SNAPSHOTS AND DISASTER RECOVERY FOR HLI

Abstract

How to guide for the scripts provided with HANA Large Instances for the snapshots and disaster recovery failover.

Microsoft

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Version

This document is derived for the SAP HANA Large Instances scripts **version 3.x**.

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Overview

This document covers the details on the scripts used for the HANA Large Instances. These scripts are proved by Microsoft and serve the following purposes:

1. Storage snapshots status, testing, backup and restore
2. Self Service Disaster Recovery failover

You can follow this document to get "How To" details about those scripts. Since these are custom scripts written for the specific purpose of HANA Large Instances, DO NOT modify them unless instructed by the Microsoft Operations team.

Disclaimer: *This guide is derived by testing the set up in the Microsoft HANA Large Instances environment, which successfully works. You are still responsible to monitor and perform restore test to ensure snapshots taken are consistent.*

Terms and Definitions

Let's understand the terms used in this documentation:

- SID: A system identifier for HANA system.
- Multipurpose DR: A disaster recovery system which has more than one instances configured. One of the instance is the DR for the production SID, other instances are non-production HANA instances.
- Normal DR: In opposite to Multi-purpose DR, a disaster recovery system which just has primary SID configured with storage replication running. There is no other workload running while production instance is up and running at primary site.
- Single SID system: A system which has only one HANA instance configured.
- Multi SID system: A system which has more than one HANA instances configured. Also known in SAP documentation as MCOS deployment.
- HLI: SAP HANA Large Instances Unit
- DR: Disaster Recovery.

What are these scripts?

The script package consists of ten scripts, the details are described as follows:

- **azure_hana_backup.pl:** To execute the storage snapshots on either the HANA data/log/shared volumes, the /hana/logbackups volume, or the OS.

- **azure_hana_replication_status.pl:** This script provides the basic details around the replication status from the production site to the disaster-recovery site. The script monitors to ensure that the replication is taking place, and it shows the size of the items that are being replicated. It also provides guidance if a replication is taking too long or if the link is down.

- **azure_hana_snapshot_delete.pl:** This script deletes a storage snapshot or a set of snapshots. You can use either the SAP HANA backup ID as found in HANA Studio or the storage snapshot name. Currently, the backup ID is only tied to the snapshots created for the HANA data/log/shared volumes. Otherwise, if the snapshot ID is entered, it seeks all snapshots that match the entered snapshot ID.

- **azure_hana_snapshot_details.pl:** This script provides a list of basic details about all the snapshots, per volume, that exist in your environment. This script can be run on the primary server or on a server unit in the disaster-recovery location. The script provides the following information broken down by each volume that contains snapshots:
    - Size of total snapshots in a volume
    - Each snapshot in that volume includes the following details:
        - Snapshot name
        - Create time
        - Size of the snapshot
        - Frequency of the snapshot
        - HANA Backup ID associated with that snapshot, if relevant

- **HANABackupCustomerDetails.txt:** This file is a modifiable configuration file that you need to modify to adapt to your SAP HANA configuration.

- **removeTestStorageSnapshot.pl:** This script deletes the test snapshot as created with the script *testStorageSnapshotConnection.pl*.

- **testHANAConnection.pl:** This script tests the connection to the SAP HANA instance and is required to set up the storage snapshots.

- **testStorageSnapshotConnection.pl:** This script has two purposes. First, it ensures that the HANA Large Instance unit that runs the scripts has access to the assigned storage and to the storage snapshot interface of your HANA Large Instances. The second purpose is to create a temporary snapshot for the HANA instance you are testing. This script should be run for every HANA instance on a server to ensure that the backup scripts function as expected.

- **azure_hana_dr_failover.pl:** Script to initiate a DR Failover into another paired region. The script needs to be executed on the HANA Large Instance **unit in the DR region**. Or the unit you want to fail over to. This script stops storage replication from the primary site to the secondary site,

restores the latest snapshot on the DR volumes, and provides the mountpoints for the DR volumes.

- **azure_hana_test_dr_failover.pl:** Script to perform a test failover into the DR site. Contrary to the azure_hana_dr_failover.pl script, this execution does not interrupt the storage replication from primary to secondary. Instead clones of the replicated storage volumes get created on the DR site and the mountpoints of the cloned volumes are provided.

How do I get these scripts?

For current HANA installations, the directory of pre-installed scripts is /hana/shared/D01/exe/linuxx86_64/hdb. Although, you must download the most recent version of the scripts from GitHub. Copy the downloaded scripts and the text file to the working directory for hdbsql.

Important things to remember

- Never modify the scripts unless instructed by the Microsoft Operations.
- When asked to modify the script or a parameter file, always use the Linux text editor such as "vi" and not the Windows editors like notepad. Using windows editor may corrupt the file format.
- Always use the latest scripts. You can download the latest version from GitHub.
- Use the same version of scripts across the landscape.
- Test the scripts and get comfortable with the parameters required and output of the script before directly using in the production system.
- Don't change the mount point name of the server provisioned by the Microsoft Operations. These scripts rely on these standard mount point names to be available for a successful execution.
- When you setup HANA user for backup (details below in this document), you need to setup backup user for each HANA instances.
- You need to provide public key for storage access. You do it one per tenant at each location.
- The number of snapshots per volume is limited to 255.
- Keep monitoring the space consumed by the storage and delete the old snapshots on a regular basis to avoid storage fill out.
- SAP does not support snapshot on the MDC environment for the following releases. Though snapshot is supported with non-MDC setup for the following releases. The script will not work if you have following HANA releases with MDC setup.
    - HANA 2 SP00
    - HANA 1 SP 12
    - HANA 1 SP11
    - HANA 1 SP10
- For HANA 2 SP1 and SP2 release: If you have MDC with more than one tenant, snapshot does not work. For single tenant it works fine.

Scenarios Covered

The following scenarios are covered in this document to illustrate the usage of the scripts.

Snapshots

- What are the prerequisite for the storage snapshot?
- How to setup snapshots?
- How to take snapshots manually?
- How to setup automatic snapshot backup?
- How to monitor the snapshots?
- How to delete a snapshot?
- How to restore a snapshot?
- What are key facts to know about the snapshots?

Note Snapshot is tested for both single SID and multi SID.

Disaster Recovery

- What are the prerequisites for DR setup?
- How to setup a disaster recovery?
- How to monitor the data sync from Primary to DR site?
- How to perform a failover to DR site?

Note DR is tested for single SID failover on a multipurpose DR setup.

Technical Setup

To test and document these scripts, the following set up was used. All the screen shots and information presented, are corresponding to the **version 3.0** of the scripts.

- Operating System: SLES 12 SP2 for SAP
- HANA Large Instances: 2xS192 (four sockets, 2 TB); One for Primary site and second for DR site
  - Primary site HLI unit (sapprdhdb80) has 3 SIDs configured: H80, H81, and H82
  - DR site HLI unit (sapdrhdb80) has 2 SIDs configured: Q85, and H80 (replication from the Primary site)
- HANA Version: HANA 2.0 SP1
- Server Names: sapprdhdb80 (Primary) and sapdrhdb85 (DR node)

CAUTION!	You may have different screens for operating system or HANA depending on the version you are using. Also, based on your HANA version, the scripts parameter may differ. Refer the script details before using them.

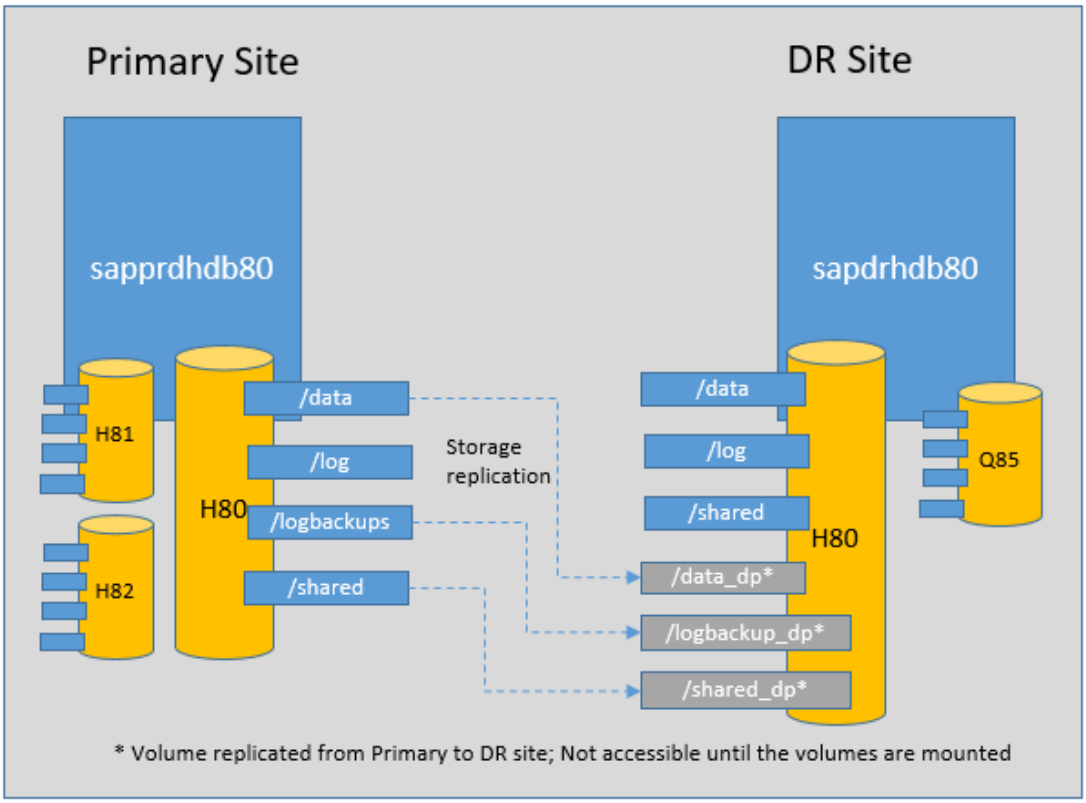


Figure 1: Technical setup

Getting Started

Please follow the guidelines to setup and execute the snapshots and disaster recovery scripts. It is must that you performed the following already before you begin with the scripts.

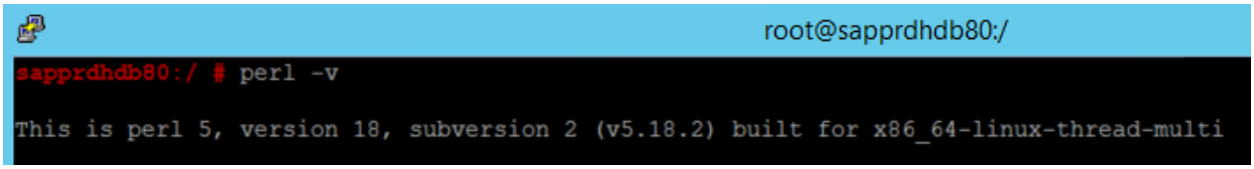
- OS is patched: Please refer for patching and SMT setup https://docs.microsoft.com/en-us/azure/virtual-machines/workloads/sap/hana-installation#setting-up-smt-server-for-suse-linux
- Time Synchronization is setup
- HANA is installed: Please refer for HANA installation instructions: https://blogs.msdn.microsoft.com/saponsqlserver/2017/11/21/sap-netweaver-installation-on-hana-database/ .
- In this document, we installed HANA 2.0 SP1 with multi SID as following:
    - **Primary site HLI unit** (sapprdhdb80) has three HANA instances configured with the SIDs: H80, H81, and H82. To install three instances, you need to run the hana installer (hdblcmgui) three times with "new instance" option, and then provide SID information each time for each instance. So, in this example, you run hdblcmgui, three times with H80, H81, and H82 SIDs.
    - **DR site HLI unit** (sapdrhdb80) has two HANA instances configured: Q85, and H80. To install two instances, you need to run the hana installer (hdblcmgui) two times with "new instance" option, and then provide SID information each time for each instance. So, in this example, you run hdblcmgui, 2 times with H80 and Q85 SIDs.

Snapshots

1. What are the prerequisite for the storage snapshot?

To ensure that snapshot script executes successfully, make sure that Perl is installed on the Linux operating system on the HANA Large Instances server. Perl will come pre-installed on your HANA Large Instance unit. To check the perl version, use the following command:

```
# perl –v
```



2. How to setup snapshots?

Once the prerequisite of the snapshots are met, you can start the process to setup the snapshots. There is no automatic snapshots execution preconfigured on the HANA Large Instances unit. The following steps are needed to set it up.

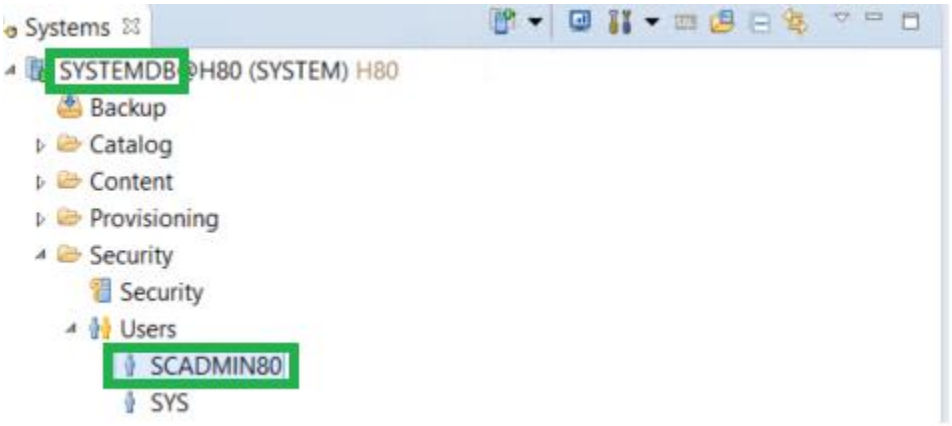
Please refer (Section: Setting up storage snapshots) for more details on how to complete the following steps (Step1 thru step 6): https://docs.microsoft.com/en-us/azure/virtual-machines/workloads/sap/hana-overview-high-availability-disaster-recovery#backup-and-restore.

Step 1: Install the SAP HANA HDB client on HLI unit. HLI units have no pre-installed HANA server instances or clients. You need to install the HANA Client on the HLI unit.

Step 2: Modify the /etc/ssh/ssh_config to add the line *MACs hmac-sha1*.

Step 3: Create a public key on HLI unit for storage access.

Step 4: Create an SAP HANA user account to access HANA instance under the SYSTEMDB (and not in the SID database).



Step 5: Authorize the SAP HANA account (hdbuserstore setup) to avoid password entry each time.

Step 6: Get the latest scripts from GitHub.

After the above steps (1 thru 6) are complete, modify the file *HANABackupDetails.txt* to update the parameters for your SAP HANA system.

Before you take snapshots, ensure that all the steps of setup are complete, and HANABackupDetails.txt file is updated with your HANA instance information.

Note	When you setup the HANA user for backup (details below in this document), you need to setup the backup user for each HANA instances. You also need to provide public key for storage access. You do it one per tenant at each locations

3. How to take snapshots manually?

Before you execute the actual scripts *azure_hana_backup.pl*, please run the following scripts and ensure that they get executed successfully. This will ensure that scripts have access to HANA and the underlying storage of the HANA Large Instance unit.

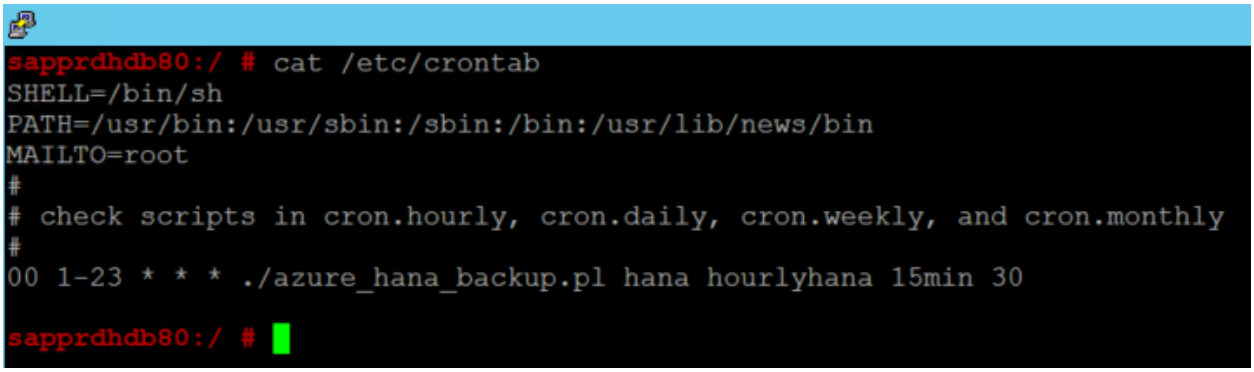
- testHANAConnection.pl
- testStorageSnapshotConnection.pl

To execute the scripts, please refer a section: Scripts Execution and details

4. How to setup automatic snapshot backup?

You schedule an automatic snapshot using a cron job. The example of the *crontab* job is following:

```
00 1-23 * * * ./azure_hana_backup.pl hana hourlyhana 15min 30
```



- 00: 0th Minute (Top of the hour)
- 1-23: every hour
- * : Every day
- * : Every month
- * : Every day of the week

You can get more crontab examples here: https://www.thegeekstuff.com/2009/06/15-practical-crontab-examples/.

In the above example, the '15mins' is a parameter that is reserved for future development and has no impact on the execution right now. The cron job schedule controls the backup timings. More details are found here: azure_hana_backup.pl.

CAUTION	Customer must monitor the *cron* job to ensure that snapshots are being generated successfully

5. How to monitor the snapshots?

You must monitor the successful execution of the scripts, a successful snapshot generation, space consumed by snapshots at the volume, and the consistency of the snapshots by restoring then to another system periodically. To get the snapshot details, please execute the script azure_hana_snapshot_details.pl.

6. How to delete a snapshot?

To delete a snapshot, please execute the script azure_hana_snapshot_delete.pl. However, if you had taken a temporary snapshot using a script testStorageSnapshotConnection.pl, you can delete the temporary snapshot(s) using the script removeTestStorageSnapshot.pl.

You can't delete the snapshot from the OS level. You must be using the script removeTestStorageSnapshot.pl to delete the storage snapshot.

CAUTION	Be extra vigilant while deleting a snapshot. Once deleted, you can't recover the deleted snapshots. However, to avoid filling up the storage space, you must keep on cleaning up the old snapshots.

7. How to restore a snapshot?

In this version, there is **NO** restore script provided for the snapshot restore as a self-service. You must contact the Microsoft operations team by opening a service request to restore a desired snapshot from the existing available snapshots. You can open a service request from Azure portal: https://portal.azure.com.

However, if you decide to perform the disaster recover failover, the script azure_hana_dr_failover.pl automatically restores the recent available (/data and /logbackups) snapshots for you.

8. What are key facts to know about the snapshots?

You must be familiar with the key attributes about the storage snapshots:

- **Location of snapshots**: The default location of the hana snapshots is under the .snapshot folder. Please note, .snapshot is a read-only hidden folder.
  - /data: /hana/data/<SID>/mnt00001/.snapshot
  - /shared: /hana/shared/<SID>/.snapshot
  - /logbackups: /hana/logbackups/<SID>/.snapshot
  - boot: boot snapshots are not visible from OS level
- **Max snapshot:** The hardware can sustain up to 255 snapshots per volume. However, if you setup a cron job with retention parameter specified, the script deletes the older snapshot to retain the number of snapshots you specified.
- **Snapshot name:** The snapshot name is the label provided by the customer.
- **Size of the snapshot:** Depends upon the size/changes on the database level.

- **Log file location:** /hana/shared/<SID>/exe/linuxx86_64/hdb/snapshotLogs and /hana/shared/<SID>/exe/linuxx86_64/hdb/statusLogs.

Disaster Recovery

1. What are the prerequisites for DR setup?

The following pre-requisites must be met before you plan the disaster recovery failover.

- You have a DR node provisioned at the DR site. There are two options for DR. One is normal DR, and other is multipurpose DR (See the definition: Terms and Definitions).
- You have storage replication working. The Microsoft operations team performs the storage replication setup at the time of DR provisioning automatically. You can monitor the storage replication using the script azure_hana_replication_status.pl.
- You have setup and configured storage snapshots at the primary location.
- You have an HANA instance installed at the DR site for the primary with the same SID as the primary instance has.
- You read and understood the DR Failover procedure located at https://docs.microsoft.com/en-us/azure/virtual-machines/workloads/sap/hana-overview-high-availability-disaster-recovery#disaster-recovery-failover-procedure.
- The *HANABackupCustomerDetail.txt* file has been updated with the DR location storage information on the DR server.
- You completed the step 1, 2, 3 and 6 from the section How to Setup Snapshot?

2. How to setup a disaster recovery?

Currently, Microsoft supports storage level replication for DR recovery. There are two ways to setup the DR.

One is normal and **other** is multipurpose. In the normal DR, you have a dedicated instance at the DR location for failover. In the multipurpose DR scenario, you have another QA or development HANA instance running on the HANA large instance unit in the DR site. But you also installed a pre-installed HANA instance that is dormant and has the same SID as the HANA instance you want to failiver to that HANA Large Instance unit. Microsoft operations sets up the environment for you including the storage replication based on the input provided in the Service Request Form (SRF) at the time of onboarding.

Also, ensure that all the prerequisites are met for the DR setup.

3. How to monitor the data sync from Primary to DR site?

Microsoft operations team already manage and monitor the DR link from Primary site to the DR site. You can monitor the data replication from your primary server to DR server using the script azure_hana_replication_status.pl.

4. How to perform a failover to DR site?

You perform a failover to DR site, by executing a script azure_hana_dr_failover.pl.

Caution	Perform it only when you are planning to perform the DR exercise or a test. The script execution breaks the storage replication. You must reach out to the Microsoft Operations to set up the replication back. Also, once the replication is re-setup, all the data at DR storage for this SID get initialized. The script that performs the failover is restoring to the most recent storage snapshot that has been replicated. If you need to restore back to an older snapshot, you need to open a support request, so, that operations can work with you to have an earlier snapshot restored in the DR site.

At the high level, here are the steps got the failover:

- You must shut down the HANA instance at **primary** site. This is only needed if you are truly doing the failover to DR site so you don't have data inconsistencies.
- Shutdown the HANA instance on the DR node for the production SID.
- Execute the script azure_hana_dr_failover.pl on the DR node with the SID to be recovered
    - The script breaks the storage replication link from the Primary to the DR site
    - The script restores the /data and /logbackups volume only, /shared volume is NOT recovered, but rather it uses the existing /shared for SID at the DR location.
    - Mount the /data and /logbackups volume – ensure to add it to the fstab file
- Restore the HANA SYSTEMDB snapshot. Please note, HANA studio only shows you the latest HANA snapshot available under the storage snapshot restored as part of the script azure_hana_dr_failover.pl execution.
- Recover the tenant database
- Start the HANA instance on the DR site for the Production SID (Example: H80 in this case)
- Perform the testing

Detailed steps can be found at azure_hana_dr_failover.pl.

Scripts Execution and details

HANABAckupCustomerDetails.txt

In the following screen, the *HANABackupCustomerDetails.txt* is configured with the three SIDs.

A customer may place a '#' at the beginning of all the lines for a given SID grouping to skip that particular SID, if they wish temporarily. Additionally, a customer may leave SID 2-10 blank if only a single SID is installed on that server.

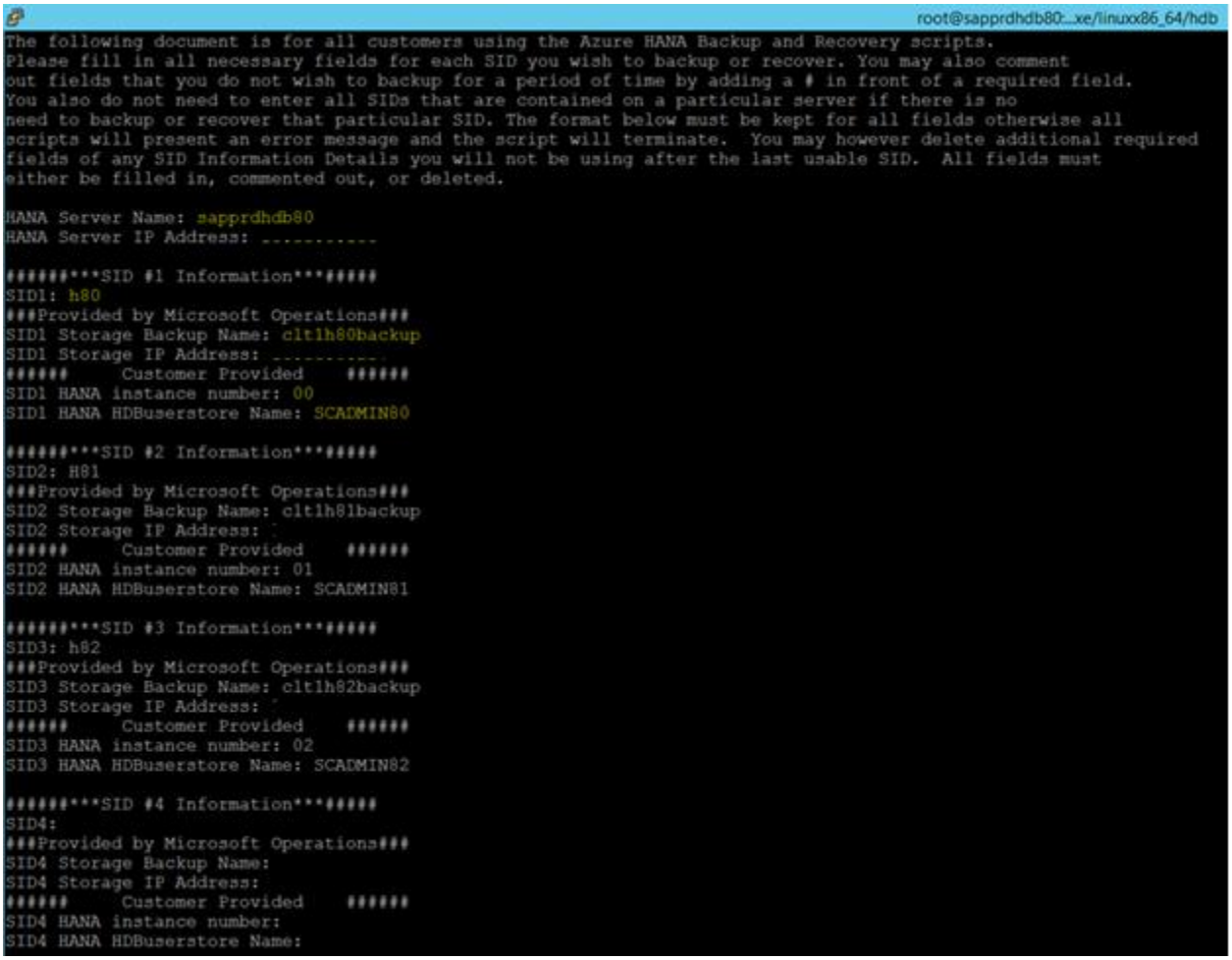
CAUTION	The document may not be altered by deleting fields, deleting additional lines, or modifying the contents of the document. If any alteration occurs, an error is thrown, and the script is halted.

```
HANA Server Name: sapprdhdb80                ← HANA Server Host Name (Case sensitive)*
HANA Server IP Address: 172.18.18.50          ← HANA Server IP address (eth0.xx IP)*

######***SID #1 Information***#####
SID1: h80                                    ← HANA SID (any case is OK)
###Provided by Microsoft Operations###
SID1 Storage Backup Name: clt1h80backup      ← Storage backup name (case sensitive)*
SID1 Storage IP Address: 172.18.18.11         ← Storage IP address*
######    Customer Provided    ######
SID1 HANA instance number: 00                ← HANA Instance Number
SID1 HANA HDBuserstore Name: SCADMIN80       ← HANA Instance Userstore name
```

*Information provided by Microsoft Service Management during onboarding/handover call, and available in excel file provided during handover. Please open a service request if you need this information again.

Note	Your storage IP address must be in the same subnet as your server pool. For example, in this case, our server pool subnet is **172.18.18**.0/24 and our assigned storage IP is **172.18.18.11**.



testHANAConnection.pl

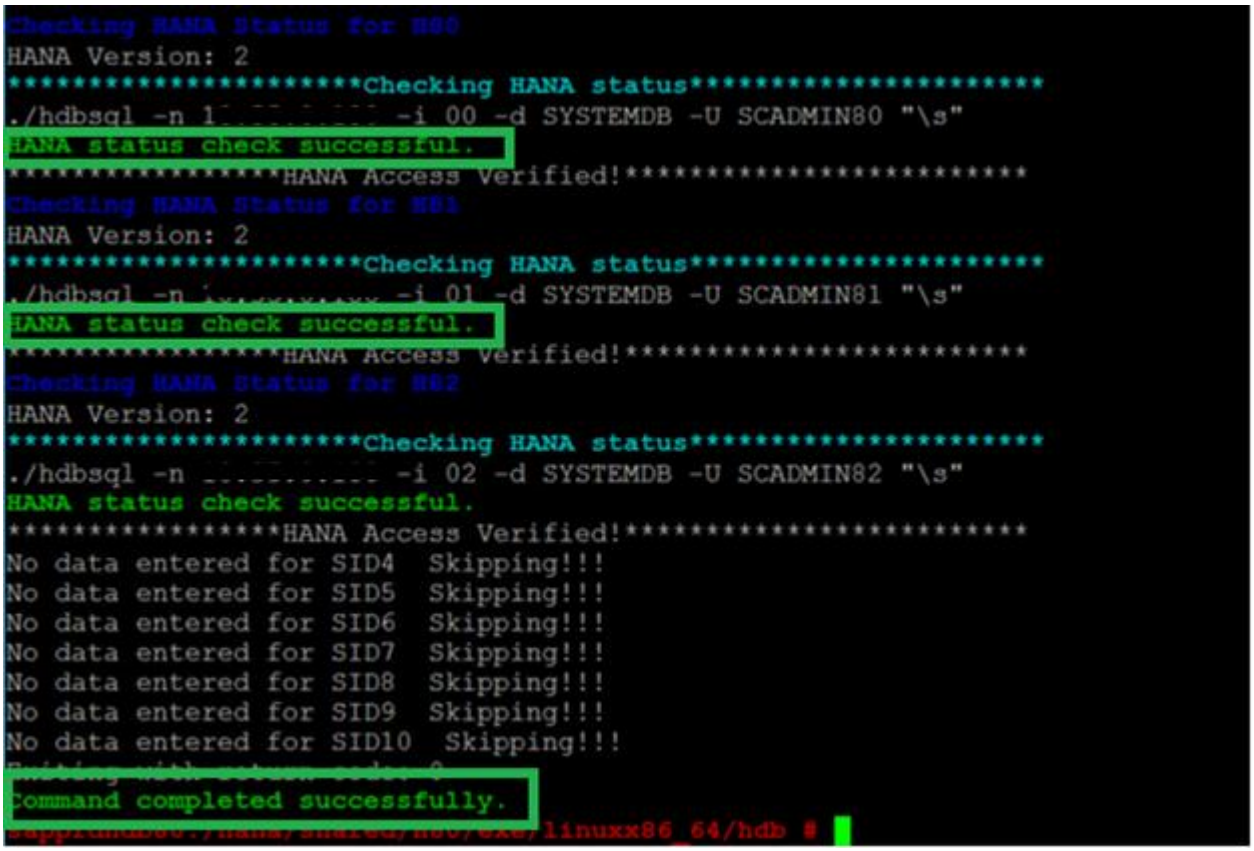
This script checks the HANA connectivity for all the HANA instances maintained in the *HANABackupCustomerDetails.txt*. It uses the HDBuserstore to connect to the SYSTEMDB and fetches the SID information.

This script does not require any parameters. Execute the script as following.

In a Multi SID environment (also referred to as MCOS deployment in HANA documentation, you can execute this script under any instance. For example, you can still be under */hana/shared/H80/exe/linuxx86_64/hdb* and run the script and it runs for all the HANA instances mentioned in the *HANABackupCustomerDetails.txt* file.

```
#./ testHANAConnection.pl
```

Output of the script



testStorageSnapshotConnection.pl

The script logs in to each IP Address listed on the HANA Backup Customer Details document and verify that it has access to the file systems for each HANA instance installed on the HLI unit. A temporary snapshot is created within each data, shared, log, and logbackups volume to verify snapshot access for each file system.

Before you execute the script *testStorageSnapshotConnection.pl*, please execute the following commands for each storage users. This ensures that the connection to storage is already established.

```
# ssh <StorageUserName>@<StorageIP>  ← actual command
# ssh clt1h80backup@172.18.18.11  ← example
```

Note	Your storage IP address must be in the same subnet as your server pool. For example, in this case, our server pool subnet is **172.18.18**.0/24 and our assigned storage IP is **172.18.18.11**.

This script does not require any input parameters. It reads the *HANABackupCustomerDetails.txt* file and connect the storage for each storage user defined.

```
# ./testStorageSnapshotConnection.pl
```

Output of the script

```
sapprdhdb80:/hana/shared/H80/exe/linuxx86_64/hdb # ./testStorageSnapshotConnection.pl
Checking Snapshot Status for h80
**********Checking access to Storage**********
Storage Access successful!!!!!!!!!!!!!
**********Getting list of volumes that match HANA instance specified**********
Collecting set of volumes hosting HANA matching pattern *h80* ...
Volume show completed successfully.
Adding volume hana_data_h80_mnt00001_t020_vol to the snapshot list.
Adding volume hana_log_backups_h80_t020_vol to the snapshot list.
Adding volume hana_log_h80_mnt00001_t020_vol to the snapshot list.
Adding volume hana_shared_h80_t020_vol to the snapshot list.
**********Creating Storage snapshot**********
Taking snapshot testStorage.temp for hana_data_h80_mnt00001_t020_vol ...
Snapshot created successfully.
Taking snapshot testStorage.temp for hana_log_backups_h80_t020_vol ...
Snapshot created successfully.
Taking snapshot testStorage.temp for hana_log_h80_mnt00001_t020_vol ...
Snapshot created successfully.
Taking snapshot testStorage.temp for hana_shared_h80_t020_vol ...
Snapshot created successfully.
**********Adding list of snapshots to volume list**********
Collecting set of snapshots for each volume hosting HANA matching pattern *h80* ...
**********Displaying Snapshots by Volume**********
hana_data_h80_mnt00001_t020_vol
snapmirror.1a2ed3ef-xxxx-xxxx-xxxx-00a098af5e36_2153538856.2018-02-06_191000
testStorage.2018-02-06_1412.temp
testStorage.2018-02-06_1418.temp
testStorage.2018-02-06_1421.temp
testStorage.2018-02-06_1428.temp
hana_log_backups_h80_t020_vol
snapmirror.1a2ed3ef-xxxx-xxxx-xxxx-00a098af5e36_2153538857.2018-02-06_190300
testStorage.2018-02-06_1412.temp
testStorage.2018-02-06_1418.temp
testStorage.2018-02-06_1421.temp
testStorage.2018-02-06_1428.temp
hana_log_h80_mnt00001_t020_vol
testStorage.2018-02-06_1412.temp
```

```
testStorage.2018-02-06_1418.temp
testStorage.2018-02-06_1421.temp
testStorage.2018-02-06_1428.temp
hana_shared_h80_t020_vol
snapmirror.1a2ed3ef-xxxx-xxxx-xxxx-00a098af5e36_2153538858.2018-02-06_191000
testStorage.2018-02-06_1412.temp
testStorage.2018-02-06_1418.temp
testStorage.2018-02-06_1421.temp
testStorage.2018-02-06_1428.temp
**********Clearing snapshot list**********
**********Clearing volume list**********
.....
**********Clearing volume list**********
No data entered for SID4  Skipping!!!
...
No data entered for SID10  Skipping!!!
Exiting with return code: 0
Command completed successfully.
sapprdhdb80:/hana/shared/H80/exe/linuxx86_64/hdb # ./testStorageSnapshotConnection.pl
```

azure_hana_snapshot_details.pl

This script provides the details of the snapshots taken by the script *azure_hana_backup.pl*.

This script does not require any input parameters. It reads the parameters from the *HANABackupCustomerDetails.txt* file.

Use the following command to execute this script.

```
# ./azure_hana_snapshot_details.pl
```

Output of the command

```
sapprdhdb80:/hana/shared/H80/exe/linuxx86_64/hdb # ./azure_hana_snapshot_details.pl
HANA Server Name: sapprdhdb80
HANA Server IP Address: 172.18.18.50
SID1: h80
Storage Backup Name: clt1h80backup
Storage IP Address: 172.18.18.11
HANA Instance Number: 00
HANA Userstore Name: SCADMIN80
SID2: h81
Storage Backup Name: clt1h81backup
Storage IP Address: 172.18.18.11
HANA Instance Number: 01
HANA Userstore Name: SCADMIN81
SID3: h82
Storage Backup Name: clt1h82backup
Storage IP Address: 172.18.18.11
HANA Instance Number: 02
```

```
HANA Userstore Name: SCADMIN82
SID4: Omitted
.....
************************************************************
****Volume: hana_shared_h82_t020_vol      ***********
************************************************************
Total Snapshot Size:  141.9MB
------------------------------------------------------------
Snapshot:   Test_HANA_Snapshot.2018-02-06_1815.1
Create Time:   "Tue Feb 06 23:17:50 2018"
Size:   216KB
Frequency:   15
HANA Backup ID:   1517958932989
------------------------------------------------------------
Snapshot:   Test_HANA_Snapshot.2018-02-06_1829.0
Create Time:   "Tue Feb 06 23:31:53 2018"
Size:   140.9MB
Frequency:   15
HANA Backup ID:   1517959775208
------------------------------------------------------------
No data entered for SID4  Skipping!!!
....
Command completed successfully.
Exiting with return code: 0
Command completed successfully.
sapprdhdb80:/hana/shared/H80/exe/linuxx86_64/hdb #
```

removeTestStorageSnapshot.pl

This script deletes the temp snapshots taken by the script *testStorageSnapshotConnection.pl*. This script does not delete any other snapshots than the temporary snapshot taken by the script *testStorageSnapshotConnection.pl*.

Note	The test snapshot may be deleted only if one or more than one regular snapshots with the regular backup script have been executed.

This script does not require any input parameters, and you can execute the script as following:

```
# ./removeTestStorageSnapshot.pl
```

Output of the script

```
Checking Snapshot Status for h80
**********Checking access to Storage**********
Storage Snapshot Access successful.
**********Getting list of volumes that match HANA instance specified**********
Collecting set of volumes hosting HANA matching pattern *h80* ...
Volume show completed successfully.
```

```
Adding volume hana_data_h80_mnt00001_t020_vol to the snapshot list.
Adding volume hana_log_backups_h80_t020_vol to the snapshot list.
Adding volume hana_shared_h80_t020_vol to the snapshot list.
**********Adding list of snapshots to volume list**********
Collecting set of snapshots for each volume hosting HANA matching pattern *h80* ...
**********Displaying Snapshots by Volume**********
hana_data_h80_mnt00001_t020_vol
Test_HANA_Snapshot.2018-02-06_1753.3
Test_HANA_Snapshot.2018-02-06_1815.2
....
Command completed successfully.
Exiting with return code: 0
Command completed successfully.
```

azure_hana_backup.pl

Execute this script to perform storage snapshots on either the HANA data/log/shared volumes, the /hana/logbackups volume, or the OS. This script needs the following inputs:

- backup type: This parameter may contain “hana”, “logs”, or “boot”
  - hana = snapshots of the volumes /hana/shared/SID (which contains /usr/sap/SID as well), and /hana/data/SID/mnt0001
  - logs = snapshots of the /hana/logbackups/SID
  - boot = TYPEI (for Type I SKUs) or TYPEII(for Type II SKUs)
- Customer snapshot prefix: Label for the snapshot. It has two purposes. The one purpose for you is to give it a name, so that you know what these snapshots are about. The second purpose is for the script azure_hana_backup.pl to determine the number of storage snapshots that are retained under that specific label.
- Snapshot frequency: This parameter is reserved for future developments and does not have any impact. We recommend setting it right now to "3min" when executing backups of the type log and "15min", when executing the other backup types
- Retention: The parameter defines the retention of the snapshots indirectly, by defining the number of snapshots of with the same snapshot prefix (label) to be kept. If the number of snapshot would exceed this parameter, the oldest snapshot is getting deleted before executing a new snapshot.

With “hana” parameter

```
# ./azure_hana_backup.pl hana Test_HANA_Snapshot 15min 10
```

Output of the script

```
# ./azure_hana_backup.pl hana Test_HANA_Snapshot 15min 10
HANA Version: 2 for SID: H80
```

```
**********Checking HANA status**********
./hdbsql -n 172.18.18.50 -i 00 -d SYSTEMDB -U SCADMIN80 "\s"
HANA status check successful.
**********Getting list of volumes that match HANA instance specified**********
Collecting set of volumes hosting HANA matching pattern *h80* ...
Volume show completed successfully.
Adding volume hana_data_h80_mnt00001_t020_vol to the snapshot list.
Adding volume hana_shared_h80_t020_vol to the snapshot list.
**********Adding list of snapshots to volume list**********
Collecting set of snapshots for each volume hosting HANA matching pattern *h80* ...
**********Displaying Snapshots by Volume**********
hana_data_h80_mnt00001_t020_vol
Test_HANA_Snapshot.2018-02-06_1753.2
Test_HANA_Snapshot.2018-02-06_1815.1
snapmirror.1a2ed3ef--xxxx-xxxx-xxxx-00a098af5e36_2153538856.2018-02-07_211000
hana_shared_h80_t020_vol
Test_HANA_Snapshot.2018-02-06_1815.1
Test_HANA_Snapshot.2018-02-06_1829.0
snapmirror.1a2ed3ef-xxxx-xxxx-xxxx-00a098af5e36_2153538858.2018-02-07_211000
**********Counting number of Snapshots that match customer provided snapshot
prefix**********
snapshot: Test_HANA_Snapshot.2018-02-06_1753.2 snapshot prefix: Test_HANA_Snapshot number: 2 prefix:
Test_HANA_Snapshot
Matched
index: 2   count: 0
**********Rotating snapshot numbering to allow new snapshot**********
Rotating older snapshots named Test_HANA_Snapshot.2 on hana_data_h80_mnt00001_t020_vol ...
Rotating older snapshots named Test_HANA_Snapshot.2 on hana_shared_h80_t020_vol ...
**********Clearing snapshot list**********
**********Adding list of snapshots to volume list**********
Collecting set of snapshots for each volume hosting HANA matching pattern *h80* ...
**********Displaying Snapshots by Volume**********
hana_data_h80_mnt00001_t020_vol
Test_HANA_Snapshot.2018-02-06_1753.2
Test_HANA_Snapshot.2018-02-06_1815.1
**********Failures are allowed if *.recent was properly cleaned up last backup**********
Checking if snapshot Test_HANA_Snapshot.recent exists for hana_data_h80_mnt00001_t020_vol on SVM 172.18.18.11 ...
hana_data_h80_mnt00001_t020_vol found.
Snapshot Test_HANA_Snapshot.recent on hana_data_h80_mnt00001_t020_vol not found.
Recent snapshot Test_HANA_Snapshot.recent does not exist on hana_data_h80_mnt00001_t020_vol.
Checking if snapshot Test_HANA_Snapshot.recent exists for hana_shared_h80_t020_vol on SVM 172.18.18.11 ...
hana_shared_h80_t020_vol found.
Snapshot Test_HANA_Snapshot.recent on hana_shared_h80_t020_vol not found.
Recent snapshot Test_HANA_Snapshot.recent does not exist on hana_shared_h80_t020_vol.
**********Creating HANA snapshot**********
Creating the HANA snapshot with command: "./hdbsql -n 172.18.18.50 -i 00 -d SYSTEMDB -U SCADMIN80 "backup data for
full system create snapshot"" ...
HANA snapshot created successfully.
**********Checking for HANA snapshot and obtaining ID**********
Checking HANA snapshot status with command: "./hdbsql -n 172.18.18.50 -i 00 -d SYSTEMDB -U SCADMIN80 "select
BACKUP_ID from M_BACKUP_CATALOG where ENTRY_TYPE_NAME = 'data snapshot' and STATE_NAME = 'prepared'"" ...
row 1518000000839
```

```
hanabackup id: 1518000000839
HANA snapshot created successfully.
**********Creating Storage snapshot**********
Taking snapshot Test_HANA_Snapshot.recent for hana_data_h80_mnt00001_t020_vol ...
Snapshot created successfully.
Taking snapshot Test_HANA_Snapshot.recent for hana_shared_h80_t020_vol ...
Snapshot created successfully.
**********Closing HANA snapshot**********
Deleting the HANA snapshot with command: "./hdbsql -n 172.18.18.50 -i 00 -d SYSTEMDB -U SCADMIN80 "backup data for
full system close snapshot backup_id 1518000000839 SUCCESSFUL 'Storage snapshot successful'"" ...
HANA snapshot closed successfully.
.....
Exiting with return code: 0
Command completed successfully.
```

With logs parameter

```
# ./azure_hana_backup.pl logs Test_LOGS_Snapshot 3mins 10
```

Output of the script with “logs” parameter

```
Executing logs Snapshots for h80
**********Getting list of volumes that match HANA instance specified**********
Collecting set of volumes hosting HANA matching pattern *h80* ...
Volume show completed successfully.
Adding volume hana_log_backups_h80_t020_vol to the snapshot list.
**********Adding list of snapshots to volume list**********
Collecting set of snapshots for each volume hosting HANA matching pattern *h80* ...
**********Displaying Snapshots by Volume**********
hana_log_backups_h80_t020_vol
snapmirror.1a2ed3ef-xxxx-xxxx-xxxx-00a098af5e36_2153538857.2018-02-07_230300
Test_LOGS_Snapshot.2018-02-07_1846.0
**********Counting number of Snapshots that match customer provided snapshot
prefix**********
snapshot: snapmirror.1a2ed3ef- xxxx-xxxx-xxxx-00a098af5e36_2153538857.2018-02-07_230300 snapshot prefix:
snapmirror number: 2018-02-07_230300 prefix: Test_LOGS_Snapshot
snapshot: Test_LOGS_Snapshot.2018-02-07_1846.0 snapshot prefix: Test_LOGS_Snapshot number: 0 prefix:
Test_LOGS_Snapshot
Matched
index: 0   count: 0
**********Snapshot Count: 0**********
**********Rotating snapshot numbering to allow new snapshot**********
Rotating older snapshots named Test_LOGS_Snapshot.0 on hana_log_backups_h80_t020_vol ...
**********Clearing snapshot list**********
**********Adding list of snapshots to volume list**********
Collecting set of snapshots for each volume hosting HANA matching pattern *h80* ...
**********Displaying Snapshots by Volume**********
hana_log_backups_h80_t020_vol
snapmirror.1a2ed3ef- xxxx-xxxx-xxxx-00a098af5e36_2153538857.2018-02-07_230300
```

```
Test_LOGS_Snapshot.2018-02-07_1846.0
**********Counting number of Snapshots that match customer provided snapshot
prefix**********
snapshot: snapmirror.1a2ed3ef- xxxx-xxxx-xxxx-00a098af5e36_2153538857.2018-02-07_230300 snapshot prefix:
snapmirror number: 2018-02-07_230300 prefix: Test_LOGS_Snapshot
snapshot: Test_LOGS_Snapshot.2018-02-07_1846.0 snapshot prefix: Test_LOGS_Snapshot number: 0 prefix:
Test_LOGS_Snapshot
Matched
index: 0   count: 0
**********Snapshot Count: 0**********
**********Deleting existing *.recent snapshot**********
**********Failures are allowed if *.recent was properly cleaned up last backup**********
Checking if snapshot Test_LOGS_Snapshot.recent exists for hana_log_backups_h80_t020_vol on SVM 172.18.18.11 ...
hana_log_backups_h80_t020_vol found.
Snapshot Test_LOGS_Snapshot.recent on hana_log_backups_h80_t020_vol not found.
Recent snapshot Test_LOGS_Snapshot.recent does not exist on hana_log_backups_h80_t020_vol.
**********Creating Storage snapshot**********
Taking snapshot Test_LOGS_Snapshot.recent for hana_log_backups_h80_t020_vol ...
Snapshot created successfully.
**********Deleting oldest snapshot list**********
**********Failure removing oldest snapshot acceptable**********
Checking if snapshot Test_LOGS_Snapshot.10 exists for hana_log_backups_h80_t020_vol on SVM 172.18.18.11 ...
hana_log_backups_h80_t020_vol found.
Snapshot Test_LOGS_Snapshot.10 on hana_log_backups_h80_t020_vol not found.
Checking status of volume hana_log_backups_h80_t020_vol and snapshot 0
Result: 0   Locked: 0
Oldest snapshot Test_LOGS_Snapshot.10 does not exist on hana_log_backups_h80_t020_vol.
**********Rotating snapshot numbering to allow new snapshot**********
j: 3  k: 2
Rotating snapshots named Test_LOGS_Snapshot.# on hana_log_backups_h80_t020_vol ...
Checking if snapshot Test_LOGS_Snapshot.2 exists for hana_log_backups_h80_t020_vol on SVM 172.18.18.11 ...
hana_log_backups_h80_t020_vol found.
Snapshot Test_LOGS_Snapshot.2 on hana_log_backups_h80_t020_vol not found.
Checking if snapshot Test_LOGS_Snapshot.1 exists for hana_log_backups_h80_t020_vol on SVM 172.18.18.11 ...
hana_log_backups_h80_t020_vol found.
Snapshot Test_LOGS_Snapshot.1 on hana_log_backups_h80_t020_vol not found.
Checking if snapshot Test_LOGS_Snapshot.0 exists for hana_log_backups_h80_t020_vol on SVM 172.18.18.11 ...
hana_log_backups_h80_t020_vol found.
Snapshot Test_LOGS_Snapshot.0 on hana_log_backups_h80_t020_vol found.
Renaming Snapshot Test_LOGS_Snapshot.0 to Test_LOGS_Snapshot.1
**********Clearing snapshot list**********
**********Adding list of snapshots to volume list**********
Collecting set of snapshots for each volume hosting HANA matching pattern *h80* ...
**********Displaying Snapshots by Volume**********
hana_log_backups_h80_t020_vol
snapmirror.1a2ed3ef- xxxx-xxxx-xxxx-00a098af5e36_2153538857.2018-02-07_230300
Test_LOGS_Snapshot.2018-02-07_1846.1
Test_LOGS_Snapshot.2018-02-07_1853.recent
**********Deleting oldest snapshot list**********
**********Failure removing oldest snapshot unacceptable unless clones exist**********
Checking if snapshot Test_LOGS_Snapshot.10 exists for hana_log_backups_h80_t020_vol on SVM 172.18.18.11 ...
hana_log_backups_h80_t020_vol found.
Snapshot Test_LOGS_Snapshot.10 on hana_log_backups_h80_t020_vol not found.
```

```
Checking status of volume hana_log_backups_h80_t020_vol and snapshot 0
Result: 0   Locked: 0
Oldest snapshot Test_LOGS_Snapshot.10 does not exist on hana_log_backups_h80_t020_vol.
**********Clearing snapshot list**********
**********Adding list of snapshots to volume list**********
Collecting set of snapshots for each volume hosting HANA matching pattern *h80* ...
**********Displaying Snapshots by Volume**********
hana_log_backups_h80_t020_vol
snapmirror.1a2ed3ef- xxxx-xxxx-xxxx-00a098af5e36_2153538857.2018-02-07_230300
Test_LOGS_Snapshot.2018-02-07_1846.1
Test_LOGS_Snapshot.2018-02-07_1853.recent
**********Rotating locked snapshots down to minimize number**********
Checking if snapshot Test_LOGS_Snapshot.10 exists for hana_log_backups_h80_t020_vol on SVM 172.18.18.11 ...
hana_log_backups_h80_t020_vol found.
Snapshot Test_LOGS_Snapshot.10 on hana_log_backups_h80_t020_vol not found.
Check Snapshot result for 10: 0
Snapshot Test_LOGS_Snapshot.10 was not previously locked
Rotating snapshots named Test_LOGS_Snapshot.# on hana_log_backups_h80_t020_vol ...
J: 11 K: 10 NumSnapshotCount: 0
**********Clearing snapshot list**********
**********Adding list of snapshots to volume list**********
Collecting set of snapshots for each volume hosting HANA matching pattern *h80* ...
**********Displaying Snapshots by Volume**********
hana_log_backups_h80_t020_vol
snapmirror.1a2ed3ef- xxxx-xxxx-xxxx-00a098af5e36_2153538857.2018-02-07_230300
Test_LOGS_Snapshot.2018-02-07_1846.1
Test_LOGS_Snapshot.2018-02-07_1853.recent
**********Renaming *.recent snapshot to *.0**********
Renaming snapshot Test_LOGS_Snapshot.recent to Test_LOGS_Snapshot.0 for hana_log_backups_h80_t020_vol on SVM
172.18.18.11 ...
Checking if snapshot Test_LOGS_Snapshot.recent exists for hana_log_backups_h80_t020_vol on SVM 172.18.18.11 ...
hana_log_backups_h80_t020_vol found.
Snapshot Test_LOGS_Snapshot.recent on hana_log_backups_h80_t020_vol found.
Snapshot rename completed successfully.
**********Clearing snapshot list**********
**********Adding list of snapshots to volume list**********
Collecting set of snapshots for each volume hosting HANA matching pattern *h80* ...
**********Displaying Snapshots by Volume**********
hana_log_backups_h80_t020_vol
snapmirror.1a2ed3ef- xxxx-xxxx-xxxx-00a098af5e36_2153538857.2018-02-07_230300
Test_LOGS_Snapshot.2018-02-07_1846.1
Test_LOGS_Snapshot.2018-02-07_1853.0
**********Clearing snapshot list**********
….
Command completed successfully.
Exiting with return code: 0
Command completed successfully.
```

With "boot" parameter

Here is the command for OS snapshot.

```
# ./azure_hana_backup.pl boot <HANA Large Instance Type> <snapshot_prefix>
<snapshot_frequency> <number of snapshots retained>
# ./azure_hana_backup.pl boot TYPEI Test_BOOT_Snapshot 15min 10
```

- HANA Large Instance Type: There are two valid values with "TYPEI" or "TYPEII" dependent on the HANA Large Instance Unit.
- TYPEI= SKUs S72, S72m, S144, S144m, S192, and S192m
- TYPEII = SKUs S384, S384m, S384xm, S576, S768, and S960

Output of the script with "boot" parameter

```
**********Adding list of snapshots to volume list**********
Collecting set of snapshots for each volume hosting HANA matching pattern *boot* ...
**********Displaying Snapshots by Volume**********
t020_sles_boot_vol
1.2017-11-28_1030.0
bens_boot.2017-12-18_1041.0
snapmirror.1a2ed3ef-xxxx-xxxx-xxxx-00a098af5e36_2153538783.2018-02-08_170000
**********Rotating snapshot numbering to allow new snapshot**********
Rotating older snapshots named Test_BOOT_Snapshot.0 on t020_sles_boot_vol ...
**********Clearing snapshot list**********
**********Adding list of snapshots to volume list**********
Collecting set of snapshots for each volume hosting HANA matching pattern *boot* ...
**********Displaying Snapshots by Volume**********
t020_sles_boot_vol
1.2017-11-28_1030.0
snapmirror.1a2ed3ef-xxxx-xxxx-xxxx-00a098af5e36_2153538783.2018-02-08_170000
**********Deleting existing *.recent snapshot**********
**********Failures are allowed if *.recent was properly cleaned up last backup**********
Checking if snapshot Test_BOOT_Snapshot.recent exists for t020_sles_boot_vol on SVM 172.18.18.11 ...
t020_sles_boot_vol found.
Snapshot Test_BOOT_Snapshot.recent on t020_sles_boot_vol not found.
Recent snapshot Test_BOOT_Snapshot.recent does not exist on t020_sles_boot_vol.
**********Creating Storage snapshot**********
Taking snapshot Test_BOOT_Snapshot.recent for t020_sles_boot_vol ...
Snapshot created successfully.
...
**********Displaying Snapshots by Volume**********
t020_sles_boot_vol
1.2017-11-28_1030.0
snapmirror.1a2ed3ef-xxxx-xxxx-xxxx-00a098af5e36_2153538783.2018-02-08_170000
Test_BOOT_Snapshot.2018-02-08_1240.0
```

```
Command completed successfully.
Exiting with return code: 0
Command completed successfully.
```

Note	When you execute the script for the first time, it may show some unexpected errors on the Multi SID environment. Just rerun the script again and it should already fix the issue.

azure_hana_snapshot_delete.pl

This script deletes the existing snapshots. You need to provide either the snapshot *backupid* (from HANA studio) or the snapshot name and volume name.

This script does require an input that specifies the SID of the HANA instance you want to delete the snapshot from.

```
# ./azure_hana_snapshot_delete.pl h81
```

Output using the option backupid

```
----------Executing Main Code----------
This script is intended to delete either a single snapshot or all snapshots that pertain to a particular HANA storage snapshot by its HANA Backup ID
found in HANA Studio.  A snapshot cannot be deleted if it is less than an hour old as deletion can interfere with replication.
Please enter whether you wish to delete by backupid
or snapshot, and, if by snapshot, enter the volume name and snapshot name where the snapshot is found.  The azure_hana_snapshot_details script may be used to identify individual
snapshot names and volume locations.

Do you want to delete by snapshot name or by HANA backup id?
Please enter (backupid/snapshot/quit): backupid
Command Entered: backupid
Please enter either the backup id of the HANA Storage Snapshot you wish to delete:
1517000002830
You have requested to delete all snapshots associated with HANA Backup ID 1517000002830. Any data that exists solely on these snapshots are lost forever. Do you wish to proceed (yes/no)?
Please enter (yes/no):  yes
…
**********Adding snapshot details to snapshot list**********
Collecting backupids for each snapshot.
**********Seeking backup id in found Storage Snapshots**********
Adding Snapshot Test_HANA_Snapshot.2018-02-06_1829.1 from volume hana_data_h81_mnt00001_t020_vol
Checking time stamp for snapshot Test_HANA_Snapshot.2018-02-06_1829.1 of volume hana_data_h81_mnt00001_t020_vol
Time threshold passed.  Okay to proceed in snapshot deletion
Snapshot Test_HANA_Snapshot.2018-02-06_1829.1 of volume hana_data_h81_mnt00001_t020_vol was successfully deleted
Command completed successfully.
```

```
Exiting with return code: 0
Command completed successfully.
```

Output using the option snapshot name

```
----------Executing Main Code----------
This script is intended to delete either a single snapshot or all snapshots that pertain to a particular HANA storage snapshot by its HANA Backup ID
found in HANA Studio.  A snapshot cannot be deleted if it is less than an hour old as deletion can interfere with replication.
Please enter whether you wish to delete by backupid
or snapshot, and, if by snapshot, enter the volume name and snapshot name where the snapshot is found.  The azure_hana_snapshot_details script may be used to identify individual
snapshot names and volume locations.

Do you want to delete by snapshot name or by HANA backup id?
Please enter (backupid/snapshot/quit): snapshot
Command Entered: snapshot
Please enter either the volume location of the snapshot you wish to delete:
hana_shared_h81_t020_vol
Please enter either the snapshot you wish to delete:
Test3_HANA_Snapshot.2018-02-07_1509.0
You have requested to delete snapshot Test3_HANA_Snapshot.2018-02-07_1509.0 from volume hana_shared_h81_t020_vol. Any data that exists only on this snapshot is lost forever. Do you wish to proceed (yes/no)?
Please enter (yes/no):  yes
.....
**********Deleting Snapshot Test3_HANA_Snapshot.2018-02-07_1509.0 from Volume hana_shared_h81_t020_vol**********
Time threshold passed.  Okay to proceed in snapshot deletion
Snapshot Test3_HANA_Snapshot.2018-02-07_1509.0 of volume hana_shared_h81_t020_vol was successfully deleted
Command completed successfully.
Exiting with return code: 0
Command completed successfully.
```

azure_hana_replication_status.pl

This script checks the storage replication status from the primary site to DR location. This script must be executed on the DR site server. This script does not require any input to be provided, rather it reads the HANABackupCustomerDetails.txt file.

```
# ./azure_hana_replication_status.pl
```

Output of the script

```
Checking Relationship Status for h80
**********Getting list of replication relationships that match HANA instance provided**********
```

```
Collecting set of relationships hosting HANA matching pattern *h80* ...
Relationship show completed successfully.
volume expected:hana_data_h80_mnt00001_t020_dp
volume expected:hana_log_backups_h80_t020_dp
volume expected:hana_shared_h80_t020_dp
**********Displaying Relationships by Volume**********
hana_data_h80_mnt00001_t020_dp
------------------------------------------------
Link Status: Active
Current Replication Activity: Idle
Latest Snapshot Replicated: 218.7MB
Size of Latest Snapshot Replicated: 0:24:18
  ***Less than 30 minutes is recommended***
************************************************
hana_log_backups_h80_t020_dp
------------------------------------------------
Link Status: Active
Current Replication Activity: Idle
Latest Snapshot Replicated: 196KB
Size of Latest Snapshot Replicated: 0:31:18
  ***Less than 10 minutes is recommended***
************************************************
hana_shared_h80_t020_dp
------------------------------------------------
Link Status: Active
Current Replication Activity: Idle
Latest Snapshot Replicated: 77.82MB
Size of Latest Snapshot Replicated: 0:24:18
  ***Less than 30 minutes is recommended***
...
Command completed successfully.
Exiting with return code: 0
Command completed successfully.
```

azure_hana_dr_failover.pl

This script stops storage replication from the primary site to the secondary site, restores the latest snapshot on the DR volumes, and provides the mountpoints for the DR volumes. This script MUST be executed on the DR server ONLY!

You perform a failover to DR site, by executing a script azure_hana_dr_failover.pl. This script requires a SID to be added as a parameter. This is the SID of the HANA instance, which needs to be recovered at the DR site.

Caution	Perform it only when you are planning to perform the DR exercise or a test. Script breaks the replication. You must reach out to the Microsoft Operations to set up the replication back. Also, once the replication is re-setup, all the data at DR storage for this SID get initialized.

At the high level, here are the steps got the failover:

- You must shut down the HANA instance at **primary** site. This is only needed if you are truly doing the failover to DR site so you don't have data inconsistencies.
- Shutdown the HANA instance on the DR node for the production SID.
- Execute the script azure_hana_dr_failover.pl on the DR node with the SID to be recovered
    - The script breaks the storage replication link from the Primary to the DR site
    - The script restores the /data and /logbackups volume only, /shared volume is NOT recovered, but rather it uses the existing /shared for SID at the DR location.
    - Mount the /data and /logbackups volume – ensure to add it to the fstab file
- Restore the HANA SYSTEMDB snapshot. Please note, HANA studio only shows you the latest HANA snapshot available under the storage snapshot restored as part of the script azure_hana_dr_failover.pl execution.
- Recover the tenant database
- Start the HANA instance on the DR site for the Production SID (Example: H80 in this case)
- Perform the testing

Here are the detailed steps for the failover.

Step1: Get the volume details of the DR node by executing the command "df –h". This is so you can reference it back, if needed, after the failover

```
sapdrhdb80:/hana/shared/Q85/hdbclient # df -h
Filesystem                                                  Size  Used Avail Use% Mounted on
devtmpfs                                                    1008G  4.0K 1008G   1% /dev
tmpfs                                                       1.5T     0  1.5T   0% /dev/shm
tmpfs                                                       1008G   19M 1008G   1% /run
tmpfs                                                       1008G     0 1008G   0% /sys/fs/cgroup
/dev/mapper/3600a09803830426c422b4b3765502f57-part2          47G   19G   29G  40% /
/dev/mapper/3600a09803830426c422b4b3765502f57-part1         979M   57M  856M   7% /boot
                    :/hana_log_h80_mnt00001_t020_vol        304G  5.2G  299G   2% /hana/log/H80/mnt00001
                   39:/hana_log_backups_q85_t020_vol        640G  3.0M  640G   1% /hana/logbackups/Q85
                    0:/hana_log_q85_mnt00001_t020_vol       640G  5.2G  635G   1% /hana/log/Q85/mnt00001
                    :/hana_shared_h80_t020_vol/shared       608G   12G  597G   2% /hana/shared/H80
                    1:/hana_shared_h80_t020_vol/usr_sap_node1 608G  12G  597G   2% /usr/sap/H80
                    9:/hana_shared_q85_t020_vol/shared      1.3T   12G  1.3T   1% /hana/shared/Q85
                    :/hana_data_h80_mnt00001_t020_vol        19G  7.6G   12G  40% /hana/data/H80/mnt00001
                   :/hana_data_q85_mnt00001_t020_vol        1.5T  7.6G  1.5T   1% /hana/data/Q85/mnt00001
                   :/hana_shared_q85_t020_vol/usr_sap_node1 1.3T   12G  1.3T   1% /usr/sap/Q85
tmpfs                                                       202G     0  202G   0% /run/user/0
sapdrhdb80:/hana/shared/Q85/hdbclient #
```

Step2: Shut down the HANA instance on the primary site (The instance which is getting failed over)

Step3: Shut down the HANA instances on the DR site (The instance of the primary SID being failed over)

Step4: Execute the script

```
# ./azure_hana_dr_failover.pl
```

Output of the script

```
**********Getting list of volumes that match HANA instance specified**********
Collecting set of volumes hosting HANA matching pattern *h80* ...
Volume show completed successfully.
Adding volume hana_data_h80_mnt00001_t020_dp to the snapshot list.
Adding volume hana_log_backups_h80_t020_dp to the snapshot list.
**********Getting list of Qtrees of shared volume**********
**********Adding list of snapshots to volume list**********
Collecting set of snapshots for each volume hosting HANA matching pattern *h80* ...
**********Displaying Snapshots by Volume*****+**********
hana_data_h80_mnt00001_t020_dp
DRTEST2_Snapshot.2018-02-09_1635.0
hana_log_backups_h80_t020_dp
Test_LOGS_Snapshot.2018-02-07_1853.0
DRTEST2_logs_Snapshot.2018-02-09_1646.0
**********Verifying correct number of snapshots exist for data volumes**********
Checking if latest snapshot name exists for HANA SID h80
Volume:hana_data_h80_mnt00001_t020_dp
Searching volume: hana_data_h80_mnt00001_t020_dp for most recent snapshot
Snapshot:DRTEST2_Snapshot.2018-02-09_1635.0
Volume:hana_log_backups_h80_t020_dp
Volume:hana_log_backups_h80_t020_dp
Searching volume: hana_log_backups_h80_t020_dp for expected latest snapshot .0
Snapshot:DRTEST2_logs_Snapshot.2018-02-09_1646.0
All data volumes have correct snapshot present
Using Log Backups Volume: hana_log_backups_h80_t020_dp
Using Log Backups Snapshot: DRTEST2_logs_Snapshot.2018-02-09_1646.0
**********Getting list of replication relationships that match HANA instance
provided**********
Collecting set of relationships hosting HANA matching pattern *h80* ...
Relationship show completed successfully.
Adding volume hana_data_h80_mnt00001_t020_dp to the replication list.
Adding volume hana_log_backups_h80_t020_dp to the replication list.
**********Displaying Relationships by Volume**********
hana_data_h80_mnt00001_t020_dp
hana_log_backups_h80_t020_dp
**********Updating Relationships by Volume**********
Relationship updated for volume hana_data_h80_mnt00001_t020_dp completed successfully.
Relationship updated for volume hana_log_backups_h80_t020_dp completed successfully.
**********Quiescing Relationships by Volume**********
Relationship quiesce for volume hana_data_h80_mnt00001_t020_dp completed successfully.
Relationship quiesce for volume hana_log_backups_h80_t020_dp completed successfully.
**********Breaking Relationships by Volume**********
Volume:   hana_data_h80_mnt00001_t020_dp   State: Quiescing
```

```
Relationship broken for volume hana_data_h80_mnt00001_t020_dp completed successfully.
Volume:   hana_log_backups_h80_t020_dp   State: Quiesced
Relationship broken for volume hana_log_backups_h80_t020_dp completed successfully.
**********Restoring Snapshots by Volume**********
Snapshot restoration for volume hana_data_h80_mnt00001_t020_dp completed successfully.
**********All Data volumes restored sucessfully**********
Snapshot restoration for volume hana_log_backups_h80_t020_dp completed successfully.
**********Mounting Dr Volumes by Volume**********
Volume hana_data_h80_mnt00001_t020_dp mounted successfully.
Volume hana_log_backups_h80_t020_dp mounted successfully.
**********Collecting Mount Point Details**********
Located location of hana_data_h80_mnt00001_t020_dp
Address found of hana_data_h80_mnt00001_t020_dp
Located location of hana_log_backups_h80_t020_dp
Address found of hana_log_backups_h80_t020_dp
**********Displaying Mount Points by Volume**********
172.18.20.241:/hana_data_h80_mnt00001_t020_dp   /hana/data/H80/mnt00001   nfs
rw,bg,hard,timeo=600,vers=4,rsize=1048576,wsize=1048576,intr,noatime,lock 0 0
172.18.20.241:/hana_log_backups_h80_t020_dp   /hana/logbackups/H80   nfs
rw,bg,hard,timeo=600,vers=4,rsize=1048576,wsize=1048576,intr,noatime,lock 0 0
Exiting with return code: 0
Command completed successfully.
```

Step5: Execute the command "**umount –a**" to unmount all the existing mountpoints.

```
# umount –a
```

```
sapdrhdb80:/ # umount -a
umount: /run/user/0: target is busy
        (In some cases useful info about processes that
         use the device is found by lsof(8) or fuser(1).)
umount.nfs4: /hana/data/Q85/mnt00001: device is busy
umount.nfs4: /hana/shared/Q85: device is busy
umount.nfs4: /hana/shared/H80: device is busy
umount.nfs4: /hana/log/Q85/mnt00001: device is busy
umount: /: target is busy
        (In some cases useful info about processes that
         use the device is found by lsof(8) or fuser(1).)
umount: /sys/fs/cgroup/systemd: target is busy
        (In some cases useful info about processes that
         use the device is found by lsof(8) or fuser(1).)
umount: /sys/fs/cgroup: target is busy
        (In some cases useful info about processes that
         use the device is found by lsof(8) or fuser(1).)
umount: /run: target is busy
        (In some cases useful info about processes that
         use the device is found by lsof(8) or fuser(1).)
umount: /dev: target is busy
        (In some cases useful info about processes that
         use the device is found by lsof(8) or fuser(1).)
sapdrhdb80:/ #
```

Step6: Modify the file **"/etc/fstab**" to comment out the data and logbackups entries for the primary SID (In this example, SID=H80) and add the new mount point entries. The new mount point entries are provided in the script output.

- Comment out the following:

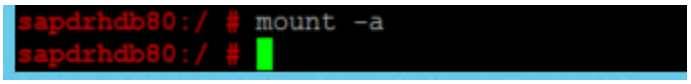
```
#172.18.20.241:/hana_data_h80_mnt00001_t020_vol      /hana/data/H80/mnt00001      nfs
rw,hard,timeo=600,vers=4,rsize=1048576,wsize=1048576,intr,noatime,lock 0 0
#172.18.20.241:/hana_log_backups_h80_t020  /hana/logbackups/H80  nfs
rw,bg,hard,timeo=600,vers=4,rsize=1048576,wsize=1048576,intr,noatime,lock 0 0
```

- Add the following lines to fstab → this is a same output from the script

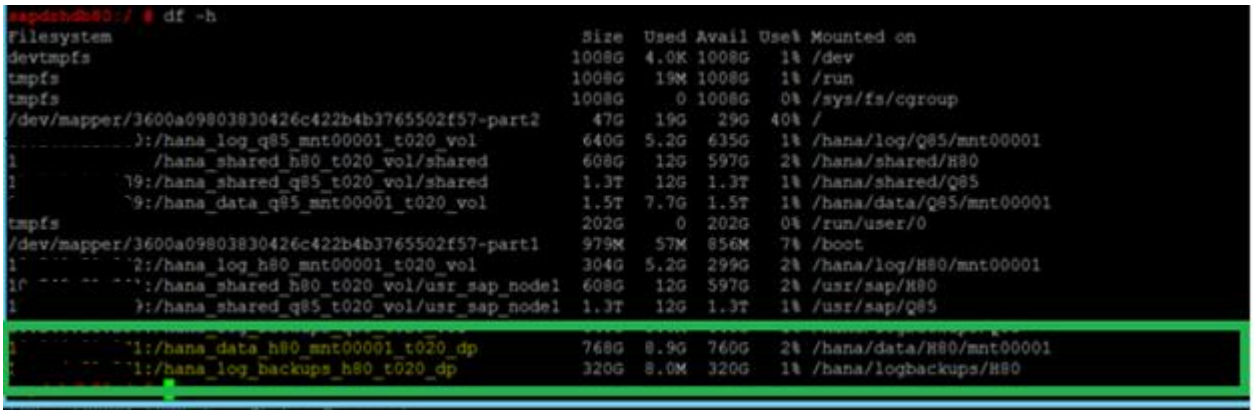
```
172.18.20.241:/hana_data_h80_mnt00001_t020_dp  /hana/data/H80/mnt00001  nfs
rw,bg,hard,timeo=600,vers=4,rsize=1048576,wsize=1048576,intr,noatime,lock 0 0
172.18.20.241:/hana_log_backups_h80_t020_dp  /hana/logbackups/H80  nfs
rw,bg,hard,timeo=600,vers=4,rsize=1048576,wsize=1048576,intr,noatime,lock 0 0
```

Step7: Execute the command "**mount –a** "to mount all the mount points

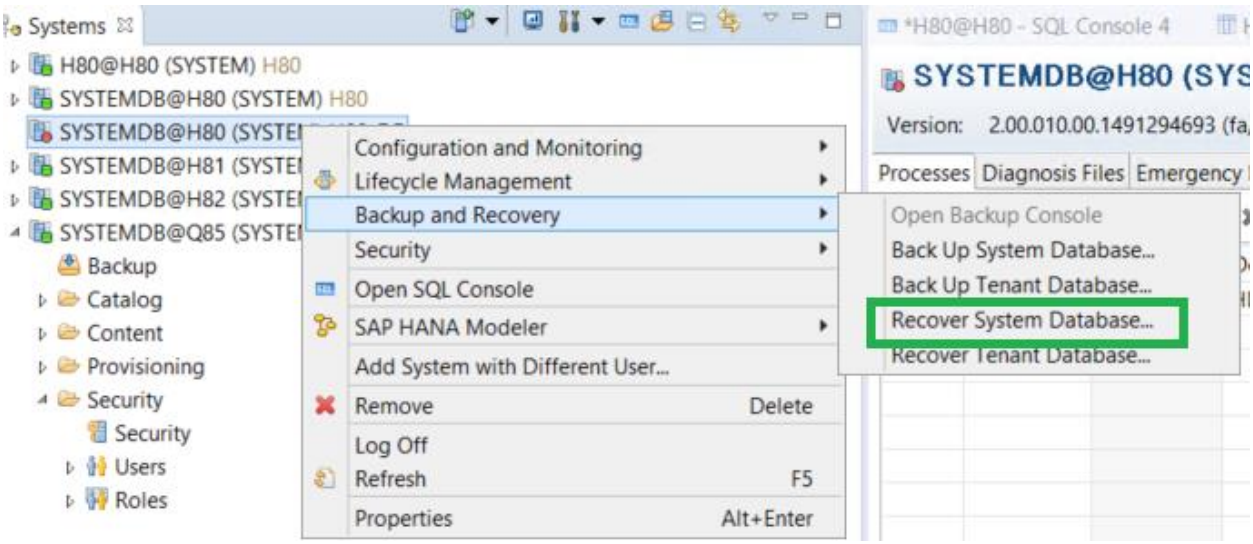
```
# mount -a
```



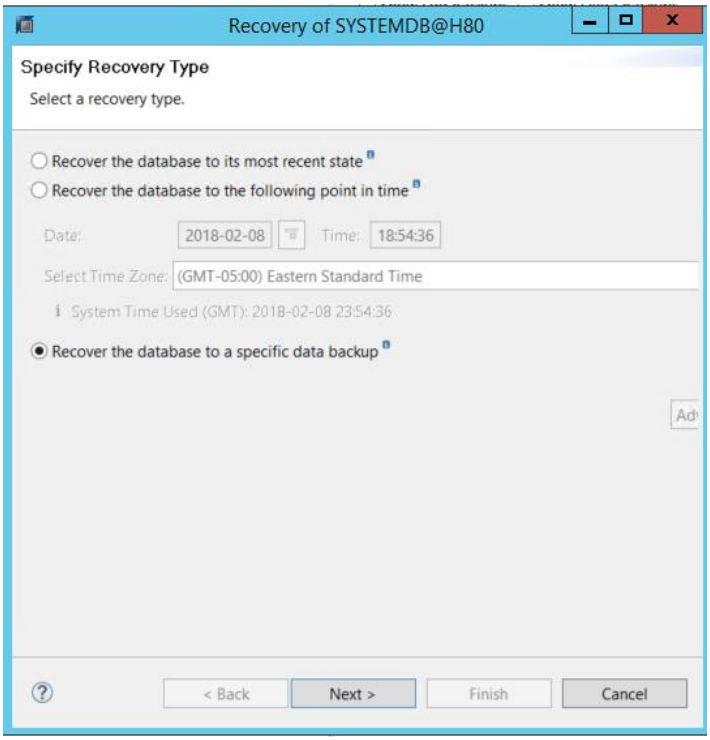
Now, If you execute "df –h" you should see the *_dp volumes mounted.



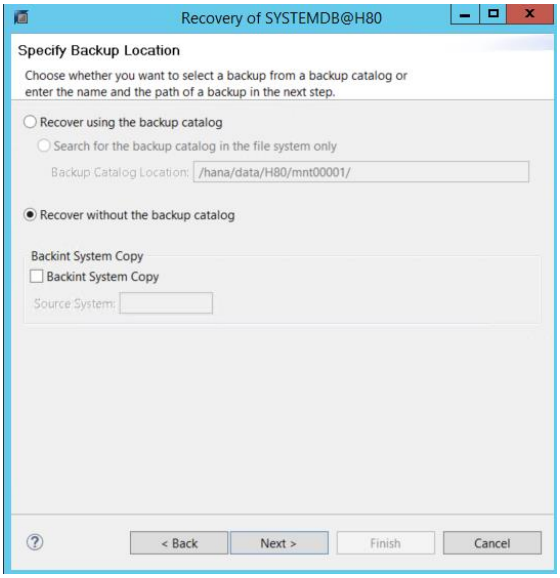
Step8: Recover the SYSTEMDB. From the HANA Studio, right click SYSTEMDB instance and chose "Backup and Recovery", and then "Recover System Database"



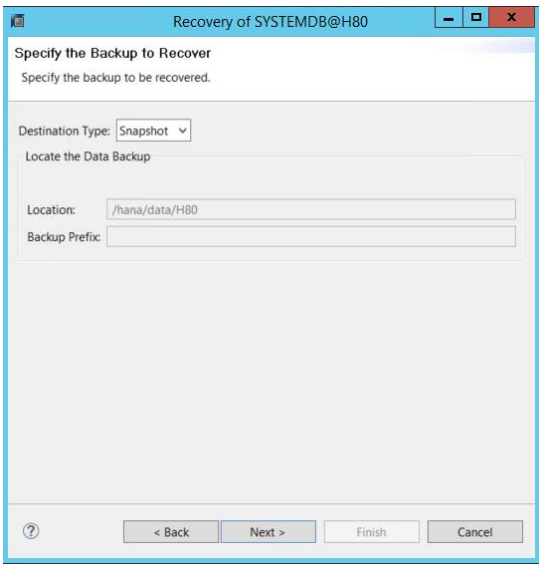
You can chose an option based on your recovery requirements. In this example, “Recover the database to a specific data backup”.



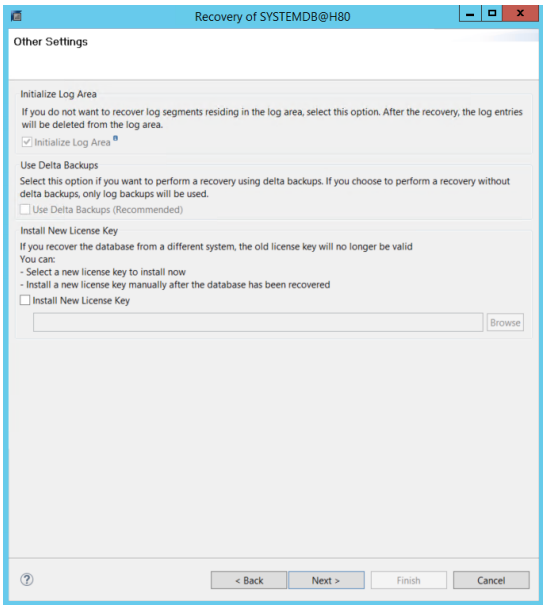
Specify the backup location. In this example, we chose “Recover without the backup catalog”.



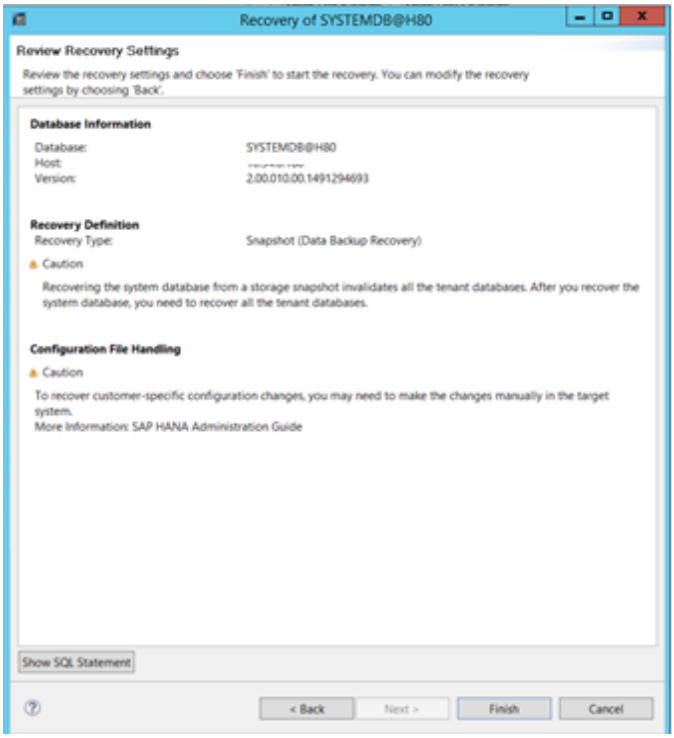
Select the destination type “Snapshot”.



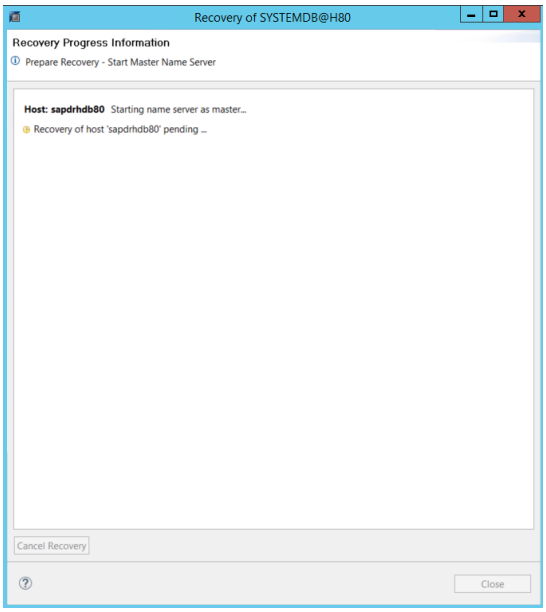
Select the “Initialize Log Area”.

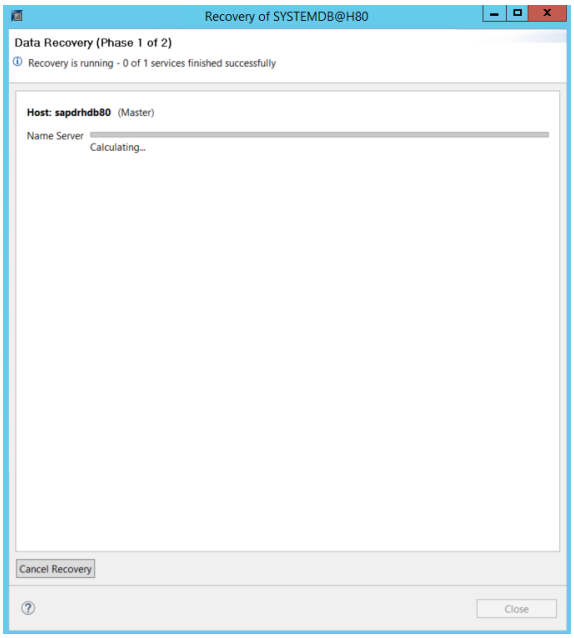


Review the details.

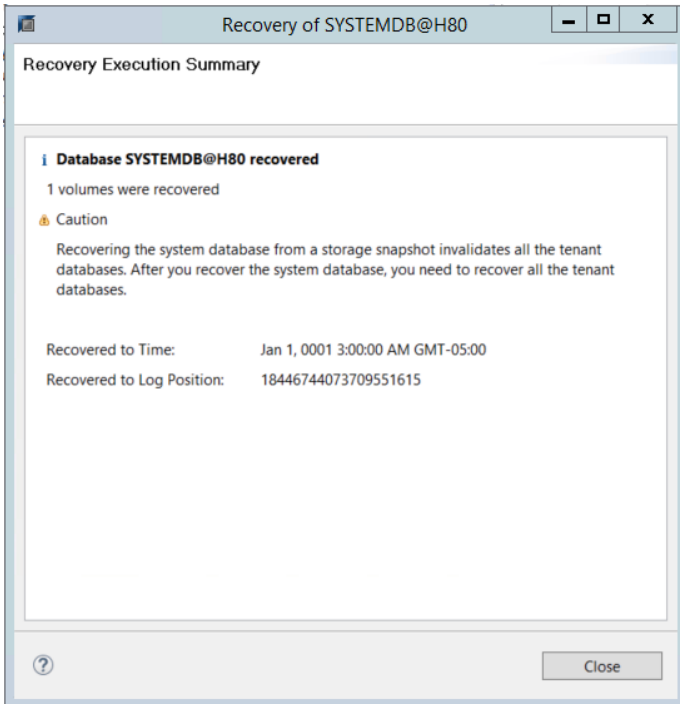


Recovery initiates.

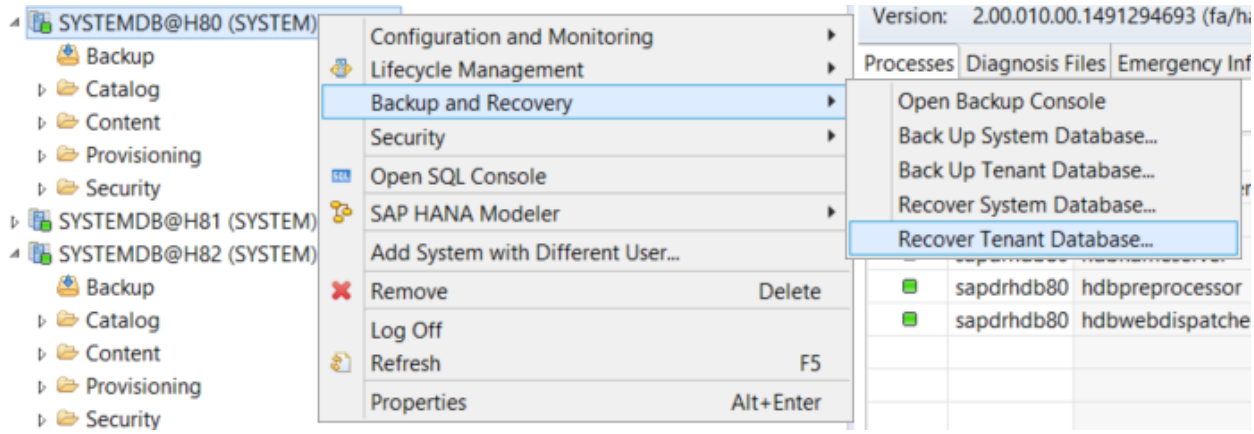




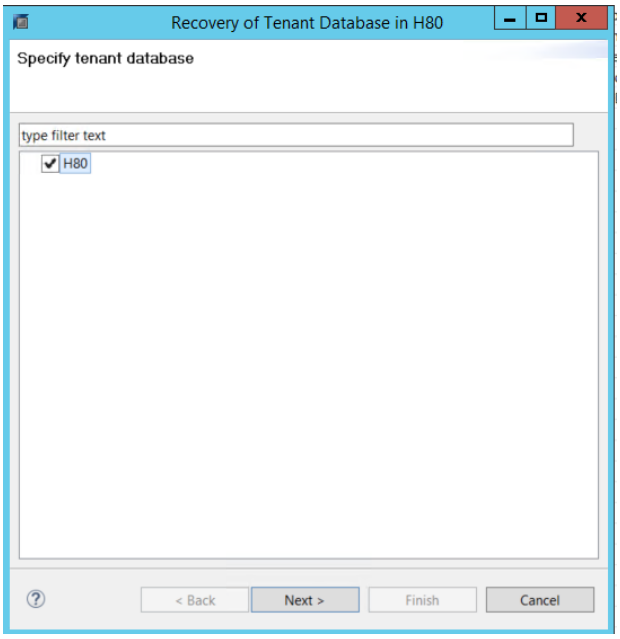
Recovery completed.



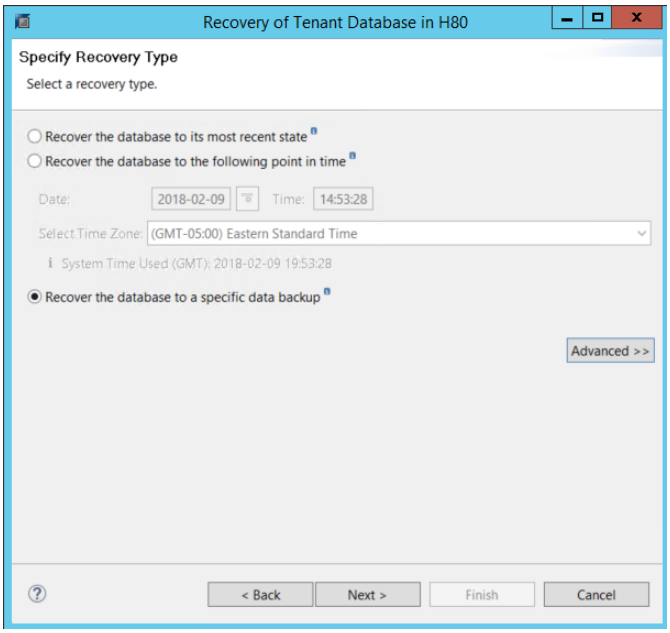
Step9: Recover the tenant database. From the HANA Studio, right click SYSTEMDB instance and chose "Backup and Recovery", and then "Recover Tenant Database".



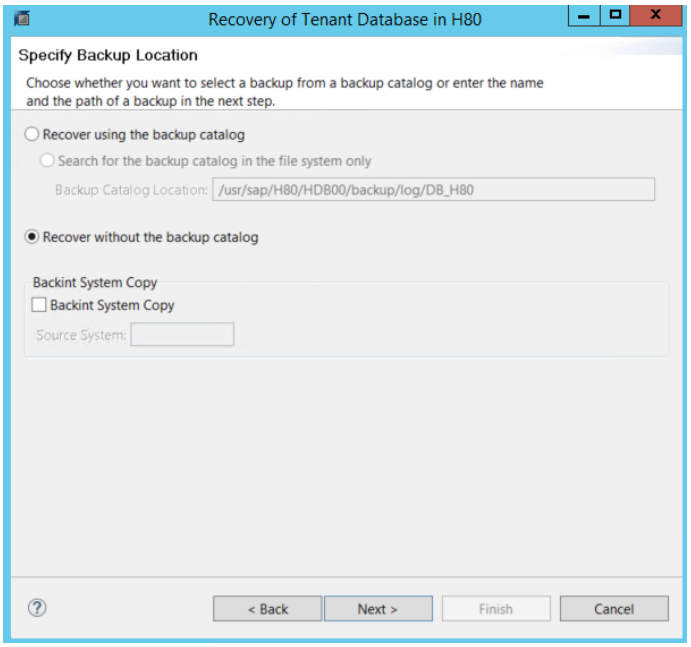
Select the tenant database.



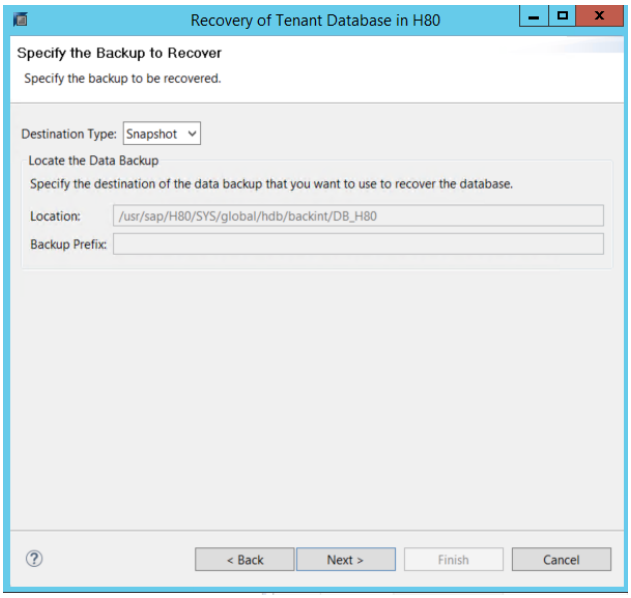
Select the recovery type. In this example, the option “Recover the database to a specific data backup” is selected.



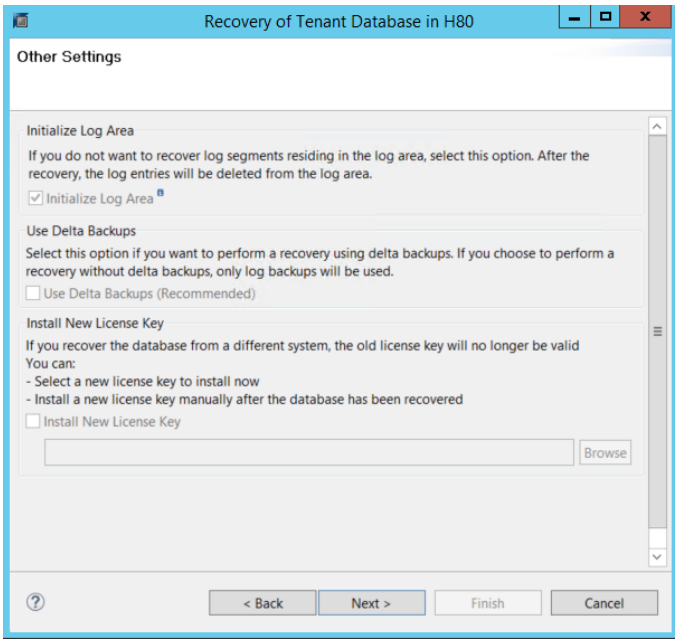
Select the backup location. In this example, the option “Recover without the backup catalog” is selected.



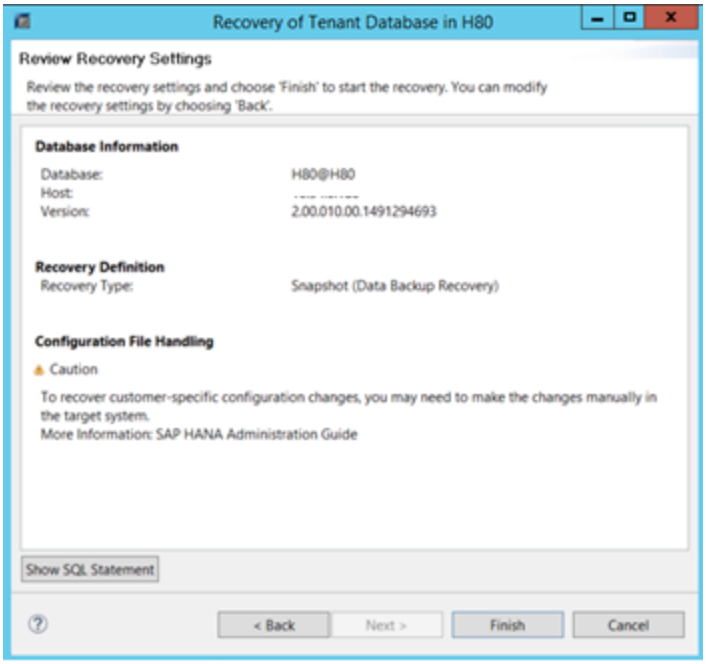
Select the destination type “Snapshot”.

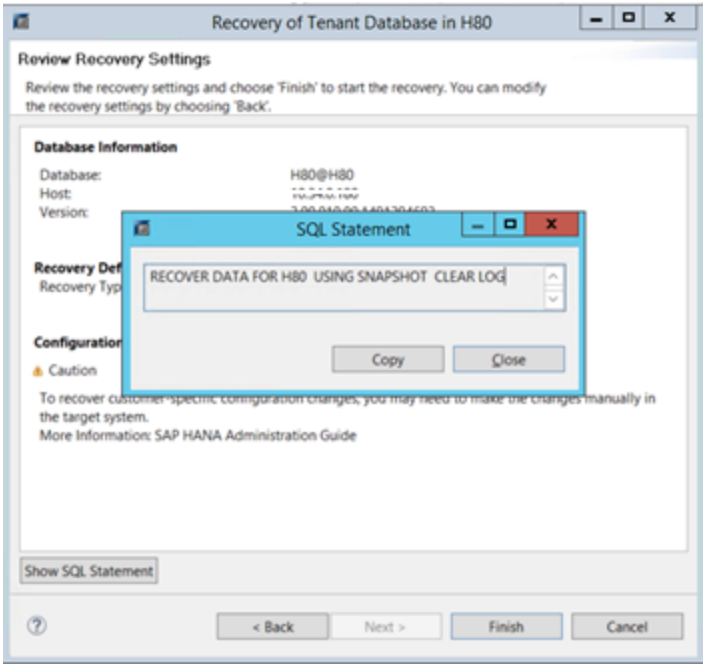


Ensure to select the “Initialize Log Area”. By default, this is selected and grated out.

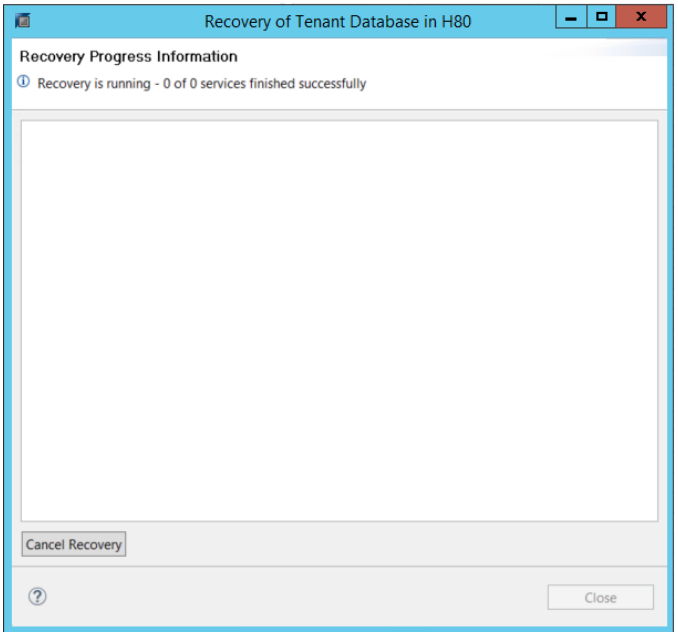


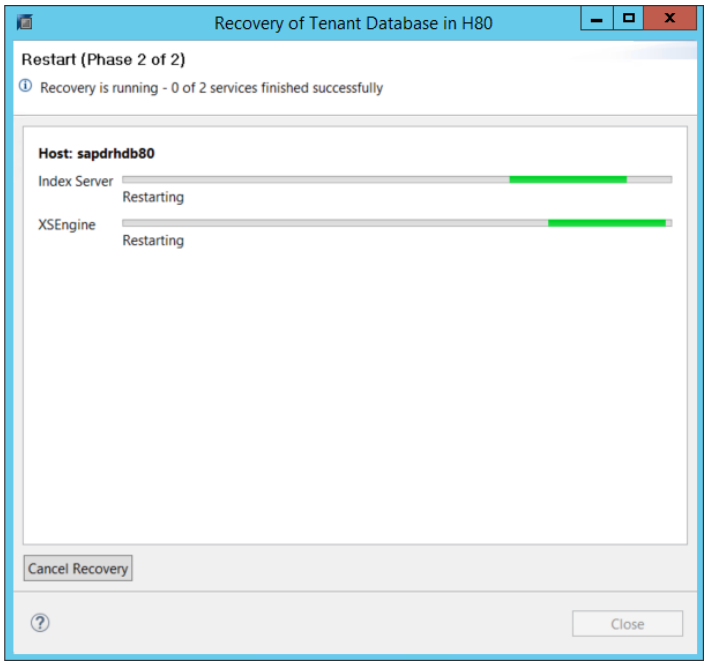
Review the settings.

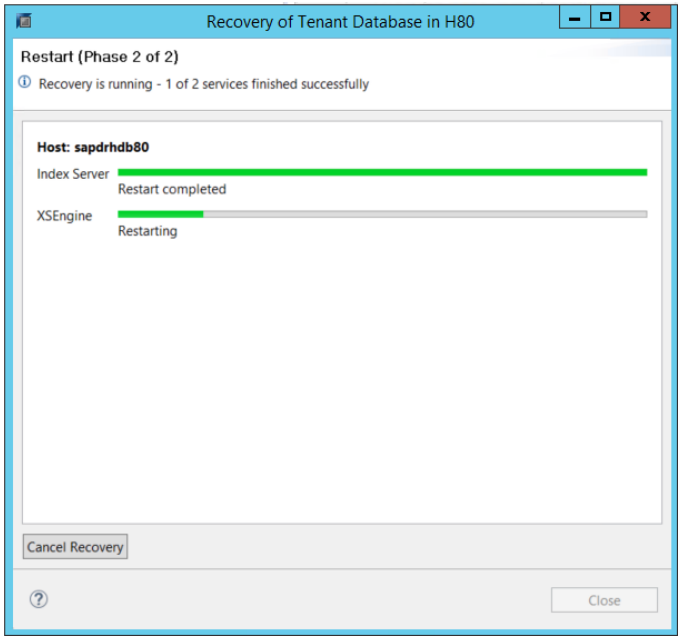




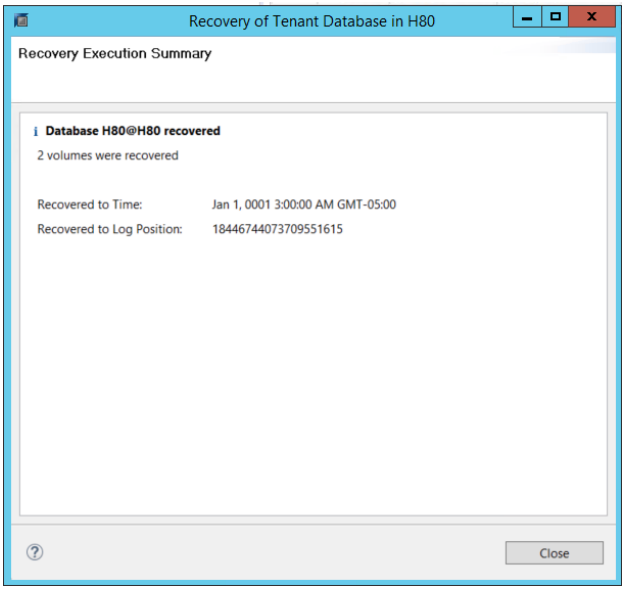
Recovery in progress.







Recovery of the tenant database complete.



azure_hana_test_dr_failover.pl

This script is similar to the DR Failover script, but rather than breaking the replication between the production site and the disaster recovery, a clone volume is created out of the disaster recovery volumes simulating the restoration of the most recent snapshot. Those cloned volumes are then usable by the customer to test Disaster Recovery without having to execute a complete failover of their HANA environment and without interruption of the storage replication. The test script is executed by SID as a parameter as well.

The only change in output is that each execution creates a new clone that must be cleaned up by Microsoft Operations when the test is concluded. Multiple different restore points can be tested in this way, each with their own restoration point. The clone is designated by the time-stamp at when the script was executed and represents the most recent data and logbackups snapshot available when run.

```
# ./azure_hana_test_dr_failover.pl
```

Output of the script

```
**********Verifying correct number of snapshots exist for data volumes**********
Checking if latest snapshot name exists for HANA SID h80
Volume:hana_data_h80_mnt00001_t020_dp
Searching volume: hana_data_h80_mnt00001_t020_dp for most recent snapshot
Snapshot:ME.2018-02-13_2046.0
Volume:hana_log_backups_h80_t020_dp
Volume:hana_log_backups_h80_t020_dp
Searching volume: hana_log_backups_h80_t020_dp for expected latest snapshot .0
```

```
Snapshot:ME.2018-02-13_2050.0
All data volumes have correct snapshot present
Using Log Backups Volume: hana_log_backups_h80_t020_dp
Using Log Backups Snapshot: ME.2018-02-13_2050.0
**********Getting list of replication relationships that match HANA instance
provided**********
Collecting set of relationships hosting HANA matching pattern *h80* ...
Relationship show completed successfully.
Adding volume hana_data_h80_mnt00001_t020_dp to the replication list.
Adding volume hana_log_backups_h80_t020_dp to the replication list.
**********Displaying Relationships by Volume**********
hana_data_h80_mnt00001_t020_dp
hana_log_backups_h80_t020_dp
**********Updating Relationships by Volume**********
Relationship updated for volume hana_data_h80_mnt00001_t020_dp completed successfully.
Relationship updated for volume hana_log_backups_h80_t020_dp completed successfully.
**********Quiescing Relationships by Volume**********
Relationship quiesce for volume hana_data_h80_mnt00001_t020_dp completed successfully.
Relationship quiesce for volume hana_log_backups_h80_t020_dp completed successfully.
**********Breaking Relationships by Volume**********
Volume:   hana_data_h80_mnt00001_t020_dp   State: Quiescing
Relationship broken for volume hana_data_h80_mnt00001_t020_dp completed successfully.
Volume:   hana_log_backups_h80_t020_dp   State: Quiesced
Relationship broken for volume hana_log_backups_h80_t020_dp completed successfully.
**********Restoring Snapshots by Volume**********
Snapshot restoration for volume hana_data_h80_mnt00001_t020_dp completed successfully.
**********All Data volumes restored sucessfully**********
Snapshot restoration for volume hana_log_backups_h80_t020_dp completed successfully.
**********Mounting Dr Volumes by Volume**********
Volume hana_data_h80_mnt00001_t020_dp mounted successfully.
Volume hana_log_backups_h80_t020_dp mounted successfully.
**********Collecting Mount Point Details**********
Located location of hana_data_h80_mnt00001_t020_dp
Address found of hana_data_h80_mnt00001_t020_dp
Located location of hana_log_backups_h80_t020_dp
Address found of hana_log_backups_h80_t020_dp
Located location of hana_log_h80_mnt00001_t020_vol
Address found of hana_log_h80_mnt00001_t020_vol
Located location of hana_shared_h80_t020_vol
Address found of hana_shared_h80_t020_vol
**********Displaying Mount Points by Volume**********
172.18.20.241:/hana_data_h80_mnt00001_t020_dp   /hana/data/H80/mnt00001   nfs
rw,bg,hard,timeo=600,vers=4,rsize=1048576,wsize=1048576,intr,noatime,lock 0 0
172.18.20.241:/hana_log_backups_h80_t020_dp   /hana/logbackups/H80   nfs
rw,bg,hard,timeo=600,vers=4,rsize=1048576,wsize=1048576,intr,noatime,lock 0 0
172.18.20.242:/hana_log_h80_mnt00001_t020_vol   /hana/log/H80/mnt00001   nfs
rw,bg,hard,timeo=600,vers=4,rsize=1048576,wsize=1048576,intr,noatime,lock 0 0
172.18.20.241:/hana_shared_h80_t020_vol/shared   /hana/shared/H80   nfs
rw,bg,hard,timeo=600,vers=4,rsize=1048576,wsize=1048576,intr,noatime,lock 0 0
172.18.20.241:/hana_shared_h80_t020_vol/usr_sap_node1   /usr/sap/H80   nfs
rw,bg,hard,timeo=600,vers=4,rsize=1048576,wsize=1048576,intr,noatime,lock 0 0
Exiting with return code: 0
Command completed successfully.
```

Troubleshooting

The following are the common issues that you may encounter while running the scripts. Please follow the resolution instructions mentioned to fix the issue. If you still encounter an issue, please open a Service Request from Azure portal and assign the request into the HANA large Instance queue, and Microsoft Operations team provides the necessary solution.

hdbuserstore location

You are looking to get the hdbuserstore location. It is found under /hana/shared/<SID>/hdbclient

Expected SID Storage Backup Name

You run a script *testHANAConnection.pl* and receive the following error:

```
sapprdhdb80:/hana/shared/H80/exe/linuxx86_64/hdb # ./testHANAConnection.pl
WARNING: Expected SID3 Storage Backup Name:
WARNING: Verify line 34 is correct. Exiting.
```

Solution: Please check if you have the proper SID information updated for each HANA instance you want a snapshot test conducted.

Also try to run the command below, and it confirms that it has access to HANA instance or not

```
./hdbsql -n 172.18.18.50 -i 00 -d SYSTEMDB -U SCADMIN80 "\s"
```

Storage check status command 'volume show -type RW -fields volume' failed: 65280

The script *testStorageSnapshotConnection.pl* fails with the following error

```
**********Checking access to Storage**********
WARNING: Storage check status command 'volume show -type RW -fields volume' failed: 65280
WARNING: Please check the following:
WARNING: Was publickey sent to Microsoft Service Team?
WARNING: If passphrase entered while using ssh-keygen, publickey must be re-created and passphrase must be left blank for both entries
WARNING: Ensure correct IP address was entered in HANABackupCustomerDetails.txt
WARNING: Ensure correct Storage backup name was entered in HANABackupCustomerDetails.txt
WARNING: Ensure that no modification in format HANABackupCustomerDetails.txt like additional lines, line numbers or spacing
WARNING: **********Exiting Script**********
sapprdhdb80:/hana/shared/H80/exe/linuxx86_64/hdb #
```

Solution: Please ensure that your storage IP address is correct. If still encounter an issue, please double confirm with Microsoft operations team for the storage IP address.

The authenticity of host '172.18.18.11 (172.18.18.11)' can't be established

You encounter the following message while running the testStorageSnapshotConnection.pl

```
Checking Snapshot Status for h80
**********Checking access to Storage**********
The authenticity of host '172.18.18.11 (172.18.18.11)' can't be established.
ECDSA key fingerprint is SHA256:QxamHRn3ZKbJAKnEimQpVVCknDSO9uB4c9Qd8komDec.
Are you sure you want to continue connecting (yes/no)?
```

Solution: The above error normally shows up when storage user has no access to the underlying storage. To check if you have access to storage using the storage user, please run the following command

```
# ssh <storageusername>@<storageIP>  ← actual command
# ssh clt1h80backup@172.18.18.11  ← example
```

Expected output is as following:

```
sapprdhdb80:/hana/shared/H80/exe/linuxx86_64/hdb # ssh clt1h80backup@1----------
dcl1-hana-c03v020-client1-prod::>
dcl1-hana-c03v020-client1-prod::> volume show -type RW -fields volume
vserver                     volume
--------------------------- ------------------------------
dcl1-hana                   hana_data_h12_mnt00001_t020_vol
dcl1-hana                   hana_data_h12_mnt00002_t020_vol
dcl1-hana                   hana_data_h14_mnt00001_t020_vol
dcl1-hana                   hana_data_h15_mnt00001_t020_vol
dcl1-hana                   hana_data_h16_mnt00001_t020_vol
dcl1-hana                   hana_data_h80_mnt00001_t020_vol
dcl1-hana                   hana_data_h81_mnt00001_t020_vol
dcl1-hana                   hana_data_h82_mnt00001_t020_vol
dcl1-hana                   hana_log_backups_h12_mnt00001_t020_vol
dcl1-hana                   hana_log_backups_h12_mnt00002_t020_vol
dcl1-hana                   hana_log_backups_h15_t020_vol
dcl1-hana                   hana_log_backups_h16_t020_vol
dcl1-hana                   hana_log_backups_h80_t020_vol
dcl1-hana                   hana_log_backups_h81_t020_vol
dcl1-hana                   hana_log_backups_h82_t020_vol
dcl1-hana                   hana_log_h12_mnt00001_t020_vol
dcl1-hana                   hana_log_h12_mnt00002_t020_vol
dcl1-hana                   hana_log_h14_mnt00001_t020_vol
dcl1-hana                   hana_log_h15_mnt00001_t020_vol
dcl1-hana                   hana_log_h16_mnt00001_t020_vol
dcl1-hana                   hana_log_h80_mnt00001_t020_vol
dcl1-hana                   hana_log_h81_mnt00001_t020_vol
dcl1-hana                   hana_log_h82_mnt00001_t020_vol
dcl1-hana                   hana_shared_h12_mnt00001_t020_vol
dcl1-hana                   hana_shared_h12_mnt00002_t020_vol
dcl1-hana                   hana_shared_h14_t020_vol
dcl1-hana                   hana_shared_h15_t020_vol
dcl1-hana                   hana_shared_h16_t020_vol
dcl1-hana                   hana_shared_h80_t020_vol
dcl1-hana                   hana_shared_h81_t020_vol
dcl1-hana                   hana_shared_h82_t020_vol
dcl1-hana                   offlinetest_h14
dcl1-hana                   rootvol_v020
dcl1-hana                   t020_sbd
dcl1-hana                   t020_sbd1_vol
dcl1-hana ------- -------- ---- t020_sles_boot_vol
36 entries were displayed.

dcl1-hana-c03v020-client1-prod::>
```