SAP HANA COPY DATA MANAGEMENT USING HPE RECOVERY MANAGER CENTRAL
EXECUTIVE SUMMARY

Protecting SAP HANA without impacting performance is proving ever more challenging in the face of all-flash data centers, unrelenting data growth, stringent recovery service level agreements (SLAs), and increasingly virtualized hybrid IT environments. Traditional approaches to data protection are unable to cost-effectively deliver the end-to-end protection that applications and hypervisors demand. A faster, easier, more efficient, and reliable way to protect data is needed.

Server-centric backup processes can impact application performance with data typically flowing through the application and backup server. Backup server infrastructures introduce escalating cost and complexity with the need to disruptively acquire and manage additional servers, software licenses, and networking equipment as application data grows. Array-based snapshots and replication provide fast, nondisruptive point-in-time copies of data. However, snapshots alone cannot deliver comprehensive backup because they have retention limitations and a dependence on the underlying storage system. Simply put, snapshots are lost if the storage system fails.

A more effective approach is to combine the benefits of snapshots and backups with an application-managed, storage-integrated, and cloud-ready data protection solution.

HPE Recovery Manager Central (RMC) software integrates HPE Nimble Storage, HPE 3PAR, and HPE Primera arrays with HPE StoreOnce backup appliances to provide a flash-integrated snapshot, replication, and backup service that augments traditional backup approaches.

HPE AI-driven intelligent storage platforms deliver world-class primary storage with integrated data management and data mobility that is built for enterprises and the cloud, resulting in reduced risk and improved return on investment (ROI). In addition to needing to protect mission-critical data, businesses increasingly rely on multiple copies of their production SAP HANA® databases for testing and development, analytics, report generation, and copies for application development purposes, managing the creation and use of these copies can become complex and costly to the point that it can negatively impact daily business operations.

Hewlett Packard Enterprise (HPE) storage systems with HPE Recovery Manager Central (RMC) software provide a faster, easier, and more efficient way to manage and protect data copies for SAP HANA databases.

Application-consistent snapshots and copies can be leveraged to accomplish critical business goals:

- Protect data rapidly and reliably with seamless integration with SAP HANA
- Clone data for development, testing, reporting, or analytics
- Restore data in the event of corruption or disaster

HPE Nimble Storage arrays with RMC eliminate the cost and performance overhead associated with host-based snapshots. The unique performance advantages of HPE arrays ensure that point-in-time (PIT) snapshots can be leveraged without the performance concerns that impact traditional array-based copies. In today's business environments, processes such as backup, recovery, development, and testing can all be enhanced by the ability to leverage PIT data copies or snapshots.

Scope

The objective of this technical white paper is to demonstrate the capabilities of RMC copy data management functionality in an SAP HANA environment. It describes various ways of creating an SAP HANA system copy. Parts or all of the highlighted copy data management features are also instruments to be used to complement an existing or new SAP HANA backup and recovery strategy.

Audience

This white paper is intended for SAP® solution architects, SAP HANA database administrators, backup and archive solution architects, backup administrators, and storage administrators or IT professionals who are involved in planning, designing, deploying, or administering SAP HANA environments. This document assumes that you have a basic understanding of SAP HANA concepts and HPE Storage technologies and solutions (HPE Nimble Storage, RMC, and StoreOnce).

1 SAP HANA Administration Guide - Planning Your Backup and Recovery Strategy
INTRODUCTION TO HPE STORAGE SOLUTIONS FOR SAP HANA

The solution described in this white paper includes various HPE products that support SAP HANA. This section provides an overview of these products. Visit https://www.hpe.com/us/en/storage/sap.html for more information.

HPE Nimble Storage

HPE Nimble Storage All-Flash Arrays combine a flash-efficient architecture with HPE InfoSight predictive analytics to achieve fast, reliable access to data and 99.9999% guaranteed availability.² Radically simple to deploy and use, the arrays are cloud-ready and SAP HANA tailored data center integration (TDI) certification for Enterprise Storage. A storage investment made today can provide benefits well into the future, thanks to HPE technology and business-model innovations. HPE Nimble Storage All Flash Arrays include all-inclusive licensing, easy upgrades, and flexible payment options, and are future-proofed for new technologies such as NVMe and Storage Class Memory (SCM).

HPE Virtual Copy basics

HPE Nimble Storage systems support two technologies to provide you with copies of SAP HANA data volumes. Each of these technologies allows you to access a point-in-time (PIT) copy of a base volume and to read data from or write data to that PIT copy. Both technologies can be leveraged to meet customer recovery point objective (RPO) and recovery time objective (RTO) requirements.

- **Physical copies**—A physical copy is a full copy of a volume. A physical copy duplicates all the data from one original base volume to a destination volume. Any change to either volume causes it to lose synchronization with the other.

- **Zero copy clone**—Zero copy clones are the snapshot implementation used to provide a PIT virtual copy volume. This technology ensures that the original data can always be obtained if a problem occurs when updating the data on a volume. Zero copy clones are always thin, unique (only one copy of the change blocks is kept and then referenced), and reservationless.

Because of the highly efficient way that the two storage systems handle metadata, you can configure thousands of read-only and read/write snapshots with the flexibility to promote any snapshot without destroying others. Unlike a physical copy, which duplicates the entire base volume, a virtual copy snapshot initially consumes no space and only increases in size when it records changes to the original volume. This allows an earlier state of the original volume to be recreated by starting with the current state and rolling back all the changes that have been made since the virtual copy snapshot was created.

HPE StoreOnce Systems

HPE StoreOnce Systems with StoreOnce Catalyst provide a single, high-performance backup architecture that spans the entire enterprise. The StoreOnce inline deduplication process eliminates redundant data blocks, which means it reduces the amount of backup data you need to store. You can choose between powerful dedicated appliances for larger offices and data centers, and flexible virtual appliances for smaller and remote offices. Industry-leading backup and restore speeds mean that shrinking backup windows and recovery SLAs can be met. StoreOnce Catalyst prevents exposure of backup copies to ransomware.

With StoreOnce, deduplication can occur at the application server or at the StoreOnce backup system, which controls the movement of deduplicated data across the enterprise using a backup application. Using HPE Cloud Bank Storage³ to cloud-enable current backup and business applications, StoreOnce systems provide even more flexibility to reduce cost, risk, and complexity.

HPE Recovery Manager Central for SAP HANA

RMC software integrates into HPE Nimble Storage arrays with StoreOnce backup systems to provide converged data protection. RMC facilitates policy-driven copy data management for business-critical applications at speeds required for all-flash storage. RMC leverages snapshot performance with storage-integrated backups to deliver flash speed application protection and copy data management with less cost and complexity than legacy solutions. The software is also built for Cloud Bank Storage, which allows you to leverage a public cloud for cost-effective long-term retention of your backups.

HPE Recovery Manager Central for SAP HANA (RMC-SH) is a data protection and copy data management solution that enables rapid recovery from PIT application-consistent snapshots of an SAP HANA database. SAP HANA supports data snapshots of the data that persists in the data area (/-hana/data) only⁴. SAP HANA automatic log backups⁵ can be performed as file-based or backint backups. RMC-SH allows SAP HANA database administrators to create, schedule, and manage snapshots on HPE Nimble Storage systems.

References:

² SAP HANA Administration Guide - Planning Your Backup and Recovery Strategy
³ https://www.youtube.com/watch?v=tmUM_5NA2xk
⁴ https://hellosap.com/viewer/6b9444c06eae958b5a19666e7cf58a203/en-US/ac114d4b5d52e9bc90bd6f8f575.html
⁵ HPE StoreOnce Catalyst Plug-in 2.1.0 for SAP HANA and download
The RMC-SH Express Protect feature provides second-level data protection with backups of SAP HANA database volumes from HPE Nimble Storage systems to HPE StoreOnce systems. Backups to HPE StoreOnce systems are self-contained volumes and are deduplicated to save space. The backups can be used to revert to the original or a different volume on an HPE Nimble Storage array. The RMC-SH Catalyst Copy feature creates a copy of an Express Protect backup on another HPE StoreOnce system or in a public cloud leveraging RMC cloud copy.

RMC-SH 6.3 supports snapshots of SAP HANA multiple database container systems and uses the data snapshot to recover an SAP HANA system with all its tenants (SAP HANA 2.0 SPS 04).6

RMC 6.0 introduced additional functionalities to complement simple, easy, and efficient copy data management for SAP HANA databases. The advantage of RMC-SH copy data management is the application-consistent data snapshot and Express Protect functionality. Steps in the process are illustrated in Figure 1:

1. **Storage snapshot**—RMC integrates into SAP HANA to take application-consistent snapshots at any given point in time.

2. **Express Protect**—You can use Express Protect technology to create efficient backups directly from HPE Nimble Storage arrays to HPE StoreOnce backup systems.

3. **Catalyst Copy to second StoreOnce system**—To meet additional disaster recovery requirements, RMC supports automating and scheduling StoreOnce Catalyst Copy, which copies Express Protect backups to one or more remote StoreOnce appliances on a second disaster recovery site.

4. **Cloud copy**—RMC integrates with Cloud Bank Storage technology, which allows you to automate and schedule the creation of a copy on a public cloud or on-premises object storage. (This technology requires Amazon® S3 protocol.)

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**FIGURE 1.** Recovery Manager Central for SAP HANA workflow

RMC-SH has four different copy policies available by default. A copy policy uses a centralized template for a collection of protection rules. The copy policy defines which type of copy (storage snapshot, clone, Express Protect) to create, where the copy resides (the copy repository), when to create a copy (frequency), and how to manage the life cycle of a copy (expiration and retention).

You can use the following standard copy policies for multitier protection:

- **Platinum**—Snapshot, Express Protect, and Cloud Copy
- **Gold**—Snapshot, Express Protect, and Catalyst Copy
- **Silver**—Snapshot and Express Protect
- **Bronze**—Snapshot

If predefined copy policies are not assigned, you can modify an existing policy or create additional customized copy policies.

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6 [https://help.sap.com/viewer/42668af650f84f9384a3337bcd373692/2.0.04/en-US/7910eb4a49826b1b0435a4e9b0938d1.html](https://help.sap.com/viewer/42668af650f84f9384a3337bcd373692/2.0.04/en-US/7910eb4a49826b1b0435a4e9b0938d1.html)
RMC-SH software is the control console where you can schedule, initiate, and monitor data snapshots. RMC-SH offers a variety of copy data management options. The starting point to manage all activities is the RMC for SAP HANA main menu, as shown in Figure 2, from the Clone / Restore option, shown in Figure 3.

**FIGURE 2.** RMC for SAP HANA main menu

**FIGURE 3.** RMC for SAP HANA Clone / Restore option
In the life cycle of an SAP HANA solution, many customers perform a system copy of an SAP HANA system to set up a system for testing, demonstration, or training. Creating an SAP HANA system copy can be a time-consuming activity. The system copy performed by RMC is based on a data snapshot, which can be created in minutes.

The available options in RMC-SH to create an SAP HANA system copy are:

- Virtual clone from a new snapshot
- Virtual clone from an existing copy
- Physical clone
- Restore

**Virtual clone from a new snapshot option**

Virtual clones enable you to create an instant-on data snapshot. A read/write virtual clone is created from the previously created data snapshot.

Creating a virtual clone from a new snapshot is a fast way to create an instant copy of the current database on the same HPE Nimble Storage array as shown in Figure 4.

![Virtual clone from a new snapshot scheme](image-url)
Virtual clone from an existing copy option
Creating a virtual clone from an existing copy enables you to select an existing snapshot (HPE Nimble Storage snapshot or Express Protect) and create a clone from it. It is a fast way to create a copy from an earlier point in time of an SAP HANA database on the same HPE Nimble Storage array.

![Virtual clone from an existing snapshot scheme](image)

FIGURE 5. Virtual clone from an existing snapshot scheme

Physical clones option
A physical clone allows you to restore data from an Express Protect backup or Catalyst Copy. The restore can be made to an existing /hana/data or different volume to the same or different array. The intention is to perform a PIT recovery of the SAP HANA database.

A physical clone enables you to create an independent copy of an earlier point in time of an SAP HANA database to the same or different HPE Nimble Storage array. The restore process takes more time because all data from the complete database needs to be transferred to the target volume.

![Physical clone scheme](image)

FIGURE 6. Physical clone scheme
**Restore option**

This option restores data back to the parent volume. The existing data is lost and is overwritten by the data from the selected existing snapshot or Express Protect.

![Diagram of SAP HANA system copy process](image)

**FIGURE 7. Restoring a backup scheme**

### THE COPY DATA MANAGEMENT PROCESS TO CREATE AN SAP HANA SYSTEM COPY

This section describes the steps to create an SAP HANA system copy. An RMC based solution as described in this document requires the following components:

- An SAP HANA solution with HPE Nimble Storage arrays as persistent storage
- HPE StoreOnce Data Protection backup appliances
- An SAP HANA database registered in RMC
- An active SAP HANA database
- A preinstalled test SAP HANA database

The following components were used for testing:

- SAP HANA 2.0 SPS04
- SUSE Linux® Enterprise Server for SAP Applications 12 SPS 4
- HPE Recovery Manager Central 6.3
- HPE Nimble OS 5.1.2
- HPE StoreOnce software code 3.18.18 and 4.2.1

RMC is supported on both Red Hat® and SUSE Linux as well as multiple SAP HANA versions. Check the HPE Recovery Manager Central compatibility matrix for a list of the latest supported versions.

When you perform an SAP HANA recovery, the storage volume must be the same size or larger than the original source data volume. This is important when cloning data to an existing HPE Nimble Storage volume.
Create an SAP HANA system copy by using the Virtual Clone from a new snapshot option

The starting point in this process is the SAP HANA menu in the RMC user interface. Click Clone / Restore and then select the option Virtual Clone from a new snapshot. Optionally, you can specify a name for the new data snapshot, as shown in Figure 8.

When you click Clone, a virtual clone volume is created from an instant data snapshot. The creation of the virtual clone takes a short time and occurs on the same HPE Nimble Storage array as the source data volume.

Perform the following steps for a recovery:
1. Attach a volume to the server/host.
2. Add a new volume to the server.
3. Mount a new volume to SAP HANA.
4. Recover a target SAP HANA system.
   - System DB using the SAP HANA cockpit
   - Tenant DB using the SAP HANA cockpit
   - System DB using SAP HANA Studio
   - Tenant DB using SAP HANA Studio

Create an SAP HANA system copy by using the Virtual Clone from an existing copy (snapshot) option

The starting point in this process is the SAP HANA menu in the RMC user interface. Click Clone / Restore and select the option Virtual Clone from an existing Copy (Snapshot). A calendar view is displayed; color coding lets you know which types of copies (snapshot, Express Protect, Catalyst Copy, remote snapshot) are available for clone activity, as shown in Figure 9.
First, select a day in the calendar. The available point in time and copy types are displayed underneath the calendar. Then select an available source copy.

Depending on the source, the clone process can take just a few seconds/minutes or longer if data needs to be transferred from a StoreOnce, Catalyst Copy, or Cloud Bank Storage device to the HPE Nimble Storage array.

You can view the clone status in the Activities menu.

Perform the following steps for a recovery:

1. **Attach volume to target host.**
2. **Add a new volume to a server.**
3. **Mount a new volume to SAP HANA.**
4. **Recover a target SAP HANA system.**
   - **System DB using the SAP HANA cockpit**
   - **Tenant DB using the SAP HANA cockpit**
   - **System DB using SAP HANA Studio**
   - **Tenant DB using SAP HANA Studio**
Physical clone

The source of a physical clone is always an HPE StoreOnce appliance. Depending on the setup, this can be a local, remote, or cloud-based appliance.

The following example uses an existing data volume of a preinstalled SAP HANA database for testing. You can also use a different HPE Nimble Storage volume. It is important to note that the size of the volume must be the same or larger than the source volume.

If necessary, stop the test SAP HANA database. Unmount the storage volume that is mounted to /hana/data and detach it from the SAP HANA server.

1. From the RMC SAP HANA menu, click Clone / Restore and navigate to Physical Clone, as shown in Figure 10.

2. The Calendar view is displayed. Color coding shows which Express Protect copies are available for cloning. Select a day in the calendar with Express Protect copies available.

3. Available point in time and copy types are displayed underneath the calendar. The example in Figure 10 shows a single Express Protect at May 24 and 25. If a Catalyst Copy is available, it is listed as well. If there are multiple Express Protect backups available per day, mark the one that should be used for the physical clone.

4. Select an Express Protect copy to be used as clone source.

Under the Copies for clone section, select the HPE Nimble Storage array and the volume to be used as the clone target.
Expand the **Storage System** section to select an HPE Nimble Storage array that will be the clone target array. Then expand **Volume(s)** to select a volume that will be the clone target volume. In this example, the clone target volume is named qt5_data, as shown in Figure 11.

This clone activity will take more time than the previous options (Virtual clone from a new snapshot, Virtual clone from an existing copy) because a fully independent clone is created, and the full data is copied to the target volume. You can monitor the status of the physical clone in the Activities menu.

Perform the following steps for a recovery:

1. Attach a volume to the target server.
2. Add a new volume to the server.
3. Mount a new volume to SAP HANA.
4. Recover a target SAP HANA system.
   - **System DB using the SAP HANA cockpit**
   - **Tenant DB using the SAP HANA cockpit**
   - **System DB using SAP HANA Studio**
   - **Tenant DB using SAP HANA Studio**
**Restore**

The copy source for a restore can be a snapshot, Express Protect, Catalyst Copy, or Cloud Copy.

To perform a restore, open the **Clone / Restore** option in the RMC SAP HANA menu and start the Restore wizard.

In the calendar view, select a day. The color coding indicates if a copy is available and which type it is. Under the calendar, select one of the available point-in-time copies to be used for the restore, as shown in Figure 12. This example lists three available snapshots and one Express Protect copy. In this example a point-in-time snapshot from 2019-05-26 09:00:27 was selected.

1. Stop the SAP HANA database.
2. Unmount the data volume /hana/data.
3. Unexport/detach volume from SAP HANA server.
4. Start the restore process. (The time required for the restore depends on the selected copy type/target device.)

You can monitor the status of the restore process in the Activities menu.

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**FIGURE 12.** Calendar view of the Clone / Restore option in the RMC SAP HANA menu
Perform the following steps for a recovery:

1. Mount the volume back to /hana/data on the SAP HANA server.
2. Recover the target SAP HANA system.
   - System DB using the SAP HANA cockpit
   - Tenant DB using the SAP HANA cockpit
   - System DB using SAP HANA Studio
   - Tenant DB using SAP HANA Studio

### STEPS TO RECOVER AN SAP HANA SYSTEM

This section describes the steps to recover an SAP HANA system after performing an RMC clone or restore process.

#### Attach a volume to a server/host

After the clone of data volume has been created, it needs to be attached to the corresponding server that is hosting the target SAP HANA system. The target system must have the same configuration as the source system.

Open the RMC SAP HANA main menu. If clones are available, a Clone row under the Copies heading displays the number of available clones, as shown in Figure 13.

![FIGURE 13. HP Recovery Manager Central user interface—SAP HANA main menu](image)

When you click the number of available clones (the column with the green icon), a list of available clones appears. In this example, there is a single clone available.

The following steps are valid when using options to create a virtual clone from a new or existing snapshot and physical clone:

1. To attach the clone to the SAP HANA target host, expand the Action tree and select Attach.
2. Click Selected Host. Figure 14 shows that the registered hosts are listed. Select your target host and click Add.
After a few seconds, the volume is attached to the host.

The RMC Activities menu shows all activities together with the duration of each activity.

**Add a new volume to the server**

The following steps are valid when using options to create a virtual clone from a new or existing snapshot and physical clone:

1. Navigate to the target server and scan for new devices by issuing the command `rescan-scsi-bus.sh`. The number of new devices found is displayed at the end of the output. The number of new devices found depends on the number of available multipath connections between the HPE Nimble Storage array and the target server.

2. Use the `multipath` command to detect all paths to the device for failover and coalesce them. The command output lists the UUID required when preparing a cloned volume for the system copy to mount the cloned data volume to the SAP HANA data path `/hana/data`. This is valid when a single volume is used per HANA node. Logical volume manager configuration is supported but is not discussed in this document.

**Mount a virtual clone volume to SAP HANA and prepare it for system copy**

If the clone was created to an HPE Nimble Storage volume different from the source volume, stop the target SAP HANA database and unmount the data volume `/hana/data` (``umount /hana/data``)

The following steps are the same for all scenarios:

1. Mount the cloned data volume to `/hana/data` (``#mount /dev/mapper/<UUID> /hana/data``)

2. Use the list command (`ls`) to view the newly mounted `/hana/data` path. It lists a directory that has the name of the source SID.

   Example: `#ls /hana/data`

   ```
   DB1
   ```

   (DB1 is the SID of the source SAP HANA database)

   When the target SAP HANA database has the same SID, no change is required. Continue with the SAP HANA recovery process.

3. If the target SAP HANA database (for example, the database used for testing) has a different SID such as QT4, you need to change the name of directory. Use the move (`mv`) command to move the file and directories from one place to another.

   Example: `#mv /hana/data/DB1 /hana/data/QT4`

4. After the move, make sure all data is accessible to the new `<sid>-adm` (for example, `qt4adm`) user and group. If you must change the folder and file ownership, use the following command:

   ```
   #chown -R qt4adm:<USERGROUP> /hana/data/QT4
   ```
Recover the SAP HANA target database by using the SAP HANA cockpit and SQL statements

To recover a complete SAP HANA system, you must first recover the system database and then its tenant. The recovery of a tenant database is always initiated from the system database.

It is not possible to do a PIT recovery of a system database using the SAP HANA cockpit. To recover a system database to a point in time, use an SQL statement.7

To start the recovery of the system database, log on to the server as a system administrator (<SID>adm). Execute the following command for the recovery:

```
# <SID>adm@hostname:/usr/sap/<SID>/HDBxx> ./HDBSettings.sh recoverSys.py --silent --
command="RECOVER DATA USING SNAPSHOT CLEAR LOG"
```

After recovering the system database, return to the SAP HANA cockpit and check the status of the system database.

Recover the tenant database by using the SAP HANA cockpit and SQL statements

1. In the SAP HANA cockpit, navigate to the main menu of the recovered system database and open the SQL console.
2. Enter the statement: ‘RECOVER DATA FOR <SID> USING SNAPSHOT CLEAR LOG’
   Example: ‘RECOVER DATA FOR QT4 USING SNAPSHOT CLEAR LOG’
3. To start the recovery process of the tenant database, click the green Run button to execute the statement.
4. After successful recovery of the tenant database, return to the SAP HANA cockpit and check the status. Now the system and tenant database have been recovered to a specific point in time.
5. Complete any manual changes on the recovered database that are required for further testing.

It is also possible to recover the tenant database to the most recent state or to a specific point in time using the SAP HANA cockpit, as shown in Figure 15.

![FIGURE 15. SAP HANA cockpit—Recovery wizard of a tenant database](image)

In both cases, log backups must exist and the location must be provided. The data snapshot that was used to recover the system database is shown with status “available” at the Backup to be used step in the Recovery wizard. Select this snapshot and continue with the next step.

7 [https://help.sap.com/viewer/6b94445c94ae695c83a1964de7c3f56/2.0.03/en-US/6cc445744848644e836d73a61e84ea00.html](https://help.sap.com/viewer/6b94445c94ae695c83a1964de7c3f56/2.0.03/en-US/6cc445744848644e836d73a61e84ea00.html)
6. At the end of the recovery wizard, a summary to recover to the most recent state appears, as shown in Figure 16.

![Figure 16. SAP HANA cockpit—Summary of recovery of tenant database](image)

The related SQL statement is:  
```
RECOVER DATABASE FOR DB1UNTIL TIMESTAMP '2020-06-03 13:26:56' USING CATALOG BACKINT USING SNAPSHOT CHECK ACCESS USING BACKINT IGNORE DELTA DATA BACKUPS
```

7. Lastly, to start the recovery process, click the **Start Recovery** button. The recovery status is displayed. After a successful recovery, return to the SAP HANA cockpit main menu.
Recover the SAP HANA target database by using SAP HANA Studio and SQL statements

To recover a complete SAP HANA system, you must first recover the system database and then its tenant. The recovery of a tenant database is always initiated from the system database.

1. In SAP HANA Studio, open the context menu, navigate to Backup and Recovery, and select Recover System Database, as shown in Figure 17.

![SAP HANA Studio—Backup and recovery options](image)

**FIGURE 17.** SAP HANA Studio—Backup and recovery options

2. The Recovery Wizard opens. Follow the instructions using these options:
   - **Recovery Type**: Recover the database to a specific data backup
   - **Backup Location**: Recover without the backup catalog
   - **Snapshot**: Destination type of backup to recover

3. The Other Settings section of the UI provides an option to install a new license key if available.
4. At the end, the wizard summarizes the selected recovery options, as shown in Figure 18.

![Review Recovery Settings](image)

**FIGURE 18.** SAP HANA Review Recovery Settings screen

5. Clicking the **Show SQL Statement** in the Review Recovery Settings window displays the SQL statement, which in this example is **RECOVER DATA USING SNAPSHOT CLEAR LOG**.

6. Start the recovery process by clicking **Finish**.

7. Close the Recovery wizard window after successful recovery of the system database.
Recover the tenant database by using SAP HANA Studio and SQL statements

1. In SAP HANA Studio, open the context menu. Then go to Backup and Recovery and select Recover Tenant Database.

2. When the Recovery Wizard opens, select the tenant database to be recovered, as shown in Figure 19. Then click Next to continue and follow the instructions using these options:
   - **Recovery Type**: Recover the database to a specific data backup
   - **Backup Location**: Recover without the backup catalog
   - **Snapshot**: Destination type of backup to recover

![SAP HANA Studio—Recovery of Tenant Database screen](image)

3. At the end of the process, the wizard summarizes the selected recovery options, as shown in Figure 20. QT4 in this example is the tenant database name.
4. Clicking the **Show SQL Statement** button in the Review Recovery Settings window displays the SQL statement, which should be ‘RECOVER DATA FOR QT4 USING SNAPSHOT  CLEAR LOG’.

5. Click **Finish** to start the recovery process.

**SUMMARY**

Intelligent enterprises are challenged by the complexity, inflexibility, and rising costs of their data management solutions. HPE RMC seamlessly integrates robust, flash-optimized HPE Nimble Storage arrays along with fast, scalable, and highly resilient HPE StoreOnce systems. In addition, it provides flash speed application-integrated data protection, copy data management, and data mobility for SAP HANA environments.

HPE data protection and copy data management solutions for databases simply and efficiently deliver the end-to-end availability, agility, and business continuity that database environments demand.
## TERMINOLOGY

### TABLE 1. This table provides an overview and description of the terms used in this document.

<table>
<thead>
<tr>
<th>HPE Nimble</th>
<th>HPE RMC</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume</td>
<td></td>
<td>An HPE Nimble Storage container comparable with what is commonly called a logical unit number (LUN).</td>
</tr>
<tr>
<td>Snapshot</td>
<td>Snapshot</td>
<td>HPE Nimble Storage snapshot implementation used to provide a point-in-time (PIT) virtual copy of a volume.</td>
</tr>
<tr>
<td>Physical copy</td>
<td>Physical copy</td>
<td>A physical copy is a full copy of a volume. A physical copy duplicates all the data from one original base volume to a destination volume.</td>
</tr>
<tr>
<td>Zero copy clone from a new snapshot</td>
<td>Zero copy clone from a new snapshot</td>
<td>A new snapshot is created and is then cloned.</td>
</tr>
<tr>
<td>Zero copy clone from an existing snapshot</td>
<td>Zero copy clone from an existing snapshot</td>
<td>An existing snapshot is cloned.</td>
</tr>
<tr>
<td>Physical clone</td>
<td>Physical clone</td>
<td>Data is restored to a new volume.</td>
</tr>
<tr>
<td>Copy</td>
<td>Copy</td>
<td>A copy can be a snapshot, clone, Express Protect, Catalyst Copy, or a cloud copy.</td>
</tr>
<tr>
<td>Copy policy</td>
<td>Copy policy</td>
<td>A centralized template is a collection of protection rules.</td>
</tr>
<tr>
<td>Export</td>
<td>Attach</td>
<td>This process makes a volume or RMC copy available to host by creating an association between copy on a storage system and a LUN on a host.</td>
</tr>
<tr>
<td>Unexport</td>
<td>Detach</td>
<td>This process makes a volume or RMC copy unavailable to host.</td>
</tr>
<tr>
<td>Express Protect</td>
<td>Express Protect</td>
<td>Express Protect backups provide a second tier of data protection with backups directly from HPE Nimble Storage to HPE StoreOnce backup systems using Express Protect technology. Express Protect backups are block-level copies of volumes that are deduplicated to save space. The backups enable you to create fast and immediate backups and restore from historical snapshots and backups.</td>
</tr>
<tr>
<td>Catalyst Copy</td>
<td>Catalyst Copy</td>
<td>Catalyst Copies are the copies of Express Protect backups on one or more remote HPE StoreOnce appliances. You can also create a copy for an existing Catalyst Copy.</td>
</tr>
<tr>
<td>Cloud copy</td>
<td>Cloud copy</td>
<td>Cloud copies are Catalyst Copies on Cloud Bank Store. You can automate and schedule creating cloud copies on a public cloud tier such as Amazon S3 or Microsoft® Azure.</td>
</tr>
<tr>
<td>Zero copy clone</td>
<td>Zero copy clone</td>
<td>Clones are HPE Nimble Storage read/write snapshots, which facilitates creating copies of your database for testing or other secondary data use cases. Clones do not occupy any additional storage space or affect the performance of the production copy.</td>
</tr>
</tbody>
</table>
Technical white paper

Resources, contacts, or additional links
- HPE Solutions for SAP HANA
- HPE Storage solutions for SAP HANA warm data tiering
- HPE GreenLake for SAP HANA
- Make the most of your SAP HANA environment
- Welcome to the next generation of hybrid cloud data protection
- HPE flash storage-integrated data protection, copy data management, and data mobility
- HPE SAP HANA Solutions
- HPE Storage for SAP HANA
- HPE Storage
- HPE SAP Alliance
- HPE Data Protection Solutions

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