

## Summary

### Symptom

To ensure optimal performance, SAP HANA database holds the bulk of its data in memory. However, it still uses persistent storage to provide a fallback in case of failure.

During normal database operation, data is automatically saved from memory to disk at regular savepoints. Additionally, all data changes are recorded in the redo log. The redo log is saved from memory to disk with each committed database transaction. After a power failure, the database can be restarted like any disk-based database, and it returns to its last consistent state by replaying the redo log since the last savepoint.

While savepoints and log writing protect your data against power failures, savepoints do not help if the persistent storage itself is damaged. To protect against data loss due to disk failures, backups are required. Backups save the payload (the actual data) of the data area and log area to different locations. Currently only backups to the file system (including network mounted file systems) are supported.

Backups are performed while the database is running. The impact of backups on system performance is negligible, and users can continue to work normally while the backup is running.

This note deals with questions and answers about the SAP HANA database backup and recovery feature. It answers general and frequently asked questions, and refers you to other sources of information. It does not describe how to perform a backup and recovery of all the components that can be part of a SAP HANA installation.

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32. How do I recover my SAP HANA database, if the data area is unusable?
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### **Other terms**

HANA; Backup; Recovery; FAQ;

### **Reason and Prerequisites**

You use SAP HANA database Version Revision 28 or higher.

### **Solution**

1. Where can I find detailed information about SAP HANA database backup and recovery?

SAP HANA database Backup and Recovery Guide on  
[http://help.sap.com/hana\\_appliance](http://help.sap.com/hana_appliance)

2. Which Users are allowed to execute Backup and Recovery?

For SQL users the system privilege BACKUP ADMIN is needed to perform a data backup. If you execute data backups using the SAP HANA Studio the privilege CATALOG READ is additionally needed. It is not recommended to use the SYSTEM user for normal database operation. Instead, we recommend that you create dedicated administration users with only the privileges necessary for backup and recovery.

The recovery process can only be started by the operating system user <sid>adm.

3. Do I have to stop the SAP HANA database for backup?

No. Data and log areas can only be backed up when the SAP HANA database is online. During data and log backup the system is available as usual.

4. Which SAP HANA database backup types are there?

As of Revision 20 SAP HANA database supports data backup and log backup.

5. Are there any preconditions to be checked before I can start a data

backup?

All configured services (see notes 1697613 and 1649519) like indexserver, statisticsserver, etc. must be running. You can check this in the Overview of the SAP HANA studio -> Operational State: All Services are started.

6. How to create a SAP HANA database data backup?

There are different ways and tools to create a data backup.

a) SAP HANA studio

In the Navigator view select the system for which you want to start a backup. Use right mouse click and choose Backup from the context menu. Specify the location (directory) and the backup file prefix to use. (The default location shows the path specified in the backup parameter basepath\_databackup.)

b) SQL commands

You can enter SQL commands either by using the SQL editor in SAP HANA studio, or by using the hdbsql program on the command line.

The backup can be started with the following SQL command:

```
BACKUP DATA USING FILE ('<target>')
```

**If no absolute path is specified, the default backup location is prepended to the target. In both cases, a suffix will be appended to the target.**

c) Batch mode

To perform data backups in batch mode, we recommend that you use the command line tool hdbsql on operating system level. hdbsql enables you to trigger backups through crontab.

For details please see the SAP HANA database Backup and Recovery Guide on [http://help.sap.com/hana\\_appliance](http://help.sap.com/hana_appliance)

d) DBACockpit (from the ABAP system only)

You can find the DBA Cockpit documentation in the SAP Help Portal <http://help.sap.com/>

7. What happens, if a scheduled data backup starts before the previous backup is completed?

The first data backup will continue normally; the second data backup will not start and you will receive an adequate error message.

8. Is there a difference between the backup procedure in single host and multi-host (scale-out) SAP HANA databases?

No. There is no difference.

9. Is the log area also saved during a data backup?

No. A SAP HANA database data backup saves the data area only.

After an initial data backup, the log area is automatically saved in log backups regularly.

10. Can data and log backups run in parallel?

If the auto log backup parameter is set, log backups started automatically and independently of data backups.

11. What data is saved in data/log backups?

When the data area is backed up, the entire payload data from all server nodes of the SAP HANA database instance is backed up. This applies for both single-host and multi-host environments.

During a log backup, the payload of the log segments is copied from the log area to service-specific log backup files.

12. Can I backup or recover individual database objects like tables or schemata?

Backup and recovery always applies to the whole database. It is not possible to backup or recover individual database objects.

13. Are 3rd party backup tools supported - beside of files as backup media?

Currently backup only supports files as backup media. Backup to pipes is not supported yet, but under development.

14. Can I configure the directories where the backup files should be located?

Yes. To ensure data security, we recommend that you specify a path to an external backup location. The backup location should never be on the same physical device as the data or log areas.

a) Data backup

The data backup files are written to the location specified by the parameter `basepath_databackup` in the persistence section of the `global.ini` configuration file. By default, the location for data backup files is `$(DIR_INSTANCE)/backup/data`.

To use a different location, you can specify a different path when you perform the backup. If you need to, you can specify a different path in the SQL command for each backup. Alternatively, you can change the value of `basepath_databackup`.

All the files for one particular data backup are written to the same location. The files belonging to the same data backup cannot be written to multiple locations.

However, each new data backup can be written to a different location. We recommend that you create the directory structures before the backup is started.

b) Log backup

The log backup files are written to the location specified by the parameter `basepath_logbackup` in the persistence section of the `global.ini` configuration file. By default, the location for log backup files is `$(DIR_INSTANCE)/backup/log`.

To use a different location, change the value of `basepath_logbackup`.

The configuration path for data and log backup must be valid throughout the whole system, and not only for specific hosts.

If you change the backup location in `basepath_databackup` and `basepath_logbackup`, the change takes effect immediately.

For further details please see the SAP HANA database Backup and Recovery Guide on [http://help.sap.com/hana\\_appliance](http://help.sap.com/hana_appliance)

15. Does SAP HANA database support backup to NFS-mounted file systems?

Yes. We recommend that backups are stored to external storage.

16. What are the naming conventions for data backup files?

Each backup file name comprises the following elements:  
<path><prefix><suffix>

The <path> and <prefix> are optional in the SQL statement. If no absolute path is specified, the default backup location is used (from parameter `basepath_databackup`). If no <prefix> is specified, just the <suffix> is added to the path.

As there is one data backup file for each service, the system adds a unique <suffix> to each backup file name.

Here is an example of a set of backup files from one data backup created with SAP HANA Studio:

```
COMPLETE_DATA_BACKUP_databackup_0_1 (name server topology)
COMPLETE_DATA_BACKUP_databackup_1_1 (name server)
COMPLETE_DATA_BACKUP_databackup_2_1 (for example, index server)
...
```

In this example, `COMPLETE_DATA_BACKUP` is the file name <prefix>; `_databackup_0_1` is the <suffix>.

The suffix that is appended to a file name prefix is only unique for each service. Consequently, the next time you back up a service, the system assigns the same backup suffix to the backup file for that service. If you do not change the file name, i. e. the <path> and/or the <prefix>, the existing backup file for that service will be overwritten by the new backup.

We therefore recommend that you copy a data backup to a new location as soon as it is created or assure that individual <path>/<prefix> combinations are used for each data backup.

17. How can I estimate the size of a data backup?

To estimate the size of a data backup, you can query the system table `M_CONVERTER_STATISTICS`. This system table contains (among others) the number of currently used blocks.

To estimate the size of the next complete data backup, you can use either of the following SQL commands:

```
select sum(allocated_page_size) from M_CONVERTER_STATISTICS
```

The result is a single value that gives the sum of the sizes of all services in bytes.

The size may differ slightly between `SELECT` statement and `DATA BACKUP` execution.

18. Where can I see a history of my data and log backups?

The backup catalog provides information about the execution of backups, recoveries and their history. It enables the system to determine whether a recovery is possible and to choose which data and log backup to use to recover the database.

The monitoring views `M_BACKUP_CATALOG` and `M_BACKUP_CATALOG_FILES` can be used to display information about the backup catalog. The system privilege `CATALOG READ` is needed for this. (For details see SAP HANA database Backup and Recovery Guide.)

19. Can I cancel a running data backup?

Yes. Starting with SAP HANA database you can cancel a data backup that is still running. To cancel a running data backup, you can use either SAP HANA studio or an SQL command - provided the user has the system privileges `CATALOG READ` and `BACKUP ADMIN`.

For further details please see the SAP HANA database Backup and Recovery Guide on [http://help.sap.com/hana\\_appliance](http://help.sap.com/hana_appliance)

20. Are backups compressed?

No. Currently backup compression is not available for the SAP HANA database.

21. Are incremental and differential backups available?

Currently incremental and differential data backups are not available.

22. How can I validate data and log backups?

During a SAP HANA database data and log backup the data is already checked regarding consistency. Additionally the recovery has built-in consistency checks for the backup files during the recovery process.

23. How often should I execute a SAP HANA database backup?

- After the initial load has finished successfully, a data backup

is strongly recommended.

- It is recommended to perform a backup (data + .ini files) before the database software is upgraded to a new version. If the software upgrade fails, the database can then be recovered with no data loss.
- After adding or removing a host or a service, a data backup is strongly recommended.
- To ensure that you can recover your database to the most recent point in time without needing to replay a large number of log backups, you should perform data backups at regular intervals.
- Archiving of log backups should be part of your overall backup strategy.

24. Are the configuration files (\*.ini) also saved during a backup?

No. The configuration files are not backed up as part of the database backup.

Configuration files that contain customer-specific changes can be backed up manually in order to more easily identify and restore customer-specific changes in a recovery situation.

Configuration files that contain customer-specific changes are located by default in the following directories:

For global configuration settings:

```
$(DIR_INSTANCE)/../SYS/global/hdb/custom/config
```

For host-specific configuration settings:

```
$(SAP_RETRIEVAL_PATH)
```

Configuration files are only created in these directories if customer-specific changes are made to them after installation. If no customer-specific changes have been made, these directories may be empty.

25. Are the configuration files (\*.ini) needed for a recovery?

Configuration files are not essential to perform a recovery. If you want to use the customer-specific configuration, you need to reconfigure the system after the recovery using SAP HANA studio. To display the configuration values, go to the Configuration tab in SAP HANA studio.

26. What general configuration options do I have for saving the log area?

You can configure the log backup behavior using the following parameters in the global.ini configuration file.

**enable\_auto\_log\_backup**



This parameter enables or disables automatic log backup immediately (no restart necessary).

Default: `enable_auto_log_backup = yes`

Important: In the default `log_mode` normal, if automatic log backup is disabled the log area grows until the file system is full. At that stage, the database will stop working until the situation is resolved.

### **log\_mode**

After changing the log mode parameters, you must restart the SAP HANA database to activate the changes. We also recommend that you create a full data backup of the database.

This parameter can have the following values:

- **log\_mode = normal** (default)

Log segments are automatically backed up if parameter `enable_auto_log_backup` is enabled.

`log_mode = normal` is recommended to provide support for point-in-time recovery.

- **log\_mode = overwrite**

Log segments are freed by savepoints and no log backup is performed. This can be useful for test installations that do not need to be backed up or recovered.

`log_mode = overwrite` is not recommended for production systems. No point-in-time recovery is possible. For recovery, only data backups are used; the logs must be disregarded.

- **log\_mode = legacy**

`log_mode = legacy` is still supported, but not recommended. After an upgrade from a SAP HANA database smaller than Revision 20 (SPS 02) it is recommended to switch to the log mode to normal (see note 1645183).

### **log\_backup\_timeout\_s**

This parameter forces log backups at a fixed time interval, specified in seconds. Log backups triggered by `log_backup_timeout_s` are performed in addition to the log backups that are performed when a log segment becomes full.

Recommended: Specify a time interval. For example 900s.

(0 = Log backups are only made when a log segment is full and when services are restarted.)

Specifying an appropriate time interval for log backups enables you

to recover a SAP HANA database with minimum data loss. For example, if you need to recover the database in a situation where the log area is unusable, and only the data and log backups are available.

The `log_backup_timeout_s` parameter only takes effect if `enable_auto_log_backup` is set.

27. How can I delete log segments that are no longer needed from the log volumes?

Caution: Do not delete log segments on operating system level, as the log area will become unusable and the database may stop working immediately.

You can release free log segments explicitly using the SQL command `ALTER SYSTEM RECLAIM LOG`. The `ALTER SYSTEM RECLAIM LOG` command physically deletes all log segments that are no longer needed.

28. Where can I find the backup catalog?

The backup catalog is stored at the following location:

```
$(DIR_INSTANCE)/../SYS/global/hdb/metadata/BackupCatalog.xml
```

Information in the backup catalog is stored as XML, making it readable by users and software. Once entries have been recorded, they must not be changed.

The backup catalog does not need to be backed up, as the system recreates it during a recovery using the accessible data and log backups.

29. How can I identify data and log backup files needed for a recovery

Note 1705945 describes, which data and log backups are needed for a recovery.

30. How can I identify old log backups?

The SAP HANA Database Backup and Recovery Guide describes in detail how to identify old data and log backups (see [http://help.sap.com/hana\\_appliance](http://help.sap.com/hana_appliance))

31. How do I recover my SAP HANA database?

The SAP HANA Studio provides point-in-time recovery with full GUI support.

In a recovery situation, you can use SAP HANA studio to restore customer-specific changes (\*.ini files) either before or at the end of the recovery.

To recover your database from SAP HANA studio -> landscape view -> open context menu of the database -> choose Recovery. Confirm that the database can be shut down - recovery is only done when the database is offline. In the recovery wizard choose one of the recovery types:

- a) Recover the database to its most recent state.

- b) Recover the database to a certain point in time.
- c) Recover the database to a specific data backup. (Just a specific data backup is used for recovery; Log entries are not replayed neither from the log backups nor from the log area.)
- d) Recover the database to a certain log position. (Advanced option to be used in exceptional cases if a previous recovery failed.)

Afterwards specify the locations of the data and log backup files if they are not in the default location. The recovery is started after you choose Next and Finish. When the recovery is done, the system is online.

32. How do I recover my SAP HANA database, if the data area is unusable?

If the data area is unusable, and all the data changes after the last complete data backup are still available in the log backups and log area, the data from committed transactions that was in memory at the time of failure can be recovered. No committed data is lost.

For recovery, all relevant log backups made after the data backup are needed.

Perform a database recovery to the **most recent state**.

33. How do I recover my SAP HANA database, if the log area is unusable?

If the log area is unusable, it is only possible to replay the log backups. As a consequence, any changes that were made after the most recent log backup will be lost. In addition, all the transactions that were open during the log backup will be rolled back.

For recovery, the data backups and the log backups are needed.

Perform a database recovery to the **most recent state** and in the Recovery Wizard choose the option **Initialize log area** to prevent the recovery of entries from the unusable log area.

34. How do I recover my SAP HANA database, if a logical error occurred (e.g. some data were deleted by mistake)?

To reset the database to a particular point in time, you need a data backup from before the point in time to recover to, the subsequent log backups, and the log area. All changes made after the recovery time will be lost.

Perform a database recovery to a **point-in-time** before the logical error.

35. Is online recovery possible?

No. Database recovery is always a full recovery of the whole database and therefore always requires a downtime.

36. Where can I see that my recovery is finished?

The SAP HANA Studio shows the progress of the recovery and reports when it is finished.

37. Can I cancel a running recovery?

No. Once it is running, a recovery cannot be canceled.

38. What do I have to do, if the recovery fails?

That depends of the situation. Mostly not all necessary backup files are available. Therefore you will have to provide the missing backup files and repeat the recovery. Otherwise you will have to use another recovery strategy corresponding to your available backup files.

39. Which information is needed to analyze backup or recovery problems?

The following information has to be provided to the SAP support in case of backup or recovery problems:

- o content of directory `$(SAP_RETRIEVAL_PATH)/trace` as minimum backup.log and all \*.trc files
- o content of backup catalog  
`$(DIR_INSTANCE)/../SYS/global/hdb/metadata/BackupCatalog.xml`
- o list of the content (recursive) of your backup directories  
`$(DIR_INSTANCE)/backup`

40. Does the recovery tolerate corrupt or missing backups?

The SAP HANA database recovery always reaches a consistent database state. If the latest data backup is corrupt, you can use an older data backup (plus the log backups between the two data backups) to reach the desired point in time. If log backups are missing or corrupt, the reachable point in time might be earlier than specified by the database administrator for the recovery.

41. Can backup and recovery be resumed?

SAP HANA database backup is always carried out during online operation, but with no impact on normal operation. It uses a shadow page concept which decouples the data that is currently being used by users from the data that is being backed up. Pause/resume does not make sense for the SAP HANA database backup. Database recovery cannot be paused/resumed either; it is always a full recovery and carried out as fast as possible in offline mode.

42. Can I copy a SAP HANA database using backup and recovery?

Yes, you can. For details look in the SAP HANA Database - Backup and Recovery Guide on [http://help.sap.com/hana\\_appliance](http://help.sap.com/hana_appliance)

43. How can I copy a SAP HANA database from a single-host to a multi-host box (scale-out)?

As of Revision 28, support for database copies using backups is available. Note that you will always have to recover the backup into a

new installation with the same number of volumes/services/hosts, and only after that can change the landscape. For a scale-out scenario this would mean that you copy the single-host database and only after that add more hosts using the addhost command.

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**Header Data**

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Primary Component:	BC-DB-HDB SAP In-Memory Database

**The Note is release-independent**

**Related Notes**

Number	Short Text
1716418	Data backup hangs when writing to NFS server
1705945	Ermittlung benötigter Wiederherstellungsdateien
1703435	Erzeugen einer Kopie einer laufenden Instanz mit Snapshots
1697613	XS Engine Service aus der Topologie entfernen
1645183	Changing log mode for SAP HANA DB after SPS2 to SPS3 upgrade