Storage controller setup

NetApp Solutions

Dorian Henderson, Ivana Devine
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Previous: Time synchronization.

This section describes the configuration of the NetApp storage system. You must complete the primary installation and setup according to the corresponding ONTAP setup and configuration guides.

Storage efficiency

Inline deduplication, cross-volume inline deduplication, inline compression, and inline compaction are supported with SAP HANA in an SSD configuration.

NetApp Volume Encryption

The use of NetApp Volume Encryption (NVE) is supported with SAP HANA.

Quality of Service

QoS can be used to limit the storage throughput for specific SAP HANA systems or other applications on a shared-use controller. One use case would be to limit the throughput of development and test systems so that they cannot influence production systems in a mixed setup.

During the sizing process, you should determine the performance requirements of a nonproduction system. Development and test systems can be sized with lower performance values, typically in the range of 20% to 50% of a production- system KPI as defined by SAP.

Starting with ONTAP 9, QoS is configured on the storage volume level and uses maximum values for throughput (MBps) and the amount of I/O (IOPS).

Large write I/O has the biggest performance effect on the storage system. Therefore, the QoS throughput limit should be set to a percentage of the corresponding write SAP HANA storage performance KPI values in the data and log volumes.

NetApp FabricPool

NetApp FabricPool technology must not be used for active primary file systems in SAP HANA systems. This includes the file systems for the data and log area as well as the `/hana/shared` file system. Doing so results in unpredictable performance, especially during the startup of an SAP HANA system.

Using the “snapshot-only” tiering policy is possible as well as using FabricPool in general at a backup target such as a NetApp SnapVault or SnapMirror destination.

Using FabricPool for tiering Snapshot copies at primary storage or using FabricPool at a backup target changes the required time for the restore and recovery of a database or other tasks such as creating system clones or repair systems. Take this into consideration for planning your overall lifecycle-management strategy and check to make sure that your SLAs are still being met while using this function.

FabricPool is a good option for moving log backups to another storage tier. Moving backups affects the time needed to recover an SAP HANA database. Therefore, the option “tiering-minimum-cooling-days” should be set to a value that places log backups, which are routinely needed for recovery, on the local fast storage tier.

Storage configuration

The following overview summarizes the required storage configuration steps. Each step is covered in detail in the subsequent sections. In this section, we assume that the storage hardware is set up and that the ONTAP software is already installed. Also, the connections between the storage ports (10GbE or faster) and the network must already be in place.

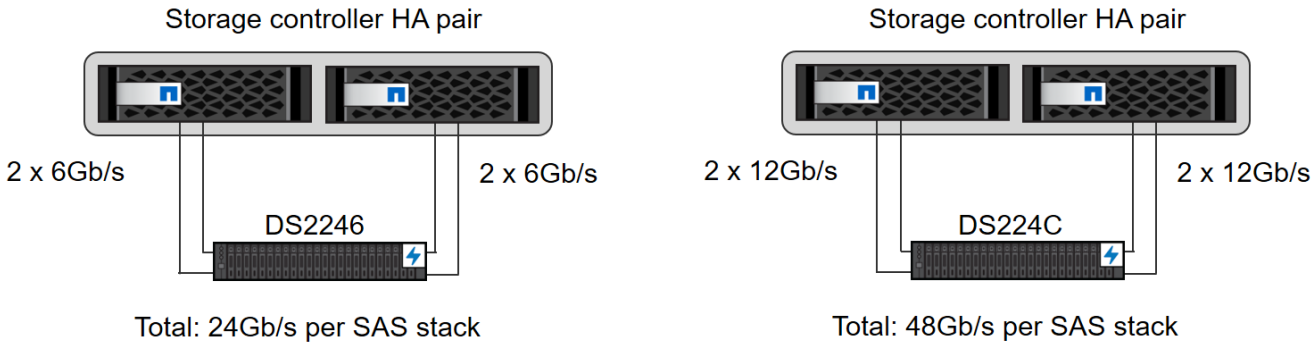
1. Check the correct disk shelf configuration as described in "Disk shelf connection."
2. Create and configure the required aggregates as described in "Aggregate configuration."
3. Create a storage virtual machine (SVM) as described in "SVM configuration."
4. Create LIFs as described in "LIF configuration."
5. Create volumes within the aggregates as described in "[Volume configuration for SAP HANA single host systems]" and "[Volume configuration for SAP HANA multiple host systems]."
6. Set the required volume options as described in "Volume options."
7. Set the required options for NFSv3 as described in "NFS configuration for NFSv3" or for NFSv4 as described in "NFS configuration for NFSv4."
8. Mount the volumes to namespace and set export policies as described in "Mount volumes to namespace and set export policies."

Disk shelf connection

SAS disk shelves

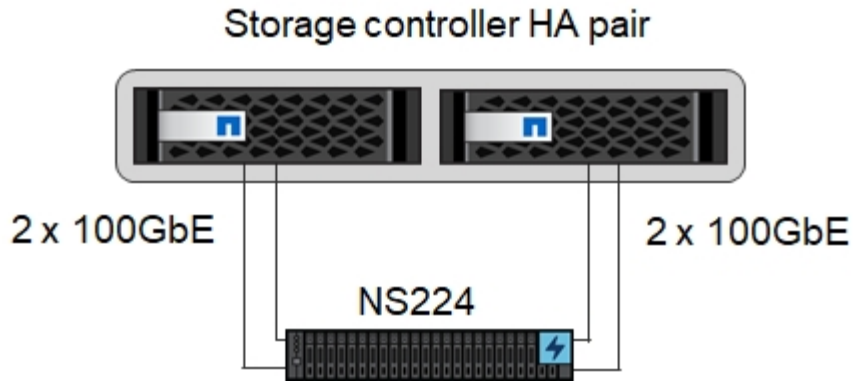
A maximum of one disk shelf can be connected to one SAS stack to provide the required performance for the SAP HANA hosts, as shown in the following figure. The disks within each shelf must be distributed equally to both controllers of the HA pair. ADPv2 is used with ONTAP 9 and the DS224C disk shelves.

With the DS224C disk shelf, quad-path SAS cabling can also be used but is not required.



NVMe (100GbE) disk shelves

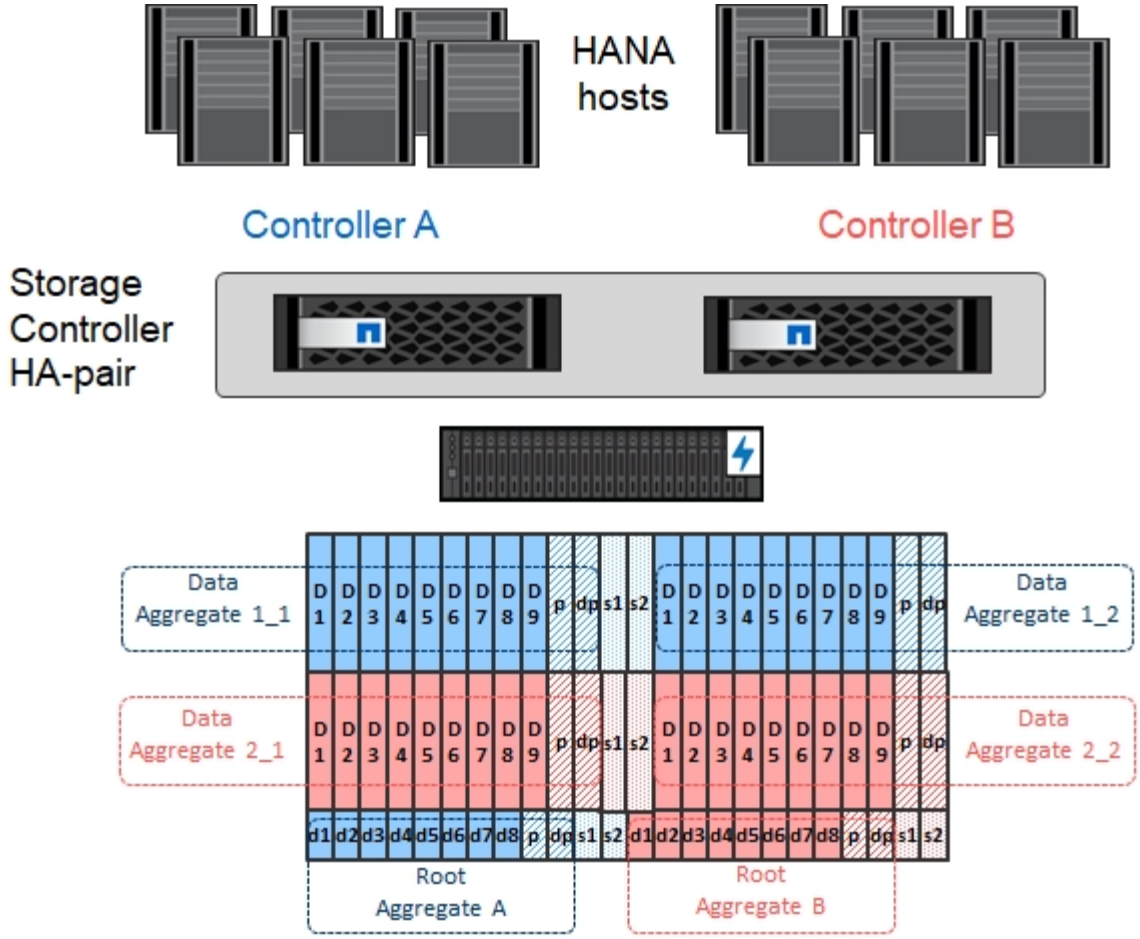
Each NS224 NVMe disk shelf is connected using two 100GbE ports per controller. The disks within each shelf must be distributed equally to both controllers of the HA pair. ADPv2, as described in the aggregate configuration chapter, is also used for the NS224 disk shelf. The following figure depicts the disk shelf connection with an NVMe drive.



Aggregate configuration

In general, you must configure two aggregates per controller, independent of the disk shelf or drive technology (SAS SSDs or NVMe SSDs) that is used. This step is necessary so that you can use all available controller resources. For AFF A200 series systems, one data aggregate is enough.

The following image shows a configuration of 12 SAP HANA hosts running on a 12Gb SAS shelf configured with ADPv2. Six SAP HANA hosts are attached to each storage controller. Four separate aggregates, two at each storage controller, are configured. Each aggregate is configured with 11 disks with nine data and two parity disk partitions. For each controller, two spare partitions are available.



SVM configuration

Multiple SAP landscapes with SAP HANA databases can use a single SVM. An SVM can also be assigned to each SAP landscape, if necessary, in case they are managed by different teams within a company.

If there is a QoS profile automatically created and assigned while creating a new SVM, remove this automatically created profile from the SVM to enable the required performance for SAP HANA:

```
vserver modify -vserver <svm-name> -qos-policy-group none
```

LIF configuration

For SAP HANA production systems, you must use different LIFs to mount the data volume and the log volume from the SAP HANA host. Therefore at least two LIFs are required.

The data and log volume mounts of different SAP HANA hosts can share a physical storage network port by either using the same LIFs or by using individual LIFs for each mount.

The maximum amount of data and log volume mounts per physical interface are shown in the following table.

Ethernet port speed	10GbE	25GbE	40GbE	100GeE
Maximum number of log or data volume mounts per physical port	2	6	12	24

Sharing one LIF between different SAP HANA hosts might require a remount of data or log volumes to a different LIF. This change avoids performance penalties if a volume is moved to a different storage controller.

Development and test systems can use more data and volume mounts or LIFs on a physical network interface.

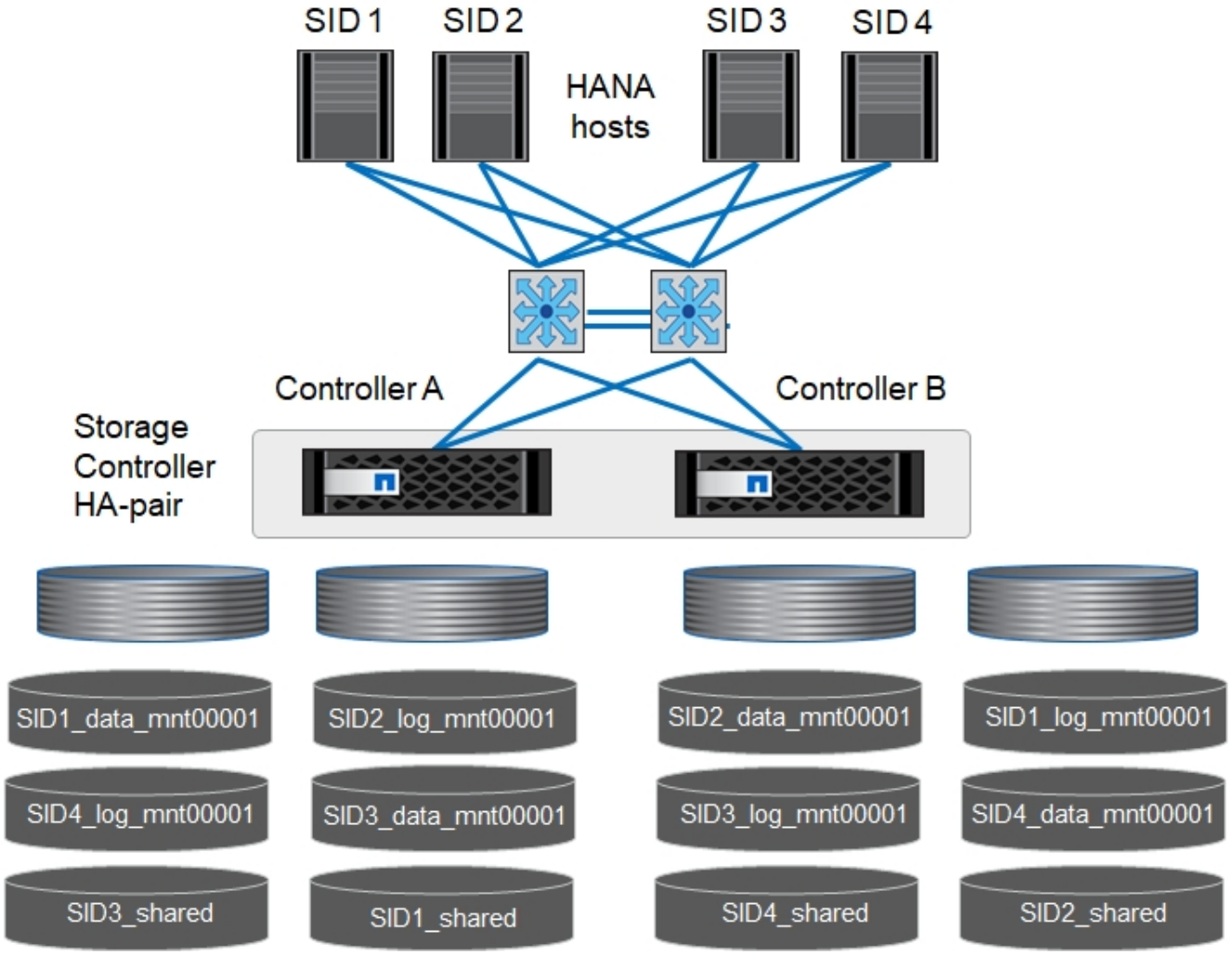
For production, development, and test systems, the `/hana/shared` file system can use the same LIF as the data or log volume.

Volume configuration for SAP HANA single-host systems

The following figure shows the volume configuration of four single-host SAP HANA systems. The data and log volumes of each SAP HANA system are distributed to different storage controllers. For example, volume `SID1_data_mnt00001` is configured on controller A, and volume `SID1_log_mnt00001` is configured on controller B.

If only one storage controller of an HA pair is used for the SAP HANA systems, data and log volumes can also be stored on the same storage controller.

If the data and log volumes are stored on the same controller, access from the server to the storage must be performed with two different LIFs: one LIF to access the data volume and the other to access the log volume.



For each SAP HANA host, a data volume, a log volume, and a volume for `/hana/shared` are configured. The following table shows an example configuration for single-host SAP HANA systems.

Purpose	Aggregate 1 at Controller A	Aggregate 2 at Controller A	Aggregate 1 at Controller B	Aggregate 2 at Controller b
Data, log, and shared volumes for system SID1	Data volume: SID1_data_mnt00001	Shared volume: SID1_shared	–	Log volume: SID1_log_mnt00001
Data, log, and shared volumes for system SID2	–	Log volume: SID2_log_mnt00001	Data volume: SID2_data_mnt00001	Shared volume: SID2_shared
Data, log, and shared volumes for system SID3	Shared volume: SID3_shared	Data volume: SID3_data_mnt00001	Log volume: SID3_log_mnt00001	–

Purpose	Aggregate 1 at Controller A	Aggregate 2 at Controller A	Aggregate 1 at Controller B	Aggregate 2 at Controller b
Data, log, and shared volumes for system SID4	Log volume: SID4_log_mnt00001	–	Shared volume: SID4_shared	Data volume: SID4_data_mnt00001

The following table shows an example of the mount point configuration for a single-host system. To place the home directory of the `sidadm` user on the central storage, the `/usr/sap/SID` file system should be mounted from the `SID_shared` volume.

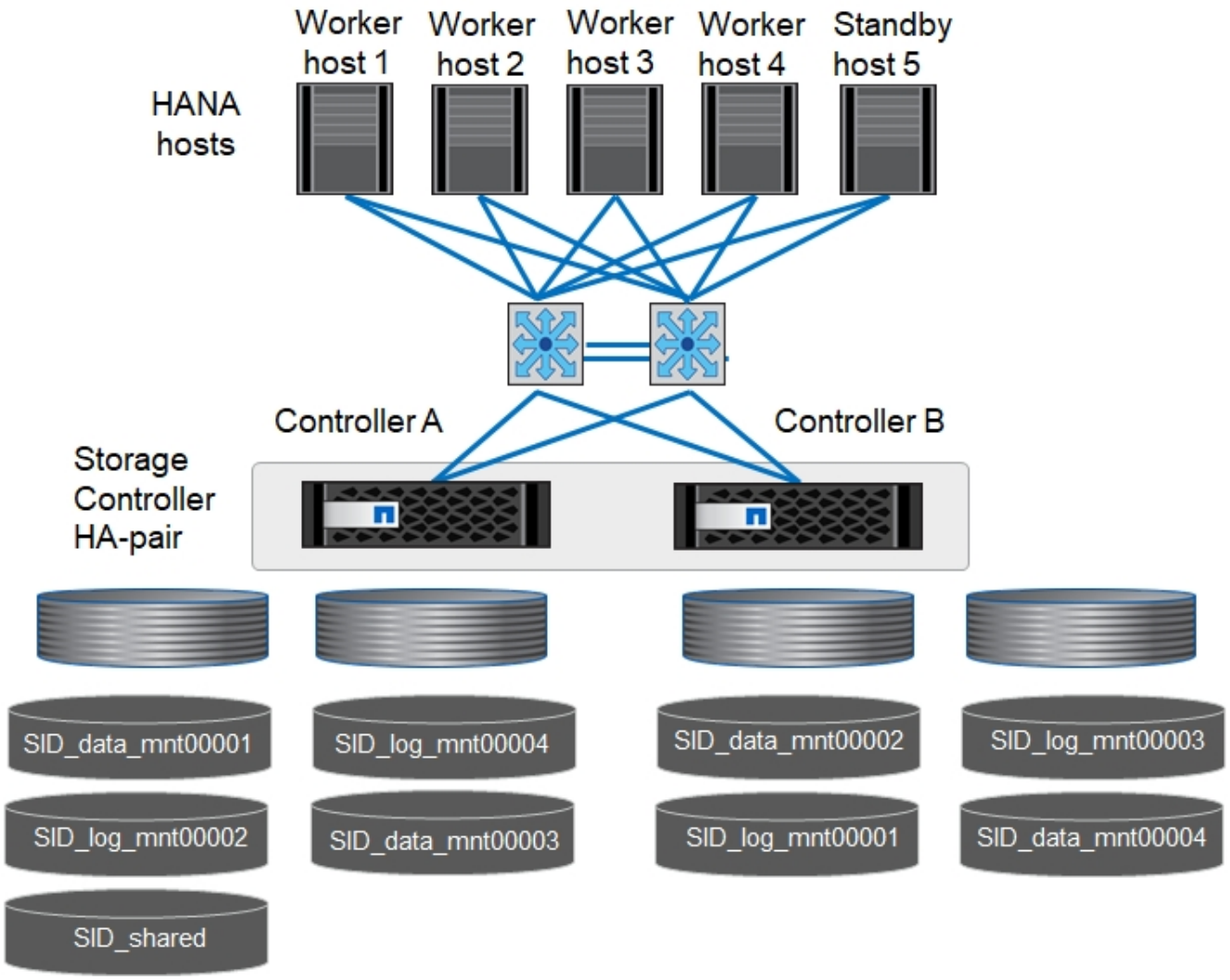
Junction path	Directory	Mount point at HANA host
SID_data_mnt00001		/hana/data/SID/mnt00001
SID_log_mnt00001		/hana/log/SID/mnt00001
SID_shared	usr-sap shared	/usr/sap/SID /hana/shared/

Volume configuration for SAP HANA multiple-host systems

The following figure shows the volume configuration of a 4+1 SAP HANA system. The data and log volumes of each SAP HANA host are distributed to different storage controllers. For example, volume `SID1_data1_mnt00001` is configured on controller A, and volume `SID1_log1_mnt00001` is configured on controller B.

If only one storage controller of an HA pair is used for the SAP HANA system, the data and log volumes can also be stored on the same storage controller.

If the data and log volumes are stored on the same controller, access from the server to the storage must be performed with two different LIFs: one LIF to access the data volume and one to access the log volume.



For each SAP HANA host, a data volume and a log volume are created. The `/hana/shared` volume is used by all hosts of the SAP HANA system. The following table shows an example configuration for a multiple-host SAP HANA system with four active hosts.

Purpose	Aggregate 1 at controller A	Aggregate 2 at controller A	Aggregate 1 at controller B	Aggregate 2 at controller B
Data and log volumes for node 1	Data volume: SID_data_mnt00001	–	Log volume: SID_log_mnt00001	–
Data and log volumes for node 2	Log volume: SID_log_mnt00002	–	Data volume: SID_data_mnt00002	–
Data and log volumes for node 3	–	Data volume: SID_data_mnt00003	–	Log volume: SID_log_mnt00003
Data and log volumes for node 4	–	Log volume: SID_log_mnt00004	–	Data volume: SID_data_mnt00004
Shared volume for all hosts	Shared volume: SID_shared			

The following table shows the configuration and the mount points of a multiple-host system with four active SAP HANA hosts. To place the home directories of the `sidadm` user of each host on the central storage, the

`/usr/sap/SID` file systems are mounted from the `SID_shared` volume.

Junction path	Directory	Mount point at SAP HANA host	Note
SID_data_mnt00001	–	/hana/data/SID/mnt00001	Mounted at all hosts
SID_log_mnt00001	–	/hana/log/SID/mnt00001	Mounted at all hosts
SID_data_mnt00002	–	/hana/data/SID/mnt00002	Mounted at all hosts
SID_log_mnt00002	–	/hana/log/SID/mnt00002	Mounted at all hosts
SID_data_mnt00003	–	/hana/data/SID/mnt00003	Mounted at all hosts
SID_log_mnt00003	–	/hana/log/SID/mnt00003	Mounted at all hosts
SID_data_mnt00004	–	/hana/data/SID/mnt00004	Mounted at all hosts
SID_log_mnt00004	–	/hana/log/SID/mnt00004	Mounted at all hosts
SID_shared	shared	/hana/shared/SID	Mounted at all hosts
SID_shared	usr-sap-host1	/usr/sap/SID	Mounted at host 1
SID_shared	usr-sap-host2	/usr/sap/SID	Mounted at host 2
SID_shared	usr-sap-host3	/usr/sap/SID	Mounted at host 3
SID_shared	usr-sap-host4	/usr/sap/SID	Mounted at host 4
SID_shared	usr-sap-host5	/usr/sap/SID	Mounted at host 5

Volume options

You must verify and set the volume options listed in the following table on all SVMs. For some of the commands, you must switch to the advanced privilege mode within ONTAP.

Action	Command
Disable visibility of Snapshot directory	vol modify -vserver <vserver-name> -volume <volname> -snapdir-access false
Disable automatic Snapshot copies	vol modify –vserver <vserver-name> -volume <volname> -snapshot-policy none
Disable access time update, except of the SID_shared volume	set advanced vol modify -vserver <vserver-name> -volume <volname> -atime-update false set admin

NFS configuration for NFSv3

The NFS options listed in the following table must be verified and set on all storage controllers. For some of the commands shown in this table, you must switch to the advanced privilege mode.

Action	Command
Enable NFSv3	nfs modify -vserver <vserver-name> v3.0 enabled

Action	Command
ONTAP 9: Set NFS TCP maximum transfer size to 1MB	set advanced nfs modify -vserver <vserver_name> -tcp-max-xfer -size 1048576 set admin
ONTAP 8: Set NFS read and write size to 64KB	set advanced nfs modify -vserver <vserver-name> -v3-tcp-max-read -size 65536 nfs modify -vserver <vserver-name> -v3-tcp-max-write -size 65536 set admin

NFS configuration for NFSv4

The NFS options listed in the following table must be verified and set on all SVMs.

For some of the commands in this table, you must switch to the advanced privilege mode.

Action	Command
Enable NFSv4	nfs modify -vserver <vserver-name> -v4.1 enabled
ONTAP 9: Set NFS TCP maximum transfer size to 1MB	set advanced nfs modify -vserver <vserver_name> -tcp-max-xfer-size 1048576 set admin
ONTAP 8: Set NFS read and write size to 64KB	set advanced nfs modify -vserver <vserver_name> -tcp-max-xfer-size 65536 set admin
Disable NFSv4 access control lists (ACLs)	nfs modify -vserver <vserver_name> -v4.1-acl disabled
Set NFSv4 domain ID	nfs modify -vserver <vserver_name> -v4-id-domain <domain-name>
Disable NFSv4 read delegation	nfs modify -vserver <vserver_name> -v4.1-read -delegation disabled
Disable NFSv4 write delegation	nfs modify -vserver <vserver_name> -v4.1-write -delegation disabled
Disable NFSv4 numeric ids	nfs modify -vserver <vserver_name> -v4-numeric-ids disabled

For NFS version 4. 0, replace `4.1` with `4.0` in the previous commands. While NFSv4.0 is supported, NFSv4.1 is preferred.

The NFSv4 domain ID must be set to the same value on all Linux servers (`/etc/idmapd.conf`) and SVMs, as described in the section “SAP HANA installation preparations for NFSv4.”

If you are using NFSV4.1, then pNFS is enabled and used by default (recommended).

Set the NFSv4 lease time at the SVM (as shown in the following table) if SAP HANA multiple host system are used.

Action	Command
Set the NFSv4 lease time	set advanced nfs modify -vserver <vserver_name> -v4-lease -seconds 10 set admin

Starting with HANA 2.0 SPS4, HANA provides parameters to control failover behavior. Instead of setting the lease time at the SVM level, NetApp recommends using these HANA parameters.

The parameters are within `nameserver.ini` as shown in the following table. Keep the default retry interval of 10 seconds within these sections.

Section within nameserver.ini	Parameter	Value
failover	normal_retries	9
distributed_watchdog	deactivation_retries	11
distributed_watchdog	takeover_retries	9

Mount volumes to namespace and set export policies

When a volume is created, the volume must be mounted to the namespace. In this document, we assume that the junction path name is the same as the volume name. By default, the volume is exported with the default policy. The export policy can be adapted if required.

Next: Host setup.