery. The Snapshot copy created at the storage volume of the secondary SAP HANA host is a crash image that cannot be used for forward recovery.

A restore operation with SnapCenter can be performed in two different ways:

- · Restore only the valid backup
- Restore the complete resource, including the valid backup and the crash imageThe following sections discuss the two different restore operations in more detail.

A restore operation from a backup that was created at the other host is described in the section Restore and Recovery from a Backup Created at the Other Host.

The following figure depicts restore operations with a single SnapCenter resource configuration.

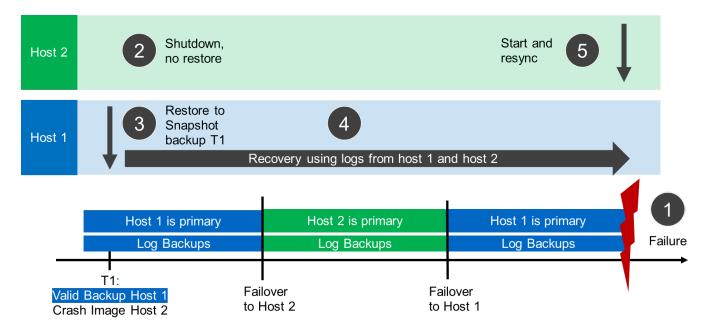


#### SnapCenter restore of the valid backup only

The following figure shows an overview of the restore and recovery scenario described in this section.

A backup has been created at T1 at host 1. A failover has been performed to host 2. After a certain point in time, another failover back to host 1 was performed. At the current point in time, host 1 is the primary host.

- 1. A failure occurred and you must restore to the backup created at T1 at host 1.
- 2. The secondary host (host 2) is shut down, but no restore operation is executed.
- 3. The storage volume of host 1 is restored to the backup created at T1.
- 4. A forward recovery is performed with logs from host 1 and host 2.
- 5. Host 2 is started, and a system replication resynchronization of host 2 is automatically started.



The following figure shows the SAP HANA backup catalog in SAP HANA Studio. The highlighted backup shows the backup created at T1 at host 1.

• 📾 🗠 i 🖗 • 🚳 • 🍫	위 친구 전		Quick Access 1	81			
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NF2 - MDC Single Tenant - Mult	Database: SYSTEMD8 V	ID:	1529595390505				
P01 - Single Container - NFS QP1 - MDC Single Tenant - NFS		Status:	Successful				
SP1 - MDC Single Tenant - NFS	Show Log Backups Show Delta Backups	Backup Type: ————————————————————————————————————	Data Backup Snapshot				
SR-SAP-System-Replication	Status Started Duration Size Backup Type Destinatio	A Started:					
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25

A restore and recovery operation is started in SAP HANA Studio. As the following figure shows, the name of the host where the backup was created is not visible in the restore and recovery workflow.



In our test scenario, we were able to identify the correct backup (the backup created at host 1) in SAP HANA Studio when the database was still online. If the database is not available, you must check the SnapCenter backup job log to identify the right backup.

a Resources all SYSTEMOR	incell –							
Specify Recovery Type Select a recovery type.	Recovery of SYSTEMDBOSSR	Select a Backup  To recover this snapshot, it must be available in the data area.						
$ \textcircled{\begin{tabular}{lllllllllllllllllllllllllllllllllll$	Locate Backup Catalog Specify location of the backup catalog.	Selected Point in Time Database will be recovered to its most recent state. Backups						
Date:         2018-06-25         "e"         Time:         08:37:41           Select Time Zone:         (GMT-04:00) Eastern Daylight Time         1         5/vitem Time:         1           1         System Time:         USed (GMT): 2019-06:25 12:37:41         1         1	Recover using the backup catalog     Sauch for the backup catalog in the file system only     Backup Catalog Location: /mnt/log_backup/SSR-Source/SYSTEMDB	The overview shows back Start Time 2018-06-22 10:04:12 2018-06-21 11:36:30	ups that were recorded in the b Location /hana/data/SSR /hana/data/SSR	Backup catalog as suc Backup Prefix SNAPSHOT SNAPSHOT	cessful. The backup a Available	at the top is estimated to have the shortest recovery time.		
○ Recover the database to a specific data backup <sup>10</sup>	Recover without the backup catalog     Backint System Copy     Backint System Copy							
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(?)	Next >	0			< <u>B</u>	ack Next > Einish Cancel		
	(?)	Einish Cancel	][					

In SnapCenter, the backup is selected and a file-level restore operation is performed. On the file-level restore screen, only the host 1 volume is selected so that only the valid backup is restored.

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	SAP HANA 💌						×		
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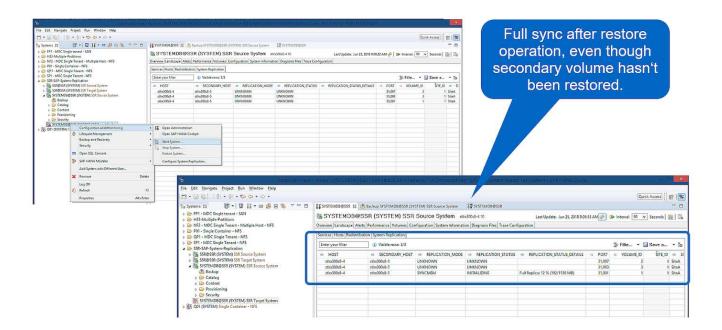
After the restore operation, the backup is highlighted in green in SAP HANA Studio. You don't have to enter an additional log backup location, because the file path of log backups of host 1 and host 2 are included in the backup catalog.

â .		Recovery	SYSTEMDER/SSR	×	Recovery of SYSTEMDBIBSSR	2 a 💌
Select a Backup Select a backup to recover	the SAP HANA database			10,000	te Log Backups ify location(s) of log backup files to be used to recover the database.	
Selected Point in Time Database will be recovered Backups The overview shows backup		up catalog as suc	cessful. The backup at the top is estimated to have the sl		D Even if no log backaps were created, a location is still needed to read data that will be used for recovery. The log backaps were written to the file system and subsequently moved, you need to specify their current location. If y tection for the log backaps, the system uses the location where the log backaps rever first served. The directory specified	you do not specify an alternative will be searched recursively.
Start Time	Location	Backup Prefix	Available		ocations	Add
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	kup availat apCenter r operatior	estor		Refresh Show More	Log backup location is included in backup catalog. No changes are	
Start Time: 0 2011 Size: 1.47	I-06-21 11:36:30 Destination Type GB Backup ID: Ia/data/SSR	E SNAPSHOT 1529595390505	Source System: SYSTEMDB@SSR External Backup ID: SnapCenter_LocalSnap_DI		required here.	
0			< gack Next>	Emish Cancel	< Back Net >	Einish Cancel

After forward recovery has finished, the secondary host (host 2) is started and SAP HANA System Replication resynchronization is started.



Even though the secondary host is up-to-date (no restore operation was performed for host 2), SAP HANA executes a full replication of all data. This behavior is standard after a restore and recovery operation with SAP HANA System Replication.

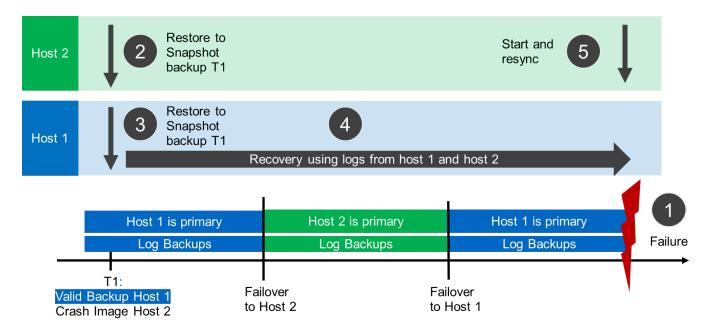


#### SnapCenter restore of valid backup and crash image

The following figure shows an overview of the restore and recovery scenario described in this section.

A backup has been created at T1 at host 1. A failover has been performed to host 2. After a certain point in time, another failover back to host 1 was performed. At the current point in time, host 1 is the primary host.

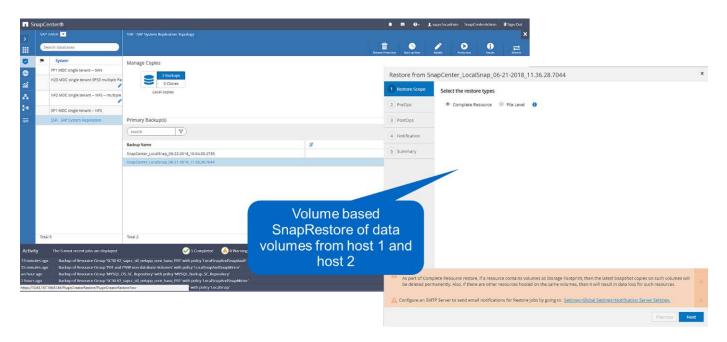
- 1. A failure occurred and you must restore to the backup created at T1 at host 1.
- 2. The secondary host (host 2) is shut down and the T1 crash image is restored.
- 3. The storage volume of host 1 is restored to the backup created at T1.
- 4. A forward recovery is performed with logs from host 1 and host 2.
- 5. Host 2 is started and a system replication resynchronization of host 2 is automatically started.



The restore and recovery operation with SAP HANA Studio is identical to the steps described in the section

#### SnapCenter restore of the valid backup only.

To perform the restore operation, select Complete Resource in SnapCenter. The volumes of both hosts are restored.



After forward recovery has been completed, the secondary host (host 2) is started and SAP HANA System Replication resynchronization is started. Full replication of all data is executed.

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PARTER - MDC Single Tenant - Multiple Host - NFS PO1 - Single Container - NFS	Services  Hosts  Redistribution  System Replication												
De QP1 - MDC Single Tenant - NFS	Enteryour filter	Vicible rowt: 3/3					-14 Fi	lte 💌 🖂 Save a 💌 🖗					
E> SP1 - MDC Single Tenant - NFS SSR-SAP-System-Replication	HOST	55 SECONDARY_HOST	REPLICATION_MODE	REPLICATION_STATUS	* REPLICATION_STATUS_DETAILS	12 PORT	12 VOLUME_ID	ŜITE_ID ··· SITE_NAME					
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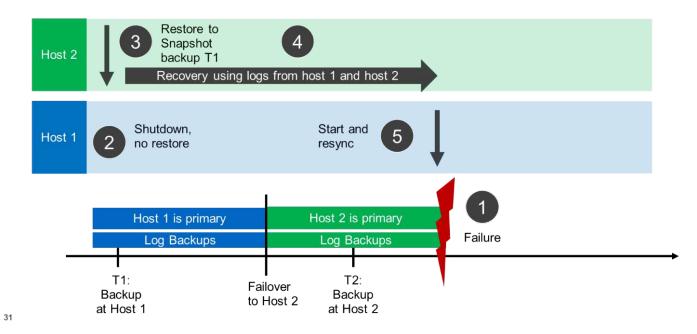
# Restore and recovery from a backup created at the other host

A restore operation from a backup that has been created at the other SAP HANA host is a valid scenario for both SnapCenter configuration options.

The following figure shows an overview of the restore and recovery scenario described in this section.

A backup has been created at T1 at host 1. A failover has been performed to host 2. At the current point in time, host 2 is the primary host.

- 1. A failure occurred and you must restore to the backup created at T1 at host 1.
- 2. The primary host (host 1) is shut down.
- 3. The backup data T1 of host 1 is restored to host 2.
- 4. A forward recovery is performed using logs from host 1 and host 2.
- 5. Host 1 is started, and a system replication resynchronization of host 1 is automatically started.



The following figure shows the SAP HANA backup catalog and highlights the backup, created at host 1, that was used for the restore and recovery operation.

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The restore operation involves the following steps:

- 1. Create a clone from the backup created at host 1.
- 2. Mount the cloned volume at host 2.
- 3. Copy the data from the cloned volume to the original location.

In SnapCenter, the backup is selected and the clone operation is started.

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>	SAP HANA 💌	SSR - SAP System Replication Topology		×
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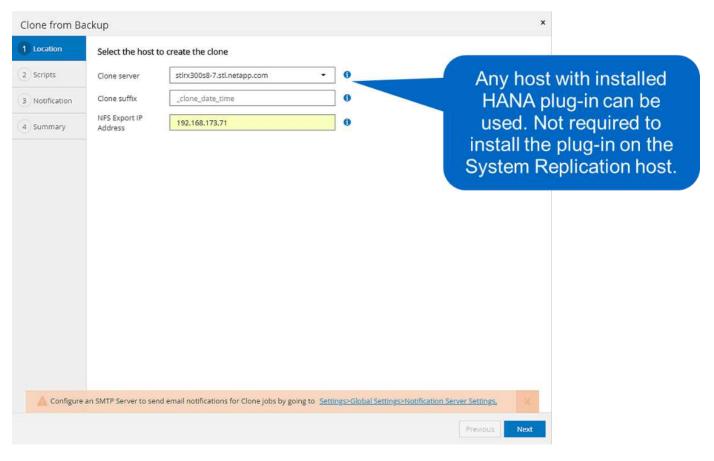
You must provide the clone server and the NFS export IP address.



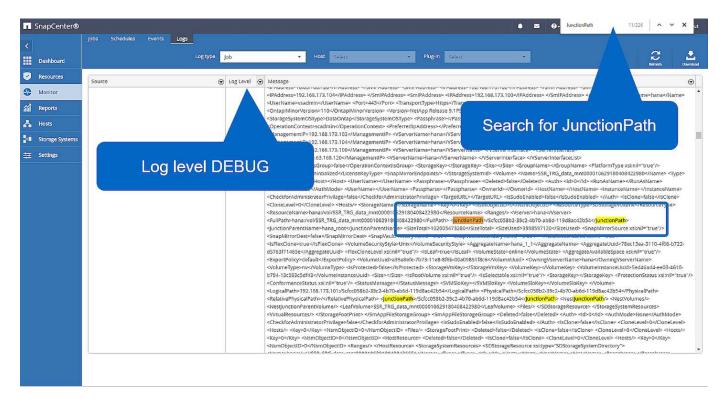
In a SnapCenter single-resource configuration, the SAP HANA plug-in is not installed at the database host. To execute the SnapCenter clone workflow, any host with an installed HANA plug-in can be used as a clone server.

#### +

In a SnapCenter configuration with separate resources, the HANA database host is selected as a clone server, and a mount script is used to mount the clone to the target host.



To determine the junction path that is required to mount the cloned volume, check the job log of the cloning job, as the following figure shows.



The cloned volume can now be mounted.

```
stlrx300s8-5:/mnt/tmp # mount 192.168.173.101:/Scc373da37-00ff-4694-b1e1-
8153dbd46caf /mnt/tmp
```

The cloned volume contains the data of the HANA database.

```
stlrx300s8-5:/mnt/tmp/# ls -al
drwxr-x--x 2 ssradm sapsys 4096 Jun 27 11:12 hdb00001
drwx----- 2 ssradm sapsys 4096 Jun 21 09:38 hdb00002.00003
drwx----- 2 ssradm sapsys 4096 Jun 27 11:12 hdb00003.00003
-rw-r--r-- 1 ssradm sapsys 22 Jun 27 11:12 nameserver.lck
```

The data is copied to the original location.

```
stlrx300s8-5:/mnt/tmp # cp -Rp hdb00001 /hana/data/SSR/mnt00001/
stlrx300s8-5:/mnt/tmp # cp -Rp hdb00002.00003/ /hana/data/SSR/mnt00001/
stlrx300s8-5:/mnt/tmp # cp -Rp hdb00003.00003/ /hana/data/SSR/mnt00001/
```

The recovery with SAP HANA Studio is performed as described in the section SnapCenter restore of the valid backup only.

## Where to find additional information

To learn more about the information described in this document, refer to the following documents:

- SAP HANA Backup and Recovery with SnapCenter
- Automating SAP HANA System Copy and Clone Operations with SnapCenter
- SAP HANA Disaster Recovery with Storage Replication

https://www.netapp.com/us/media/tr-4646.pdf

# **Version history**

Version History:

Version	Date	Document Version History
Version 1.0	October 2018	Initial version
Version 2.0	January 2022	Update to cover SnapCenter 4.6 HANA System Replication support

# SAP HANA Disaster Recovery with Azure NetApp Files

# TR-4891: SAP HANA disaster recovery with Azure NetApp Files

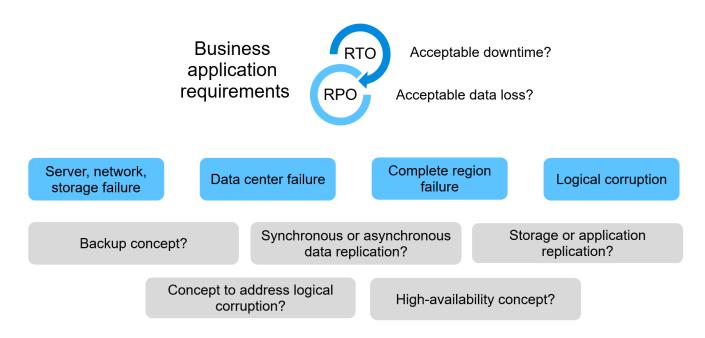
Studies have shown that business application downtime has a significant negative impact on the business of enterprises.

Authors: Nils Bauer, NetApp Ralf Klahr, Microsoft

In addition to the financial impact, downtime can also damage the company's reputation, staff morale, and customer loyalty. Surprisingly, not all companies have a comprehensive disaster recovery policy.

Running SAP HANA on Azure NetApp Files (ANF) gives customers access to additional features that extend and improve the built-in data protection and disaster recovery capabilities of SAP HANA. This overview section explains these options to help customers select options that support their business needs.

To develop a comprehensive disaster recovery policy, customers must understand the business application requirements and technical capabilities they need for data protection and disaster recovery. The following figure provides an overview of data protection.



#### **Business application requirements**

There are two key indicators for business applications:

- The recovery point objective (RPO), or the maximum tolerable data loss
- The recovery time objective (RTO), or the maximum tolerable business application downtime

These requirements are defined by the kind of application used and the nature of your business data. The RPO and the RTO might differ if you are protecting against failures at a single Azure region. They might also differ if you are preparing for catastrophic disasters such as the loss of a complete Azure region. It is important to evaluate the business requirements that define the RPO and RTO, because these requirements have a significant impact on the technical options that are available.

### High availability

The infrastructure for SAP HANA, such as virtual machines, network, and storage, must have redundant components to make sure that there is no single point of failure. MS Azure provides redundancy for the different infrastructure components.

To provide high availability on the compute and application side, standby SAP HANA hosts can be configured for built-in high availability with an SAP HANA multiple-host system. If a server or an SAP HANA service fails, the SAP HANA service fails over to the standby host, which causes application downtime.

If application downtime is not acceptable in the case of server or application failure, you can also use SAP HANA system replication as a high-availability solution that enables failover in a very short time frame. SAP customers use HANA system replication not only to address high availability for unplanned failures, but also to minimize downtime for planned operations, such as HANA software upgrades.

### Logical corruption

Logical corruption can be caused by software errors, human errors, or sabotage. Unfortunately, logical corruption often cannot be addressed with standard high-availability and disaster recovery solutions. As a result, depending on the layer, application, file system, or storage where the logical corruption occurred, RTO and RPO requirements can sometimes not be fulfilled.

The worst case is a logical corruption in an SAP application. SAP applications often operate in a landscape in which different applications communicate with each other and exchange data. Therefore, restoring and recovering an SAP system in which a logical corruption has occurred is not the recommended approach. Restoring the system to a point in time before the corruption occurred results in data loss, so the RPO becomes larger than zero. Also, the SAP landscape would no longer be in sync and would require additional postprocessing.

Instead of restoring the SAP system, the better approach is to try to fix the logical error within the system, by analyzing the problem in a separate repair system. Root cause analysis requires the involvement of the business process and application owner. For this scenario, you create a repair system (a clone of the production system) based on data stored before the logical corruption occurred. Within the repair system, the required data can be exported and imported to the production system. With this approach, the productive system does not need to be stopped, and, in the best-case scenario, no data or only a small fraction of data is lost.



The required steps to setup a repair system are identical to a disaster recovery testing scenario described in this document. The described disaster recovery solution can therefore easily be extended to address logical corruption as well.

#### Backups

Backups are created to enable restore and recovery from different point-in-time datasets. Typically, these backups are kept for a couple of days to a few weeks.

Depending on the kind of corruption, restore and recovery can be performed with or without data loss. If the RPO must be zero, even when the primary and backup storage is lost, backup must be combined with synchronous data replication.

The RTO for restore and recovery is defined by the required restore time, the recovery time (including database start), and the loading of data into memory. For large databases and traditional backup approaches, the RTO can easily be several hours, which might not be acceptable. To achieve very low RTO values, a backup must be combined with a hot-standby solution, which includes preloading data into memory.

In contrast, a backup solution must address logical corruption, because data replication solutions cannot cover all kinds of logical corruption.

#### Synchronous or asynchronous data replication

The RPO primarily determines which data replication method you should use. If the RPO must be zero, even when the primary and backup storage is lost, the data must be replicated synchronously. However, there are technical limitations for synchronous replication, such as the distance between two Azure regions. In most cases, synchronous replication is not appropriate for distances greater than 100km due to latency, and therefore this is not an option for data replication between Azure regions.

If a larger RPO is acceptable, asynchronous replication can be used over large distances. The RPO in this case is defined by the replication frequency.

### HANA system replication with or without data preload

The startup time for an SAP HANA database is much longer than that of traditional databases because a large amount of data must be loaded into memory before the database can provide the expected performance. Therefore, a significant part of the RTO is the time needed to start the database. With any storage-based replication as well as with HANA System Replication without data preload, the SAP HANA database must be started in case of failover to the disaster recovery site.

SAP HANA system replication offers an operation mode in which the data is preloaded and continuously updated at the secondary host. This mode enables very low RTO values, but it also requires a dedicated server that is only used to receive the replication data from the source system.

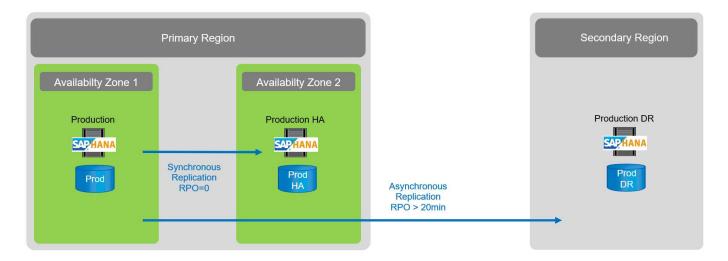
# **Disaster recovery solution comparison**

A comprehensive disaster recovery solution must enable customers to recover from a complete failure of the primary site. Therefore, data must be transferred to a secondary site, and a complete infrastructure is necessary to run the required production SAP HANA systems in case of a site failure. Depending on the availability requirements of the application and the kind of disaster you want to be protected from, a two-site or three-site disaster recovery solution must be considered.

The following figure shows a typical configuration in which the data is replicated synchronously within the same Azure region into a second availability zone. The short distance allows you to replicate the data synchronously to achieve an RPO of zero (typically used to provide HA).

In addition, data is also replicated asynchronously to a secondary region to be protected from disasters, when the primary region is affected. The minimum achievable RPO depends on the data replication frequency, which is limited by the available bandwidth between the primary and the secondary region. A typical minimal RPO is in the range of 20 minutes to multiple hours.

This document discusses different implementation options of a two- region disaster recovery solution.



### **SAP HANA System Replication**

SAP HANA System Replication works at the database layer. The solution is based on an additional SAP HANA system at the disaster recovery site that receives the changes from the primary system. This secondary system must be identical to the primary system.

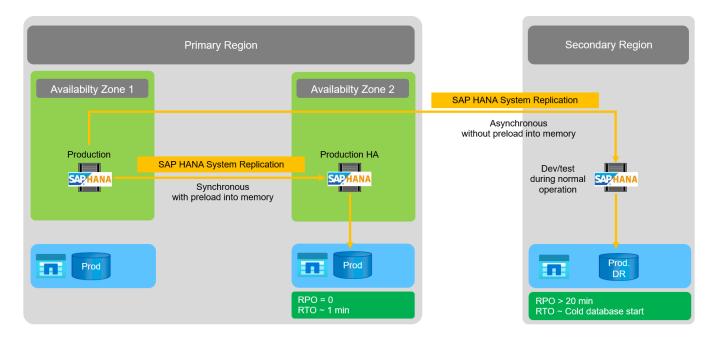
SAP HANA System Replication can be operated in one of two modes:

- With data preloaded into memory and a dedicated server at the disaster recovery site:
  - The server is used exclusively as an SAP HANA System Replication secondary host.
  - Very low RTO values can be achieved because the data is already loaded into memory and no database start is required in case of a failover.
- Without data preloaded into memory and a shared server at the disaster recovery site:
  - The server is shared as an SAP HANA System Replication secondary and as a dev/test system.
  - RTO depends mainly on the time required to start the database and load the data into memory.

For a full description of all configuration options and replication scenarios, see the SAP HANA Administration Guide.

The following figure shows the setup of a two-region disaster recovery solution with SAP HANA System Replication. Synchronous replication with data preloaded into memory is used for local HA in the same Azure region, but in different availability zones. Asynchronous replication without data preloaded is configured for the remote disaster recovery region.

The following figure depicts SAP HANA System Replication.



#### SAP HANA System Replication with data preloaded into memory

Very low RTO values with SAP HANA can be achieved only with SAP HANA System Replication with data preloaded into memory. Operating SAP HANA System Replication with a dedicated secondary server at the disaster recovery site allows an RTO value of approximately 1 minute or less. The replicated data is received and preloaded into memory at the secondary system. Because of this low failover time, SAP HANA System Replication is also often used for near-zero-downtime maintenance operations, such as HANA software upgrades.

Typically, SAP HANA System Replication is configured to replicate synchronously when data preload is chosen. The maximum supported distance for synchronous replication is in the range of 100km.

#### SAP System Replication without data preloaded into memory

For less stringent RTO requirements, you can use SAP HANA System Replication without data preloaded. In this operational mode, the data at the disaster recovery region is not loaded into memory. The server at the DR region is still used to process SAP HANA System Replication running all the required SAP HANA processes. However, most of the server's memory is available to run other services, such as SAP HANA dev/test systems.

In the event of a disaster, the dev/test system must be shut down, failover must be initiated, and the data must be loaded into memory. The RTO of this cold standby approach depends on the size of the database and the read throughput during the load of the row and column store. With the assumption that the data is read with a throughput of 1000MBps, loading 1TB of data should take approximately 18 minutes.

#### SAP HANA disaster recovery with ANF Cross-Region Replication

ANF Cross-Region Replication is built into ANF as a disaster recovery solution using asynchronous data replication. ANF Cross-Region Replication is configured through a data protection relationship between two ANF volumes on a primary and a secondary Azure region. ANF Cross-Region Replication updates the secondary volume by using efficient block delta replications. Update schedules can be defined during the replication configuration.

The following figure shows a two- region disaster recovery solution example, using ANF Cross- Region Replication. In this example the HANA system is protected with HANA System Replication within the primary region as discussed in the previous chapter. The replication to a secondary region is performed using ANF

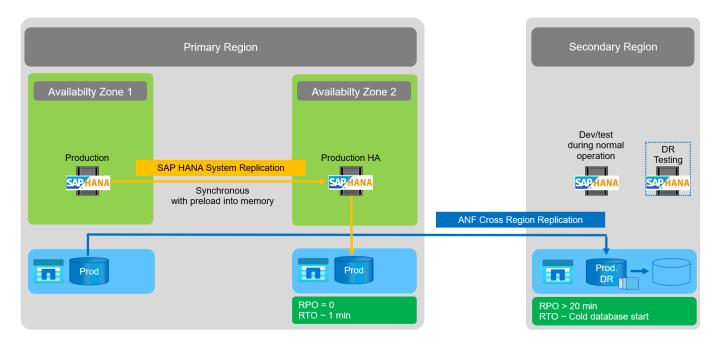
cross region replication. The RPO is defined by the replication schedule and replication options.

The RTO depends mainly on the time needed to start the HANA database at the disaster recovery site and to load the data into memory. With the assumption that the data is read with a throughput of 1000MB/s, loading 1TB of data would take approximately 18 minutes. Depending on the replication configuration, forward recovery is required as well and will add to the total RTO value.

More details on the different configuration options are provided in chapter Configuration options for cross region replication with SAP HANA.

The servers at the disaster recovery sites can be used as dev/test systems during normal operation. In case of a disaster, the dev/test systems must be shut down and started as DR production servers.

ANF Cross-Region Replication allows you to test the DR workflow without impacting the RPO and RTO. This is accomplished by creating volume clones and attaching them to the DR testing server.



#### Summary of disaster recovery solutions

The following table compares the disaster recovery solutions discussed in this section and highlights the most important indicators.

The key findings are as follows:

- If a very low RTO is required, SAP HANA System Replication with preload into memory is the only option.
  - A dedicated server is required at the DR site to receive the replicated data and load the data into memory.
- In addition, storage replication is needed for the data that resides outside of the database (for example shared files, interfaces, and so on).
- If RTO/RPO requirements are less strict, ANF Cross-Region Replication can also be used to:
  - Combine database and nondatabase data replication.
  - · Cover additional use cases such as disaster recovery testing and dev/test refresh.
  - With storage replication the server at the DR site can be used as a QA or test system during normal operation.

• A combination of SAP HANA System Replication as an HA solution with RPO=0 with storage replication for long distance makes sense to address the different requirements.

	Storage replication	SAP HANA system replic	ation
	Cross-region replication	With data preload	Without data preload
RTO	Low to medium, depending on database startup time and forward recovery	Very low	Low to medium, depending on database startup time
RPO	RPO > 20min asynchronous replication	RPO > 20min asynchronous replication RPO=0 synchronous replication	RPO > 20min asynchronous replication RPO=0 synchronous replication
Servers at DR site can be used for dev/test	Yes	No	Yes
Replication of nondatabase data	Yes	No	No
DR data can be used for refresh of dev/test systems	Yes	No	No
DR testing without affecting RTO and RPO	Yes	No	No

The following table provides a comparison of disaster recovery solutions.

# **ANF Cross-Region Replication with SAP HANA**

## ANF Cross-Region Replication with SAP HANA

Application agnostic information on Cross-Region Replication can be found at the following location.

Azure NetApp Files documentation | Microsoft Docs in the concepts and how- to guide sections.

## Configuration options for Cross-Region Replication with SAP HANA

The following figure shows the volume replication relationships for an SAP HANA system using ANF Cross-Region Replication. With ANF Cross-Region Replication, the HANA data and the HANA shared volume must be replicated. If only the HANA data volume is replicated, typical RPO values are in the range of one day. If lower RPO values are required, the HANA log backups must be also replicated for forward recovery.



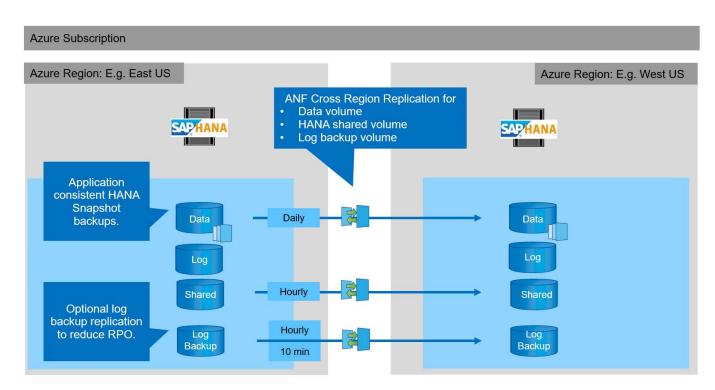
The term "log backup" used in this document includes the log backup and the HANA backup catalog backup. The HANA backup catalog is required to execute forward recovery operations.



The following description and the lab setup focus on the HANA database. Other shared files, for example the SAP transport directory would be protected and replicated in the same way as the HANA shared volume.

To enable HANA save-point recovery or forward recovery using the log backups, application-consistent data Snapshot backups must be created at the primary site for the HANA data volume. This can be done for example with the ANF backup tool AzAcSnap (see also What is Azure Application Consistent Snapshot tool for Azure NetApp Files | Microsoft Docs). The Snapshot backups created at the primary site are then replicated to the DR site.

In the case of a disaster failover, the replication relationship must be broken, the volumes must be mounted to the DR production server, and the HANA database must be recovered, either to the last HANA save point or with forward recovery using the replicated log backups. The chapter Disaster recovery failover, describes the required steps.



The following figure depicts the HANA configuration options for cross-region replication.

With the current version of Cross-Region Replication, only fixed schedules can be selected, and the actual replication update time cannot be defined by the user. Available schedules are daily, hourly and every 10 minutes. Using these schedule options, two different configurations make sense depending on the RPO requirements: data volume replication without log backup replication and log backup replication with different schedules, either hourly or every 10 minutes. The lowest achievable RPO is around 20 minutes. The following table summarizes the configuration options and the resulting RPO and RTO values.

	Data volume replication	Data and log backup volume replication	Data and log backup volume replication
CRR schedule data volume	Daily	Daily	Daily
CRR schedule log backup volume	n/a	Hourly	10 min

	Data volume replication	Data and log backup volume replication	Data and log backup volume replication
Max RPO	24 hours + Snapshot schedule (e.g., 6 hours)	1 hour	2 x 10 min
Max RTO	Primarily defined by HANA startup time	HANA startup time + recovery time	HANA startup time + recovery time
Forward recovery	NA	Logs for the last 24 hours + Snapshot schedule (e.g., 6 hours)	Logs for the last 24 hours + Snapshot schedule (e.g., 6 hours)

### **Requirements and best practices**

Microsoft Azure does not guarantee the availability of a specific virtual machine (VM) type upon creation or when starting a deallocated VM. Specifically, in case of a region failure, many clients might require additional VMs at the disaster recovery region. It is therefore recommended to actively use a VM with the required size for disaster failover as a test or QA system at the disaster recovery region to have the required VM type allocated.

For cost optimization it makes sense to use an ANF capacity pool with a lower performance tier during normal operation. The data replication does not require high performance and could therefore use a capacity pool with a standard performance tier. For disaster recovery testing, or if a disaster failover is required, the volumes must be moved to a capacity pool with a high-performance tier.

If a second capacity pool is not an option, the replication target volumes should be configured based on capacity requirements and not on performance requirements during normal operations. The quota or the throughput (for manual QoS) can then be adapted for disaster recovery testing in the case of disaster failover.

Further information can be found at Requirements and considerations for using Azure NetApp Files volume cross-region replication | Microsoft Docs.

#### Lab setup

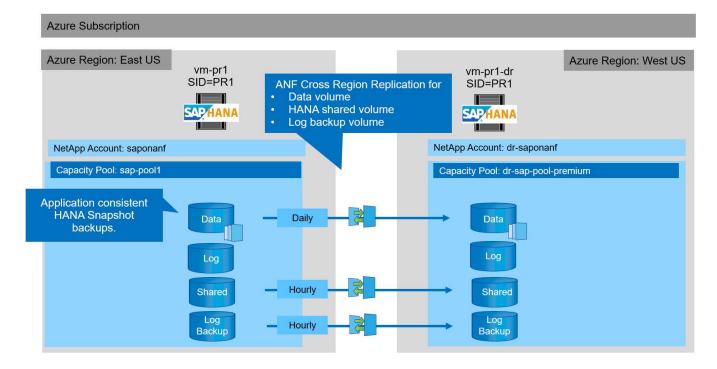
Solution validation has been performed with an SAP HANA single-host system. The Microsoft AzAcSnap Snapshot backup tool for ANF has been used to configure HANA application-consistent Snapshot backups. A daily data volume, hourly log backup, and shared volume replication were all configured. Disaster recover testing and failover was validated with a save point as well as with forward recovery operations.

The following software versions have been used in the lab setup:

- Single host SAP HANA 2.0 SPS5 system with a single tenant
- SUSE SLES for SAP 15 SP1
- AzAcSnap 5.0

A single capacity pool with manual QoS has been configured at the DR site.

The following figure depicts the lab setup.



#### Snapshot backup configuration with AzAcSnap

At the primary site, AzAcSnap was configured to create application-consistent Snapshot backups of the HANA system PR1. These Snapshot backups are available at the ANF data volume of the PR1 HANA system, and they are also registered in the SAP HANA backup catalog, as shown in the following two figures. Snapshot backups were scheduled for every 4 hours.

With the replication of the data volume using ANF Cross-Region Replication, these Snapshot backups are replicated to the disaster recovery site and can be used to recover the HANA database.

The following figure shows the Snapshot backups of the HANA data volume.

#### 1-data-mnt00001)

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Overview		♀ Search snapshots					
Activity log		Name	$\uparrow_{\downarrow}$	Location	↑↓	Created	↑↓
Access control (IAM)		(B) azacsnap_2021-02-12T145015-1799555Z		East US		02/12/2021, 03:49:48 PM	
Tags		(S) azacsnap_2021-02-12T145227-1245630Z		East US		02/12/2021, 03:51:24 PM	
tings		(L) azacsnap2021-02-12T145828-3863442Z		East US		02/12/2021, 03:58:01 PM	
Properties		🕒 azacsnap_2021-02-16T134021-9431230Z		East US		02/16/2021, 02:39:18 PM	
Locks		🕒 azacsnap_2021-02-16T134917-6284160Z		East US		02/16/2021, 02:48:55 PM	
rage service		🕒 azacsnap_2021-02-16T135737-3778546Z		East US		02/16/2021, 02:56:32 PM	••
Mount instructions		🕒 azacsnap2021-02-16T160002-1354654Z		East US		02/16/2021, 04:59:40 PM	
Export policy		🕒 azacsnap2021-02-16T200002-0790339Z		East US		02/16/2021, 08:59:42 PM	
Snapshots		🕒 azacsnap2021-02-17T000002-1753859Z		East US		02/17/2021, 12:59:32 AM	
Replication		🕲 azacsnap2021-02-17T040001-5454808Z		East US		02/17/2021, 04:59:31 AM	••
nitoring		azacsnap_2021-02-17T080002-2933611Z		East US		02/17/2021, 08:59:40 AM	

Metrics

The following figure shows the SAP HANA backup catalog.

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STEMDB(	DPR1 🖄 Backup	SYSTE 💼 S	SYSTEMDB@	0PR1 👔	SYSTEMDB@PR1	SYSTEMDB@PR1	🖄 Backup SYSTE	23 🐧 SY	STEMDB@PF	R1 🐧 SI	STEMDB@PR1	🔥 SYSTEMDB@PR1	-
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Show	Log Backups Show I	Jelta Backuns					Backup Type:	Data Back					
		vena backups					Destination Type:	Snapshot	200 <b>0</b> .				
Status	Started	Duration	Size	Backup Type	Destinatio		Started:		021 2:50:15 PM	A (UTC)			
9	Feb 17, 2021 8:00:02	00h 00m 42s	3.13 GB	Data Backup	Snapshot		Finished:		021 2:50:48 PN				
	Feb 17, 2021 4:00:01	00h 00m 35s	3.13 GB	Data Backup	Snapshot		Duration:	00h 00m					
	Feb 17, 2021 12:00:0	00h 00m 36s	3.13 GB	Data Backup	Snapshot		Size:	3.13 GB					
	Feb 16, 2021 8:00:02	00h 00m 34s	3.13 GB	Data Backup	Snapshot		Throughput:	n.a.					
•	Feb 16, 2021 4:00:02	00h 00m 38s	3.13 GB	Data Backup	Snapshot		System ID:	Thu:					
•	Feb 16, 2021 1:57:37	00h 00m 32s	3.13 GB	Data Backup	Snapshot		Comment:	8.0	r.				
	Feb 16, 2021 1:49:17	00h 00m 32s	3.13 GB	Data Backup	Snapshot		comment.		t prefix: azacs	nap iew (20201214.6	(5524)		
	Feb 16, 2021 1:40:22	00h 00m 34s	3.13 GB	Data Backup	Snapshot			10015 TCI	Sient Sterrier		552.19		
8	Feb 12, 2021 2:58:28	00h 00m 32s	3.13 GB	Data Backup	Snapshot		Additional Information	n: <ok></ok>					
	Feb 12, 2021 2:52:27	00h 00m 32s	3.13 GB	Data Backup	Snapshot			100					
	Feb 12, 2021 2:50:15	00h 00m 32s	3.13 GB	Data Backup	Snapshot								
0							Location:	/hana/da	ata/PR1/mnt0	00001/			
0													
0							Host S	ervice	C144	Name	Source	EBID	
0													
•							1.100 Contraction (1.100 Contraction)	ameserver		hdb00001	volume	azacsnap_2021-02-12T14501	

#### Configuration steps for ANF Cross-Region Replication

A few preparation steps must be performed at the disaster recovery site before volume replication can be configured.

- A NetApp account must be available and configured with the same Azure subscription as the source.
- A capacity pool must be available and configured using the above NetApp account.
- A virtual network must be available and configured.
- Within the virtual network, a delegated subnet must be available and configured for use with ANF.

Protection volumes can now be created for the HANA data, the HANA shared and the HANA log backup volume. The following table shows the configured destination volumes in our lab setup.



To achieve the best latency, the volumes must be placed close to the VMs that run the SAP HANA in case of a disaster failover. Therefore, the same pinning process is required for the DR volumes as for any other SAP HANA production system.

HANA volume	Source	Destination	Replication schedule
HANA data volume	PR1-data-mnt00001	PR1-data-mnt00001-sm- dest	Daily
HANA shared volume	PR1-shared	PR1-shared-sm-dest	Hourly
HANA log/catalog backup volume	hanabackup	hanabackup-sm-dest	Hourly

For each volume, the following steps must be performed:

- 1. Create a new protection volume at the DR site:
  - a. Provide the volume name, capacity pool, quota, and network information.

- b. Provide the protocol and volume access information.
- c. Provide the source volume ID and a replication schedule.
- d. Create a target volume.
- 2. Authorize replication at the source volume.
  - Provide the target volume ID.

The following screenshots show the configuration steps in detail.

At the disaster recovery site, a new protection volume is created by selecting volumes and clicking Add Data Replication. Within the Basics tab, you must provide the volume name, capacity pool and network information.



The quota of the volume can be set based on capacity requirements, because volume performance does not have an effect on the replication process. In the case of a disaster recovery failover, the quota must be adjusted to fulfill the real performance requirements.



If the capacity pool has been configured with manual QoS, you can configure the throughput in addition to the capacity requirements. Same as above, you can configure the throughput with a low value during normal operation and increase it in case of a disaster recovery failover.

# Create a new protection volume

Basics Protocol Replication Tags Review + create

This page will help you create an Azure NetApp Files volume in your subscription and enable you to access the volume from within your virtual network. Learn more about Azure NetApp Files

Volume details		
Volume name *	PR1-data-mnt00001-sm-dest	~
Capacity pool * 🕡	dr-sap-pool1	$\sim$
Available quota (GiB) 🛈	4096	
		4 TiB
Quota (GiB) * 🔋	500	~
		500 GiB
Virtual network * 🛈	dr-vnet (10.2.0.0/16,10.0.2.0/24)	$\sim$
	Create new	
Delegated subnet * 🕠	default (10.0.2.0/28)	$\sim$
	Create new	
Show advanced section		
Review + create	< Previous Next : Protocol >	

In the Protocol tab, you must provide the network protocol, the network path, and the export policy.



The protocol must be the same as the protocol used for the source volume.

# Create a new protection volume

Access Protocol type	NFS      SMI	B 🔿 Dual-protocol (NI	FSv3 and SMB)		
Configuration					
File path * 🛈	PR1-data-mnt000	01-sm-dest			
Versions *	NFSv4.1				$\sim$
Kerberos	🔘 Enabled 🧿	Disabled			
Export policy Configure the volume's expo	rt policy, This can be edited later.	Learn more			
Configure the volume's expo	rt policy. This can be edited later. ve down $\bar{\uparrow}$ Move to top $\begin{tabular}{ll} \begin{tabular}{ll} \label{eq:constraint} \label{eq:constraint} \label{eq:constraint}$		Delete Root Acces	s	
Configure the volume's expo ↑ Move up ↓ Mo	ve down $\bar{\uparrow}$ Move to top $\begin{array}{c} & & \end{array}$	Move to bottom		58 	***
Configure the volume's expo ↑ Move up ↓ Mo	ve down ↑ Move to top ↓ Allowed clients	Move to bottom 📋 I Access	Root Acces		••••

Within the Replication tab, you must configure the source volume ID and the replication schedule. For data volume replication, we configured a daily replication schedule for our lab setup.



The source volume ID can be copied from the Properties screen of the source volume.

# Create a new protection volume

Basics Protocol Replication 1	Tags Review + create
Source volume ID (i)	/subscriptions/28cfc403-f3f6-4b07-9847-4eb16109e870/resourceGroups/rg 🗸
Replication schedule (i)	Daily
	Every 10 minutes
	Hourly
	Daily

Review + create

< Previous

Next : Tags >

As a final step, you must authorize replication at the source volume by providing the ID of the target volume.



You can copy the destination volume ID from the Properties screen of the destination volume.

#### -data-mnt00001)

## Authorize

×

PR1-data-mnt00	0001	(saponanf/sap-pool1/PR1-data-mnt00001)   Replicatio	Authorize
₽ Search (Ctrl+/)	«		1 Update the replication schedule
Overview			Update the replication schedule
Activity log		You don't have any data protection volumes. Click Add data protection to get started.	Destination volume id ①
Access control (IAM)			ol1/volumes/PR1-data-mnt00001-sm-de
Tags			
Settings			
III Properties			
🔒 Locks			
Storage service			
O Mount instructions			
Export policy			
🕑 Snapshots			
Replication			

The same steps must be performed for the HANA shared and the log backup volume.

#### **Monitoring ANF Cross-Region Replication**

The following three screenshots show the replication status for the data, log backup, and shared volumes.

The volume replication lag time is a useful value to understand RPO expectations. For example, the log backup volume replication shows a maximum lag time of 58 minutes, which means that the maximum RPO has the same value.

The transfer duration and transfer size provide valuable information on bandwidth requirements and change the rate of the replicated volume.

The following screenshot shows the replication status of HANA data volume.

me > Azure NetApp Files > dr-saponanf > PR1-data-mnt0001-sm-dest (dr-saponanf/dr-sap-pool-premium/PR1-data-mnt0001-sm-dest)

	PR1-data-mnt0001-sm-dest (dr-saponanf/dr-sap-pool-premium/PR1-data-mnt0001-sm-dest)   Replicati	ion
-	Volume	

	Volume replication lag time	\$	Is volume replication transferring	S	Volume replication progress
Activity log		<i>,</i> .			
Access control (IAM)	2.55days				
Tags	2.31days				23.84MiB
1070	2.08days		80		
ttings	44.44hours		70		19.07Mi8
Properties	38,89hpurs		60		
	33.33hours		50		14.31Mi8
Locks	27.78hours		40		
rage service	22.22hours 16,67hours		30		9.54MIB
	11.11hours		20		4.77MiB
Mount instructions	5.56hours	-	10		
Export policy	Osec		-0		08
Snapshots		6 AM UTC+01:00	12 PM 6 PM Feb 23 6 A	M UTC+01:00	12 PM 6 PM Feb 23 6 AM UTC+013
Replication	Volume replication lag time (Avg) di-saponanf/di-sap-pool-premium/pr1-data-mnt0001-sm-dest 5.06 hours		Is volume replication transferring (Avg) dr-saponant/dr-sap-pool-premium/pr1-data-mnt0001-sm-dest 0		Volume replication progress (Avg) dr-saponant/dr-sap-pool-premium/pr1-data-mnt0001-sm-dest 24.02 MiB
onitoring					
Metrics	Volume replication last transfer duration	\$	Volume replication last transfer size	\$	Volume replication total transfer
Metrics	Volume replication last transfer duration	Ŕ	Volume replication last transfer size	Ŕ	
	1.87min	\$2		Ŕ	326618
comation Tasks (preview)		\$	14968	\$2 	
omation	1.67min 1.5min	\$	1466a 14969 1369	\$2 	27968
omation Tasks (preview) Export template	1.57min 1.5min 1.33min		1.4858 1.4958 1.358 1.1258	\$2 	326618
omation Tasks (preview) Export template port + troubleshooting	1.67min 1.5min 1.32min 1.17min		1.4658 1.4858 1.358 1.1268 53.87M8	\$	27968
omation Tasks (preview) Export template port + troubleshooting	1.67min 1.5min 1.7min Jinin 50ee		1.4858 1.4958 1.358 1.1258	\$	27968 27968
omation Tasks (preview) Export template	1.87mn 13mn 137mn 137mn 50se	9	1.4658 1.4858 1.358 1.1268 53.87M8	\$7	32608 27969 23368 18608 1409
omation Tasks (preview) Export template port + troubleshooting	1.67min 1.3min 1.3min Jimin Stree 40sec		14668 14608 1368 11268 5187Me 6284Me	\$7	12698 27969 23368 18698
omation Tasks (preview) Export template port + troubleshooting	1.67min 1.5min 1.7min 1.7min 1.05ec 40sec 80sec		14959 14909 1308 11209 2525/118 2525/118 2522118	\$7	32608 27969 23368 18608 1409
omation Tasks (preview) Export template sort + troubleshooting	1.07min 1.3min 1.17min 1.17min 50ec 40ae 20ae		14859 14909 1308 1108 5187Me 522Me 5122Me 8147Me		3.2658 2.7959 

The following screenshot shows the replication status of HANA log backup volume.

P Search (Ctrl+/)	« 🖉 Edit 🔗 Break peering 📋 Delete 🖒 Refresh					
Overview					10 10 10 10 10 10 10 10 10 10 10 10 10 1	
Activity log	Volume replication lag time	\$	ls volume replication transferring	Ś	Volume replication progress	\$
R Access control (IAM)						
🎙 Tags	58.33min		0.35		14.9G)8	
ettings	50min		0.25		11.18GI8	
Properties	41.67min		0.2		9.31GiB	
Locks	33.33min	1			7.45GIB	
torage service	25min	$\mathbb{H}^{-}$	0.15		5.59GiB	
Mount instructions	16.67min	11	0.05		3.73GIB	
Export policy			0		1.86Gi8	
Snapshots	01ec 12 PM 6 PM Feb 23 6 AM		12 PM 6 PM Feb 23 6 AM	UTC+01.00	08 12 PM 6 PM Feb 23 6 AM UTC	
Replication	Volume replication lag time (Avg) dr-saponanf/dr-sap-pool-premium/hanabackup-sm-dest		Is volume replication transferring (Avg) dr-taponant/dr-sap-pool-premium/hanabackup-sm-dest 4.57 m		Volume replication progress (Avg) dr-sapponanf/dr-sap-pool-premium/hanabackup-sm-dest 14.46 GiB	
lonitoring	29.48 min		4.37 m		14.40 GB	
Metrics	Volume replication last transfer duration	\$	Volume replication last transfer size	\$	Volume replication total transfer	\$
utomation					32,6GIB	
Tasks (preview)	16sec		17.17MiB		27.94GiB	
Export template	14sec	V.	15.26MIB	<i>(</i>	23,286/8	
pport + troubleshooting	10sec		11,44MiB		18.63GIB	
New support request	.8sec		9.54Mi8		13.97Gi8	
New support request	6sec		7.63MiB 5.72MiB			
	4sec		5.72MIB 3.81MIB		9.31GiB	
	2sec		1.91MiB		4.66518	
	Dsec		_ 08		08	
	12 PM 6 PM Feb 23 8 AM Volume replication last transfer duration (Avg) driagonar/f/driag-pool-premum/hanabadup-sm-dest 13.67 sec		12 PM 6 PM Feb 23 6 AM Volume replication last transfer size (Avg) dri-sappranf/dr-sap-pool-premium/hanabackup-sm-dest 14.67 MB		12 PM 6 PM Feb 23 6 AM UTC Volume replication total transfer (Avg) drasport/drasp-pool-premium/hanabackup-sm-dest 28,28 giß	

>me > Azure NetApp Files > dr-saponanf > hanabackup-sm-dest (dr-saponanf/dr-sap-pool-premium/hanabackup-sm-dest) hanabackup-sm-dest (dr-saponanf/dr-sap-pool-premium/hanabackup-sm-dest) | Replication

The following screenshot shows the replication status of HANA shared volume.

me > Azure NetApp Files > dr-saponanf > PR1-shared-sm-dest (dr-saponanf/dr-sap-pool-premium/PR1-shared-sm-dest)

PR1-shared-sm-dest (dr-saponanf/dr-sap-pool-premium/PR1-shared-sm-dest) | Replication

Overview	Volume replication lag time	ls volume replication transferring	> Volume replication progress
Activity log	Volume replication lag time	Is volume replication transferring	> Volume replication progress
Access control (IAM)		100	1009
Tags	58.33min	90	909 808
Settings	50min	70	708
Properties	- 41.67min 33.33min	60	608
A Locks	25min	50 40	408
Storage service	16.67min	30	308
Mount instructions	8.33min	10	108
Export policy	Osec	0	08
	12 PM 6 PM Feb 23 6 AM 010-01:00	12 PM 6 PM Feb 23 6 AM 010-01:00	12 PM 6 PM Feb 23 6 AM 010-01:00
3 Snapshots			
	Volume replication lag time (Avg) dr-saponanf/dr-sap-pool-premium/pr1-shared-sm-dest	Is volume replication transferring (Avg) dr-saponant/dr-sap-pool-premium/prt-shared-sm-dest O	Volume replication progress (Avg) d-saponant/id-sap-pool-premium/pr1-shared-sm-dest
Replication	Volume replication lag time (Avg)	Is volume replication transferring (Avg) dr-saponant/idr-sap-pool-premium/pr1-shared-sm-dest	Volume replication progress (Avg)
Replication Monitoring	Volume replication lag time (Avg) dr-saponanf/dr-sap-pool-premium/pr1-shared-sm-dest	Is volume replication startlering (Avg) dr.sponetr/dr-sp-pool-premum/prf-shared-sm-dest 0	Volume replication progress (Avg) dr-sponerf(dr-sp-pod-premum/pr1-shared-sm-dest =-
図、Snapshots 配 Replication Monitoring 値 Metrics Automation	Volume replication last transfer duration	Is volume replication startlering (Avg) dr.sponetr/dr-sp-pool-premum/prf-shared-sm-dest 0	Volume replication progress (Avg) dr-apprend //dr-asp-pool-premuum/pr1-shared-sm-dest ==
Replication     Monitoring     Metrics	Volume replication lag time (Avg) dr-apprendidr-sap-port-premum/pr1-shared-sm-dest 29.45 miti	Nuclame replication transforming (Ang) dragonarrifolisap-pool-prenum (pr) shared-am-dest 0 Volume replication last transfer size	Volume replication total transfer
Peplication Monitoring Metrics Automation Tasks (preview)	Volume replication last transfer duration	budane replication transform (Aref) 0 Volume replication last transfer size	Volume replication total transfer
Replication     Monitoring     Metrics     Automation	Volume replication last transfer duration	It volume replication stantening (Aug) or approxide ap-pool permum pri-shared sm-dett O Volume replication last transfer size	Volume replication total transfer
Replication  Monitoring  Metrics  Automation  Tasks (preview)  Export template	Volume replication last transfer duration	Involume replication transfering (wol) O Volume replication last transfer size  SEAME  SEAME  SEAME  SEAME  SEAME  SEAME  SEAME  477MB  477MB	
Replication  Monitoring  Metrics  Automation  Support template  Support + troubleshooting	Volume replication last transfer duration	Insidume repetitions transforming (weight assponser/fid=sigs-pool-premium (prt-shaned-sim-steet 0 Volume replication last transfer size <u> S-SAMRE S-</u>	Volume replication total transfer
Replication  Monitoring  Metrics  Automation  Tasks (preview)  Export template  Support + troubleshooting	Volume replication last transfer duration  Volume replication last transfer duration	b-vdume replication transferring (ver) 0 Volume replication last transfer size SEMME SEMME SEMME SZEME SZEM	Volume replication total transfer
Replication  Monitoring  Metrics  Automation  Tasks (preview)  Export template  Support + troubleshooting	Volume replication last transfer duration  Volume replication last transfer duration	biodemonspreadures transform (Jung) 0 Volume replication last transfer size S5446 S5446 S5646 S7246 S724 S7246 S7	Volume replication total transfer

#### **Replicated snapshot backups**

With each replication update from the source to the target volume, all block changes that happened between the last and the current update are replicated to the target volume. This also includes the snapshots, which have been created at the source volume. The following screenshot shows the snapshots available at the target volume. As already discussed, each of the snapshots created by the AzAcSnap tool are application-consistent images of the HANA database that can be used to execute either a savepoint or a forward recovery.



Within the source and the target volume, SnapMirror Snapshot copies are created as well, which are used for resync and replication update operations. These Snapshot copies are not application consistent from the HANA database perspective; only the application-consistent snapshots created via AzaCSnap can be used for HANA recovery operations.

me > Azure NetApp Files > dr-saponanf > PR1-data-mnt0001-sm-dest (dr-saponanf/dr-sap-pool-premium/PR1-data-mnt0001-sm-dest)

E. PR1-data-mnt0001-sm-dest (dr-saponanf/dr-sap-pool-premium/PR1-data-mnt0001-sm-dest) | Snapshots

Overview					
Activity log	Name	↑↓ Location	↑↓	Created	¢↓
R Access control (IAM)	3 azacsnap_2021-02-18T120002-2150721Z	West US		02/18/2021, 01:00:05 PM	
Tags	(D) azacsnap_2021-02-18T160002-1442691Z	West US		02/18/2021, 05:00:49 PM	
ttings	(D) azacsnap_2021-02-18T200002-0758687Z	West US		02/18/2021, 09:00:05 PM	
Properties	(D) azacsnap_2021-02-19T000002-0039686Z	West US		02/19/2021, 01:00:05 AM	
Locks	(D) azacsnap_2021-02-19T040001-8773748Z	West US		02/19/2021, 05:00:06 AM	
rage service	(D) azacsnap_2021-02-19T080001-5198653Z	West US		02/19/2021, 09:00:05 AM	
Mount instructions	(D) azacsnap_2021-02-19T120002-1495322Z	West US		02/19/2021, 01:00:06 PM	
Export policy	(D) azacsnap_2021-02-19T160002-3698678Z	West US		02/19/2021, 05:00:05 PM	
Snapshots	(D) azacsnap_2021-02-22T120002-3145398Z	West US		02/22/2021, 01:00:06 PM	
Replication	(D) snapmirror.b1e8e48d-7114-11eb-b147-d039ea1e211e_2155791247.2021-02-22_1431	159 West US		02/22/2021, 03:32:00 PM	
nitoring	(D) azacsnap_2021-02-22T160002-0144647Z	West US		02/22/2021, 05:00:05 PM	
Metrics	(D) azacsnap_2021-02-22T200002-0649581Z	West US		02/22/2021, 09:00:05 PM	
	(D) azacsnap_2021-02-23T000002-0311379Z	West US		02/23/2021, 01:00:05 AM	
Tasks (preview)	Snapmirror.b1e8e48d-7114-11eb-b147-d039ea1e211e_2155791247.2021-02-23_0010	000 West US		02/23/2021, 01:10:00 AM	

## **Disaster recovery testing**

#### **Disaster Recovery Testing**

Support + troubleshooting

To implement an effective disaster recovery strategy, you must test the required workflow. Testing demonstrates whether the strategy works and whether the internal documentation is sufficient, and it also allows administrators to train on the required procedures.

ANF Cross-Region Replication enables disaster recovery testing without putting RTO and RPO at risk. Disaster recovery testing can be done without interrupting data replication.

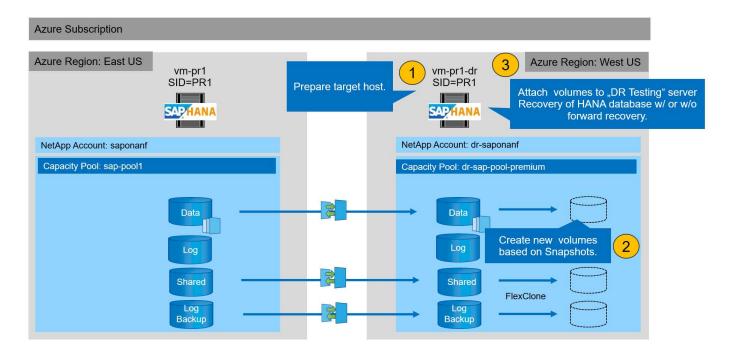
The disaster recovery testing workflow leverages the ANF feature set to create new volumes based on existing Snapshot backups at the disaster recovery target. See How Azure NetApp Files snapshots work | Microsoft Docs.

Depending on whether log backup replication is part of the disaster recovery setup or not, the steps for disaster recovery are slightly different. This section describes the disaster recovery testing for data-backup-only replication as well as for data volume replication combined with log backup volume replication.

To perform disaster recovery testing, complete the following steps:

- 1. Prepare the target host.
- 2. Create new volumes based on Snapshot backups at the disaster recovery site.
- 3. Mount the new volumes at the target host.
- 4. Recover the HANA database.
  - Data volume recovery only.
  - Forward recovery using replicated log backups.

The following subsections describe these steps in detail.



### Prepare the target host

This section describes the preparation steps required at the server that is used for the disaster recovery failover.

During normal operation, the target host is typically used for other purposes, for example, as a HANA QA or test system. Therefore, most of the described steps must be executed when disaster failover testing is executed. On the other hand, the relevant configuration files, like /etc/fstab and /usr/sap/sapservices, can be prepared and then put in production by simply copying the configuration file. The disaster recovery failover procedure ensures that the relevant prepared configuration files are configured correctly.

The target host preparation also includes shutting down the HANA QA or test system as well as stopping all services using systemctl stop sapinit.

#### Target server host name and IP address

The host name of the target server must be identical to the host name of the source system. The IP address can be different.



Proper fencing of the target server must be established so that it cannot communicate with other systems. If proper fencing is not in place, then the cloned production system might exchange data with other production systems, resulting in logically corrupted data.

#### Install required software

The SAP host agent software must be installed at the target server. For full information, see the SAP Host Agent at the SAP help portal.



If the host is used as a HANA QA or test system, the SAP host agent software is already installed.

#### Configure users, ports, and SAP services

The required users and groups for the SAP HANA database must be available at the target server. Typically, central user management is used; therefore, no configuration steps are necessary at the target server. The required ports for the HANA database must be configured at the target hosts. The configuration can be copied from the source system by copying the /etc/services file to the target server.

The required SAP services entries must be available at the target host. The configuration can be copied from the source system by copying the /usr/sap/sapservices file to the target server. The following output shows the required entries for the SAP HANA database used in the lab setup.

```
vm-prl:~ # cat /usr/sap/sapservices
#!/bin/sh
LD_LIBRARY_PATH=/usr/sap/PR1/HDB01/exe:$LD_LIBRARY_PATH;export
LD_LIBRARY_PATH;/usr/sap/PR1/HDB01/exe/sapstartsrv
pf=/usr/sap/PR1/SYS/profile/PR1_HDB01_vm-pr1 -D -u pr1adm
limit.descriptors=1048576
```

#### Prepare HANA log volume

Because the HANA log volume is not part of the replication, an empty log volume must exist at the target host. The log volume must include the same subdirectories as the source HANA system.

```
vm-pr1:~ # ls -al /hana/log/PR1/mnt00001/
total 16
drwxrwxrwx 5 root root 4096 Feb 19 16:20 .
drwxr-xr-x 3 root root 22 Feb 18 13:38 ..
drwxr-xr-- 2 pr1adm sapsys 4096 Feb 22 10:25 hdb00001
drwxr-xr-- 2 pr1adm sapsys 4096 Feb 22 10:25 hdb00002.00003
drwxr-xr-- 2 pr1adm sapsys 4096 Feb 22 10:25 hdb00003.00003
vm-pr1:~ #
```

#### Prepare log backup volume

Because the source system is configured with a separate volume for the HANA log backups, a log backup volume must also be available at the target host. A volume for the log backups must be configured and mounted at the target host.

If log backup volume replication is part of the disaster recovery setup, the replicated log backup volume is mounted at the target host, and it is not necessary to prepare an additional log backup volume.

#### Prepare file system mounts

The following table shows the naming conventions used in the lab setup. The volume names at the disaster recovery site are included in /etc/fstab.

HANA PR1 volumes	Volume and subdirectories at disaster recovery site	Mount point at target host
Data volume	PR1-data-mnt00001-sm-dest	/hana/data/PR1/mnt00001
Shared volume	PR1-shared-sm-dest/shared PR1-shared-sm-dest/usr-sap-PR1	/hana/shared /usr/sap/PR1
Log backup volume	hanabackup-sm-dest	/hanabackup



The mount points from this table must be created at the target host.

Here are the required /etc/fstab entries.

```
vm-pr1:~ # cat /etc/fstab
# HANA ANF DB Mounts
10.0.2.4:/PR1-data-mnt0001-sm-dest /hana/data/PR1/mnt00001 nfs
rw,vers=4,minorversion=1,hard,timeo=600,rsize=262144,wsize=262144,intr,noa
time,lock, netdev,sec=sys 0 0
10.0.2.4:/PR1-log-mnt00001-dr /hana/log/PR1/mnt00001 nfs
rw,vers=4,minorversion=1,hard,timeo=600,rsize=262144,wsize=262144,intr,noa
time, lock, netdev, sec=sys 0 0
# HANA ANF Shared Mounts
10.0.2.4:/PR1-shared-sm-dest/hana-shared /hana/shared nfs
rw,vers=4,minorversion=1,hard,timeo=600,rsize=262144,wsize=262144,intr,noa
time,lock, netdev,sec=sys 0 0
10.0.2.4:/PR1-shared-sm-dest/usr-sap-PR1 /usr/sap/PR1 nfs
rw,vers=4,minorversion=1,hard,timeo=600,rsize=262144,wsize=262144,intr,noa
time,lock, netdev,sec=sys 0 0
# HANA file and log backup destination
10.0.2.4:/hanabackup-sm-dest
                               /hanabackup nfs
rw,vers=3,hard,timeo=600,rsize=262144,wsize=262144,nconnect=8,bg,noatime,n
olock 0 0
```

#### Create new volumes based on snapshot backups at the disaster recovery site

Depending on the disaster recovery setup (with or without log backup replication), two or three new volumes based on snapshot backups must be created. In both cases, a new volume of the data and the HANA shared volume must be created.

A new volume of the log backup volume must be created if the log backup data is also replicated. In our example, data and the log backup volume have been replicated to the disaster recovery site. The following steps use the Azure Portal.

1. One of the application-consistent snapshot backups is selected as a source for the new volume of the HANA data volume. Restore to New Volume is selected to create a new volume based on the snapshot backup.

#### PR1-data-mnt00001-sm-dest (dr-saponanf/dr-sap-pool1/PR1-data-mnt00001-sm-dest)

# E PR1-data-mnt00001-sm-dest (dr-saponanf/dr-sap-pool1/PR1-data-mnt00001-sm-dest) | Snapshots

Activity log	Name ↑↓	Location	↑↓ Created	¢	٠́4
Access control (IAM)	3 azacsnap_2021-02-16T134021-9431230Z	West US	02/16/2021, 02:40:27	PM	
Tags	B azacsnap_2021-02-16T134917-6284160Z	West US	02/16/2021, 02:49:20	PM	
ttings	(U) azacsnap_2021-02-16T135737-3778546Z	West US	02/16/2021, 02:57:41	PM	
Properties	(U) azacsnap_2021-02-16T160002-1354654Z	West US	02/16/2021, 05:00:05	PM	
Locks	(D) azacsnap_2021-02-16T200002-0790339Z	West US	02/16/2021, 09:00:08	PM	
orage service	(U) azacsnap_2021-02-17T000002-1753859Z	West US	02/17/2021, 01:00:06	AM	
Mount instructions	B azacsnap_2021-02-17T040001-5454808Z	West US	02/17/2021, 05:00:05	AM	
Export policy	(b) azacsnap_2021-02-17T080002-2933611Z	West US	02/17/2021, 09:00:18	AM	
Snapshots	🛞 snapmirror.b1e8e48d-7114-11eb-b147-d039ea	West US	02/17/2021, 12:46:22	PM I	
Replication	(B) azacsnap_2021-02-17T120001-9196266Z	West US	02/17/2021, 01:00:08	PM	
onitoring	(S) azacsnap_2021-02-17T160002-2801612Z	West US	02/17/2021, 05:00:06	PM	
Metrics	(C) azacsnap_2021-02-17T200001-9149055Z	West US	02/17/2021, 09:00:05	PM	
	(S) azacsnap_2021-02-18T000001-7955243Z	West US	02/18/2021, 01:00:07	Restore to new volume	
itomation	🛞 snapmirror.b1e8e48d-7114-11eb-b147-d039ea	West US	02/18/2021, 01:10:00	o	
Tasks (preview) Export template				Delete	

2. The new volume name and quota must be provided in the user interface.

Home > Azure NetApp Files > dr-saponanf > dr-sap-pool1 (dr-saponanf/dr-sap-pool1) > PR1-data-mnt00001-sm-dest (d

# Create a volume

Basics Protocol Tags Review + create

This page will help you create an Azure NetApp Files volume in your subscription and enable you to access the volume from within your virtual network. Learn more about Azure NetApp Files

Volume details		
Volume name *	PR1-data-mnt00001-sm-dest-clone	~
Restoring from snapshot 🛈	azacsnap_2021-02-18T000001-7955243Z	
Available quota (GiB) 🛈	2096	
		2.05 TiB
Quota (GiB) * 🕡	500	~
		500 GiB
Virtual network (i)	dr-vnet (10.2.0.0/16,10.0.2.0/24)	$\sim$
Delegated subnet 🛈	default (10.0.2.0/28)	$\sim$
Show advanced section		

3. Within the protocol tab, the file path and export policy are configured.

Home > Azure NetApp Files > dr-saponanf > dr-sap-pool1 (dr-saponanf/dr-sap-pool1) > PR1-data-mnt00001-sm-dest (d

# Create a volume

Basics Protocol Ta	gs Review + create				
Configure access to your ve	olume.				
Access					
Protocol type	NFS O SMI	B 🔘 Dual-protocol (I	NFSv3 and SMB)		
Configuration					
File path * ③	PR1-data-mnt000	01-sm-dest-clone			
Versions	NFSv4.1				$\sim$
Kerberos	◯ Enabled .	Disabled			
Export policy					
Configure the volume's exp	port policy. This can be edited later.	Learn more			
$\uparrow$ Move up $\downarrow$ M	Nove down 🗍 Move to top 🚽	Move to bottom 📋	Delete		
Index	Allowed clients	Access	Root Access		
1	0.0.0/0	Read & Write	∨ On	$\sim$	•••
			×	$\sim$	

4. The Create and Review screen summarizes the configuration.

Home > Azure NetApp Files > dr-saponanf > dr-sap-pool1 (dr-saponanf/dr-sap-pool1) > PR1-data-mnt00001-sm-dest (dr-sapon

# Create a volume

Validation passed	
Basics Protocol Tags	Review + create
Basics	
Subscription	Pay-As-You-Go
Resource group	dr-rg-sap
Region	West US
Volume name	PR1-data-mnt00001-sm-dest-clone
Capacity pool	dr-sap-pool1
Service level	Standard
Quota	500 GiB
Networking	
Virtual network	dr-vnet (10.2.0.0/16,10.0.2.0/24)
Delegated subnet	default (10.0.2.0/28)
Protocol	
Protocol	NFSv4.1
File path	PR1-data-mnt00001-sm-dest-clone

### 5. A new volume has now been created based on the HANA snapshot backup.

<ul> <li>NetApp account</li> </ul>								
	+ Add volume $+$ Add data replication	🕐 Refresh						
Overview								
Activity log	Name	^↓ Quota	↑↓	Protocol type ↑↓	Mount path ↑↓	Service level ↑↓	Capacity pool	↑↓
Access control (IAM)	🛒 hanabackup-sm-dest	1000 GiB		NFSv3	10.0.2.4:/hanabackup-sm-dest		dr-sap-pool1	
Tags	R1-data-mnt00001-sm-dest	500 GiB		NFSv4.1	10.0.2.4:/PR1-data-mnt00001-s		dr-sap-pool1	
ettings	R1-data-mnt00001-sm-dest-clone	500 GiB		NFSv4.1	10.0.2.4:/PR1-data-mnt00001-s	Standard	dr-sap-pool1	
Properties	R1-log-mnt00001-dr	250 GiB		NFSv4.1	10.0.2.4:/PR1-log-mnt00001-dr	Standard	dr-sap-pool1	
Locks	R1-shared-sm-dest	250 GiB		NFSv4.1	10.0.2.4:/PR1-shared-sm-dest	Standard	dr-sap-pool1	
Active Directory connections torage service Capacity pools Volumes								
ata protection								
Snapshot policies								
utomation								
Tasks (preview)								
Export template								
upport + troubleshooting								
R New support request								

The same steps must now be performed for the HANA shared and the log backup volume as shown in the following two screenshots. Since no additional snapshots have been created for the HANA shared and log backup volume, the newest SnapMirror Snapshot copy must be selected as the source for the new volume. This is unstructured data, and the SnapMirror Snapshot copy can be used for this use case.

#### pool1/hanabackup-sm-dest)

Search (Ctrl+/)	*	🕂 Add snapshot 💍 Refresh						
Overview								
Activity log		Name	↑↓	Location	↑↓	Created	¢1	Į.
Access control (IAM)		() snapmirror.b1e8e48d-7114-1	1eb-b147-d039ea	West US		02/18/2021, 02:05:00	PM	
👂 Tags		Snapmirror.b1e8e48d-7114-1	1eb-b147-d039ea	West US		02/18/2021, 03:05:00	(1) Restore to new volume	
ettings								
Properties							🖉 Revert volume	
🖞 Locks							Delete	
torage service								
Mount instructions								
Export policy								
Snapshots								

The following screenshot shows the HANA shared volume restored to new volume.

#### pool1/PR1-shared-sm-dest) BR1-shared-sm-dest (dr-saponanf/dr-sap-pool1/PR1-shared-sm-dest) | Snapshots × Volume + Add snapshot 🕐 Refresh P Search (Ctrl+/) Overview P Search snapshots Activity log Name ↑. Location ↑. Created 11 Access control (IAM) Snapmirror.b1e8e48d-7114-11eb-b147-d039ea--- West US ..... 02/18/2021.02:05:00 PM Tags Snapmirror.b1e8e48d-7114-11eb-b147-d039ea--- West US 02/18/2021, 03:05:00 🕥 Restore to new volume Settings & Revert volume Properties Delete 🔒 Locks Storage service Mount instructions Export policy (C) Snapshots Replication

If a capacity pool with a low performance tier has been used, the volumes must now be moved to a capacity pool that provides the required performance.

All three new volumes are now available and can be mounted at the target host.

#### Mount the new volumes at the target host

i

The new volumes can now be mounted at the target host, based on the /etc/fstab file created before.

vm-pr1:~ # mount -a

The following output shows the required file systems.

vm-pr1:/hana/data/PR1/mnt00001/hdb00001 # df			
Filesystem	1K-blocks	Used	
Available Use% Mounted on			
devtmpfs	8190344	8	
8190336 1% /dev			
tmpfs	12313116	0	
12313116 0% /dev/shm			
tmpfs	8208744	17292	
8191452 1% /run			
tmpfs	8208744	0	
8208744 0% /sys/fs/cgroup			
/dev/sda4	29866736	2438052	
27428684 9% /			
/dev/sda3	1038336	101520	
936816 10% /boot			
/dev/sda2	524008	1072	
522936 1% /boot/efi			
/dev/sdb1	32894736	49176	
31151560 1% /mnt			
tmpfs	1641748	0	
1641748 0% /run/user/0			
10.0.2.4:/PR1-log-mnt00001-dr	107374182400	256	
107374182144 1% /hana/log/PR1/mnt00001			
10.0.2.4:/PR1-data-mnt00001-sm-dest-clone	107377026560	6672640	
107370353920 1% /hana/data/PR1/mnt00001			
10.0.2.4:/PR1-shared-sm-dest-clone/hana-shared	d 107377048320	11204096	
107365844224 1% /hana/shared			
10.0.2.4:/PR1-shared-sm-dest-clone/usr-sap-PR1	1 107377048320	11204096	
- 107365844224			
10.0.2.4:/hanabackup-sm-dest-clone	107379429120	35293440	
107344135680 1% /hanabackup			
-			

#### HANA database recovery

The following shows the steps for HANA database recovery

Start the required SAP services.

vm-pr1:~ # systemctl start sapinit

The following output shows the required processes.

```
vm-pr1:/ # ps -ef | grep sap
        23101
               1 0 11:29 ?
                                     00:00:00
root
/usr/sap/hostctrl/exe/saphostexec pf=/usr/sap/hostctrl/exe/host profile
         23191
                  1 3 11:29 ?
                                      00:00:00
pr1adm
/usr/sap/PR1/HDB01/exe/sapstartsrv
pf=/usr/sap/PR1/SYS/profile/PR1 HDB01 vm-pr1 -D -u pr1adm
        23202
                  1 5 11:29 ?
                                      00:00:00
sapadm
/usr/sap/hostctrl/exe/sapstartsrv pf=/usr/sap/hostctrl/exe/host profile -D
                                      00:00:00
                  1 0 11:29 ?
root
        23292
/usr/sap/hostctrl/exe/saposcol -1 -w60
pf=/usr/sap/hostctrl/exe/host profile
        23359 2597 0 11:29 pts/1
root
                                      00:00:00 grep --color=auto sap
```

The following subsections describe the recovery process with and without forward recovery using the replicated log backups. The recovery is executed using the HANA recovery script for the system database and hdbsql commands for the tenant database.

#### Recovery to latest HANA data volume backup savepoint

The recovery to the latest backup savepoint is executed with the following commands as user pr1adm:

· System database

```
recoverSys.py -- command "RECOVER DATA USING SNAPSHOT CLEAR LOG"
```

Tenant database

Within hdbsql: RECOVER DATA FOR PR1 USING SNAPSHOT CLEAR LOG

You can also use HANA Studio or Cockpit to execute the recovery of the system and the tenant database.

The following command output show the recovery execution.

#### System database recovery

```
prladm@vm-prl:/usr/sap/PR1/HDB01> HDBSettings.sh recoverSys.py
-- command="RECOVER DATA USING SNAPSHOT CLEAR LOG"
[139702869464896, 0.008] >> starting recoverSys (at Fri Feb 19 14:32:16
2021)
[139702869464896, 0.008] args: ()
[139702869464896, 0.009] keys: {'command': 'RECOVER DATA USING SNAPSHOT
CLEAR LOG' }
using logfile /usr/sap/PR1/HDB01/vm-pr1/trace/backup.log
recoverSys started: ======2021-02-19 14:32:16 ==========
testing master: vm-pr1
vm-pr1 is master
shutdown database, timeout is 120
stop system
stop system on: vm-pr1
stopping system: 2021-02-19 14:32:16
stopped system: 2021-02-19 14:32:16
creating file recoverInstance.sql
restart database
restart master nameserver: 2021-02-19 14:32:21
start system: vm-pr1
sapcontrol parameter: ['-function', 'Start']
sapcontrol returned successfully:
2021-02-19T14:32:56+00:00 P0027646
                                       177bab4d610 INFO
                                                             RECOVERY
RECOVER DATA finished successfully
recoverSys finished successfully: 2021-02-19 14:32:58
[139702869464896, 42.017] 0
[139702869464896, 42.017] << ending recoverSys, rc = 0 (RC TEST OK), after
42.009 secs
prladm@vm-prl:/usr/sap/PR1/HDB01>
```

#### Tenant database recovery

If a user store key has not been created for the pr1adm user at the source system, a key must be created at the target system. The database user configured in the key must have privileges to execute tenant recovery operations.

```
prladm@vm-prl:/usr/sap/PR1/HDB01> hdbuserstore set PR1KEY vm-pr1:30113
<backup-user> <password>
```

The tenant recovery is now executed with hdbsql.

The HANA database is now up and running, and the disaster recovery workflow for the HANA database has been tested.

#### Recovery with forward recovery using log/catalog backups

Log backups and the HANA backup catalog are being replicated from the source system.

The recovery using all available log backups is executed with the following commands as user pr1adm:

· System database

```
recoverSys.py --command "RECOVER DATABASE UNTIL TIMESTAMP '2021-02-20 00:00' CLEAR LOG USING SNAPSHOT"
```

Tenant database

```
Within hdbsql: RECOVER DATABASE FOR PR1 UNTIL TIMESTAMP '2021-02-20 00:00:00' CLEAR LOG USING SNAPSHOT
```



To recover using all available logs, you can just use any time in the future as the timestamp in the recovery statement.

You can also use HANA Studio or Cockpit to execute the recovery of the system and the tenant database.

The following command output show the recovery execution.

#### System database recovery

prladm@vm-prl:/usr/sap/PR1/HDB01> HDBSettings.sh recoverSys.py --command "RECOVER DATABASE UNTIL TIMESTAMP '2021-02-20 00:00:00' CLEAR LOG USING SNAPSHOT" [140404915394368, 0.008] >> starting recoverSys (at Fri Feb 19 16:06:40 2021) [140404915394368, 0.008] args: () [140404915394368, 0.008] keys: {'command': "RECOVER DATABASE UNTIL TIMESTAMP '2021-02-20 00:00:00' CLEAR LOG USING SNAPSHOT"} using logfile /usr/sap/PR1/HDB01/vm-pr1/trace/backup.log recoverSys started: =======2021-02-19 16:06:40 =============== testing master: vm-pr1 vm-pr1 is master shutdown database, timeout is 120 stop system stop system on: vm-pr1 stopping system: 2021-02-19 16:06:40 stopped system: 2021-02-19 16:06:41 creating file recoverInstance.sql restart database restart master nameserver: 2021-02-19 16:06:46 start system: vm-pr1 sapcontrol parameter: ['-function', 'Start'] sapcontrol returned successfully: 2021-02-19T16:07:19+00:00 P0009897 177bb0b4416 INFO RECOVERY RECOVER DATA finished successfully, reached timestamp 2021-02-19T15:17:33+00:00, reached log position 38272960 recoverSys finished successfully: 2021-02-19 16:07:20 [140404915394368, 39.757] 0 [140404915394368, 39.758] << ending recoverSys, rc = 0 (RC TEST OK), after 39.749 secs

#### Tenant database recovery

```
prladm@vm-prl:/usr/sap/PR1/HDB01> hdbsql -U PR1KEY
Welcome to the SAP HANA Database interactive terminal.
Type: \h for help with commands
      \q to quit
hdbsql SYSTEMDB=> RECOVER DATABASE FOR PR1 UNTIL TIMESTAMP '2021-02-20
00:00:00' CLEAR LOG USING SNAPSHOT
0 rows affected (overall time 63.791121 sec; server time 63.788754 sec)
hdbsql SYSTEMDB=>
```

The HANA database is now up and running, and the disaster recovery workflow for the HANA database has been tested.

#### Check consistency of latest log backups

Because log backup volume replication is performed independently of the log backup process executed by the SAP HANA database, there might be open, inconsistent log backup files at the disaster recovery site. Only the latest log backup files might be inconsistent, and those files should be checked before a forward recovery is performed at the disaster recovery site using the hdbbackupcheck tool.

If the hdbbackupcheck tool reports an error for the latest log backups, the latest set of log backups must be removed or deleted.

```
prladm@hana-10: > hdbbackupcheck
/hanabackup/PR1/log/SYSTEMDB/log_backup_0_0_0_0.1589289811148
Loaded library 'libhdbcsaccessor'
Loaded library 'libhdblivecache'
Backup '/mnt/log-backup/SYSTEMDB/log_backup_0_0_0_0.1589289811148'
successfully checked.
```

The check must be executed for the latest log backup files of the system and the tenant database.

If the hdbbackupcheck tool reports an error for the latest log backups, the latest set of log backups must be removed or deleted.

# **Disaster recovery failover**

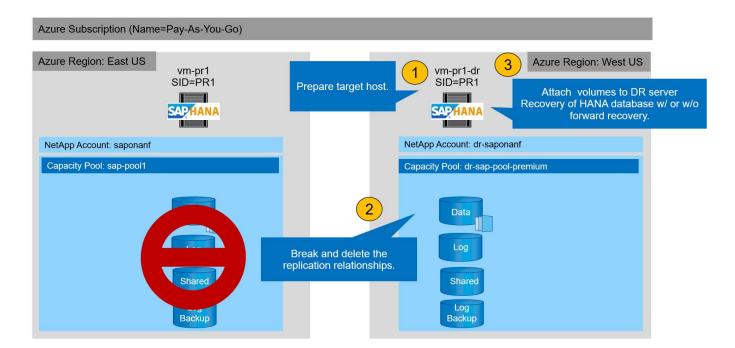
#### Disaster recovery failover

Depending on whether the log backup replication is part of the disaster recovery setup, the steps for disaster recovery are slightly different. This section describes the disaster recovery failover for data-backup-only replication as well as for data volume replication combined with log backup volume replication.

To execute disaster recovery failover, complete these steps:

- 1. Prepare the target host.
- 2. Break and delete the replication relationships.
- 3. Restore the data volume to the latest application- consistent snapshot backup.
- 4. Mount the volumes at the target host.
- 5. Recover the HANA database.
  - Data volume recovery only.
  - Forward recovery using replicated log backups.

The following subsections describe these steps in detail, and the following figure depicts disaster failover testing.



#### Prepare the target host

This section describes the preparation steps required at the server that is used for the disaster recovery failover.

During normal operation, the target host is typically used for other purposes, for example, as a HANA QA or test system. Therefore, most of the described steps must be executed when disaster failover testing is executed. On the other hand, the relevant configuration files, like /etc/fstab and /usr/sap/sapservices, can be prepared and then put in production by simply copying the configuration file. The disaster recovery failover procedure ensures that the relevant prepared configuration files are configured correctly.

The target host preparation also includes shutting down the HANA QA or test system as well as stopping all services using systemctl stop sapinit.

#### Target server host name and IP address

The host name of the target server must be identical to the host name of the source system. The IP address can be different.



Proper fencing of the target server must be established so that it cannot communicate with other systems. If proper fencing is not in place, then the cloned production system might exchange data with other production systems, resulting in logically corrupted data.

#### Install required software

The SAP host agent software must be installed at the target server. For full information, see the SAP Host Agent at the SAP help portal.



If the host is used as a HANA QA or test system, the SAP host agent software is already installed.

#### Configure users, ports, and SAP services

The required users and groups for the SAP HANA database must be available at the target server. Typically, central user management is used; therefore, no configuration steps are necessary at the target server. The required ports for the HANA database must be configured at the target hosts. The configuration can be copied from the source system by copying the /etc/services file to the target server.

The required SAP services entries must be available at the target host. The configuration can be copied from the source system by copying the /usr/sap/sapservices file to the target server. The following output shows the required entries for the SAP HANA database used in the lab setup.

```
vm-pr1:~ # cat /usr/sap/sapservices
#!/bin/sh
LD_LIBRARY_PATH=/usr/sap/PR1/HDB01/exe:$LD_LIBRARY_PATH;export
LD_LIBRARY_PATH;/usr/sap/PR1/HDB01/exe/sapstartsrv
pf=/usr/sap/PR1/SYS/profile/PR1_HDB01_vm-pr1 -D -u pr1adm
limit.descriptors=1048576
```

#### Prepare HANA log volume

Because the HANA log volume is not part of the replication, an empty log volume must exist at the target host. The log volume must include the same subdirectories as the source HANA system.

```
vm-pr1:~ # ls -al /hana/log/PR1/mnt00001/
total 16
drwxrwxrwx 5 root root 4096 Feb 19 16:20 .
drwxr-xr-x 3 root root 22 Feb 18 13:38 ..
drwxr-xr-- 2 pr1adm sapsys 4096 Feb 22 10:25 hdb00001
drwxr-xr-- 2 pr1adm sapsys 4096 Feb 22 10:25 hdb00002.00003
drwxr-xr-- 2 pr1adm sapsys 4096 Feb 22 10:25 hdb00003.00003
vm-pr1:~ #
```

#### Prepare log backup volume

Because the source system is configured with a separate volume for the HANA log backups, a log backup volume must also be available at the target host. A volume for the log backups must be configured and mounted at the target host.

If log backup volume replication is part of the disaster recovery setup, the replicated log backup volume is mounted at the target host, and it is not necessary to prepare an additional log backup volume.

#### Prepare file system mounts

The following table shows the naming conventions used in the lab setup. The volume names at the disaster recovery site are included in /etc/fstab.

HANA PR1 volumes	Volume and subdirectories at disaster recovery site	Mount point at target host
Data volume	PR1-data-mnt00001-sm-dest	/hana/data/PR1/mnt00001
Shared volume	PR1-shared-sm-dest/shared PR1-shared-sm-dest/usr-sap-PR1	/hana/shared /usr/sap/PR1
Log backup volume	hanabackup-sm-dest	/hanabackup



The mount points from this table must be created at the target host.

Here are the required /etc/fstab entries.

```
vm-pr1:~ # cat /etc/fstab
# HANA ANF DB Mounts
10.0.2.4:/PR1-data-mnt0001-sm-dest /hana/data/PR1/mnt00001 nfs
rw,vers=4,minorversion=1,hard,timeo=600,rsize=262144,wsize=262144,intr,noa
time,lock, netdev,sec=sys 0 0
10.0.2.4:/PR1-log-mnt00001-dr /hana/log/PR1/mnt00001 nfs
rw, vers=4, minorversion=1, hard, timeo=600, rsize=262144, wsize=262144, intr, noa
time, lock, netdev, sec=sys 0 0
# HANA ANF Shared Mounts
10.0.2.4:/PR1-shared-sm-dest/hana-shared /hana/shared nfs
rw,vers=4,minorversion=1,hard,timeo=600,rsize=262144,wsize=262144,intr,noa
time,lock, netdev,sec=sys 0 0
10.0.2.4:/PR1-shared-sm-dest/usr-sap-PR1 /usr/sap/PR1 nfs
rw,vers=4,minorversion=1,hard,timeo=600,rsize=262144,wsize=262144,intr,noa
time,lock, netdev,sec=sys 0 0
# HANA file and log backup destination
10.0.2.4:/hanabackup-sm-dest
                                /hanabackup nfs
rw,vers=3,hard,timeo=600,rsize=262144,wsize=262144,nconnect=8,bg,noatime,n
olock 0 0
```

#### Break and delete replication peering

In case of a disaster failover, the target volumes must be broken off so that the target host can mount the volumes for read and write operations.



For the HANA data volume, you must restore the volume to the latest HANA snapshot backup created with AzAcSnap. This volume revert operation is not possible if the latest replication snapshot is marked as busy due to the replication peering. Therefore, you must also delete the replication peering.

The next two screenshots show the break and delete peering operation for the HANA data volume. The same operations must be performed for the log backup and the HANA shared volume as well.

Break replication peering Break replication peering

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	PR1-data-mnt0001-sm-dest	(dr-saponanf/dr-sap-pool-premium/PR1-data-mnt
-	Volume	

🔎 Search (Ctrl+/)	« 🖉 Edit 🧬 Break peering 📋 Delete 🖒 Refresh			▲ Warning! This action will stop data replication between the
Overview				volumes and might result in loss of data.
Activity log	End point type : Destination		Source	Type 'yes' to proceed
Access control (IAM)	Healthy : Healthy		Relationship sta	yes ves
🗳 Tags	Mirror state : Mirrored		Replication sch Total progress	
Settings	et. J. C. L. a			
III Properties	Show data for last:     1 hour 6 hours 12 hours 1 day 7 days			
A Locks	Volume replication lag time	ŝ	ls volume replication transfer	
Storage service			100	
Mount instructions	9.72hpurs		90	
Export policy	8.33hours	••	80	
🛞 Snapshots	6.94hours		70	
Replication	5.50hours		50	

#### Ir-sap-pool-premium/PR1-data-mnt0001-sm-dest)

PR1-data-mnt0001-sm-dest (dr-saponanf/dr-sap-pool-premium/PR1-data-mnt

Delete replication
Delete replication object

₽ Search (Ctrl+/)	« 🤇 Resync 🗎 Delete 🖒 Refresh			▲ Warning this operation will delete the connection between
S Overview	← Essentials			PR1-data-mnt00001 and PR1-data-mnt0001-sm-dest
Activity log	End point type : Destination		Source	
Access control (IAM)	Healthy : Healthy		Relationship sta	This will delete the replication object of PR1-data-mnt00001, type 'yes' to proceed
Tags	Mirror state : Broken		Replication sch	yes 🗸
Settings			Total progress	
Properties	Show data for last:     1 hour 6 hours 12 hours 1 day 7 days			
🔒 Locks	Volume replication lag time	\$	Is volume replication transfer	
Storage service		~		
Mount instructions	1.67min 1.5min		90	
Export policy	1.33min		80	
() Snapshots	1.17min		70	
Replication	1min 50sec		50	

Since replication peering was deleted, it is possible to revert the volume to the latest HANA snapshot backup. If peering is not deleted, the selection of revert volume is grayed out and is not selectable. The following two screenshots show the volume revert operation.

# E PR1-data-mnt0001-sm-dest (dr-saponanf/dr-sap-pool-premium/PR1-data-mnt0001-sm-dest) | Snapshots

Overview	✓ Search snapshots				
Activity log	Name ↑↓	Location	$\uparrow_{\downarrow}$	Created	¢↓
Access control (IAM)	(L) azacsnap_2021-02-18T120002-2150721Z	West US		02/18/2021, 01:00:05 PM	9
Tags	(L) azacsnap_2021-02-18T160002-1442691Z	West US		02/18/2021, 05:00:49 PM	5
ttings	(L) azacsnap_2021-02-18T200002-0758687Z	West US		02/18/2021, 09:00:05 PM	3
Properties	(L) azacsnap_2021-02-19T000002-0039686Z	West US		02/19/2021, 01:00:05 AM	3
Locks	(L) azacsnap_2021-02-19T040001-8773748Z	West US		02/19/2021, 05:00:06 AM	
orage service	(E) azacsnap_2021-02-19T080001-5198653Z	West US		02/19/2021, 09:00:05 AM	
Mount instructions	(E) azacsnap_2021-02-19T120002-1495322Z	West US		02/19/2021, 01:00:06 PM	
Export policy	(E) azacsnap_2021-02-19T160002-3698678Z	West US		02/19/2021, 05:00:05 PM	
Snapshots	(E) azacsnap_2021-02-22T120002-3145398Z	West US		02/22/2021, 01:00:06 PM	
Replication	(B) snapmirror.b1e8e48d-7114-11eb-b147-d039ea	West US		02/22/2021, 03:32:00 PM	
onitoring	(E) azacsnap_2021-02-22T160002-0144647Z	West US		02/22/2021, 05:00:05 PM	
Metrics	(U) azacsnap_2021-02-22T200002-0649581Z	West US		02/22/2021, 09:00:05 PM	
	(E) azacsnap_2021-02-23T000002-0311379Z	West US		02/23/2021, 01:00:05 / 🕥 Restore to new	v volume
tomation	Snapmirror.b1e8e48d-7114-11eb-b147-d039ea	West US		02/23/2021, 01:10:00 /	
Tasks (preview)					
Export template				Delete	
oport + troubleshooting					

#### Ir-sap-pool-premium/PR1-data-mnt0001-sm-dest)

# S PR1-data-mnt0001-sm-dest (dr-saponanf/dr-sap-pool-premium/PR1-data-mnt

Overview		
Activity log	Name ^↓	Location
Access control (IAM)	() azacsnap_2021-02-18T120002-2150721Z	West US
Tags	(L) azacsnap_2021-02-18T160002-1442691Z	West US
settings	(G) azacsnap_2021-02-18T200002-0758687Z	West US
Properties	(b) azacsnap_2021-02-19T000002-0039686Z	West US
🖞 Locks	(B) azacsnap_2021-02-19T040001-8773748Z	West US
Storage service	(B) azacsnap_2021-02-19T080001-5198653Z	West US
Mount instructions	(B) azacsnap_2021-02-19T120002-1495322Z	West US
Export policy	() azacsnap_2021-02-19T160002-3698678Z	West US
🕄 Snapshots	() azacsnap_2021-02-22T120002-3145398Z	West US
C Replication	(b) snapmirror.b1e8e48d-7114-11eb-b147-d039ea	West US
Monitoring	(S) azacsnap_2021-02-22T160002-0144647Z	West US
M Metrics	(B) azacsnap_2021-02-22T200002-0649581Z	West US
	(L) azacsnap2021-02-23T000002-0311379Z	West US
Automation		West US
Tasks (preview)		
Export template		
Support + troubleshooting		

Revert volume to snapshot ×.

▲ This action is irreversible and it will delete all the volumes snapshots that are newer than azacsnap\_2021-02-23700002-03113792. Please type 'PR1-data-mnt0001-smdest' to confirm.

Are you sure you want to revert 'PR1-data-mnt0001-sm-dest' to state of 'azacsnap\_2021-02-23T000002-0311379Z'? PR1-data-mnt0001-sm-dest

After the volume revert operation, the data volume is based on the consistent HANA snapshot backup and can now be used to execute forward recovery operations.



If a capacity pool with a low performance tier has been used, the volumes must now be moved to a capacity pool that can provide the required performance.

#### Mount the volumes at the target host

The volumes can now be mounted at the target host, based on the /etc/fstab file created before.

```
vm-pr1:~ # mount -a
```

The following output shows the required file systems.

vm-pr1:~ # df		
Filesystem	1K-blocks	Used
Available Use% Mounted on		
devtmpfs	8201112	0
8201112 0% /dev		
tmpfs	12313116	0
12313116 0% /dev/shm		
tmpfs	8208744	9096
8199648 1% /run		
tmpfs	8208744	0
8208744 0% /sys/fs/cgroup		
/dev/sda4	29866736	2543948
27322788 9% /		
/dev/sda3	1038336	79984
958352 8% /boot		
/dev/sda2	524008	1072
522936 1% /boot/efi		
/dev/sdb1	32894736	49180
31151556 1% /mnt		
10.0.2.4:/PR1-log-mnt00001-dr	107374182400	6400
107374176000 1% /hana/log/PR1/mnt00001		
tmpfs	1641748	0
1641748 0% /run/user/0		
10.0.2.4:/PR1-shared-sm-dest/hana-shared	107377178368	11317248
107365861120		
10.0.2.4:/PR1-shared-sm-dest/usr-sap-PR1	107377178368	11317248
107365861120		
10.0.2.4:/hanabackup-sm-dest	107379678976	35249408
107344429568 1% /hanabackup		
10.0.2.4:/PR1-data-mnt0001-sm-dest		6696960
107369814272 1% /hana/data/PR1/mnt0000	1	
vm-pr1:~ #		

#### HANA database recovery

#### The following shows the steps for HANA database recovery

Start the required SAP services.

```
vm-pr1:~ # systemctl start sapinit
```

The following output shows the required processes.

```
vm-pr1:/ # ps -ef | grep sap
root
         23101
               1 0 11:29 ?
                                      00:00:00
/usr/sap/hostctrl/exe/saphostexec pf=/usr/sap/hostctrl/exe/host profile
                  1 3 11:29 ?
        23191
                                       00:00:00
prladm
/usr/sap/PR1/HDB01/exe/sapstartsrv
pf=/usr/sap/PR1/SYS/profile/PR1 HDB01 vm-pr1 -D -u pr1adm
                  1 5 11:29 ?
         23202
                                       00:00:00
sapadm
/usr/sap/hostctrl/exe/sapstartsrv pf=/usr/sap/hostctrl/exe/host profile -D
root
         23292
                   1
                      0 11:29 ?
                                       00:00:00
/usr/sap/hostctrl/exe/saposcol -1 -w60
pf=/usr/sap/hostctrl/exe/host profile
root
         23359 2597 0 11:29 pts/1
                                       00:00:00 grep --color=auto sap
```

The following subsections describe the recovery process with and without forward recovery using the replicated log backups. The recovery is executed using the HANA recovery script for the system database and hdbsql commands for the tenant database.

#### Recovery to latest HANA data volume backup savepoint

The recovery to the latest backup savepoint is executed with the following commands as user pr1adm:

· System database

```
recoverSys.py -- command "RECOVER DATA USING SNAPSHOT CLEAR LOG"
```

Tenant database

```
Within hdbsql: RECOVER DATA FOR PR1 USING SNAPSHOT CLEAR LOG
```

You can also use HANA Studio or Cockpit to execute the recovery of the system and the tenant database.

The following command output show the recovery execution.

```
prladm@vm-prl:/usr/sap/PR1/HDB01> HDBSettings.sh recoverSys.py
--command="RECOVER DATA USING SNAPSHOT CLEAR LOG"
[139702869464896, 0.008] >> starting recoverSys (at Fri Feb 19 14:32:16
2021)
[139702869464896, 0.008] args: ()
[139702869464896, 0.009] keys: {'command': 'RECOVER DATA USING SNAPSHOT
CLEAR LOG' }
using logfile /usr/sap/PR1/HDB01/vm-pr1/trace/backup.log
recoverSys started: ======2021-02-19 14:32:16 ==========
testing master: vm-pr1
vm-pr1 is master
shutdown database, timeout is 120
stop system
stop system on: vm-pr1
stopping system: 2021-02-19 14:32:16
stopped system: 2021-02-19 14:32:16
creating file recoverInstance.sql
restart database
restart master nameserver: 2021-02-19 14:32:21
start system: vm-pr1
sapcontrol parameter: ['-function', 'Start']
sapcontrol returned successfully:
2021-02-19T14:32:56+00:00 P0027646
                                        177bab4d610 INFO
                                                             RECOVERY
RECOVER DATA finished successfully
recoverSys finished successfully: 2021-02-19 14:32:58
[139702869464896, 42.017] 0
[139702869464896, 42.017] << ending recoverSys, rc = 0 (RC TEST OK), after
42.009 secs
prladm@vm-prl:/usr/sap/PR1/HDB01>
```

#### Tenant database recovery

If a user store key has not been created for the pr1adm user at the source system, a key must be created at the target system. The database user configured in the key must have privileges to execute tenant recovery operations.

```
prladm@vm-prl:/usr/sap/PR1/HDB01> hdbuserstore set PR1KEY vm-pr1:30113
<backup-user> <password>
```

The tenant recovery is now executed with hdbsql.

The HANA database is now up and running, and the disaster recovery workflow for the HANA database has been tested.

#### Recovery with forward recovery using log/catalog backups

Log backups and the HANA backup catalog are being replicated from the source system.

The recovery using all available log backups is executed with the following commands as user pr1adm:

· System database

```
recoverSys.py --command "RECOVER DATABASE UNTIL TIMESTAMP '2021-02-20 00:00' CLEAR LOG USING SNAPSHOT"
```

Tenant database

```
Within hdbsql: RECOVER DATABASE FOR PR1 UNTIL TIMESTAMP '2021-02-20 00:00:00' CLEAR LOG USING SNAPSHOT
```



To recover using all available logs, you can just use any time in the future as the timestamp in the recovery statement.

You can also use HANA Studio or Cockpit to execute the recovery of the system and the tenant database.

The following command output show the recovery execution.

#### System database recovery

prladm@vm-prl:/usr/sap/PR1/HDB01> HDBSettings.sh recoverSys.py --command "RECOVER DATABASE UNTIL TIMESTAMP '2021-02-20 00:00:00' CLEAR LOG USING SNAPSHOT" [140404915394368, 0.008] >> starting recoverSys (at Fri Feb 19 16:06:40 2021) [140404915394368, 0.008] args: () [140404915394368, 0.008] keys: {'command': "RECOVER DATABASE UNTIL TIMESTAMP '2021-02-20 00:00:00' CLEAR LOG USING SNAPSHOT"} using logfile /usr/sap/PR1/HDB01/vm-pr1/trace/backup.log recoverSys started: =======2021-02-19 16:06:40 =============== testing master: vm-pr1 vm-pr1 is master shutdown database, timeout is 120 stop system stop system on: vm-pr1 stopping system: 2021-02-19 16:06:40 stopped system: 2021-02-19 16:06:41 creating file recoverInstance.sql restart database restart master nameserver: 2021-02-19 16:06:46 start system: vm-pr1 sapcontrol parameter: ['-function', 'Start'] sapcontrol returned successfully: 2021-02-19T16:07:19+00:00 P0009897 177bb0b4416 INFO RECOVERY RECOVER DATA finished successfully, reached timestamp 2021-02-19T15:17:33+00:00, reached log position 38272960 recoverSys finished successfully: 2021-02-19 16:07:20 [140404915394368, 39.757] 0 [140404915394368, 39.758] << ending recoverSys, rc = 0 (RC TEST OK), after 39.749 secs

#### **Tenant database recovery**

prladm@vm-prl:/usr/sap/PR1/HDB01> hdbsql -U PR1KEY Welcome to the SAP HANA Database interactive terminal. Type: \h for help with commands \q to quit hdbsql SYSTEMDB=> RECOVER DATABASE FOR PR1 UNTIL TIMESTAMP '2021-02-20 00:00:00' CLEAR LOG USING SNAPSHOT 0 rows affected (overall time 63.791121 sec; server time 63.788754 sec) hdbsql SYSTEMDB=> The HANA database is now up and running, and the disaster recovery workflow for the HANA database has been tested.

#### Check consistency of latest log backups

Because log backup volume replication is performed independently of the log backup process executed by the SAP HANA database, there might be open, inconsistent log backup files at the disaster recovery site. Only the latest log backup files might be inconsistent, and those files should be checked before a forward recovery is performed at the disaster recovery site using the hdbbackupcheck tool.

If the hdbbackupcheck tool reports an error for the latest log backups, the latest set of log backups must be removed or deleted.

```
prladm@hana-10: > hdbbackupcheck
/hanabackup/PR1/log/SYSTEMDB/log_backup_0_0_0_0.1589289811148
Loaded library 'libhdbcsaccessor'
Loaded library 'libhdblivecache'
Backup '/mnt/log-backup/SYSTEMDB/log_backup_0_0_0_0.1589289811148'
successfully checked.
```

The check must be executed for the latest log backup files of the system and the tenant database.

If the hdbbackupcheck tool reports an error for the latest log backups, the latest set of log backups must be removed or deleted.

# **Update history**

The following technical changes have been made to this solution since its original publication.

Version	Date	Update summary
Version 1.0	April 2021	Initial version

# TR-4646: SAP HANA Disaster Recovery with Storage Replication

TR-4646 is an overview of the options for disaster recovery protection for SAP HANA. It includes detailed setup information and a use case description of a three-site disaster recovery solution based on synchronous and asynchronous NetApp SnapMirror Storage replication. The described solution uses NetApp SnapCenter with the SAP HANA plug-in to manage database consistency.

Author: Nils Bauer, NetApp

https://www.netapp.com/pdf.html?item=/media/8584-tr4646pdf.pdf

# TR-4711: SAP HANA Backup and Recovery Using NetApp Storage Systems and Commvault Software

TR-4711 describes the design of a NetApp and Commvault solution for SAP HANA, which includes Commvault IntelliSnap snapshot management technology and NetApp Snapshot technology. The solution is based on NetApp storage and the Commvault data protection suite.

Authors: Marco Schoen, NetApp; Dr. Tristan Daude, Commvault Systems

https://www.netapp.com/pdf.html?item=/media/17050-tr4711pdf.pdf

# **SnapCenter Integration for SAP ASE Database**

This document describes the SnapCenter integration specifics for SAP ASE Database used in an SAP environment.

# Introduction

The document is not intended to be a step-by-step description of how to setup the complete environment but will cover concepts and relevant details related to:

- Example configuration overview
- Sample Layout
- Protect SAP ASE Instance
- Restore and Recover SAP ASE Instance

Author: Michael Schlosser, NetApp

#### Example configuration overview

Example Implementation for SnapCenter ASE Plugin for an SAP System running on the Azure Platform.



This implementation describes the minimal required volume configuration. Data Dump Backups and Log Dump Backups are configured according to SAP Note 1588316.

Alternatively, the volume structure described in this MS Technical Community Blog could be used.

#### **Demo Environment**

Jumpbox Win + Linux	A01
Azure NetApp Files	
	a01-datalog snapcenter-vault

#### Software versions

Software	Version
Linux OS	SLES for SAP 15 SP5
SAP	SAP NetWeaver 7.5
SAPASE	16.0 SP04 PL06 HF1
SnapCenter	6.1

### ASE Volume Design

Following least volume Layout must be used to enable backup / recovery and clone use-cases for the SAP ASE database. The example configuration use <SID>: A01.

Volume Name	Directory (qtree) on Volume	Mount Point on Server	Comment
<sid>-sapase</sid>	sybase	/sybase	Parent directory for ASE related files
		/sybase/ <sid>/backups</sid>	Data Dump Backups (might be placed on a different volume)
		/sybase/ <sid>/log_archives</sid>	Log Dump Backups (might be placed on a different volume)
	<sid>adm</sid>	/home/ <sid>adm</sid>	Home directory of user <sid>adm</sid>
	usrsaptrans	/usr/sap/trans	Transport directory
	usrsap <sid></sid>	/usr/sap/ <sid></sid>	Usr sap
	sapmnt <sid></sid>	/sapmnt/ <sid></sid>	SAP GlobalHost Dir
<sid>-datalog</sid>	sapdata_1	/sybase/ <sid>/sapdata_1</sid>	DB Data (SID)

Volume Name	Directory (qtree) on Volume	Mount Point on Server	Comment
	saplog_1	/sybase/ <sid>/saplog_1</sid>	DB Log (SID)
	saptemp	/sybase/ <sid>/saptemp</sid>	PSAPTEMP
	sybsecurity	/sybase/ <sid>/sybsecurity</sid>	Sybase security DB
	sybsystem	/sybase/ <sid>/sybsystem</sid>	Sybase system DB
	sybtemp	/sybase/ <sid>/sybtemp</sid>	Sybase system DB - Temp
	sapdiag	/sybase/ <sid>/sapdiag</sid>	'saptools' database

#### Steps to Protect Database A01

- · Check File distribution, according to the sample Layout
- Check Prerequisites for the Host (vm-a01)
- Check Prerequisites for the Database (A01)
- Deploy / Install SnapCenter Agent on Host (vm-a01)
- Create SnapCenter Instance Resource Configuration

#### **Prerequisites on Host**

More current information might be available here.

Before you add a host and install the plug-ins package for Linux, you must complete all the requirements.

- If you are using iSCSI, the iSCSI service must be running.
- You can either use the password-based authentication for the root or non-root user or SSH key based authentication.
- SnapCenter Plug-in for Unix File Systems can be installed by a non-root user. However, you should configure the sudo privileges for the non-root user to install and start the plug-in process. After installing the plug-in, the processes will be running as an effective non-root user.
- Create credentials with authentication mode as Linux for the install user.
- You must have installed Java 11 on your Linux host.
- · Ensure that you have installed only the certified edition of JAVA 11 on the Linux host
- · For information to download JAVA, see: Java Downloads for All Operating Systems
- You should have bash as the default shell for plug-in installation.

#### Prerequisites for the Database – Enable Logging and Backups

- Create Directories for backups and log\_archives (/sybase/A01/backups, /sybase/A01/log\_archives)
- Connect to database A01 (as OS-user syba01)
  - ∘ isql -S A01 -U sapsa -X -w 1024
- Create Dump configuration for DATA (A01DB) according to SAP Note 1588316
  - use master
  - ∘ go

 exec sp\_config\_dump @config\_name='A01DB', @stripe\_dir = '/sybase/A01/backups' , @compression = '101' , @verify = 'header'

∘ go

- Create Dump configuration for LOG (A01LOG) according to SAP Note 1588316
  - use master
  - ∘ go
  - sp\_config\_dump @config\_name='A01LOG', @stripe\_dir = '/sybase/A01/log\_archives', @compression = '101', @verify = 'header'
  - ∘ go
- Enable full logging for Database A01
  - $\circ\,$  sp\_dboption A01, 'trunc log on chkpt' , false
  - ∘ go
  - sp\_dboption A01, 'full logging for all', 'true'
  - ∘ go
  - sp\_dboption A01, 'enforce dump tran sequence', 'true'
  - ∘ go
- Database DUMP Backup to enable Log DUMP Backup
  - dump database A01 using config ='A01DB'
  - ∘ go
  - Log Dump
  - dump transaction A01 using config = 'A01LOG'
  - ° go
- Ensure, that regular Log Backups are configured, according to SAP Note 1588316

#### Optional - create dedicated database user

For SAP Environments user sapsa could be used.

- Connect to database A01 (as OS-user syba01)
  - ∘ isql -S A01 -U sapsa -X -w 1024
- create user
  - create login backup with password <password>
  - ∘ go
- · assign permissons / roles to the user
  - or grant role sa\_role,sso\_role,oper\_role,sybase\_ts\_role to backup
  - ∘ go

#### Deploy SnapCenter Agent to Host vm-a01

Further information could be found in the SnapCenter documentation.

Select SAP ASE and Unix File Systems Plugins.

Add Host			
Host Type	Linux	•	
Host Name	vm-a01		
Credentials	snapcenter-linux	- +	0
Select Plug-ins to Inst	all SnapCenter Plug-ins Package IBM DB2 MySQL Oracle Database PostgreSQL SAP HANA Unix File Systems	5.1 for Linux MongoDB Oracle Application SAP ASE SAP MaxDB Storage	s <b>()</b>
More Options : Por	rt, Install Path, Custom Plug-Ins		
Submit Cancel			

# Create SnapCenter Instance Resource Configuration for Database A01

 $\text{Resources} \rightarrow \text{SAP} \, \text{ASE} \rightarrow \text{Add} \, \text{Resources}$ 

Add SAP ASE Resource				×
1 Name	Provide Resource	Details		
2 Storage Footprint	Name	A01	0	
3 Resource Settings	Host Name	vm-a01.1h05kdpkcgaujd4qsseqlcdygg.bx.internal.cloudapp.net		
4 Summary	Туре	Instance		
	Credential Name	None	+	0
	× Add informat Credential Nam Username Password	ion for the credential ne sapsa-A01 sapsap Add		
		Previous	N	ext

If Password contains Special Characters, they must be masked with a backslash. E.g. Test!123!  $\rightarrow$  Test\!123\!

Add SAP ASE Reso	urce				×
1 Name	Provide Resource	Details			
2 Storage Footprint	Name	A01		0	
3 Resource Settings	Host Name	vm-a01.1h05kdpkcgaujd4qsseqlcdygg.bx.internal.cloudapp.net	•	]	
4 Summary	Туре	Instance	•	]	
	Credential Name	sapsa-A01		+	0

 $(\mathbf{i})$ 

Storage Footprint	Storage Type O ONTAP	O Azure NetApp Files	
Resource Settings	Storage Systems for storage footpr	int	
Summary	SAP-EastUS	A01-datalog	<b>3</b>
2000 (100 (100 (100 (100 (100 (100 (100	Modify SAP-EastUS		
		AF-EdSLOD or more Capacity pools and their associated Volumes	
	Capacity pool	Volume	
	sap-premium-mqos	A01-datalog ×	
			Save

If you are using the volume design out of the MS Technical Community Blog.

Volumes /vol<SID>sybase, /vol<SID>data, /vol<SID>log has to be configured as Storage Footprint

Following Resource Settings Custom key-value pairs must be made (at least).

 $(\mathbf{i})$ 

Add SAP ASE Resource ×			
1 Name	Resource Settings ()		
2 Storage Footprint	Custom key-value pairs for SAP ASE plug-in	1	^
3 Resource Settings	Name	Value	
4 Summary	SYBASE_ISQL_CMD	isql -X	×
	SYBASE_USER	syba01	×
	SYBASE_SERVER	A01	×
	SYBASE_EXCLUDE_TEMPDB	Y	×
	SYBASE_DATABASES_EXCLUDE	saptempdb	+ ×
			Previous Next

The following table lists the Sybase plug-in parameters, provides their settings, and describes them:

Parameter	Setting	Description
SYBASE_ISQL_CMD	Example: /opt/sybase/OCS- 150/bin/isql -X	Defines the path to the isql command. Available Options: https://infocenter.sybase.com/help/index.jsp? topic=/com.sybase.infocenter.dc34237.1500/html/ mvsinst/CIHHFDGC.htm
SYBASE_USER	user_name	Specifies the operating system user who can run the isql command. This parameter is required for UNIX. This parameter is required if the user running the Snap Creator Agentstart and stop commands (usually the root user) and the user running the isql command are different.
SYBASE_SERVER	data_server_name	Specifies the Sybase data server name (-S option on isql command).For example: A01

Parameter	Setting	Description
SYBASE_DATABASES	db_name:user_name/pas sword	Lists the databases within the instance to back up. The master database is added; for example: DBAtest2:sa/53616c7404351e.If a database named +ALL is used, then database automatic discovery is used, and the sybsyntax, sybsystemdb, sybsystemprocs, and tempdb databases are excluded.
		For example: +ALL:sa/53616c71a6351e
		Encrypted passwords are supported if the NTAP_PWD_PROTECTION parameter is set.
SYBASE_DATABASES_E XCLUDE	db_name	Allows databases to be excluded if the +ALL construct is used. You can specify multiple databases by using a semicolon-separated list.For example, pubs2;test_db1
SYBASE_TRAN_DUMP	db_name:directory_path	Enables you to perform a Sybase transaction dump after creating a Snapshot copy.For example: pubs2:/sybasedumps/pubs2 You must specify each database that requires a
		transaction dump.
SYBASE_TRAN_DUMP_ FORMAT	%S_%D_%T.cmn	Enables you to specify the dump naming convention. The following keys can be specified:
		%S = instance name from SYBASE_SERVER
		%D = database from SYBASE_DATABASES
		%T = unique timestamp
		Here is an example: %S_%D_%T.log
SYBASE_TRAN_DUMP_ COMPRESS	(Y / N)	Enables or disables native Sybase transaction dump compression.
SYBASE	Example: /Sybase	Specifies the location of the Sybase installation.
SYBASE_MANIFEST	Example: A01:/sybase/A01/sapdiag	Specifies the databases for which the manifest file should be created, along with the location where the manifest file should be placed.
SYBASE_MANIFEST_FO RMAT	%S%Dmanifest Example: %S_%Dmanifest	Enables you to specify the manifest file naming convention. The following keys can be specified:
		%S = Instance name from SYBASE_SERVER
		%D = database from SYBASE_DATABASES

Parameter	Setting	Description
SYBASE_MANIFEST_DE LETE	(Y / N)	Allows the manifest to be deleted after the Snapshot copy has been created. The manifest file should be captured in the Snapshot copy so that it is always available with the backup.
SYBASE_EXCLUDE_TE MPDB	(Y / N)	Enables automatic exclusion of user-created temporary databases.

#### Sequence to Recover System A01

- 1. stop SAP System A01 (including database), stop sapinit
- 2. umount Filesystems
- 3. restore Volumes A01-datalog (using SnapCenter)
- 4. mount Filesystems
- 5. start Database A01 (with option –q, to avoid automatic online and keep database forward recoverable according to SAP Note 1887068)
- 6. start BackupServer A01
- 7. online database saptools, sybsecurity, sybmgmtdb
- 8. recover Database A01 (using isql)
- 9. online database A01
- 10. start sapinit, SAP System A01

#### **Recover Instance A01**

- Stop SAP System + DB A01 on host vm-a01
  - User a01adm: stopsap
  - · User root: /etc/init.d/sapinit stop
  - User root: umount -a -t nfs
- Restore Backup
  - SnapCenter GUI: Select required Backup for Restore

		Remove Protection	Back up Now	Modify	Maintenance	Details	Refrest
anage Copies							
6 Backups				Summ	ary Card		
0 Clones				9 Backup	os		
Local copies Backups				0 Clones			
eles ser De elecente)							
rimary Backup(s)							Restore
						-	4
search 🛛						Corre	Hestore
search 🛛 🔍	Snapshot Lock Expiration	Co	ount				Restore End D
search 🛛 💟	Snapshot Lock Expiration	Co	ount 1		C	Corre 02/07/2025 1:	Restore End Da
search	Snapshot Lock Expiration	Co	ount 1 1				Restore End Da
search	Snapshot Lock Expiration	Co	ount 1 1		02	02/07/2025 1:	End D 23:58 PM 09:07 AM
search	Snapshot Lock Expiration	Co	1		02	02/07/2025 1: 2/07/2025 11:	End D 23:58 PM 09:07 AM 32:23 AM
	Snapshot Lock Expiration	Co	1		02 0 0	02/07/2025 11: 2/07/2025 11: 02/07/2025 9:	End Da 23:58 PM 09:07 AM 32:23 AM 36:32 PM

• For ANF Deployment - only Complete Resource is available

Restore from SnapCenter_sybase_ondemand_02-07-2025_13_23_21_3633			
Restore scope	Select the restore types		
2 PreOps	Complete Resource ()		
3 PostOps			
4 Notification			

 $(\mathbf{i})$ 

Selecting Complete Resource will trigger a Volume Based Snap Restore (VBSR). Within Azure it is called volume revert.

#### () Important

Active filesystem data and snapshots that were taken after the selected snapshot will be lost. The snapshot revert operation will replace *all* the data in the targeted volume with the data in the selected snapshot. You should pay attention to the snapshot contents and creation date when you select a snapshot. You cannot undo the snapshot revert operation.



For other deployment Types (e.g. On-Prem ANF) a Single File Snap Restore (SFSR) operation could be orchestrated. Select File Level and the according Volume and Checkmark "All" – see following screenshot.

Restore from Sn	napCenter_sybase_ondemand_02-10-2025_18.16.17.1615	×
1 Restore scope	Select the restore types	
2 PreOps	O Complete Resource ()	
3 PostOps	File Level	
4 Notification	Select files to restore	
5 Summary	Volume/Qtree All File Path	
	Svm-sap01.muccbc.hq.netapp.com:/vol/A0 Provide one or more file paths separ	ated by comma
🛕 Configure an SM1	ITP Server to send email notifications for Restore jobs by going to <u>Settings&gt;Global Settings&gt;Notification Server</u>	Settings.
		Previous

Summary would be displayed and with Finish the actual restore is started.

Restore from Sna	apCenter_sybase_ondemand_0.	2-07-2025_13_23_21_3633	×
1 Restore scope	Summary		
2 PreOps	Backup Name	SnapCenter_sybase_ondemand_02-07-2025_13_23_21_3633	
3 PostOps	Backup date	02/07/2025 1:23:58 PM	
- concept	Restore scope	Complete Resource	
4 Notification	Pre restore command		
5 Summary	Unmount command		
Junnary	Mount command		
	Post restore command		
	Send email	No	
	d notifications for Restore jobs, an SMTP se s>Global Settings>Notification Server Settin	erver must be configured. Continue to the Summary page to save your information, an ags to configure the SMTP server.	d X
		Previous	sh

- Mount Filesystems (vm-a01)
  - User root: mount -a -t nfs
- Start Database A01 + BackupServer
  - Modify RUN\_A01 and add -q \ (according to SAP Note 1887068)
  - User syba01: RUN\_A01 &
  - User syba01: RUN\_A01\_BS&
- · Online databases saptools, sybsecurity , sybmgmtdb
  - User syba01: isql -S A01 -U sapsa -X -w 1024
  - online database saptools
  - ° go
  - online database sybsecurity
  - ∘ go
  - online database sybmgmtdb
  - ∘ go

- recover Database A01
  - sp\_dump\_history (to show the transaction log dumps)

∘ go

- Load transaction log dumps according your needs for more information see documentation: https://infocenter.sybase.com/help/index.jsp?topic=/com.sybase.infocenter.dc36272.1572/html/ commands/X75212.htm
- ° Example:

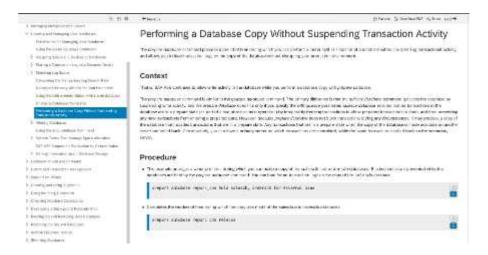
LOAD TRAN A01 FROM '/sybase/A01/log\_archives/A01.TRAN.20250207.140248.6.000'

- ∘ go
- online database A01
- ∘ go
- remove -q from RUN\_A01
- · start SAP System
  - · User root: /etc/init.d/sapinit start
  - · User a01adm: startsap

# Additional information and version history

#### Quiesce vs. prepare

See the documentation on xref:./backup/ SAP help page.



SnapCenter SAP ASE Plugin uses the quiesce database command, however it could be replaced by the prepare command. If required, it must be changed in the SYBASE.pm in line 473, 475, 479, 481, 673, 675 e.g.

sandleslier i om /ani/Waldes/seependes/see/alamins/an/1/878455/29382.av lagen presses
part legisters a, "groups detainer tagrans its holt det for enternal data to Missatter", "got";
Septimi-collectiversare - URAL "MiNFC101202" preserve determine adverse tables of the determine the "Emerithematic news includers
Sought-scallest/versage a dila. "Virgitititi: commune detabase taphane ido taid ids for external fare in
pear (Marganessen, "pressers database tarsay, 50 rations", "pr");
<pre>http://www.interstates.com/interstates.co</pre>
sas-insite *

#### **Recorded Demos**

Following recoded Demos are available to support the documentation.

Installation and Configuration ASE Plugin, Backup of ASE database

#### **External Documentation**

To learn more about the information that is described in this document, review the following documents and/or websites:

- SAP Installation Azure on ANF
- SnapCenter Prerequisites for Plugins
- SnapCenter Install Plugins
- Sybase Infocenter isql
- · Sybase Infocenter load transaction log dumps
- SAP Notes (login required)
  - 1887068 SYB: Using external backup and restore with SAP ASE: https://me.sap.com/notes/ 1887068/E
  - 1618817 SYB: How to restore an SAP ASE database server (UNIX): https://me.sap.com/notes/ 1618817/E
  - 1585981 SYB: Ensuring Recoverability for SAP ASE: https://me.sap.com/notes/1585981/E
  - 1588316 SYB: Configure automatic database and log backups: https://me.sap.com/notes/1588316/E
  - NetApp Product Documentation: https://www.netapp.com/support-and-training/documentation/
  - NetApp SAP Solutions Informations about Use-Cases, Best-Practices and Benefits

#### Version history

Version	Date	Document version history
Version 1.0	April 2025	Initial version – backup / recovery ASE database

# **SnapCenter Integration for IBM DB2 Database**

This document describes the SnapCenter integration specifics for IBM DB2 Database used in an SAP environment.

# Introduction

The document is not intended to be a step-by-step description of how to setup the complete environment but will cover concepts and relevant details related to:

- Example configuration overview
- Sample Layout
- Protect DB2 database
- Restore and Recover DB2 database

Author: Michael Schlosser, NetApp

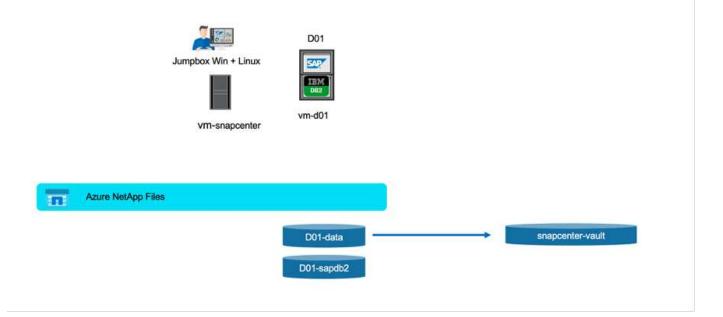
# Example configuration overview

Example Implementation for SnapCenter DB2 Plugin for an SAP System running on the Azure Platform.



This implementation describes the minimal required volume configuration.

Alternatively, the volume structure described in this MS Technical Community blog could be used.



# **Demo Environment**

#### Software versions

Software	Version
Linux OS	SLES for SAP 15 SP5
SAP	SAP NetWeaver 7.5
DB2	10.5.0.7
SnapCenter	6.1

#### **DB2 Volume Design**

Following least volume Layout must be used to enable backup / recovery and clone use-cases for the DB2 database. The example configuration use <SID>: D01.

Volume Name	Directory (qtree) on Volume	Mount Point on Server	Comment
<sid>-sapdb2</sid>	db2	/db2	
		/db2/ <sid></sid>	Parent directory for DB2 related files

Volume Name	Directory (qtree) Volume	on Mount Point on Server	Comment
		/db2/db2 <sid></sid>	Home directory of user db2 <sid> and DB2 Software</sid>
		/db2/ <sid>/db2dump</sid>	DB2 diagnostic log and dump files
		/db2/ <sid>/backup</sid>	Backup dlocation (might be placed on a different volume)
		/db2/ <sid>/log_arch</sid>	Offline Redo Logs (might be placed on a different volume – snapshot will be triggered)
		/db2/ <sid>/log_dir</sid>	Online Redo Logs (might be placed on a different volume – snapshot will be triggered)
	<sid>adm</sid>	/home/ <sid>adm</sid>	Home directory of user <sid>adm</sid>
	sap <sid></sid>	/home/sap <sid></sid>	Home directory of user sap <sid></sid>
	usrsaptrans	/usr/sap/trans	Transport directory
	usrsap <sid></sid>	/usr/sap/ <sid></sid>	Usr sap
	sapmnt <sid></sid>	/sapmnt/ <sid></sid>	SAP GlobalHost Dir
<sid>-data</sid>	sapdata1	/db2/ <sid>/sapdata1</sid>	DB Data
	sapdata2	/db2/ <sid>/sapdata2</sid>	DB Data
	sapdata3	/db2/ <sid>/sapdata3</sid>	DB Data
	sapdata4	/db2/ <sid>/sapdata4</sid>	DB Data
	saptmp1	/db2/ <sid>/saptmp1</sid>	DB Temp Files
	saptmp2	/db2/ <sid>/saptmp2</sid>	DB Temp Files
	saptmp3	/db2/ <sid>/saptmp3</sid>	DB Temp Files
	saptmp4	/db2/ <sid>/saptmp4</sid>	DB Temp Files
	db2 <sid></sid>	/db2/ <sid>/db2<sid></sid></sid>	Instance Files

Because auto-discovery is enabled by default for the DB2 plug-in, a snapshot is created for volumes that match the following file paths.

Database StoragePath	/db2/D01/saptmp4/, /db2/D01/saptmp3/, /db2/D01/saptmp2/, /db2/D01/saptmp1/, /db2/D01/sapdata4/, /db2/D01/sapdata3/, /db2/D01/sapdata2/, /db2/D01/sapdata1/
Database LogPath	/db2/D01/log_dir/NODE0000/LOGSTREAM0000/
Database Archive Path (Primary)	DISK:/db2/D01/log_arch/

#### Steps to Protect Database D01

- Check File distribution, according to the sample Layout
- Check Prerequisites for the Host (vm-d01)
- Check Prerequisites for the Database (D01)
- Deploy / Install SnapCenter Agent on Host (vm-d01)
- Create SnapCenter Instance Resource Configuration

### Prerequisites on Host

More current information might be available here:

- https://docs.netapp.com/us-en/snapcenter/protect-scu/ reference\_prerequisites\_for\_adding\_hosts\_and\_installing\_snapcenter\_plug\_ins\_package\_for\_linux.html
- https://docs.netapp.com/us-en/snapcenter/protect-db2/prerequisites-for-using-snapcenter-plug-in-for-ibmdb2.html

Before you add a host and install the plug-ins package for Linux, you must complete all the requirements.

- If you are using iSCSI, the iSCSI service must be running.
- You can either use the password-based authentication for the root or non-root user or SSH key based authentication.
- SnapCenter Plug-in for Unix File Systems can be installed by a non-root user. However, you should configure the sudo privileges for the non-root user to install and start the plug-in process. After installing the plug-in, the processes will be running as an effective non-root user.
- Create credentials with authentication mode as Linux for the install user.
- You must have installed Java 11 on your Linux host.
- · Ensure that you have installed only the certified edition of JAVA 11 on the Linux host
- · For information to download JAVA, see: Java Downloads for All Operating Systems
- You should have bash as the default shell for plug-in installation.

### Prerequisites for the Database – Enable Logging and Backups



to enable offline logs a offline full backup of the database is required. Typically it is already enabled for productive systems.

- Create Directories for backup and log\_arch (/db2/D01/backup, /sybase/D01/log\_arch)
- Enable logarchmeth1 (as OS-user db2d01)
  - db2 update db cfg for D01 using logarchmeth1 DISK:/db2/D01/log\_arch/
- Create offline backup (as OS-user db2d01)
  - db2stop force
  - db2start admin mode restricted access
  - db2 backup db D01 to /db2/D01/backup
  - db2 activate db D01

#### Deploy SnapCenter Agent to Host vm-d01

Further information could be found in the SnapCenter documentation.

Select IBM DB2 and Unix File Systems Plugins.

 $(\mathbf{i})$ 

Add Host						
Host Type	Linux	-				
Host Name	vm-d01					
Credentials	linux-snapcenter	- + 0				
Select Plug-ins to Install SnapCenter Plug-ins Package 6.1 for Linux   IBM DB2 MongoDB   MySQL Oracle Applications ()   Oracle Database SAP ASE   PostgreSQL SAP MaxDB						
	<ul> <li>SAP HANA</li> <li>Unix File Systems</li> </ul>	🗌 Storage 🚺				
More Options : Port, Install Path, Custom Plug-Ins						
Submit Cancel						

After the installation a discovery of the Databases on the host is triggered.

NetApp SnapCenter®						
<		Jobs	Schedules	Events Logs		
=	Dashboard	search	i by name			
0	Resources	All Jobs				
0	Monitor	ID	Status	Name		
<b>a</b> il	Reports	189	~	Discover resources for host 'vm-d01.1h05kdpkcgaujd4qsseqlcdygg.bx.internal.cloudapp.net'		
A	Hosts	188	~	Discover resources for host 'vm-d01.1h05kdpkcgaujd4qsseqlcdygg.bx.internal.cloudapp.net'		
		187	<b>A</b>	Package Installation on host 'vm-d01.1h05kdpkcgaujd4qsseqlcdygg.bx.internal.cloudapp.net'		
2	Storage Systems	186	~	Add Host 'vm-d01.1h05kdpkcgaujd4qsseqlcdygg.bx.internal.cloudapp.net'		
<b>#</b>	Settings	185	~	Validate Host 'vm-d01.1h05kdpkcgaujd4qsseqlcdygg.bx.internal.cloudapp.net'		

### Create Resource Configuration for Database D01

Select discovered Resource D01

NetApp Snap	Center®								- Lossee	SnapCenterAdmin	Sign Out
	BM 082										
Deshboerd	Vew Data	tate • Sharthyta	utasis V							+	+
D Assources	4. *	Name	Туре	Instance	Host	Resource Groups	Policies	-	Last back	op Overall Stat	
Musikoe	1.	DOX	Database	db2d01	vm-d01.1h05kdpkcgavjd4qsse					Not protected	ē.
al Reports					glicitygg.bs.internal.cloudapp. net						
A inn											
-I Storage Systems											

### Configure Snapshot Name

mN.	etApp SnapCenter®		•		1.00040	SnapCenterAdmin	Sign Out	
>	IIM 087	Database - Protect						4
	Search databases						i	
•	D.P. Name	Prosective resource by electing protection policies, and notification servings.     Configure an SATF Server to send multi-additioners for infersivel are infersived pills by pang to concerning and integra technication remainings.		-			×	
	-001	Application Setting:       Nices       Netform       Settings         Provide format for custom snapshot name         Image: Cost cost of Snapshot tage         Image: Cost of Snapshot tage<						
	Tutal 1						Panet	

No specific application settings required, configure policy and notification settings as required.

II No	tApp SnapCenter®		. 0	- Lentapp	TrapCenter Admin	#Sign Ove
>	EM D02 -	Dutatione - Protect				
	Search databases					()
	il Marrie	If you want to send notifications for scheduled or on demand jobs, an SMIP server must be configured. Continue to the summary page to save your information, and then go to Settings annel.	-Global Set	tings-Notificator	on Server Settings to co	ofigure the SMEP
0	00	A Backup replication is not supported for resources on Acure NetSpp Files. The replication settings of the policy selected are ignored.				×
2						
٨		0 0 0 0 0				
20		Resource Application Settings Pulloes Nutrification Summary				
≅ ▲						
A		Database name D01 folicy db2, showmand: On deimaid				
		Send email				
		O Application Settings				
						-
	Tetal 1				1100	tut Firsth

And finish the configuration.

#### Sequence to Recover System D01

- 1. Stop SAP System D01 (including database)
- 2. Restore SnapCenter Backup (Volume D01-data)
  - a. Unmount Filesystems
  - b. Restore Volume
  - c. Mount Filesystems
  - d. Init database as mirror db
- 3. Recover Database D01 (using db2 rollforward)
- 4. Start SAP System D01

#### **Recover Database D01**

- Stop SAP System + DB D01 on host vm-d01
  - User d01adm: stopsap
- Restore Backup
  - SnapCenter GUI: Select required Backup for Restore

-	letApp SnapCenter®				0: 1:	tapp SnapCe	nter Admin	#Sign Cval
> 	IBM DR2	10011 Tesolingy			4	<u>*</u>	<u>(</u> )	×
1 X Y R O O	DDH	Manage Copies		191	Summary Ci Backup Clohes	ird		
		Primary Backup(s) Userch V Backup Name ScopCarmer JBL production (JS 26-2005; 14, 22, 57, 4124	Snapshot Lock Expiration	Count			Care -	Ender Branner End Date EDSO PHA

For ANF Deployment – only Complete Resource is available

Restore from Sn	Restore from SnapCenter_db2_ondemand_03-26-2025_14_42_07_4144 ×					
1 Restore scope	Select the restore types					
2 PreOps	Complete Resource					
3 PostOps						
(4) Notification						
5 Summary						

Summary would be displayed and with Finish the actual restore is started.

Restore from Sn	apCenter_db2_ondema	nd_03-26-2025_14_42_07_4144	×
Restore scope	Summary		
2 PreOps	Backup Name	SnapCenter_db2_ondernand_03-26-2025_14_42_07_4144	
<b>O D u u D u</b>	Backup date	03/26/2025 2:43:50 PM	
3 PostOps	Restore scope	Complete Resource without Volume Revert	
4 Notification	Pre restore command		
<u>a.</u>	Post restore command		
5 Summary	Send email	No	
		an SMTP server must be configured. Continue to the Summary page to save your info erver Settings to configure the SMTP server.	ormation, and
		Previo	bus Finish

"db2inidb D01 as mirror" is done as part of SnapCenter Restore Workflow.

- Check recover status Database D01 (as user db2d01)
  - db2 rollforward db D01 query status
- Recover database as needed here an losless recovery is initated (as user db2d01)
  - $\,\circ\,$  db2 rollforward db D01 to end of logs
- Stop database recovery and online database D01 (as user db2d01)
  - db2 rollforward db D01 stop
- Start SAP System (as user d01adm)
  - startsap

(i)

#### Additional information and version history

Following recoded Demos are available to support the documentation.

Installation and Configuration DB2 Plugin, Backup of DB2 database

#### Restore and Recovery of DB2 database

To learn more about the information that is described in this document, review the following documents and/or websites:

- SAP on DB2 Installation Azure on ANF
- SnapCenter Prerequisites for Plugins
- SnapCenter Install Plugins
- SnapCenter DB2 Plugin Documentation
- SAP Notes (login required)
  - 83000 DB2/390: Backup and Recovery Options: https://me.sap.com/notes/83000
  - 594301 DB6: Admin Tools and Split Mirror: https://me.sap.com/notes/594301
- NetApp Product Documentation: https://www.netapp.com/support-and-training/documentation/
- NetApp SAP Solutions Information about Use-Cases, Best-Practices and Benefits

#### Version history

Version	Date	Document version history
Version 1.0	April 2025	Initial version – backup / recovery DB2 database

# **SnapCenter Integration for SAP MaxDB Database**

This document describes the SnapCenter integration specifics for SAP MaxDB Database used in an SAP environment.

### Introduction

The document is not intended to be a step-by-step description of how to setup the complete environment but will cover concepts and relevant details related to:

- Example configuration overview
- Sample Layout
- Protect SAP MaxDB Instance
- Restore and Recover SAP MaxDB Instance

### Example configuration overview

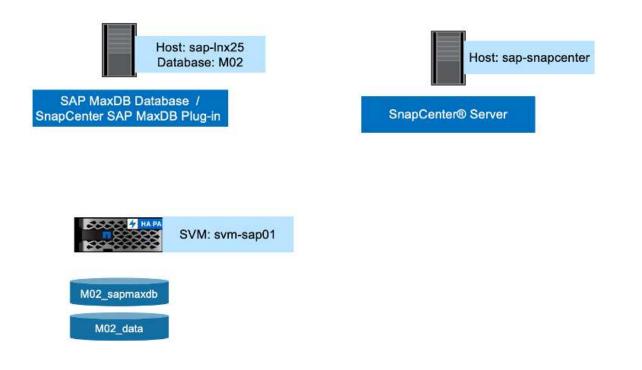
Example Implementation for SnapCenter MaxDB Plugin for an SAP System running in our Demo Center.



This implementation describes the minimal required volume configuration. Data Dump Backups and Log Dump Backups, Backup Template, etc. are configured according to SAP Note "1928060 - Data backup and recovery with file system backup" and referenced Notes from there.

Alternatively, the volume structure described in MS Techcommunity Blog could be used.

### **Demo Environment**



### Software versions

Software	Version
Linux OS	SLES for SAP 15 SP5
SAP	SAP NetWeaver 7.5
SAP MaxDB	DBMServer 7.9.10 Build 004-123-265-969
SnapCenter	6.1

### MaxDB Volume Design

Following least volume Layout must be used to enable backup / recovery and clone use-cases for the SAP MaxDB database. The example configuration use <SID>: M02.

Volume Name	Directory (qtree) on Volume	Mount Point on Server	Comment
<sid>_sapmaxdb</sid>	sapdb	/sapdb	Parent directory for MaxDB related files
		/sapdb/ <sid>/saplog</sid>	Redo Logs (might be placed on a different volume)
		/sapdb/ <sid>/backu p</sid>	Dump Backups (Data + Log) (might be placed on a different volume)
	<sid>adm</sid>	/home/ <sid>adm</sid>	Home directory of user <sid>adm</sid>
	sdb	/home/sdb	Home directory of User sdb
	sqd <sid></sid>	/home/sqd <sid></sid>	Home directory of User sqd <sid></sid>

Volume Name	Directory (qtree) on Volume	Mount Point on Server	Comment
	usrsaptrans	/usr/sap/trans	Transport directory
	usrsap <sid></sid>	/usr/sap/ <sid></sid>	Usr sap
	sapmnt <sid></sid>	/sapmnt/ <sid></sid>	SAP GlobalHost Dir
<sid>_data</sid>	sapdata	/sapdb/ <sid>/sapda ta</sid>	DB Data Files (SID)

### **Steps to Protect Database M02**

- · Check File distribution, according to the sample Layout
- Check Prerequisites for the Host (sap-Inx25)
- Check Prerequisites for the Database (M02)
- Deploy / Install SnapCenter Agent on Host (sap-Inx25)
- Create SnapCenter Instance Resource Configuration

### **Prerequisites on Host**

More current information might be available here.

Before you add a host and install the plug-ins package for Linux, you must complete all the requirements.

- If you are using iSCSI, the iSCSI service must be running.
- You can either use the password-based authentication for the root or non-root user or SSH key based authentication.
- SnapCenter Plug-in for Unix File Systems can be installed by a non-root user. However, you should configure the sudo privileges for the non-root user to install and start the plug-in process. After installing the plug-in, the processes will be running as an effective non-root user.
- Create credentials with authentication mode as Linux for the install user.
- You must have installed Java 11 on your Linux host.
- Ensure that you have installed only the certified edition of JAVA 11 on the Linux host
- For information to download JAVA, see: Java Downloads for All Operating Systems
- You should have bash as the default shell for plug-in installation.

#### Prerequisites for the Database – Create Backup Templates, Enable Logbackup

- Create Directories for data and log backups (/sapdb/M02/backup/data, /sapdb/M02/backup/log owner sdb:sdba – Permissions 755)
- Connect to database M02 (as OS-user sqdm02)
  - dbmcli -d M02 -u CONTROL,<password>
- Create Data File Backup Template (M02\_DATA) according to SAP Note 1928060
  - backup\_template\_create M02\_DATA to FILE /sapdb/M02/backup/data/M02\_DATA content DATA
- Create Data Backup Template (M02\_LOG) according to SAP Note 1928060

- backup\_template\_create M02\_LOG to FILE /sapdb/M02/backup/log/M02\_LOG content LOG
- Create Data Snapshot Backup Template (M02\_SNAP) according to SAP Note 1928060
  - backup\_template\_create M02\_SNAP to EXTERNAL SNAPSHOT
- Create Fake-Backup to enable LOG Backup
  - util\_connect
  - backup\_start M02\_SNAP
  - backup\_finish M02\_SNAP ExternalBackupID first\_full\_fake\_backup
- Switch Database Logging Mode
  - ∘ autolog\_off
  - ∘ autolog\_on M02\_LOG INTERVAL 300
  - autolog\_show

### Deploy SnapCenter Agent to Host sap-Inx25

Further Information could be found in the SnapCenter documentation.

Select SAP MaxDB and Unix File Systems Plugins.

Add Host		
Host Type	Linux	•
Host Name	sap-lnx25	
Credentials	linux-snapcenter	- + 0
Select Plug-ins to Inst	<b>all</b> SnapCenter Plug-ins Package 6.	1 for Linux
	MySQL	🗌 Oracle Applications 🐧
	Oracle Database	SAP ASE
	PostgreSQL	SAP MaxDB
	SAP HANA	🗌 Storage 🚺
	Unix File Systems	
More Options : Po	rt, Install Path, Custom Plug-Ins	

## Create SnapCenter Resource Configuration for Database M02

 $\mathsf{Resources} \to \mathsf{SAP}\ \mathsf{MaxDB} \to \mathsf{Add}\ \mathsf{Resources}$ 

Cancel

Submit

Add SAP MaxDB Re	esource		×
1 Name	Provide Resource I	Details	
2 Storage Footprint	Name	M02	0
3 Resource Settings	Host Name	sap-lnx25.muccbc.hq.netapp.com	]
4 Summary	Туре	Database -	]
	Credential Name •		
	≚ Add information Credential Name Username Password	on for the credential control-M02 control Add	
			-
		Previous	Next

If Password contains Special Characters, they must be masked with a backslash (e.g. Test!123!  $\rightarrow$  Test\!123\!).

 $(\mathbf{i})$ 

Add SAP MaxDB R	esource				×
1 Name	Provide Resource	Details			
2 Storage Footprint	Name	M02		0	
3 Resource Settings	Host Name	sap-lnx25.muccbc.hq.netapp.com	·		
4 Summary	Туре	Database	•		
	Credential Name	control-M02	÷	+	0
4 Summary					

dd SAP MaxDB R	iesource				
Name	Provide Storage F	ootprint Details			
Storage Footprint	Storage Type	ONTAP	O Azure NetApp	Files	
Resource Settings	Add Storage Fo	ootprint			
Summary	Storage System	svm-sap01.muc	ccbc.hq.netapp.com	•	×
	Select one or more	e volumes and if req	quired their associate	d Qtrees and LUNs	
	Volume name			LUNs or Qtrees	
	M02_data		•	Default is 'None' or type to find	
	M02_sapmaxdb		•	Default is 'None' or type to find	+ ×

Following Resource Settings Custom key-value pairs must be made (at least).

Add SAP MaxDB Res	source		×
1 Name	Resource Settings 0		
2 Storage Footprint	Custom key-value pairs for SAP MaxDB pl	ug-in	^
3 Resource Settings	Name	Value	
4 Summary	DBMCLICMD	/sapdb/M02/db/bin/dbmcli	×
	SQLCLICMD	/sapdb/M02/db/bin/sqlcli	×
	MAXDB_UPDATE_HIST_LOG	Y	×
	MAXDB_BACKUP_TEMPLATES	M02:M02_SNAP	+ ×
			Previous

The following table lists the MaxDB plug-in parameters, provides their settings, and describes them:

Parameter	Setting	Description
HANDLE_LOGWRITER	(Y / N)	Executes suspend logwriter (N) or resume logwriter (Y) operations.
DBMCLICMD	path_to_dbmcli_cmd	Specifies the path to the MaxDB dbmcli command.If not set, dbmcli on the search path is used.
SQLCLICMD	path_to_sqlcli_cmd	Specifies the path for the MaxDB sqlcli command.If not set, sqlcli is used on the search path.
MAXDB_UPDATE_HIST_ LOG	(Y / N)	Instructs the MaxDB backup program whether or not to update the MaxDB history log.

Parameter	Setting	Description
MAXDB_BACKUP_TEMP LATES	template_name (e.g. M02_SNAP)	Specifies a backup template for each database.The template must already exist and be an external type of backup template.
		To enable Snapshot copy integration for MaxDB 7.8 and later, you must have MaxDB background server functionality and already configured MaxDB backup template.
MAXDB_BG_SERVER_P REFIX	<b>bg_server_prefix (e.g.</b> na_bg)	Specifies the prefix for the background server name. If the MAXDB_BACKUP_TEMPLATES parameter is set, you must also set the MAXDB_BG_SERVER_PREFIX parameter. If you do not set the prefix, the default value na_bg_DATABASE is used.

Add SAP MaxDB Re	source			×
1 Name	Summary			
2 Storage Footprint	Name	M02		
0	Туре	Database		
3 Resource Settings	Host	sap-Inx25.muccbc.hq	netapp.com	
4 Summary	Credential Name	control-M02		
	Storage Footprint			
	Storage System	Volume	LUN/Qtree	
	svm-sap01.muccbc.hq.netapp.com	M02_data		
		M02_sapmaxdb		
	Custom Resource Parameters			
	Key		Value	
	DBMCLICMD		/sapdb/M02/db/bin/dbmcli	
	SQLCLICMD		/sapdb/M02/db/bin/sqlcli	
	MAXDB_UPDATE_HIST_LOG		Y	
	MAXDB_BACKUP_TEMPLATES		M02:M02_SNAP	
			Previous	Finish

Now the configuration could be finished and Backup scheduled according to the overall protection concept.

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-	Settings							
▲	Alerts							

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			maxdb_ordemand	None	To schedule operations select a policy that has the appropriate schedule associated, or modify the selected policy to allow schedules.	No				
			Total 1							
	Total 1							Active	te Windows	evicus Next

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### Sequence to Recover System M02

- 1. stop SAP System M02 (including database), stop sapinit
- 2. umount Filesystem /sapdb/M02/sapdata
- 3. restore Volumes M02\_data (using SnapCenter)
- 4. mount Filesystem /sapdb/M02/sapdata
- 5. start Database M02 and connect (admin mode)
- 6. Gather Backup Information
- 7. recover database data backup
- 8. recover database log backups
- 9. stop database
- 10. start sapinit, SAP System M02

#### **Recover Instance M02**

- Stop SAP System + DB M02 on host sap-Inx25
  - User m02adm: stopsap
  - $\circ\,$  Optional if database has not been stopped successfully User: sqdm02
  - dbmcli -d M02 -u CONTROL,<password>
    - db\_offline
  - User root: /etc/init.d/sapinit stop
  - User root: umount /sapdb/M02/sapdata
- Restore Backup
  - SnapCenter GUI: Select required Bacukp for Restore

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•	1.	M02	2 Backups			Summary	Card			
ail.			0 Clones			≥ Backups				
*			Local copies			0 Clones				
H						0 Snapshots L	ocked			
<b>A</b>			Primary Backup(s)							
			(search 7)						th E	
			Backup Name	Snapshot Lock Expiration	Count				End Date	
			SnapCenter_moxdb_ondemand_05-20 2025_13:29:34.4378		N.		đ	5/20/2025 1	30:03 PM 🗖	
			SnapCenter_maxdb_ondemand_05-20-2025_13:27.47.2824		Ť.		65	5/20/2025 1	28:21 PM 🗖	
	Total 1		Total 2							

Selecting Complete Resource will trigger a Volume Based Snap Restore (VBSR). Within Azure it is called volume revert. For ANF Deployment **only Complete Resource is available**.

#### () Important

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Active filesystem data and snapshots that were taken after the selected snapshot will be lost. The snapshot revert operation will replace *all* the data in the targeted volume with the data in the selected snapshot. You should pay attention to the snapshot contents and creation date when you select a snapshot. You cannot undo the snapshot revert operation.



For other deployment Types (e.g. On-Prem ANF) a Single File Snap Restore (SFSR) Operation could be orchestrated. Select File Level and the according Volume and Checkmark "All" – see following screenshot.

Restore from Sn	apCenter_maxdb_ondemand_05-20-20	25_13.29	.34.4378	×
1 Restore scope	Select the restore types			
2 PreOps 3 PostOps	Complete Resource			
(4) Notification	Select files to restore			
5 Summary	Volume/Qtree	All	File Path	
	<ul> <li>svm-sap01.muccbc.hq.netapp.com:/vol/M</li> <li>svm-sap01.muccbc.hq.netapp.com:/vol/M</li> </ul>		Provide one or more file paths separated by comma	
🛕 Configure an SM	IP Server to send email notifications for Restore jobs b	by going to	Settings>Global Settings>Notification Server Settings.	
			Previous	xt

Summary would be displayed and with Finish the actual restore is started.

Restore from Sn	hapCenter_maxdb_ondem	nand_05-20-2025_13.29.34.4378	×
Restore scope	Summary		
2 PreOps	Backup Name	SnapCenter_maxdb_ondemand_05-20-2025_13.29.34.4378	
3 PostOps	Backup date	05/20/2025 1:30:03 PM	
5 Postops	Restore scope	File Level	
4 Notification	Pre restore command		
(F. communication)	Unmount command		
5 Summary	Mount command		
	Post restore command		
	Send email	No	
		n SMTP server must be configured. Continue to the Summary page to save your in ver Settings to configure the SMTP server.	formation, and
		Prev	vious Finish

- Mount Filesystems (sap-Inx25)
  - User root: mount /sapdb/M02/sapdata
- Start Database M02 in admin mode an connect
  - User: sqdm02: dbmcli -d M02 -u CONTROL,<password>
    - db\_admin
    - db\_connect
- Gather Backup Information
  - backup\_history\_open
  - backup\_history\_list -c label,action,pages,stop,media -r last

```
[dbmcli on M02>backup_history_list -c label,action,pages,stop,media -r last
OK
END
DAT_00000008|SAVE WARM| 0|2025-05-20 13:29:50|M02_SNAP
```

- \_\_\_\_
- Recover Database

- Recover Data Backup
  - recover\_start M02\_SNAP data ExternalBackupID DAT\_000000008

ок			
Returncode	0		
Date	20250520		
Time	00151550		
Server	sap-lnx25		
Database	M02		
Kernel Version	Kernel	7.9.10	Build 004-123-265-969
Pages Transferred	0		
Pages Left			
Volumes			
Medianame	M02_SNAP		
Location			
Errortext			
Label	DAT_00000	0008	
Is Consistent	true		
First LOG Page	512226		
Last LOG Page			
DB Stamp 1 Date	20250520		
DB Stamp 1 Time	00132933		
DB Stamp 2 Date			
DB Stamp 2 Time			
Page Count			
Devices Used	0		
Database ID	sap-lnx25	:M02_202	41203_104036
Max Used Data Page	3187892	un and Card <del>an</del> 1997-1997	n an ann an ann — a ann an Airtean Airtean an Airtean an Airtean an Airtean Airtean Airtean Airtean Airtean Air

\_\_\_\_

- Recover Log Backup as necessary
  - e.g. recover\_start M02\_LOG LOG 147

dbmcli on M02>recover\_start M02\_LOG LOG 147 OK Returncode 0 Date 20250521 Time 00112001 Server sap-lnx25 Database MØ2 Build 004-123-265-969 Kernel Version Kernel 7.9.10 Pages Transferred 24 Pages Left 0 Volumes 1 Medianame M02\_LOG Location /sapdb/M02/backup/log/M02\_LOG.147 Errortext Label LOG\_00000147 Is Consistent 514072 First LOG Page Last LOG Page 514075 DB Stamp 1 Date 20250520 DB Stamp 1 Time 00180238 DB Stamp 2 Date 20250520 DB Stamp 2 Time 00180539 Page Count 4 Devices Used 1 Database ID sap-lnx25:M02\_20241203\_104036 Max Used Data Page Converter Page Count

- Optional Information autorecover to a specific time stamp (without need to specify dedicated data / log backp
  - e.g. autorecover until 20250520 200000

dbmcli on M02>autorecover until 20250520 200000 OK Returncode 0 Date 20250521 00131559 Time Server sap-lnx25 Database M02 Kernel Version Kernel 7.9.10 Build 004-123-265-969 Pages Transferred 10096 Pages Left 0 Volumes 1 Medianame M02\_LOG Location /sapdb/M02/backup/log/M02\_LOG.102 Errortext LOG\_000000102 Label Is Consistent First LOG Page 256227 Last LOG Page 341559 DB Stamp 1 Date 20241203 00190348 DB Stamp 1 Time DB Stamp 2 Date 20241226 DB Stamp 2 Time 00193615 Page Count 85333 Devices Used 1 Database ID sap-lnx25:M02\_20241203\_104036 Max Used Data Page Converter Page Count

· End Recovery and stop Database

• db\_offline



Further information about Recovery is available in the MaxDB Documentation

- start SAP System
  - · User root: /etc/init.d/sapinit start
  - User m02adm: startsap

### Additional information and version history

#### **Recorded Demos**

Following recoded Demos are available to support the documentation.

Installation MaxDB Plugin, Configuration MaxDB Plugin, Backup of MaxDB database

Restore and Recovery of MaxDB database

#### **External Documentation**

To learn more about the information that is described in this document, review the following documents and/or websites:

- SAP Installation Azure on ANF
- SnapCenter Prerequisites for Plugins
- SnapCenter Install Plugins
- MaxDB Recovery Documentation
- SAP Notes (login required)
  - 1928060 Data backup and recovery with file system backup
  - 2282054 Background DBM server
  - · 616814 Suspend log writer for split mirror or snapshot
- HowTo SAP MaxDB Backup with Database Manager CLI
- HowTo SAP MaxDB Recovery with Database Manager CLI
- NetApp Product Documentation
- NetApp SAP Solutions Informations about Use-Cases, Best-Practices and Benefits

#### Version history

Version	Date	Document version history
Version 1.0	May 2025	Initial version – backup / recovery MaxDB database

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