SAP HANA backup and restore solution overview

Snap Creator Framework

NetApp
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SAP HANA backup and restore solution overview

Corporations today require their SAP applications to be available 24 hours a day, seven days a week. Consistent levels of performance are expected regardless of increasing data volumes and routine maintenance tasks such as system backups.

Running SAP database backups can have a significant performance effect on a production SAP system. Because backup windows are shrinking and the amount of data that needs to be backed up is increasing, it is difficult to define a point in time when backups can be performed with minimal effect on business processes. The time needed to restore and recover SAP systems is of particular concern because the downtime must be minimized.

Considerations for backing up SAP HANA systems

SAP HANA administrators must deliver a reliable level of service, minimizing downtime or performance degradation due to backups.

To deliver this level of service, SAP HANA administrators contend with challenges in the following areas:

- Performance effect on production SAP systems

  Backups typically have a significant performance impact on the production SAP system because there is a heavy load on the database server, the storage system, and the storage network during backups.

- Shrinking backup windows

  Backups can be created only during times with low I/O or batch activities occurring on the SAP system. It is very difficult to define a backup window when the SAP system is active all the time.

- Rapid data growth

  Rapid data growth together with shrinking backup windows result in ongoing investments in the backup infrastructure: more tape drives, new tape drive technology, faster storage networks. Growing databases also result in more tape media or disk space for backups. Incremental backups can address these issues, but result in a very slow restore process, which is usually not acceptable.

- Increasing cost of downtime

  Unplanned downtime of an SAP system always has a financial effect on the business. A significant part of the unplanned downtime is the time that is required to restore and recover the SAP system in case of a failure. The backup and recovery architecture must be designed based on an acceptable recovery time objective (RTO).

- Backup and recovery time

  Backup and recovery time are included in SAP upgrade projects. The project plan for a SAP upgrade always includes at least three backups of the SAP database. The time required to perform these backups reduces the total available time for the upgrade process. The decision whether to backup and recover is generally based on the amount of time required to restore and recover the database from the backup that was created previously. The option to restore very quickly provides more time to solve problems that might occur during the upgrade rather than just restore the system back to its previous state.

The NetApp solution

A database backup can be created in minutes by using NetApp Snapshot technology. The time needed to create a Snapshot copy is independent of the size of the database because a Snapshot copy does not move any data blocks.

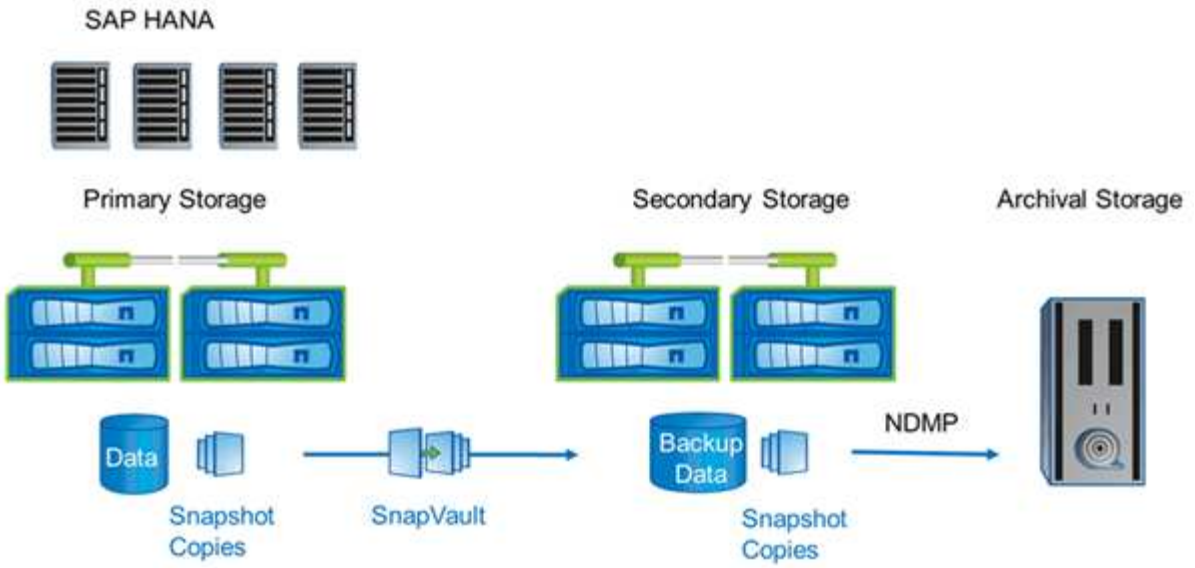
The use of Snapshot technology also has no performance effect on the production SAP system. Therefore, the creation of Snapshot copies can be scheduled without having to consider peak activity periods. SAP and NetApp customers typically schedule several online Snapshot backups during the day. For example, backups might occur every four hours. These Snapshot backups are typically kept for three to five days on the primary storage system.

Snapshot copies also provide key advantages for the restore and recovery operation. NetApp SnapRestore functionality allows restoring the entire database or parts of the database to the point in time when any available Snapshot copy was created. This restore process is done in a few minutes, independently of the size of the database. The time needed for the recovery process is also dramatically reduced, because several Snapshot copies have been created during the day, and fewer logs need to be applied.

Snapshot backups are stored on the same disk system as the active online data. Therefore NetApp recommends using Snapshot backups as a supplement, not a replacement for backups to a secondary location such as disk or tape. Although backups to a secondary location are still necessary, there is only a slight probability that these backups will be needed for restore and recovery. Most restore and recovery actions are handled by using SnapRestore on the primary storage system. Restores from a secondary location are only necessary if the primary storage system holding the Snapshot copies is damaged or if it is necessary to restore a backup that is no longer available from a Snapshot copy. For example, you might need to restore a backup from two weeks ago.

A backup to a secondary location is always based on Snapshot copies created on the primary storage. Therefore, the data is read directly from the primary storage system without generating load on the SAP database server. The primary storage communicates directly with the secondary storage and sends the backup data to the destination using the SnapVault disk-to-disk backup. The NetApp SnapVault functionality offers significant advantages compared to traditional backups. After an initial data transfer, in which all the data has to be transferred from the source to the destination, all subsequent backups copy only the changed blocks to the secondary storage. This significantly reduces the load on the primary storage system and the time needed for a full backup. A full database backup requires less disk space because SnapVault stores only the changed blocks at the destination.

Backing up data to tape as a long-term backup might still be required. This could be, for example, a weekly backup that is kept for a year. In this case, the tape infrastructure can be directly connected to the secondary storage, and the data could be written to tape by using the Network Data Management Protocol (NDMP).



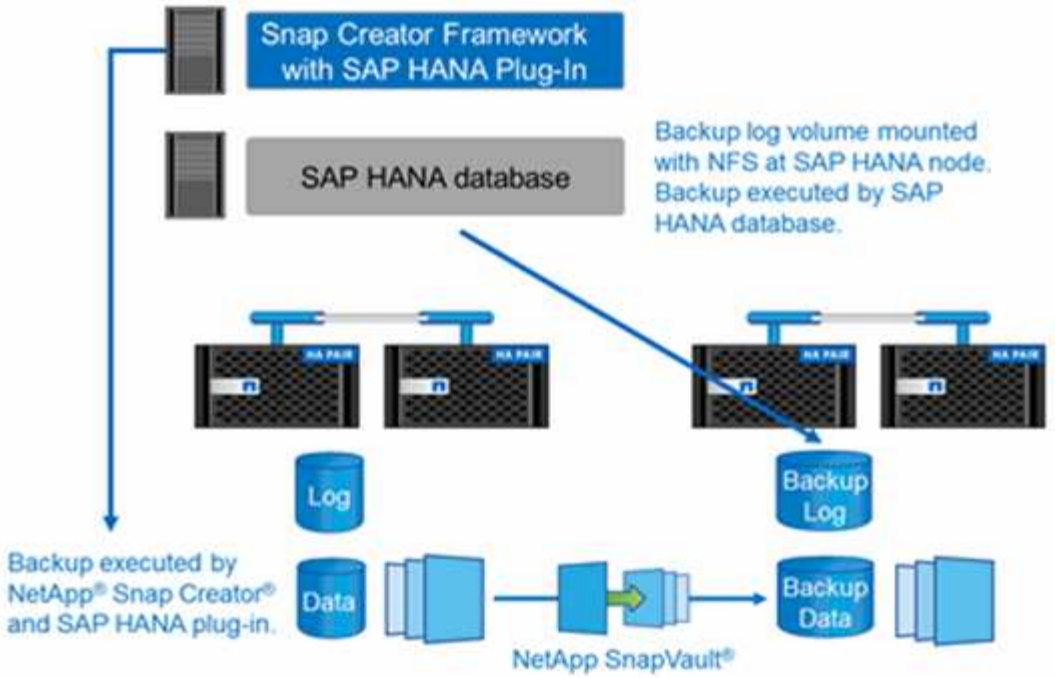
Backup solution components

The Snap Creator backup solution for SAP HANA consists of SAP HANA data file backup using storage-based Snapshot copies, replication of data file backups to a secondary offsite backup location, SAP HANA log file backup using the HANA database log backup functionality, database block integrity check using a file-based backup, and housekeeping of data file, log file backups, and the SAP HANA backup catalog.

Database backups are executed by Snap Creator in conjunction with a plug-in for SAP HANA. The plug-in ensures database consistency so that the Snapshot copies that are created on the primary storage system are based on a consistent image of the SAP HANA database.

Snap Creator allows you to replicate the consistent database images to a secondary storage using SnapVault. Typically, there will be different retention policies defined for the backups at the primary storage and the backups at the secondary storage. Snap Creator handles the retention at the primary storage as well as the secondary storage.

The log backup is executed automatically by the SAP HANA database tools. The log backup destination should not be on the same storage system where the log volume of the database is located. Configuring the log backup destination on the same secondary storage where the database backups get replicated with SnapVault is recommended. With this configuration, the secondary storage has similar availability requirements as the primary storage so that it is certain that the log backups can always be written to the secondary storage.



The backup schedules and retention policies must be defined based on customer requirements. The following table shows an example configuration of the different schedules and retention policies.

	Executed by Snap Creator	**Primary storage**	**Secondary storage**
Database backups	Schedule 1: every 4 hours	Retention: 6 (=> 6 hourly Snapshot copies)	Retention: 6 (=> 6 hourly Snapshot copies)
Schedule 2: once per day	Retention: 3 (=> 3 daily Snapshot copies)	Retention: 28 (4 weeks) (=> 28 daily Snapshot copies)	Log backups
SAP HANA database tools schedule: every 15 minutes	NA	Retention: 28 days (4 weeks)	Block integrity check

With this example, six hourly and three daily backups are kept at the primary storage. At the secondary storage, the database backups are kept for four weeks. To be able to recover any of the data backups, you must set the same retention for the log backups.

SAP HANA plug-in overview

The SAP HANA plug-in works in conjunction with the Snap Creator Framework to provide a backup solution for SAP HANA databases that rely on a NetApp storage back end. The Snapshot backups created by Snap Creator are registered in the HANA Catalog and are visible in HANA Studio.

Snap Creator Framework supports two types of SAP HANA databases: single containers and multitenant database containers (MDC) single tenant database.

Snap Creator and the SAP HANA plug-in are supported with Data ONTAP operating in 7-Mode and clustered Data ONTAP with the SAP HANA database nodes attached to the storage controllers using either NFS or Fibre Channel. The required interfaces to the SAP HANA database are available for Service Pack Stack (SPS) 7 and later.

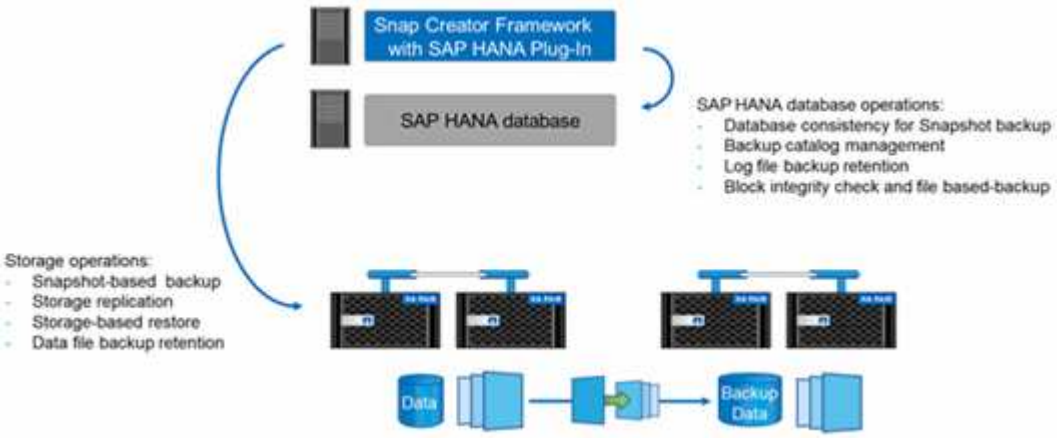
The Snap Creator Framework communicates with the storage systems to create Snapshot copies and to replicate the data to a secondary storage using SnapVault. Snap Creator is also used to restore the data either with SnapRestore at the primary storage or with SnapVault restore from the secondary storage.

The Snap Creator plug-in for SAP HANA uses the SAP HANA hdbsql client to execute SQL commands in order to provide database consistency and to manage the SAP HANA backup catalog. The SAP HANA plug-in is supported for both SAP Certified Hardware Appliances and Tailored Datacenter Integration (TDI) programs.

The Snap Creator plug-in for SAP HANA uses the SAP HANA hdbsql client to execute SQL commands for the following tasks:

- Provide database consistency to prepare a storage-based Snapshot backup
- Manage log file backup retention on file system level
- Manage the SAP HANA backup catalog for data file and log file backups
- Execute a file-based backup for block integrity check

The following illustration shows an overview of the communication paths of Snap Creator with the storage and the SAP HANA database.



Snap Creator performs the following steps to back up the database:

1. Creates an SAP HANA database Snapshot copy to obtain a consistent image on the persistence layer.
2. Creates a storage Snapshot copy of the data volume(s).
3. Registers the storage Snapshot backup within the SAP HANA backup catalog.
4. Deletes the SAP HANA Snapshot copy.
5. Executes a SnapVault update for the data volume.
6. Deletes the storage Snapshot copies at the primary and/or secondary storage, based on the defined retention policies for backups at the primary and secondary storage.
7. Deletes the SAP HANA backup catalog entries if the backups do not exist anymore at the primary and the secondary storage.
8. Deletes all log backups that are older than the oldest data backup on the file system and within the SAP HANA backup catalog.

Requirements

The SAP HANA plug-in enables you to create backups and perform point-in-time recovery of HANA databases.

Support for the SAP HANA plug-in is as follows:

- Host operating system: SUSE Linux Enterprise Server (SLES), 32-bit and 64-bit
- Clustered Data ONTAP or Data ONTAP operating in 7-Mode
- At least one SAP HANA database node attached via NFS
- SAP HANA running Service Pack Stack (SPS) 7 or later

For the latest information about support or to view compatibility matrices, see the NetApp Interoperability Matrix Tool.

Required licenses

The primary storage controllers must have a SnapRestore and SnapVault license installed. The secondary storage must have a SnapVault license installed.

No license is required for Snap Creator and the Snap Creator SAP HANA plug-in.

Capacity requirements for Snapshot backups

A higher block change rate on the storage layer has to be considered compared to the change rate with traditional databases. Due to the table merge process of the column store, much more data than just the block changes is written to disk. Until more customer data is available, the current estimation for the change rate is 20% to 50% per day.

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