

User Guide for Synology High Availability (SHA)

—
Based on
DSM 7.0 and Synology High Availability 2.1.0



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Chapter 1: Introduction

High Availability solutions are in high demand for anyone involved in the deployment of important services such as databases, a company file server, virtualized storage, and more. All of these services have extremely low tolerance and cannot afford to be interrupted in the event of unexpected disasters or events.

Because of its high cost and complicated setup, high availability is typically portrayed as an enterprise-only solution. However, **Synology High Availability (SHA)** is available on the majority of plus-series and all FS/XS-series devices, making it a cost-effective solution for protecting critical services. When a disaster strikes, SHA helps to reduce the impact on the effort needed to resolve any system or hardware issues, while also allowing businesses to avoid downtime for mission-critical applications and minimize lost revenue.

To achieve high availability, SHA utilizes two Synology NAS that function as either the **active** or **passive** server to form a **high-availability cluster**. These servers are connected by a **Heartbeat connection**, which is a dedicated, private network connection that facilitates data synchronization and replication between the two devices. If the active server malfunctions or a service is abnormal, services will automatically **failover** to the passive server for it to take over services to minimize any downtime. With this in mind, users can rest assured that their services are constantly maintained, even in the event of sudden disaster.

Those who wish to make full use of the support provided by Synology High Availability will benefit from the information in this User Guide.

For information regarding SHA design and architecture, common scenarios, best practices, and performance metrics, please refer to the [SHA White Paper](#).

Chapter 2: Required Environment

2.1 Supported models (as of March 2024)

Please refer to the **Applied Models** section on [this page](#) for the latest information on SHA and its supported devices.

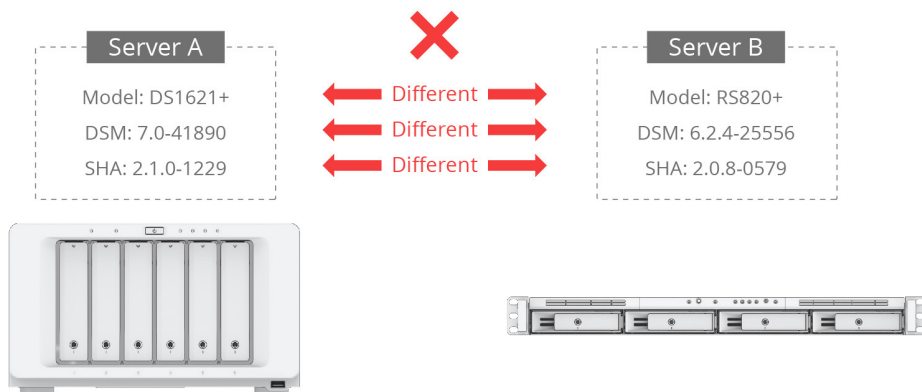
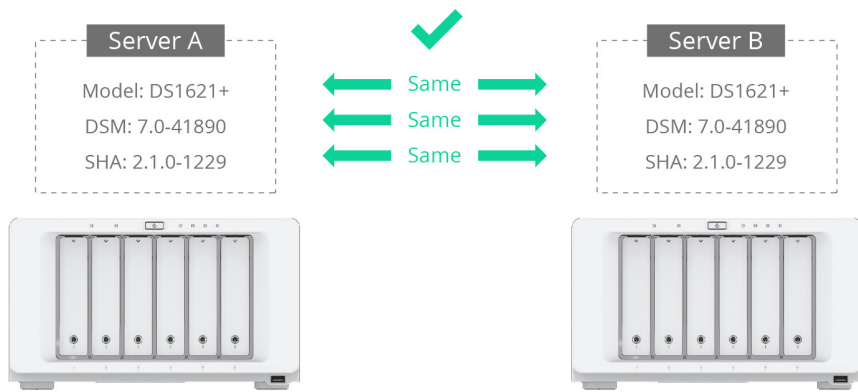
Series	Supported models
FS series	FS6400, FS3600, FS3410, FS3400, FS3017, FS2500, FS2017, FS1018
HD series	HD6500
SA series	SA6400, SA3610, SA3600, SA3410, SA3400
24 series	DS224+
23 series	RS2423RP+, RS2423+, DS923+, DS723+, DS423+, DS1823xs+
22 series	RS822RP+, RS822+, RS422+, DS3622xs+, DS2422+, DS1522+
21 series	RS4021xs+, RS3621xs+, RS3621RPxs, RS2821RP+, RS2421RP+, RS2421+, RS1221RP+, RS1221+, DS1821+, DS1621xs+, DS1621+, DVA3221
20 series	RS820RP+, RS820+, DS1520+, DS920+, DS720+, DS620slim, DS420+, DS220+
19 series	RS1619xs+, RS1219+, DS2419+II, DS2419+, DS1819+, DS1019+
18 series	RS3618xs, RS2818RP+, RS2418RP+, RS2418+, RS818RP+, RS818+, DS3018xs, DS1618+, DS918+, DS718+
17 series	RS18017xs+, RS4017xs+, RS3617xs+, RS3617RPxs, RS3617xs, DS3617xsII, DS3617xs, DS1817+, DS1817, DS1517+, DS1517
16 series	RS18016xs+, RS2416RP+, RS2416+, DS916+, DS716+II, DS716+
15 series	RS815RP+, RS815+, DS3615xs, DS2415+, DS2015xs, DS1815+, DS1515+, DS1515, DS715, DS415+
14 series	RS3614xs+, RS3614RPxs, RS3614xs, RS2414RP+, RS2414+, RS814RP+, RS814+
13 series	RS10613xs+, RS3413xs+, DS2413+, DS1813+, DS1513+, DS713+

2.2 System requirements

In Synology High Availability (SHA), the active server and the passive server are referred to as "hosts".

Models and versions

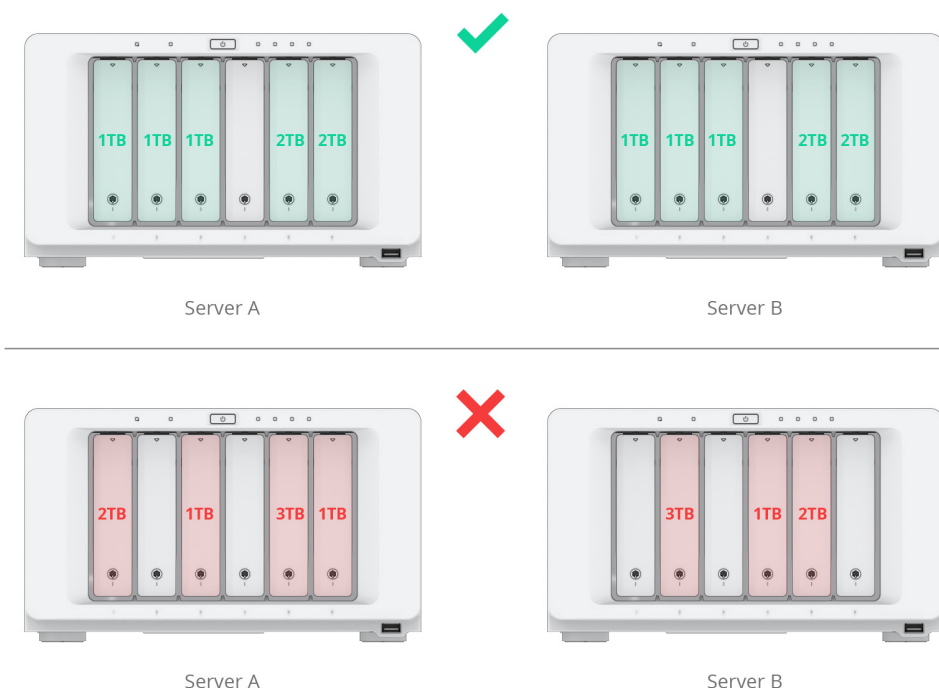
- To create an SHA cluster, two Synology NAS (hosts) with support for SHA are required to act as the active and passive servers.
- We recommend that the models of the two hosts are identical, but you can also use two hosts that are similar models to create a **Hybrid High Availability cluster**. For more information, refer to [this article](#).
- Both hosts need to have the same DSM and Synology High Availability package versions installed. We recommend you to install the latest versions.



Volumes and disks

- We recommend that the drive capacity of both hosts be identical.

- The active and passive servers must have the same number of drives. Additionally, the drives must be placed in the exact same slots on each device. Refer to the image below for example:



The illustration above is for reference only. The number and size of disks in your environment may differ.

- The hosts must not contain any SHR-formatted volumes. Go to **Storage Manager > Volume** to make sure that no SHR volumes exist. If there are SHR volumes, you must remove them before setting up a cluster. For information on how to change your RAID type, refer to [this article](#).
- To create an SSD cache on a SHA cluster, the memory capacity on each host must be identical.

Network environment

Network settings

Make sure that your network settings meet the following requirements; otherwise, you may experience connection errors after performing a failover.

- Both hosts must be assigned static IP addresses for the Cluster connection.
- Both hosts must connect to the same network via the same network interface. For example, if one host connects to subnet A via LAN 1, the other host also must connect to subnet A via LAN 1.

Note: NTP service will be automatically enabled on the active server once the high-availability cluster is created.

Number of network ports

Both hosts must have the same number of LAN ports. If your host is equipped with additional network interface cards, these network cards also count as additional LAN ports.

Note: With a **hybrid high-availability cluster**, you can have a different number of built-in network ports on each host. Refer to [this article](#) for more details.

Connection restrictions

The servers cannot connect to the network via IPv6, PPPoE, or Wi-Fi. Please make sure to **disable** these functions before attempting to create a high-availability cluster.

Heartbeat connection

To ensure that the Heartbeat connection functions properly, the system will automatically confirm and adjust certain connection configurations during cluster setup. Refer to the information below for more details:

- Other than the active and passive servers, there should be no other devices between the Heartbeat connection.
- We highly recommend you to connect the two hosts directly without passing through any switches.
- Make sure to use the fastest network interface on both hosts. For example, if one host is equipped with an additional 10GbE network card, the connection must also use an additional 10GbE network card.
- A Heartbeat connection can transfer Jumbo Frame packets to the other Synology NAS using a specified network interface. If the connection passes through a switch, make sure that the switch also supports Jumbo Frame.
- A Heartbeat connection requires low latency, and its response time should be less than 1 ms.
- The connection speed of the Heartbeat connection must be faster than 50MB/s.
- If the Heartbeat connection bandwidth is insufficient, the upload speed will be affected. Therefore, the bandwidth of the Heartbeat connection must be higher than the total sum of the bandwidths of all cluster connections. We recommend you to choose the fastest network interface, including Link Aggregation or 10G/40G network interface.

Notes:

- With a Heartbeat connection, two IP addresses (e.g., 169.254.1.1 and 169.254.1.2) will be generated for data synchronization between the active and passive server. Make sure that these IP addresses are not occupied by other devices in the network.
- The Heartbeat interface does not support VLAN ID.
- Traffic control on a switch may cause packet loss. To avoid this, make sure that traffic control is set to **auto**.

Link aggregation settings

Both servers must use the same link aggregation settings for the data network and the Heartbeat connection. Once the high-availability cluster has been created, link aggregation settings cannot be modified.

Notes:

- If the Heartbeat connection is direct and does not pass through a switch, select **IEEE 802.3ad Dynamic Link Aggregation** or **Balance XOR** as the Link Aggregation mode. Otherwise, the Heartbeat connection may experience issues.
- If the Heartbeat connection passes through a switch, select **Adaptive Load Balancing or Balance XOR** as the Link Aggregation mode and disable **IEEE 802.3ad (Dynamic) Link Aggregation (LACP, 802.1AX)** on the switch.
- Once a high-availability cluster has been created, the bond selected for the Heartbeat connection will automatically enter “**round-robin**” mode to provide support for auto failover and load balancing. The bond will return to its initial configuration if the cluster is destroyed.

Open vSwitch settings

The status of **Open vSwitch** must be the same on both servers (enabled or disabled). **Open vSwitch** settings can still be modified after the high-availability cluster is created.

2.3 Limitations

Package and software limitations

Once the high-availability cluster is formed, the following packages and features will no longer be available:

- PetaSpace
- Migration Assistant
- The ability to restart/shut down the high-availability cluster in Synology Central Management System (CMS).
- The cluster feature for Virtual Machine Manager
- The cluster feature for Synology MailPlus Server
- **Synology Directory Server** should be configured **after** cluster creation. If you have already installed **Synology Directory Server** prior to cluster creation, refer to the [Create a cluster with a Synology NAS in use](#) section for instructions.

USB device limitations

SHA does not support switchover/failover for USB devices. Any services or applications provided by USB devices may not work properly after switchover/failover.

Note: If you have encrypted shared folders and have chosen a USB device for the **Key store location** in its **Key Manager**, but you want the shared folder to be mounted automatically after switchover/failover, follow the instructions in [this article](#).

Chapter 3: Set Up and Configure an SHA Cluster

3.1 Connect the hosts

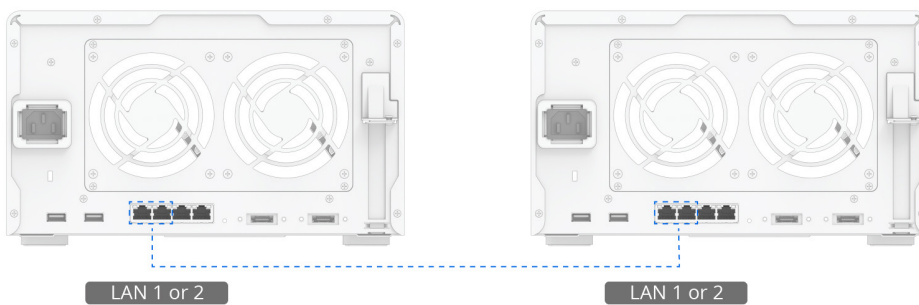
To achieve broader bandwidth for the cluster and Heartbeat connections, we recommend you to set up network interfaces as follows:

- If you have four 1 GbE network interfaces available, set up dual-interface Link Aggregation for the cluster and Heartbeat connections.
- If you have two 10 GbE network interfaces available, we recommend you use one as the cluster connection and the other as the Heartbeat connection.

This section explains how to connect the hosts to create a high-availability cluster.

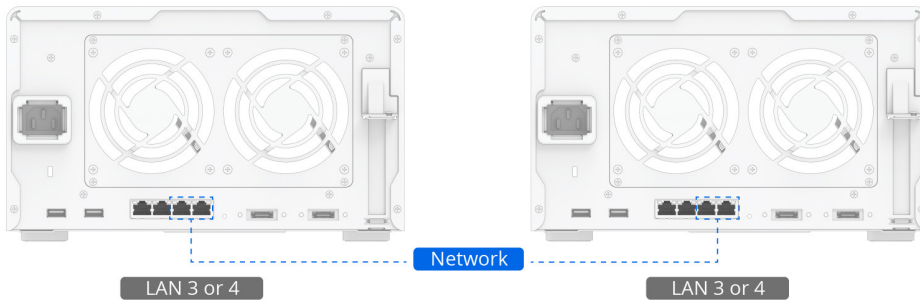
1. Use a network cable to connect the two hosts. This connection will serve as the Heartbeat connection between the two hosts and assist with communicating and copying data from the active (primary) server to the passive (secondary) server. This connection must meet the requirements listed in the [Heartbeat connection](#) section of **Chapter 2: Required environment > System requirements > Network environment**.

Heartbeat Connection



- Use a network cable to connect the two servers to the network through the remaining network interface. Make sure that these connections are functioning properly and belong to the same network. To avoid service interruptions caused by network disconnection, we recommend you to use multiple switches in the network environment.

Cluster Connection



- The hosts are now ready to create a high-availability cluster. Continue on to the following section.

3.2 Create a cluster

Create a cluster with two new Synology NAS

This section provides instructions on how to create a high-availability cluster using two **new** Synology NAS. For example, we will use two brand-new DS1621+ Synology NAS, **Server A** (active) and **Server B** (passive). In this example, the cluster is created before the creation of any volumes. Using two different models (hybrid high-availability cluster) may have an impact on the cluster. Refer to [this article](#) for more details.

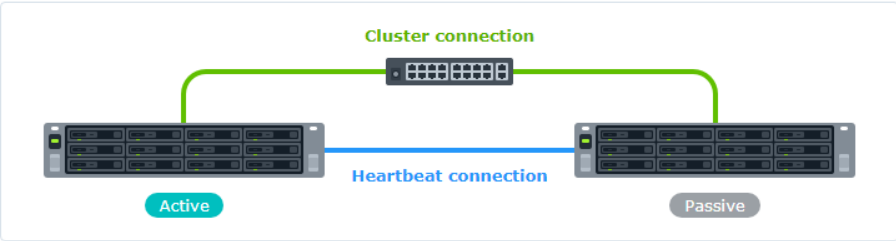
- If needed, go to **Control Panel > Network > General** to edit the **Server name** on each device.
- Go to **Control Panel > Network > Network Interface**, select a network interface for the Heartbeat connection and click **Edit**. Then, select **Get network configuration automatically (DHCP)**. Click **OK** when done.
- The IP address of both servers must belong to the same subnet and must be assigned static IP addresses. To assign a static IP address, select the network interface, click **Edit**, select **Use manual configuration**, and then enter the required information. Refer to the following settings for example:
 - Server A
 - Server name: NAS-A
 - LAN 1: DHCP IP address
 - LAN 2: Static IP address 10.17.196.12

- Server B
 - Server name: NAS-B
 - LAN 1: DHCP IP address
 - LAN 2: Static IP address 10.17.196.13
4. On each server, go to the **Package Center** and install **Synology High Availability**.
 5. Sign in on the host that you want to assume the role of the active server (Server A) with an account belonging to the **administrators** group.
 6. Open **Synology High Availability**.
 7. Click **Create high-availability cluster** to open the cluster creation wizard.

Synology High Availability

High-availability Cluster

Synology High Availability is designed to maximize the service continuity of your Synology NAS.



The high-availability cluster consists of two hosts and two network connections:

- The **active server** is responsible for running all services.
- The **passive server** is placed on standby, only receiving data from the active server in real time. It is not available for user login until it takes over the services once the active server malfunctions.
- The **cluster network connection** is responsible for the primary access to the cluster.
- The **Heartbeat network connection** syncs data between the two hosts.

Create high-availability cluster

8. Read the content of the **Before you start** page carefully. After confirming that the configurations of your two servers meet the requirements, click **Next**.

Synology High Availability
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Before you start

Synology High Availability requires two [compatible Synology NAS](#) and identical system configurations.

1. Make sure the following configurations are identical on both hosts:
 - Storage**
 - The number, capacity and inserted slots of drives i
 - Network**
 - The total number of network interfaces i
 - The network settings
 - DSM version**
2. Make sure both hosts are assigned with at least one set of static IP address as the cluster connection to enable external communication with client devices.
3. Make sure to set up a Heartbeat connection to enable internal communication between the two host servers.
4. Make sure the hostnames of both hosts are different i
5. Refer to the [video tutorial](#) on how to set up a high-availability cluster

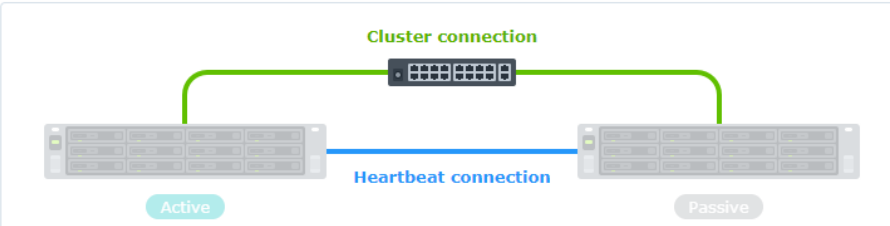
Back
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9. If the recommended network configuration meets your needs, configure your network according to the recommendations.

10. Select the network interfaces for the **Cluster connection** and **Heartbeat connection**. For example, we used **LAN 2** for the cluster interface and **LAN 1** for the Heartbeat interface. Click **Next**.

Synology High Availability
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Set up network interfaces



Both cluster and Heartbeat interfaces are crucial in the high-availability cluster. [Link Aggregation](#) is highly recommended for a better performance.

Cluster interface is the network interface used for accessing the cluster. i

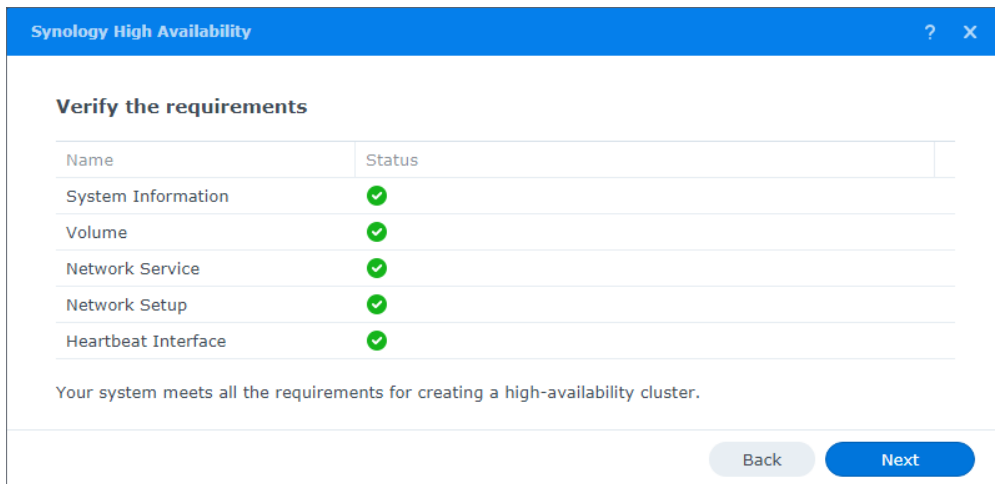
LAN 2 (1 Gbps)
▼

Heartbeat interface is the network interface used for syncing data between the hosts. i

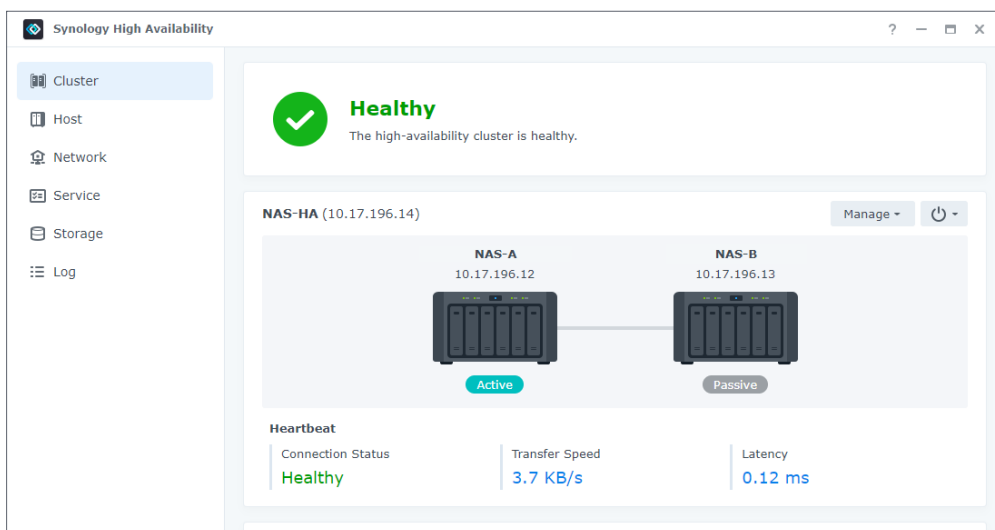
LAN 1 (1 Gbps)
▼

Back
Next

11. Enter the credentials of an account belonging to the **administrators** group for the passive server. Click **Next**.
12. Specify a name for the high-availability cluster and the IP address that you will use to access the cluster. The cluster IP must be in the same subnet as both servers and must be a Static IP. **Do not use a DHCP IP**. Click **Next** when you're done. We used the following name and IP address for example:
 - Cluster Hostname: NAS-HA
 - Cluster Static IP address: 10.17.196.14
13. The wizard will check if your system meets the requirements. Click **Next** once the verification is complete.



14. Confirm your settings and click **Done**.
15. Tick the checkbox after reading the instructions and click **Yes**.
16. The wizard will start creating the high-availability cluster. The time needed varies depending on your environment.
 - During the cluster creation process, **do not** power off the active server or the passive server. If a power failure occurs during the cluster creation process, the cluster will fail to be created.
17. Once the process is complete, you can access the data and services via the new cluster hostname and IP address.



Notes:

- You can use **Synology Assistant** to check the status of the cluster by searching for your Synology NAS. You can only see the cluster Hostname and cluster IP address after the cluster is created.
- You can access shared folders and services via cluster Hostname or cluster IP address.
- Once the cluster is created, the passive server will no longer actively provide services, but will remain in standby mode.
- You can manage the cluster in **Synology High Availability**. Refer to [Chapter 4: Navigate the SHA User Interface](#) for more information.

Create a cluster with a Synology NAS in use

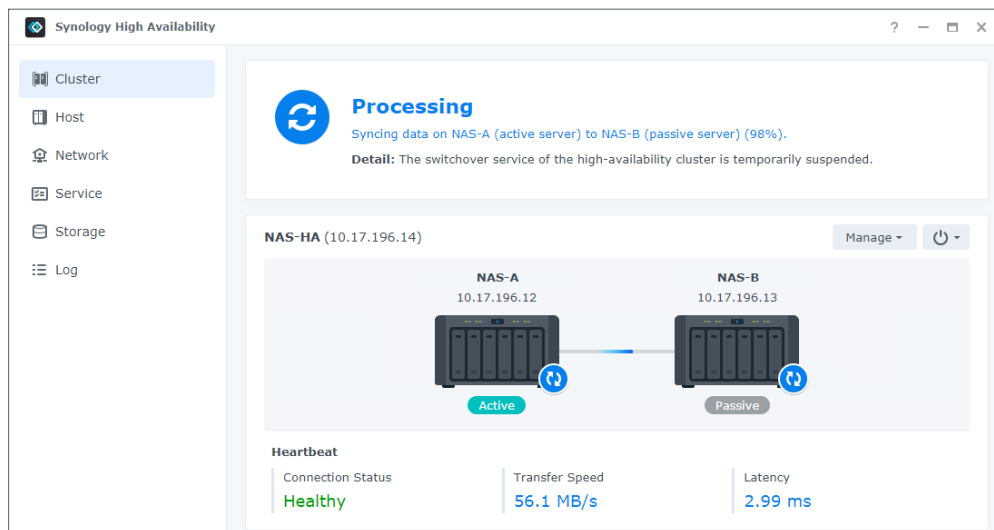
This section explains the process of creating a high-availability cluster with a Synology NAS that you're already using.

For example, you already have a Synology DS1621+. After the device has been used for a period of time, you purchase another brand new DS1621+ to create a high-availability cluster.

The process of creating a high-availability cluster with Synology NAS in use is mostly the same as [creating a cluster with two new Synology NAS](#). However, there are a few key differences to keep in mind:

1. Make sure that the existing environment meets the requirements as defined in [Chapter 2: Required environment](#).
2. Synology High Availability does not support Synology NAS implemented with SHR (Synology Hybrid RAID). If you have already set up SHR on your existing Synology NAS, make sure to remove the SHR storage pool before you proceed to create a high-availability cluster. The RAID type of SHR storage pools cannot be changed directly to other non-SHR RAID types. Follow the steps below to back up the data, create a new storage pool of other RAID types, and then restore the data on the new storage pool.
 - a. Back up the storage pool. Refer to [this article](#) for instructions.
 - b. Go to **Storage Manager** > **Storage** and select the SHR storage pool you want to remove.
 - c. Click **Remove**.
 - d. Create a new storage pool and select a non-SHR RAID type. Refer to the respective help articles for [DSM 7.0](#) and [DSM 6.2](#) for instructions.
 - e. Create one or more new volumes. Refer to the respective help articles for [DSM 7.0](#) and [DSM 6.2](#) for instructions.
 - f. Restore the backed-up data to the newly created storage pool and volume. Refer to [this article](#) for instructions.

3. High-availability clusters must be created before you install **Synology Directory Server**. If you already have **Synology Directory Server** installed, follow the steps below to back up its data and configurations and then uninstall/reinstall the package.
 - a. Back up **Synology Directory Server** using **Hyper Backup**. Refer to the respective articles for [DSM 7.0](#) and [DSM 6.2](#) for more instructions.
 - b. Go to the **Package Center** and uninstall **Synology Directory Server**.
 - c. Create a high-availability cluster.
 - d. Reinstall **Synology Directory Server** and restore the package data and configurations using **Hyper Backup**. Refer to the respective help articles for [DSM 7.0](#) and [DSM 6.2](#) for instructions.
4. Once you've created the cluster, you will be redirected to the main page, and the system will perform the initial synchronization. All data on the active server will be fully synchronized to the passive server.



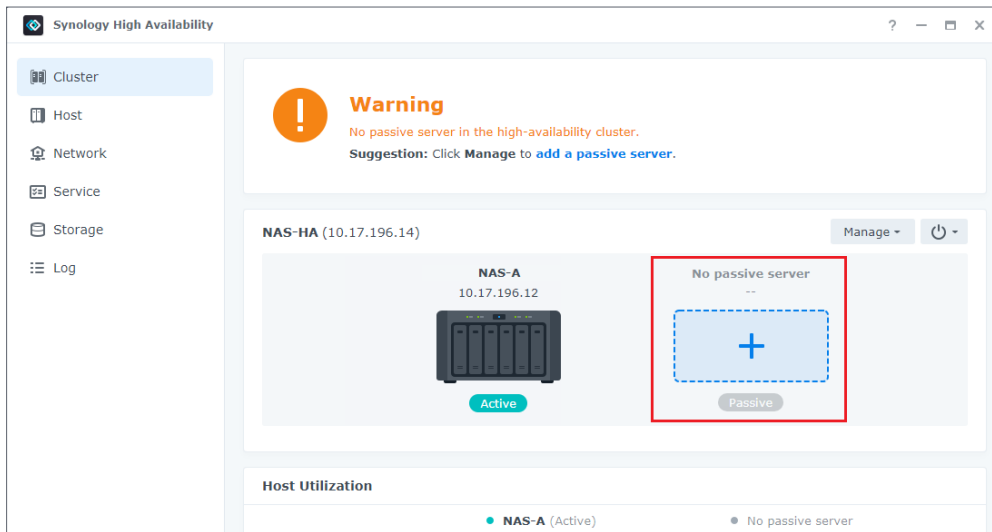
Note: Do not use the original Hostname or IP address of the active server to access your Synology NAS. If services are transferred to another server after a failover, the original active server will become the passive server. If you continue to use the original device's Hostname or IP address, you will not be able to access the device's services in the event of a failover.

Add a passive server to an existing cluster

This section explains the process of adding a passive server to an existing cluster. For example, the active server currently in use and the passive server to be added to the cluster are both DS1621+. These servers will be referred to as Server A and Server B, respectively.

1. Refer to steps 1-4 in [Create a cluster with two new Synology NAS](#) to set up your passive server (Server B).
2. Sign into the active server with an account belonging to the **administrators** group.
3. Open **Synology High Availability**.

4. Click + to add the passive server.



5. Click **Yes** to open the cluster creation wizard. Services on the active server will continue during cluster creation.
6. Read the content of the **Before you start** page carefully. After confirming that the configurations of the two servers meet the requirements, click **Next**.
7. The cluster interface and Heartbeat interface will be based on the settings of the existing active server. If you want to change the cluster or Heartbeat interface, you will have to remove the high-availability cluster, reconfigure the network settings of the two hosts, and then re-create the high-availability cluster. Click **Next**.
8. Enter the credentials of an account belonging to the administrators group on the passive server. Click **Next**.
9. The wizard will check if your system meets the requirements. Click **Next** when complete.
10. Confirm your settings and click **Done**.
11. Tick the checkbox after reading the instructions and click **Yes**.
12. The wizard will start creating the high-availability cluster. The time needed varies depending on your environment.
 - During the process of adding the passive server, **do not** power off the active server or the passive server. If a power failure occurs during the cluster creation process, the cluster will fail to be created.
13. Once completed, you will be redirected to the main page. The cluster status will show that the data is being synchronized.

3.3 Tests and simulations

SHA's **failover** mechanism is the key to minimizing service interruption resulted from system malfunctions. To ensure your disaster recovery plan is robust and tested, you can simulate disaster scenarios to assess your SHA setup.

Before you start

- Make sure you have backed up any important data. Your devices may get disconnected while running tests, which could result in data loss.
- Sign in to DSM using the **cluster** IP address. We do not recommend using the active server IP address to sign in, and the passive server IP address is unavailable.
- If a problem occurs during the testing process that causes the cluster or a server to be removed, you can sign in to DSM again using the **active server's IP address**.

Manual switchover and automatic failover

A **switchover** can be manually triggered for system maintenance with little service interruption. An **auto-failover** can be triggered by various events. When certain errors occur (such as network unavailability, software error, hard disk damage, RAID damage, etc.), the system can automatically initiate a failover of services from the active to the passive server to maximize availability.

To trigger a switchover:

On the **Cluster** page, confirm that the status of the cluster is **Healthy**, and then click **Manage** > **Switchover**. The servers in the cluster should exchange roles: the original active server will assume the role of the passive server, while the original passive server will take over the provision of services to become the active server.

To trigger an auto-failover:

On the **Cluster** page, confirm that the status of the cluster is **Healthy**, and then recreate one of the following events to induce an error and trigger auto-failover:

- Remove the power source from the active server to simulate a power outage.
- Disconnect the active server from the **Cluster connection** to simulate network failure. **Do not** disconnect the Heartbeat connection.

Refer to [this article](#) for step-by-step instructions on how to manually initiate a switchover, trigger an auto-failover, or simulate connection problems.

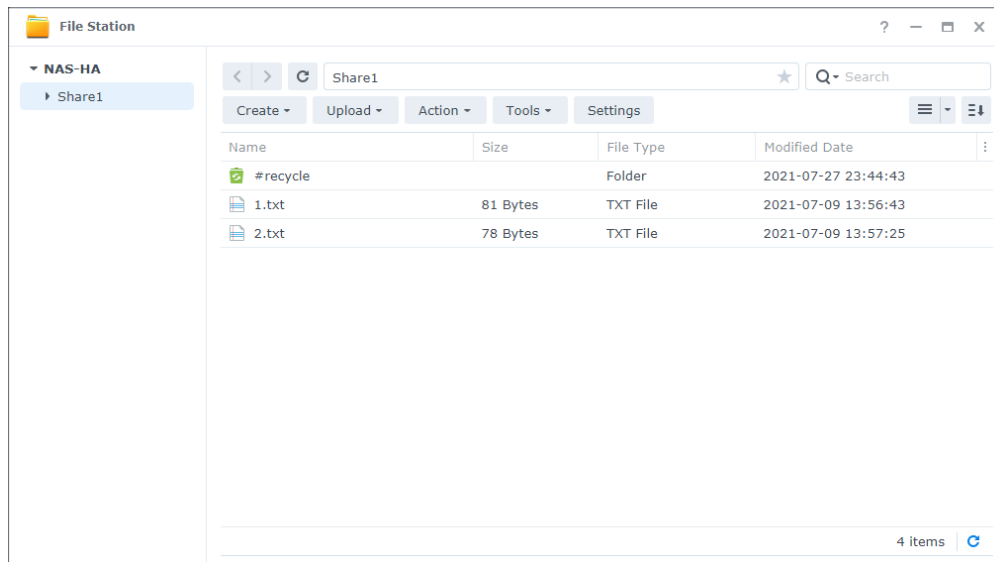
Split-brain error simulation and solutions

A **split-brain** error occurs when there is an interrupted connection between the Heartbeat and Cluster connections. Both the active and passive servers will try to assume the role of the active server and result in a “split-brain”. This may lead to data inconsistencies on the servers and must be resolved as soon as possible. For more information on split-brain, you can refer to the [Split-brain](#) section of **Chapter 4: Navigate the SHA User Interface**.

This section demonstrates how to test and solve the split-brain error. Since the testing process will affect the status of the cluster, we recommend you to do this when the cluster is not providing services.

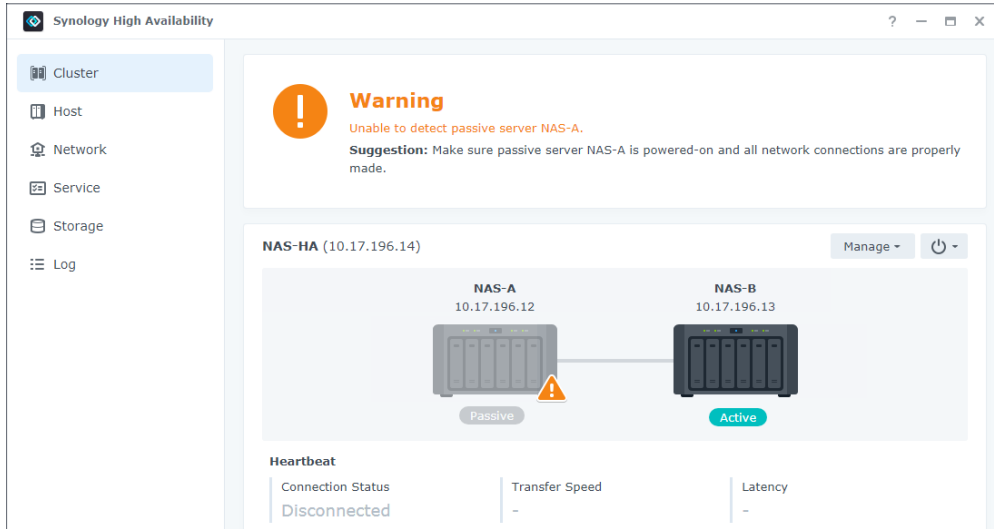
Enter Safe Mode (Split-brain Mode)

1. Go to **Control Panel > Shared Folder** to create a shared folder (**Share1**). Upload some test files (**1.txt** and **2.txt**) to **Share1** through **File Station**.

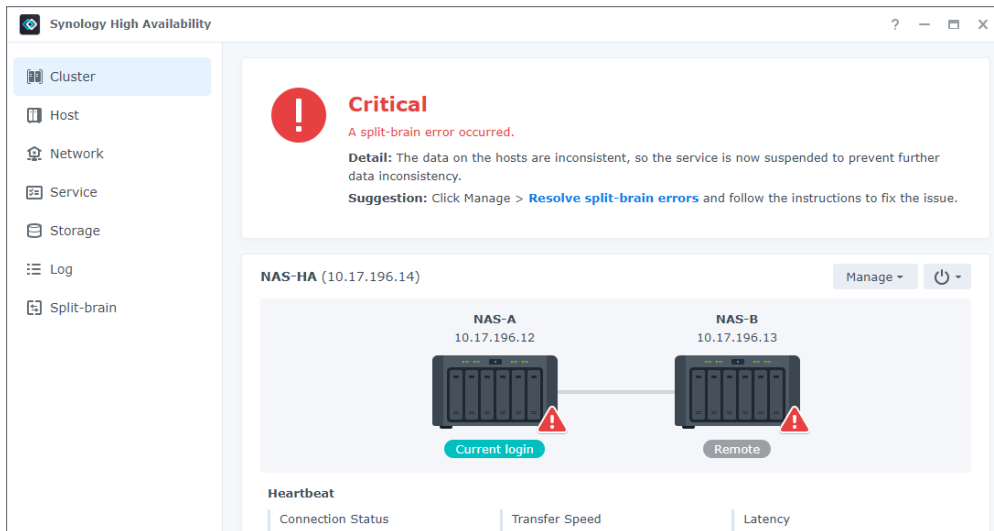


2. Quickly unplug all cables from the active server (NAS-A). Services will be temporarily unavailable.
3. The system will notice that the active server (NAS-A) is unavailable and perform auto-failover to the passive server (NAS-B). The passive server (NAS-B) will become the active server and start providing services.

4. Sign in to NAS-B using the high-availability cluster IP address. The high-availability cluster status will show that NAS-B is the active server and NAS-A is **undetectable**. In this case, NAS-A and NAS-B are both acting as the active server.¹



5. Make some changes to the data in the shared folder **Share1** of NAS-B to create differences (data inconsistencies) between the files on each server.
6. After about ten minutes, reconnect NAS-A's Heartbeat interface and the primary cluster interface network cable. Once NAS-A and NAS-B are reconnected, the system will start to consolidate the data. When the system discovers that the data is inconsistent (split-brain error), the High Availability cluster will enter Safe Mode.



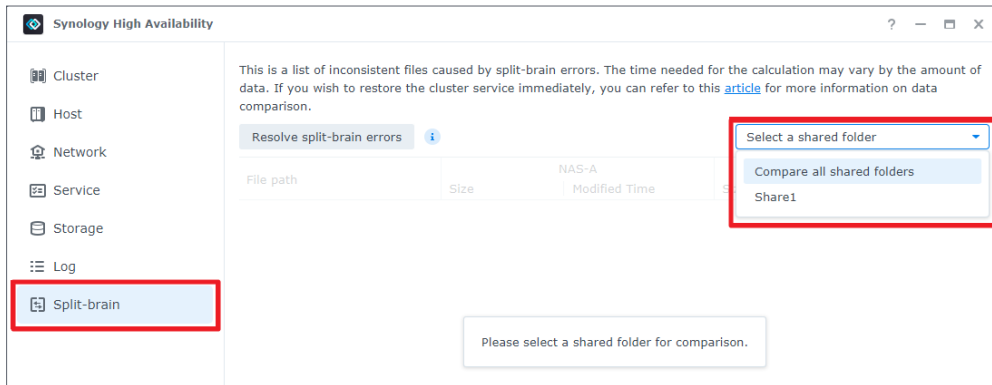
7. After waiting some time, sign in to DSM (NAS-A) via one of the server's IP address. You will see that the high-availability cluster status displays **Split-brain error**.

Notes:

1. If you do not see the split-brain error status, it means that the simulation was unsuccessful. Plug your devices back in and follow the steps from the beginning of this section to try again.

Solve the split-brain error

1. Sign in to DSM (NAS-A) via the cluster IP address.
2. Services on both the servers and the IP addresses of the high-availability cluster will be unavailable until the split-brain error is resolved.
3. A new tab named **Split-brain** will appear on the left panel. On this tab, the differences between the files in the shared folders on the two servers and the time that the servers became the active servers will be shown. Select the shared folder to compare from the drop-down menu on the right.



4. **File Station** will be in **read-only** mode, so you will still be able to download or view the files.
5. On the **Cluster** tab, you can either shut down the cluster or resolve the split-brain error by clicking the **Manage** button. There are two possible options. Refer to the **Split-brain** section of **Chapter 4: Navigate the SHA User Interface** for more details.
6. Select **Keep data from only one of the servers** and select **NAS-B** as the **new active server**.
7. Finish applying the settings. After a few minutes, you will be redirected to the **Cluster** page and the cluster status will show that the data is being synchronized.
8. You can go to **File Station** to check again if the data of **Share1** contains the most recent data after the synchronization is complete.

3.4 Set up storage for SHA

Before you start

This user guide uses the following examples, which are based on SHA's minimum requirements:

- **HDD:** 2
- **Storage pool:** RAID-1
- **Storage space / file system:** Btrfs

Notes:

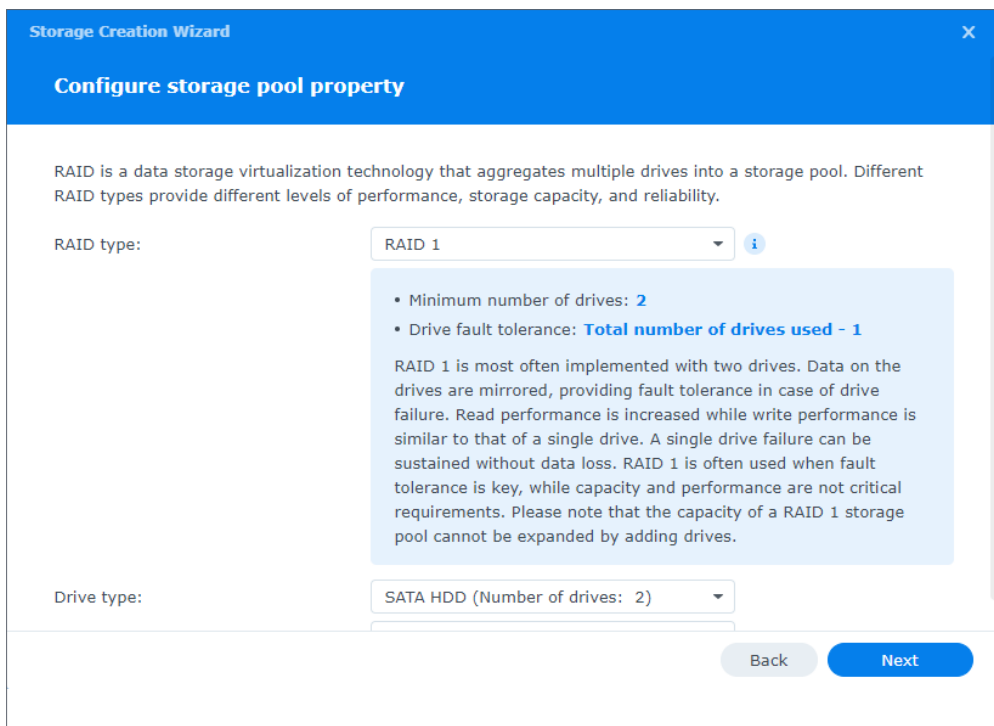
- Only RAID 1, RAID 5, RAID 6, RAID 10, RAID F1 and BASIC are supported.
- Please install a brand new hard disk, as a used hard disk may encounter unexpected issues.
- The storage settings will be synchronized on both the active and passive servers so that the settings on both servers will be the same.

Storage settings

1. Sign in to **DSM** using the cluster IP address and go to **Storage Manager**.
2. Go to **Storage** and click **Create Now > Start**.



3. Configure the storage pool properties and select **RAID 1** for the RAID Type.



4. Select and deploy the two drives and click **Next**.

Storage Creation Wizard [X]

Select drives

Please select at least 2 drives to create a storage pool with the RAID type of **RAID 1**.

<input checked="" type="checkbox"/>	Drive	Model	Drive type	Drive Size
<input checked="" type="checkbox"/>	Drive 1	WD5000AAKX-00ERM...	SATA / HDD	465.8 GB
<input checked="" type="checkbox"/>	Drive 2	WD5000AAKX-00ERM...	SATA / HDD	465.8 GB

Estimated capacity: **461.2 GB**

5. Select **Perform drive check** and click **Next**.

Storage Creation Wizard [X]

Drive check

Performing a drive check can automatically reconfigure a drive, thereby reducing the risk of data access errors.

Perform drive check
Drive check may take a longer time because it is performed simultaneously during storage pool creation.

Skip drive check
Drive bad sectors will be reconfigured only when the bad sectors are being accessed.

6. Allocate the capacity size and click **Next**.

7. Select **Btrfs** for the file system and click **Next**. For more information on file systems, refer to [this article](#).

Storage Creation Wizard [X]

Select a file system

Btrfs (recommended)
The Btrfs file system supports advanced features including shared folder snapshots and replication, shared folder quota, and advanced data integrity protection.

ext4
The ext4 file system is widely used in the Linux operating system and can be easily migrated to DiskStation running earlier versions of DSM.

[More information about choosing file systems](#)

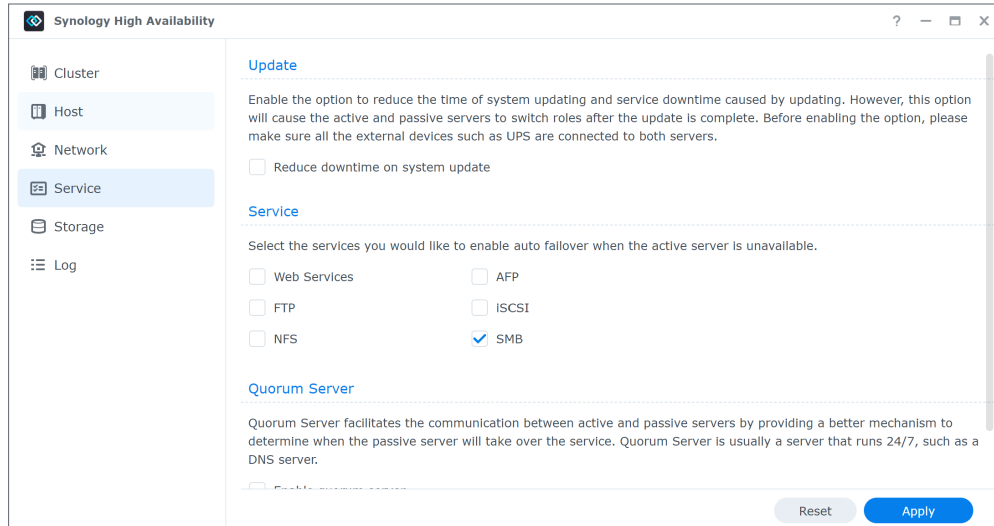
8. Confirm your settings and click **Apply**.

9. Click **OK** to complete the storage pool creation.

10. If you want to create a second storage pool or volume, click **Create**.

3.5 Monitored services

Select the services that you want to monitor with **Synology High Availability**. If a monitored service fails on the active server, the system will fail over to the passive server as long as it is operating normally.



3.6 Quorum server

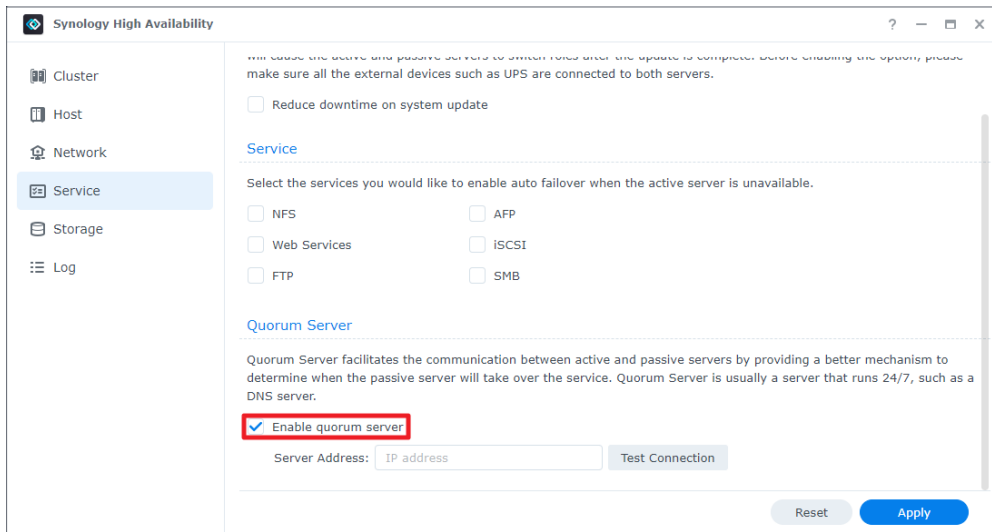
Quorum servers can help reduce the possibility of split-brain errors. On the **Service** page, you can assign another server as the **quorum server**, which will constantly connect to both the active and passive servers. A gateway server or a DNS server would both be appropriate examples for the quorum server, since they are able to connect to both the active and passive servers. The quorum server is meant to provide Ping services only, so no applications are required to be installed.

A quorum server will allow for the following situations:

- If the passive server cannot connect to both the active and quorum servers, failover will not be performed in order to prevent split-brain errors.
- If the active server cannot connect to the quorum server while the passive server can, switchover will be triggered in order to ensure better availability.

Set up a quorum server

1. Go to **Synology High Availability > Service**.
2. Tick **Enable quorum server** and enter the IP address of the quorum server.



3. Make sure that the quorum server is always connected to both active and passive servers.
4. Click **Test Connection** to make sure that the quorum server is connected properly.
5. Click **Apply**.

3.7 UPS

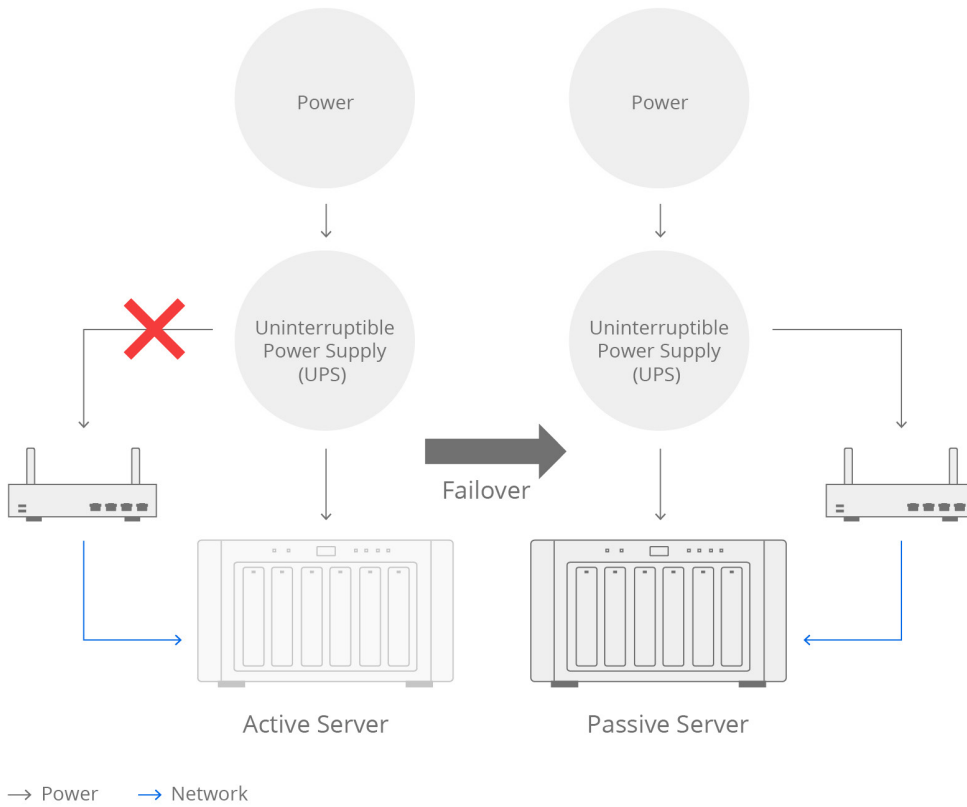
SHA clusters allow you to set up an **Uninterruptible Power Supply (UPS)** for each device. If there is a power failure, the active and passive servers will enter **Safe Mode** to reduce power consumption and prevent data loss. You can also use different types of UPS for each server, depending on your needs.

The following three types of UPS are supported by SHA:

- SNMP UPS
- USB UPS
- Synology UPS server

SHA UPS behavior

We recommend using different power supplies for each server in the cluster to set up UPS. You can choose a suitable type of UPS according to the equipment’s requirements. If something happens to the power supply, UPS will help prevent the Synology NAS from powering off unexpectedly.



If the **active** server experiences issues with its power supply, the active server will enter **Safe Mode** once the specified waiting period has been reached. The system will then switch services over to the passive server so that they can run without interruption.

If the **passive** server experiences issues with its power supply, the passive server will enter **Safe Mode** alone and not affect services on the active server. Once the power issue is resolved, the passive server will automatically restart and return to the cluster to continue synchronizing data.

If your environment does not allow for different power supply sources or the connection of different UPS, you can connect any type of UPS to one of the servers. For example, connect either the active server or the passive server to the UPS. If a power supply interruption occurs, the server connected to the UPS will receive the notification of power failure and forward the notification to the server that is not connected to the UPS. The two servers will then both enter Safe Mode until power is recovered. Then, they will automatically restart to continue providing high-availability services.

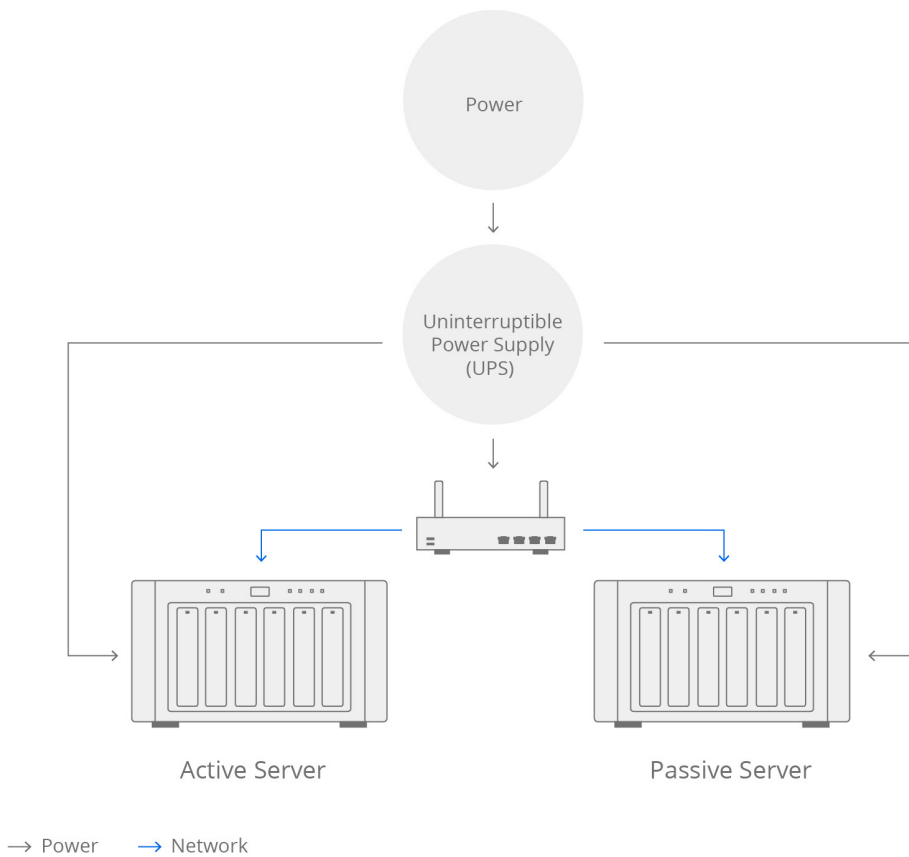
SHA UPS configurations

If the two servers are connected to the same network switch

Connect the server to the same power source as the network switch and set up any type of UPS (USB UPS / SNMP UPS / Synology UPS server) as the power source protection.

If you use USB UPS, connect the communication terminal to one of the servers. The server will serve as the main receiving end-point. In this case, if a power failure occurs, the entire cluster will enter Safe Mode.

If you use a SNMP UPS or Synology UPS server, you can connect one or both of the servers to the same UPS. In this case, if a power failure occurs, both servers will enter Safe Mode.

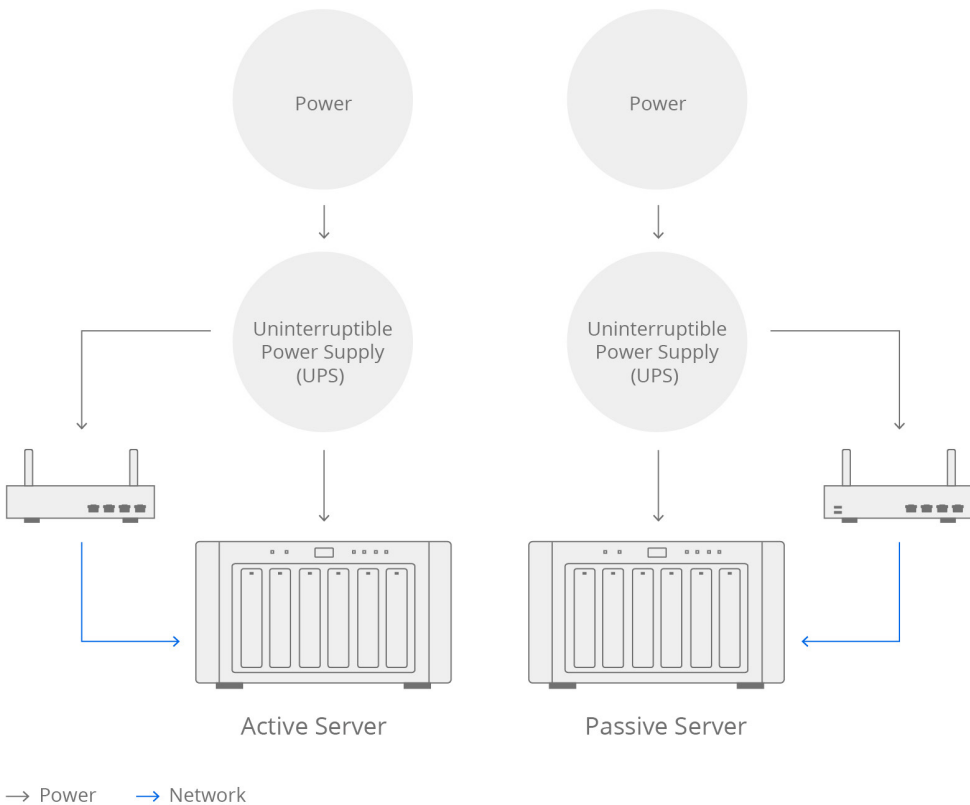


If the two servers can be connected to different power sources and network switches

We recommend you to connect the active server and the passive server to the power supply of the corresponding network switch. You can set up one or two UPS types (USB UPS / SNMP UPS / Synology UPS server).

If you use USB UPS, connect the communication interfaces of the two UPS to the active server and the passive server, respectively.

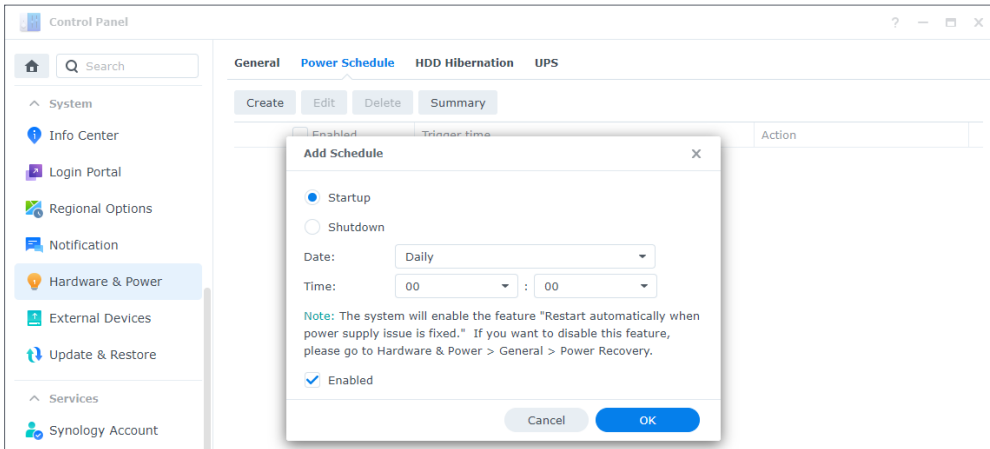
If you use SNMP UPS or Synology UPS server, you will need to set up a corresponding UPS IP address for each server. In this case, if there is a problem with one of the power supplies, the connected server will enter Safe Mode. If the power supply is that of the active server, services will fail over to the passive server.



Note: For more information on UPS configuration, refer to the respective help articles for [DSM 7.0](#) and [DSM 6.2](#).

3.8 Power schedule

At **Control Panel > Hardware & Power > Power Schedule**, you can click **Create** to add a schedule for the system to automatically start up or shut down.



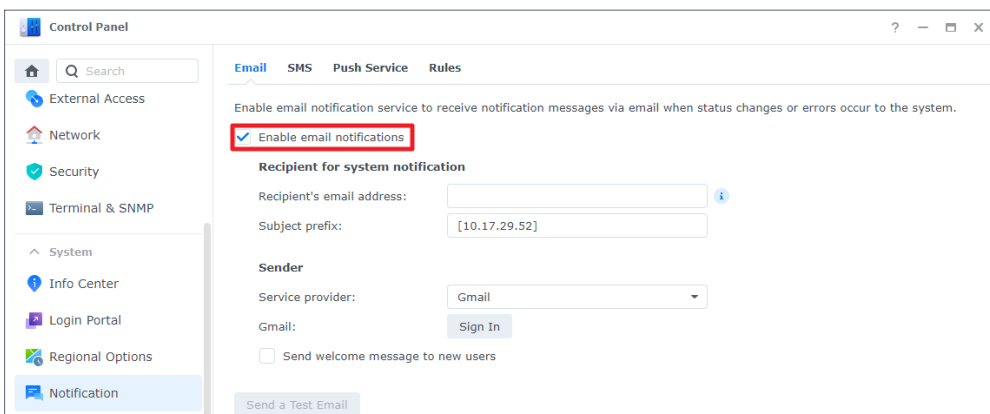
Note: Make sure that the power supply of the two servers is normal when the servers are scheduled to start up. When the two servers start up, the original role settings (active/passive) will remain the same. If a power failure occurs on the active server and only the passive server is powered on, the passive server will not take over services to avoid a Split-brain error.

3.9 System notifications

If a major event or problem occurs in the system, you may want to be notified as soon as possible. This section provides instructions for notifications settings.

Enable email notifications

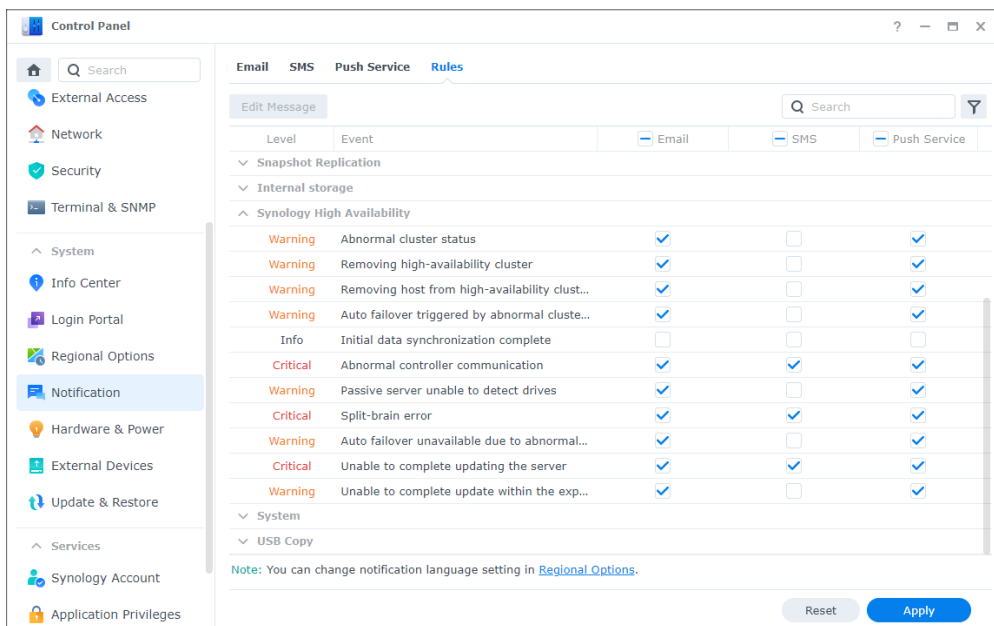
1. Go to **Control Panel > Notification > Email**.
2. Tick **Enable email notifications**.



3. Enter one or more email addresses in the **Recipient's email address** field. System notifications will be sent to the addresses entered here. Ten addresses are allowed. You can separate multiple addresses with a semi-colon (;).
4. If necessary, add a subject prefix in the **Subject prefix** field. This prefix will be added to the subject of each message sent by your Synology NAS, helping you identify and filter messages.
5. Refer to the respective help articles for [DSM 7.0](#) and [DSM 6.2](#) for more information.

Notification content settings

At **Control Panel > Notification > Rules**, you can select which types of events will trigger the system to send notification messages, as well as the medium (e-mail, SMS, mobile devices, DSM, and web browsers) through which you receive messages.



Chapter 4: Navigate the SHA User Interface

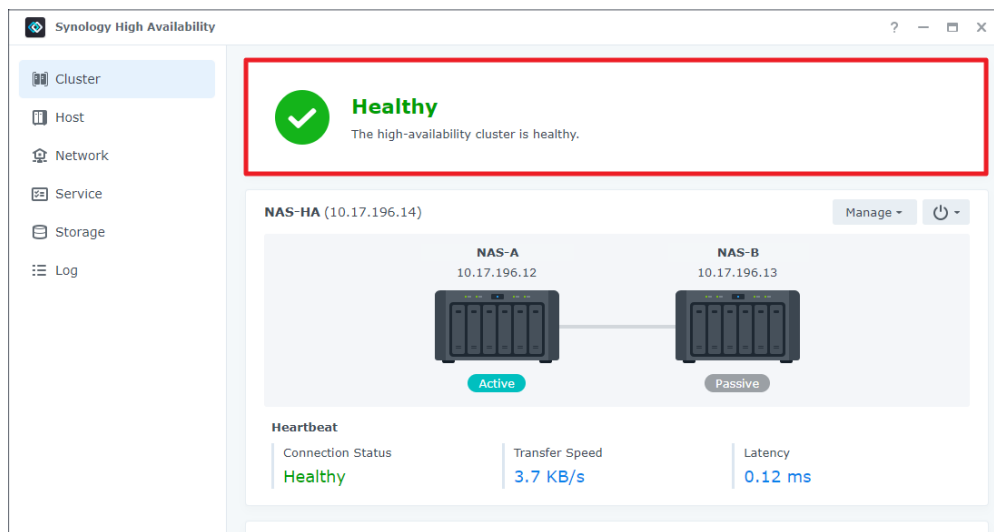
To learn more about how to navigate the SHA User Interface, you can refer to the respective help articles for [DSM 7.0](#) and [DSM 6.2](#).

4.1 Cluster

The **Cluster** page provides an overview of your SHA cluster. This page is divided into four sections, offering you details on the cluster status, host utilization, and recent system logs. You can also manage the cluster on this page.

Refer to the respective help articles for [DSM 7.0](#) and [DSM 6.2](#) for more details.

High-availability cluster status

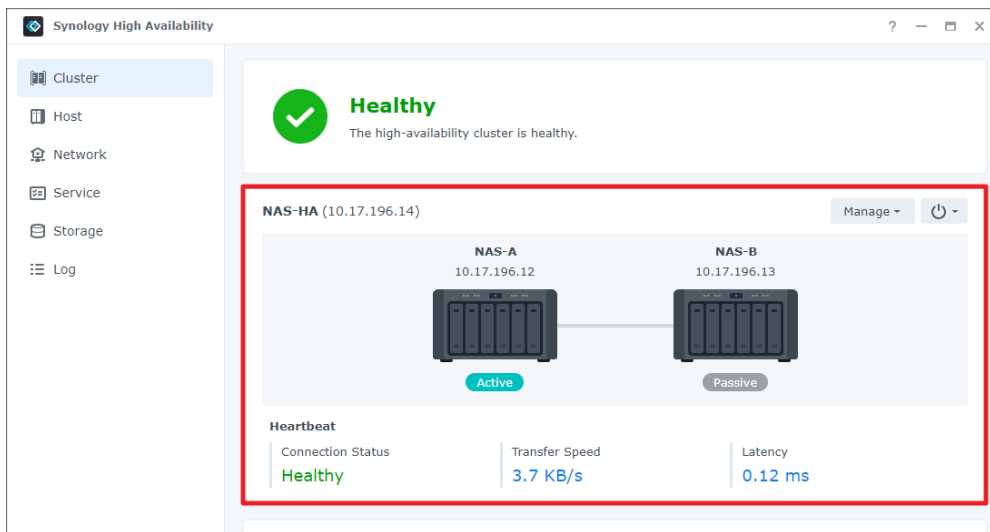


The top of the page displays the overall status of the high-availability cluster. You can check if the system is running as expected. Some solutions will be provided if there are system abnormalities.

Status	Description
Healthy	The cluster is healthy. Data is being replicated between the hosts. The auto-failover feature is available.
Processing	The system is processing certain operations, such as data replication, volume repair/expansion, or others. The auto-failover feature is not available.
Updating	The system or the package is updating. The auto-failover feature is not available.
Warning	The system has detected errors in the cluster, but the services may still be running. The auto-failover function may be unavailable. Any errors must be addressed as soon as possible.
Critical	The system has detected one or more critical errors in the cluster, and the hosts are not able to run the usual services. All errors must be addressed as soon as possible. The system may encounter a split-brain error , where it may fail to determine which of the hosts is the active server. In this case, all services will be suspended to avoid further data inconsistencies until the issues are resolved.

To troubleshoot abnormal high availability cluster statuses (Warning or Critical), refer to **Chapter 2: SHA Troubleshooting** in the [Synology High Availability \(SHA\) Troubleshooting Guide](#).

High-availability cluster information



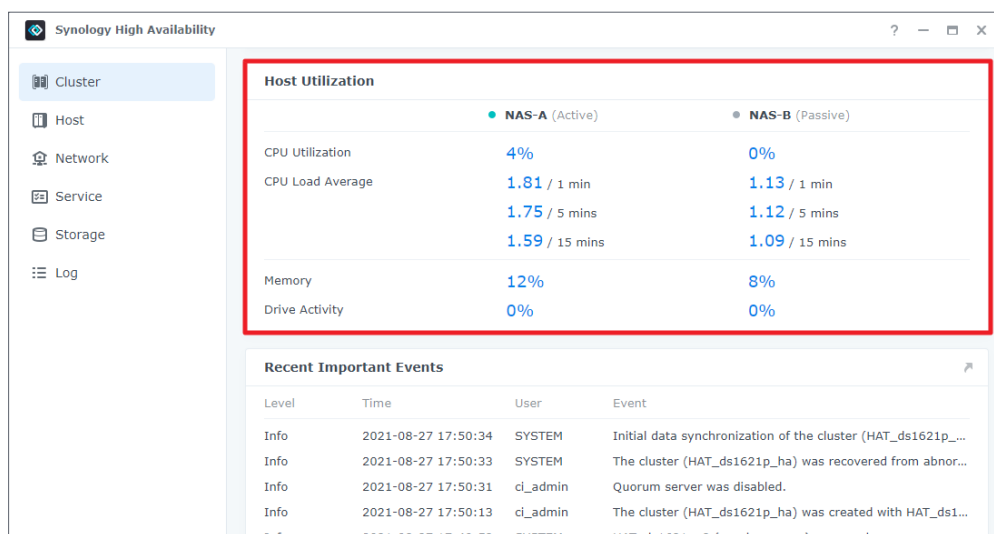
This section provides basic information on the **Cluster connection** with a simulated illustration. A warning/critical icon will be displayed if there is a system error. You can also view the Heartbeat connection status, the transfer speed, and the latency in this section.

If certain events or errors occur on either of the servers, a beeping sound will alert you. You can click **Beep Off** to turn off the sound. Please note that the beeping sound will reoccur at restart if the issue is not resolved. Click the **power button** to shut down or restart the cluster. You can also click **Manage** to perform updates, switchovers, add or remove the passive server, or remove the cluster entirely.

Notes:

- Once a high-availability cluster is removed, you will have to fully re-synchronize your data to create a new one.
- If you shut down or remove the passive server, the auto-failover function will be unavailable.

Host Utilization

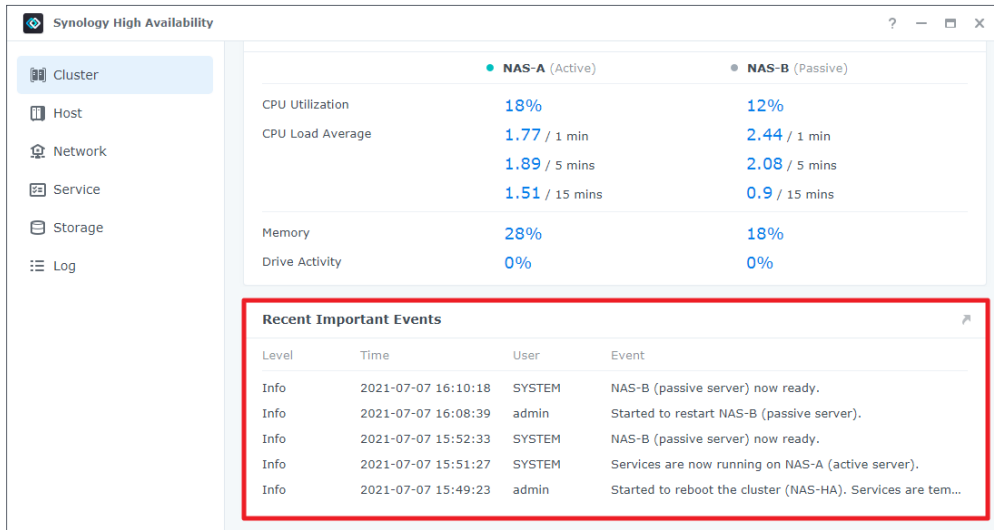


In this grid, you can monitor the resource usage of the two hosts. The resource usage of the hosts are correlated, however, the statistics of the active server are usually be higher since it is responsible for running all services.

In this section, you can check the following:

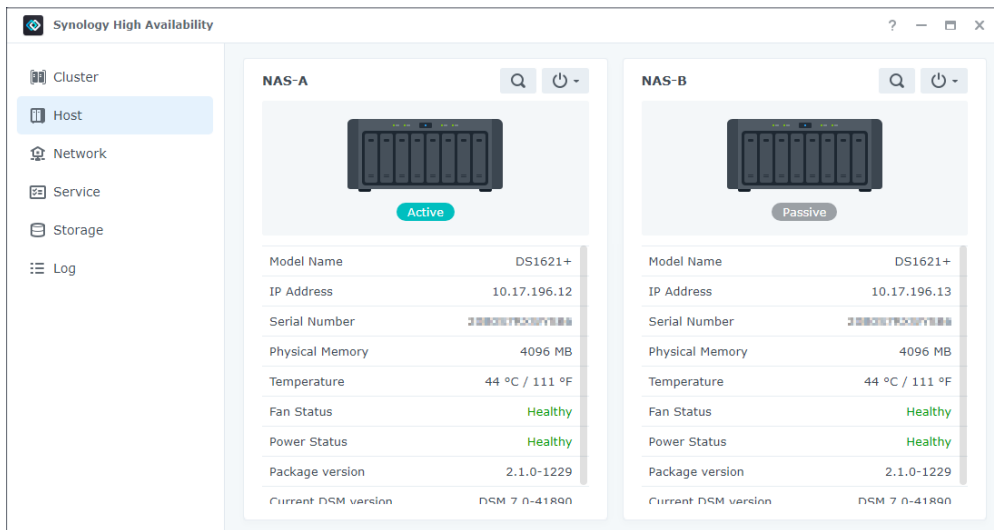
- **CPU utilization and load average:** To ensure that the system reserves sufficient resources to monitor the cluster, we recommend that the CPU utilization is lower than 80%.
- **Memory usage:** This indicates how much memory has been occupied. We recommend that 20% of the memory is reserved for system-related monitoring.
- **Drive activity:** This information indicates if the drives are running data read/write activities.

Recent Important Events



The five most recent logs will be listed in this section for you catch up with the latest cluster activities. This information includes the date and time, the user, and the event details. This section is useful for when something happens and you would like to see the most recent activities in the cluster. For complete log records, refer to the **Log** tab.

4.2 Host



The **Host** page displays crucial information about the two hosts. This includes the **Find** button — for locating your NAS via a beeping sound and LED light — and the **Power** buttons for each server. This page also shows each host's information, along with their hardware statuses and software versions. Refer to the respective help articles for [DSM 7.0](#) and [DSM 6.2](#) for more details.

4.3 Network

This page contains two tabs, one that provides the network settings of the high-availability cluster and the other of the hosts. You can get an overview of the network interface usage and create or remove additional Cluster connections if necessary.

Refer to the respective help articles for [DSM 7.0](#) and [DSM 6.2](#) for more details.

HA Cluster

Interface	Speed	IP address	Connection	Details
LAN 1	1 Gbps	-	Connected	Heartbeat interface
LAN 2	1 Gbps	10.17.196.14	Connected	Primary cluster interface
LAN 3	-	-	Disconnected	
LAN 4	-	-	Disconnected	

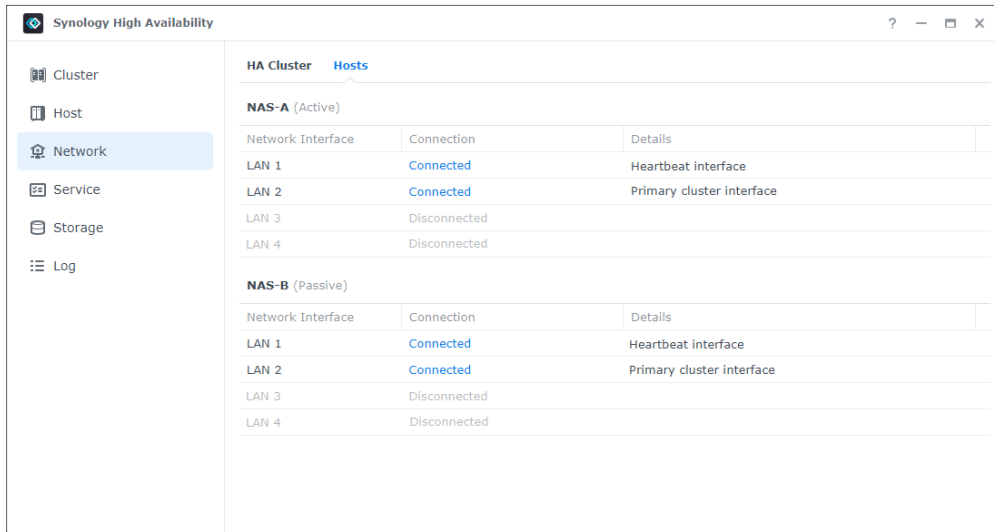
Under **General**, you can view or edit the hostname of the cluster.

All network connections, regardless of whether they are used or unused, are displayed in the **Network** field. At least one of the cluster interfaces is displayed here. Click the **Manage Network Interface** button to configure the cluster's IP or network settings. The hosts' IP addresses and network settings can be configured by clicking **Manage Network Interface** > **Configure Server Network**. The Heartbeat interface listed is the only Heartbeat connection allowed in the cluster and cannot be managed.

Notes:

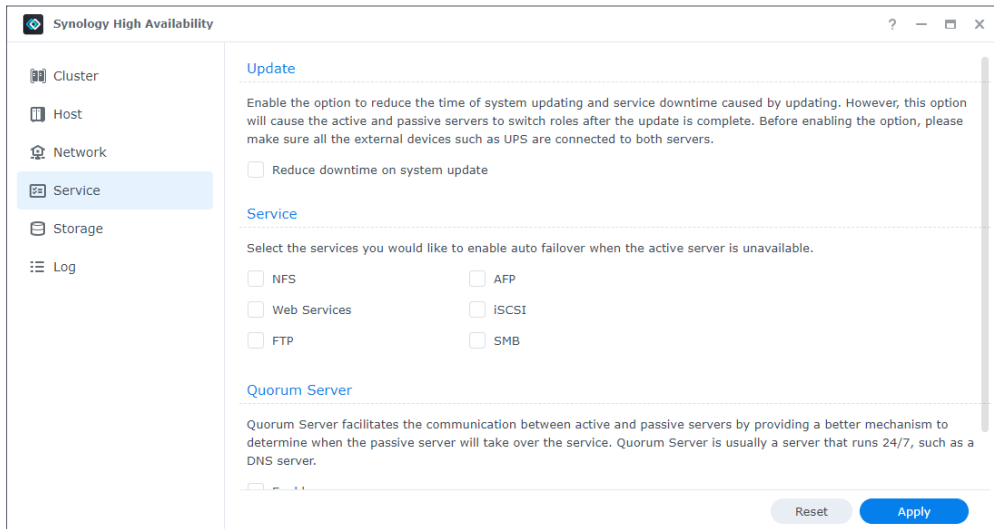
- Make sure that all Ethernet cables are properly connected.
- If you are unable to configure the network interface settings, please go to the **Cluster** page first to resolve any system abnormalities.

Hosts



This tab shows the statuses and details of the network interfaces on the active and the passive servers.

4.4 Service



This page allows you to monitor certain services. If a monitored service fails on the active server, the system will fail over to the passive server as long as the passive server is operating normally.

Supported services

- Windows File Service
- iSCSI Target
- FTP
- Mac File Service
- NFS Service
- Synology Directory Server
- Web Services

Refer to the respective help articles for [DSM 7.0](#) and [DSM 6.2](#) for more details.

Quorum Server

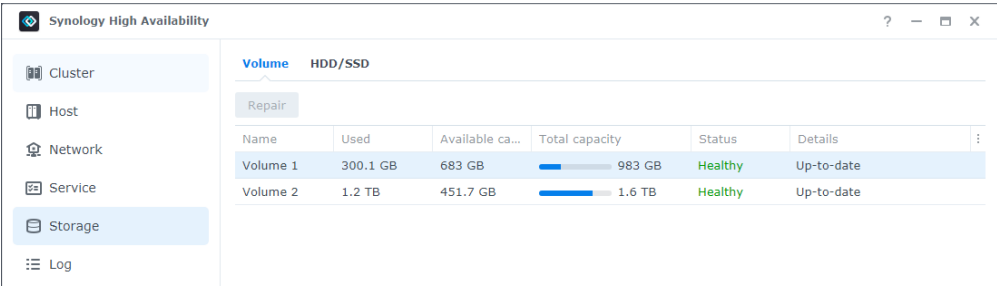
Quorum servers can help reduce the possibility of split-brain errors. Refer to the [Quorum Server](#) section of [Chapter 3: Set Up and Configure an SHA Cluster](#) for more information and setup instructions.

4.5 Storage

This page details the statuses of the storage volumes on the active and passive servers in the high-availability cluster. Refer to the respective help articles for [DSM 7.0](#) and [DSM 6.2](#) for more details.

Because the capacity and configuration of volumes on the active and passive servers are recommended to be identical, the volumes on the two servers are usually displayed together in single units. Therefore, you must go to this page to view both the active and passive servers' volume statuses. However, the volumes on the **active** server are only viewable in **Storage Manager** when accessing a high-availability cluster.

Volume



The screenshot shows the 'Synology High Availability' interface with a sidebar on the left containing 'Cluster', 'Host', 'Network', 'Service', 'Storage', and 'Log'. The main content area is titled 'Volume HDD/SSD' and includes a 'Repair' button. Below the button is a table with the following data:

Name	Used	Available ca...	Total capacity	Status	Details
Volume 1	300.1 GB	683 GB	983 GB	Healthy	Up-to-date
Volume 2	1.2 TB	451.7 GB	1.6 TB	Healthy	Up-to-date

This page contains information on the names, used capacity, available space, total capacity, status, and other details about the volumes and iSCSI LUNs in the cluster.

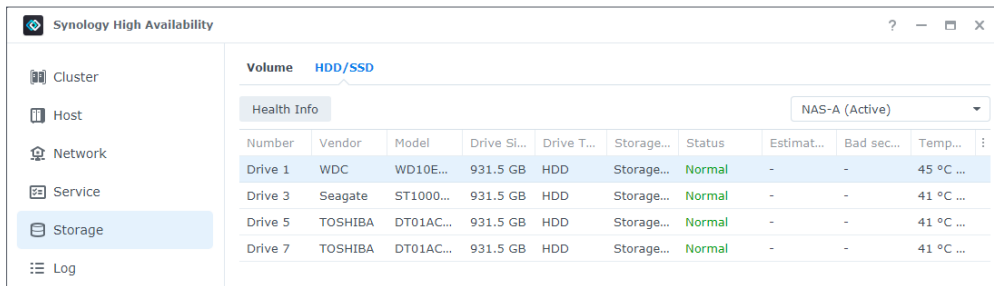
Chapter 4: Navigate the SHA User Interface

The following situations may require you to repair a malfunctioning volume or iSCSI LUN:

- If a volume on one of the servers has crashed
- If the passive server is offline
- If a file system error occurs

You can use the **Repair** button in the case that you replaced a drive or if there is a file system error. For more details on solving these issues, refer to the respective help articles for [DSM 7.0](#) and [DSM 6.2](#).

HDD/SSD

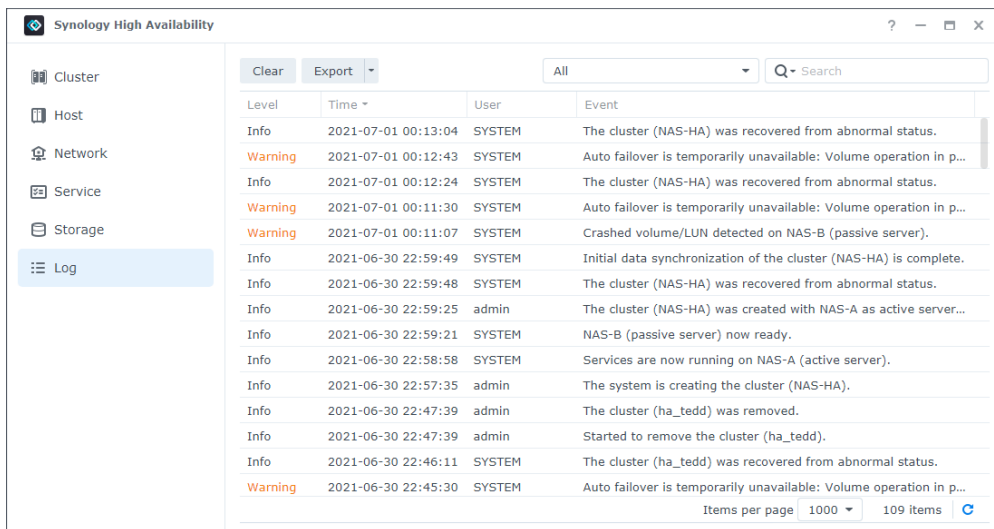


Number	Vendor	Model	Drive Si...	Drive T...	Storage...	Status	Estimat...	Bad sec...	Temp...
Drive 1	WDC	WD10E...	931.5 GB	HDD	Storage...	Normal	-	-	45 °C ...
Drive 3	Seagate	ST1000...	931.5 GB	HDD	Storage...	Normal	-	-	41 °C ...
Drive 5	TOSHIBA	DT01AC...	931.5 GB	HDD	Storage...	Normal	-	-	41 °C ...
Drive 7	TOSHIBA	DT01AC...	931.5 GB	HDD	Storage...	Normal	-	-	41 °C ...

This tab provides the status and details on the drives. You can select a drive and click **Health Info** to view its statistics, run a **S.M.A.R.T.** test, and check its history.

Note: Do not change a drive's position once a volume has been created. This may risk you losing the volume.

4.6 Log



Level	Time	User	Event
Info	2021-07-01 00:13:04	SYSTEM	The cluster (NAS-HA) was recovered from abnormal status.
Warning	2021-07-01 00:12:43	SYSTEM	Auto failover is temporarily unavailable: Volume operation in p...
Info	2021-07-01 00:12:24	SYSTEM	The cluster (NAS-HA) was recovered from abnormal status.
Warning	2021-07-01 00:11:30	SYSTEM	Auto failover is temporarily unavailable: Volume operation in p...
Warning	2021-07-01 00:11:07	SYSTEM	Crashed volume/LUN detected on NAS-B (passive server).
Info	2021-06-30 22:59:49	SYSTEM	Initial data synchronization of the cluster (NAS-HA) is complete.
Info	2021-06-30 22:59:48	SYSTEM	The cluster (NAS-HA) was recovered from abnormal status.
Info	2021-06-30 22:59:25	admin	The cluster (NAS-HA) was created with NAS-A as active server...
Info	2021-06-30 22:59:21	SYSTEM	NAS-B (passive server) now ready.
Info	2021-06-30 22:58:58	SYSTEM	Services are now running on NAS-A (active server).
Info	2021-06-30 22:57:35	admin	The system is creating the cluster (NAS-HA).
Info	2021-06-30 22:47:39	admin	The cluster (ha_tedd) was removed.
Info	2021-06-30 22:47:39	admin	Started to remove the cluster (ha_tedd).
Info	2021-06-30 22:46:11	SYSTEM	The cluster (ha_tedd) was recovered from abnormal status.
Warning	2021-06-30 22:45:30	SYSTEM	Auto failover is temporarily unavailable: Volume operation in p...

The **Log** page monitors and records the events of the high-availability cluster. You can view, search for, sort, clear, and export logs.

4.7 Split-brain

When a high-availability cluster is functioning normally, only one of the hosts should act as the active server. The passive server detects the active server via the Heartbeat and the Cluster connections. You can set up multiple paths to connect the hosts to the data network to achieve data redundancy, but if the Heartbeat connection and the primary Cluster connection were both to fail, both servers may attempt to assume the role of the active server and result in a "split-brain" error.

In this case, connections to the IP addresses of the high-availability cluster will be redirected to either of the two servers, causing inconsistent data to be written. Once either of the connections is reconnected, the system will detect the split-brain error and the data inconsistency between the hosts.

If you want to simulate a split-brain error on your SHA cluster, refer to the [Split-brain error simulation and solutions](#) section of **Chapter 3.3: Tests and simulations**.

Resolve a split-brain error

1. Reconnect the **Heartbeat** and **Cluster** connections.
2. Connect to either of the servers with the cluster IP address and open **Synology High Availability**.
3. To view the differences in the data on the two servers before resolving the split-brain error, go to the **Split-brain** page and select the shared folder you want to compare.
 - The system may take some time to check the files. If you need to solve the split-brain error as soon as possible, **skip this step** and select **Keep all data of both servers** in the next step. To compare the data, follow the instructions in [this article](#).
4. Click **Manage > Resolve split-brain errors** on the **Cluster** page and follow the onscreen instructions. There are two options to choose from:¹
 - **Keep all data of both servers:** Choose one host as the new active server and remove the other. The new active server will still be in the cluster. The removed host will keep its data and return to standalone status. A full data synchronization is required the next time you add a passive server.
 - **Keep data from only one of the servers:** Choose one of the hosts as the new active server. The system will sync the data and settings on the new active server to the new passive server.²

Notes:

1. Make sure both hosts in the cluster are powered on before you choose the new active server when resolving the error. Shutting down the cluster does not solve the error. The split-brain error will remain until you address it using the methods mentioned in this article.
2. The changes made on the passive server during the split-brain will be lost if you choose this option.

Chapter 5: Maintain Your High-Availability Cluster

5.1 Software updates

Synology periodically releases DSM and package updates that you can install on your high-availability cluster. We recommend keeping the operating system and installed packages as up-to-date as possible. These updates may include new features and function improvements, but more importantly may offer critical bug fixes and security patches.

Before you start

- Make sure that any system errors have been resolved and the SHA cluster status is **Healthy**.
- Although updating DSM will not affect the data on your Synology NAS, we strongly recommend you to back up your data before proceeding.

Update DSM on a high-availability cluster

The system starts DSM update on the passive server first. It may take between five and ten minutes for the system to complete the process and restart the passive server. Services will remain uninterrupted on the active server during this process. Once the passive server is updated and back online, the system will perform a switchover to exchange the roles of the active and the passive server.¹

After the switchover is complete, the system proceeds to update the new passive server (original active server). Services will remain uninterrupted on the new active server (original passive server) during this process. Once the new passive server is updated and back online, the system will perform a switchover again, returning the cluster to its original state.

To update DSM on a high-availability cluster:

1. Go to **Synology High Availability > Cluster**.
2. Click **Manage** and select **Update DSM** from the drop-down menu. This option will be unavailable if the cluster is not healthy or not ready for a DSM update.
3. Click **Yes** to be redirected to the **Update & Restore** page in **Control Panel**.
4. Your Synology NAS will check if there is a new version available. If there is a new version available, click **Download** and then click **Update Now** to begin the update process.²

To update DSM manually on a high-availability cluster:

1. Go to Synology [Download Center](#), select your model, and click **Download** next to the DSM version you need.

2. Go to **Synology High Availability > Cluster**.
3. Click **Manage** and select **Update DSM** from the drop-down menu. This option will be unavailable if the cluster is not healthy or not ready for a DSM update.
4. Click **Yes** to be redirected to the **Update & Restore** page in **Control Panel**.
5. Click **Manual DSM Update**.
6. Upload the DSM update file you got from the Download Center and click **OK** to begin the update process.

To update DSM manually on a hybrid high-availability cluster:

If you are using two **different** Synology NAS models to create a **hybrid high-availability cluster**, you can only update DSM manually.

1. Go to Synology **Download Center**, select the model, and click **Download** next to the latest DSM version. Make sure to download the appropriate update file for each model.
2. Go to **Synology High Availability > Cluster**.
3. Click **Manage** and select **Update DSM** from the drop-down menu. This option will be unavailable if the cluster is not healthy or not ready for a DSM update.
4. Click **Yes** to be redirected to the **Update & Restore** page in **Control Panel**.
5. Click **Manual DSM Update**.
6. Upload the DSM update file to each server and then click **OK** to begin the update process.

Update the Synology High Availability package

Services will still be available while updating the **Synology High Availability** package.

1. Go to **Synology High Availability > Cluster**.
2. Click **Manage** and select **Update Package** from the drop-down menu. This option will be unavailable if the cluster is not healthy or not ready for an update.
3. Click **Yes** to be redirected to the **Synology High Availability** page in the **Package Center**.
4. If a newer version of the package is available, click **Update** to start the installation process.

Notes:

1. The system will only update one Synology NAS if there is no passive server in the high-availability cluster.
2. Available updates may vary depending on your current DSM configurations.
3. Both the active and the passive servers must be installed with the same DSM and Synology High Availability package versions.
4. Depending on the number of connections or services, the time the system takes to complete the update may vary.
5. Do not remove the power source, shut down the system, or disconnect any of the servers in the high-availability cluster while the system is updating.
6. You can safely shut down the cluster or individual servers after the update is complete and the cluster status is **Healthy**.

5.2 Drive firmware update

If you installed **Synology** drives (HDD/SSD) in your high-availability cluster, you can update their firmware via DSM. Firmware updates ensure the compatibility and continued use of the Synology drives installed in your Synology NAS. If the firmware status of one or more drives in **DSM > Storage Manager > HDD/SSD** is **Update required**, please proceed with the update.

1. In **Storage Manager**, go to the **HDD/SSD** page.
2. Select a Synology drive and click **Action > Firmware Update**.
3. Click **Update**.

Notes:

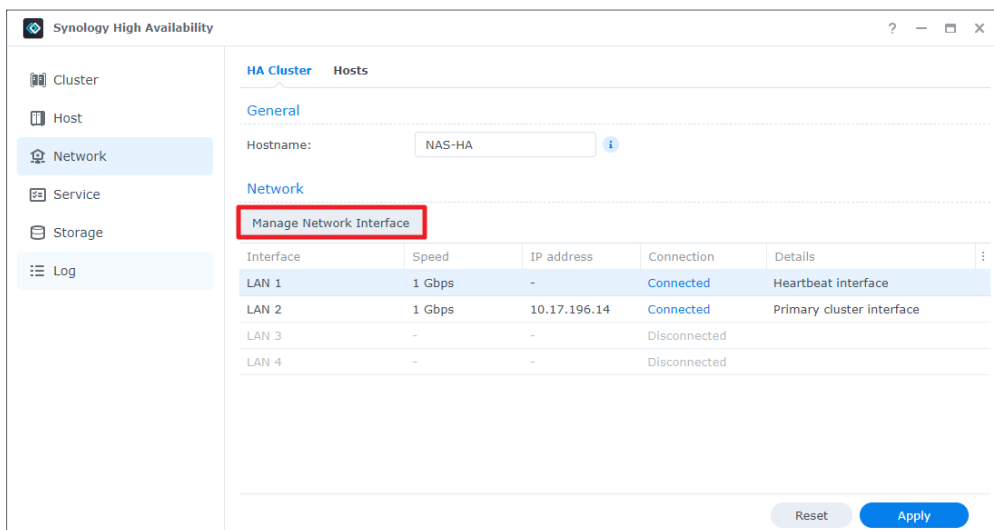
- We strongly recommend you to first back up the data on the selected Synology drives before updating their firmware.
- If the Synology drives are in use (e.g., assigned to a storage pool or as hot spares), a system restart will be required in order to halt all services during the update and prevent any application errors.
- You can perform firmware updates for Synology drives on both servers from the active server.

5.3 Network management

Modify the IP addresses of servers or the cluster

Synology High Availability (since version 2.0.2) allows you to modify the IP addresses of the network interfaces on the active and the passive servers without removing the cluster. You can also modify the IP address of the cluster.¹

1. Go to **Synology High Availability > Network**, and click **Manage Network Interface**.



2. You can edit, enable, and disable² the SHA cluster IP address, or click **Configure Server Network** to edit the IP addresses of the active and passive servers.

Manage Network Interface - LAN 2

High-availability Cluster Settings

Enable high-availability cluster interface i

HA cluster IP address:

Set as default gateway

Set MTU value manually

MTU value:

Server Network Information

	Server 1 (10.1.1.100)	Server 2 (10.1.1.101)
Use DHCP	No	No
IP address	10.1.1.100	10.1.1.101
Subnet mask	255.255.255.0	255.255.255.0

Configure Server Network

Cancel Apply

3. Select **Use manual configuration** and edit the network information of either or both servers.

Configure Server Network Interface - LAN 2

Active Server (10.1.1.100)

Get network configuration automatically (DHCP)

Use manual configuration

IP address:

Subnet mask:

Gateway: i

DNS Server:

Passive Server (10.1.1.101)

Get network configuration automatically (DHCP)

Use manual configuration

IP address:

Subnet mask:

Gateway: i

DNS Server:

Cancel OK

4. Click **OK** when you're done.

5. Click **Apply** to save your settings.

Notes:

1. You can also modify the IP address of any bonded network interfaces, however, you cannot change the following:
 - Link Aggregation settings (e.g., Link Aggregation mode)
 - VLAN settings
 - Network interfaces of the Cluster connection and Heartbeat connectionIf you want to change these settings, you will have to remove the cluster and create a new cluster with new settings.
2. You cannot disable the cluster IP on the primary cluster interface.

Migrate the cluster to another network

1. Move your devices to the new network environment.
2. Open **Synology Assistant**¹ on a computer within the new network environment.
3. Find the cluster via the cluster name (under **Server Name**), or the cluster's original IP address.
4. The status of the cluster should be **Connection failed**.
5. Right-click on the cluster and click **Setup** to configure the new network settings.
6. Enter a DSM administrator's username and password.
7. Select **Use manual configuration** and specify the new IP information.
8. Click **OK** to save your settings.
9. Go to **Synology Assistant** again, and you will see that your cluster's IP address has changed.
10. Double-click on the cluster and sign in.
11. You can modify other network settings by going to **Synology High Availability > Network**.

Notes:

1. To download Synology Assistant, go to Synology [Download Center](#), select your model, click on the **Desktop Utilities** tab, and click **Download** next to **Synology Assistant**.

5.4 Storage capacity expansion

Expand the storage capacity by adding new drives

Before you start

Please note that only storage pools implemented with the following RAID types can be expanded using this method: RAID 1, RAID 5, RAID 6, RAID 10, RAID F1.

1. Perform Data Scrubbing ([DSM 7.0](#) / [DSM 6.2](#)) to check if your volume and storage pool are normal. If the status is anything other than normal, make sure to repair it first.
2. Prepare drives that are listed on the [Synology Products Compatibility List](#). Using incompatible drives may lower system performance or cause data loss.
3. Back up your data. The expansion process will not delete any existing data, but we still strongly recommend you to back up your data before proceeding.
4. In **Storage Manager**, do the following:
 - Go to **HDD/SSD** to check if the inserted drive is healthy.
 - Make sure the inserted drive meets the drive requirements. Go to **HDD/SSD** to check the drive size and type.
 - Go to **Storage** (DSM 7.0) or **Storage Pool** (DSM 6.2) to check if the storage pool status is healthy.
5. Make sure your Synology NAS model supports using drives located in expansion units. For more information, refer to [this article](#).
6. Make sure the maximum total capacity of the volumes and LUNs on your high-availability cluster has not reached or exceeded 400 TB. For more information, refer to the [Synology High Availability specifications](#).

Add new drives to a high-availability cluster

1. Insert new drives into identical empty slots on both the active and the passive servers. To avoid injury or damaging your Synology NAS, make sure to follow the drive installation instructions found in the **Hardware Installation Guide** for your Synology device.¹
2. Make sure that all of the new drives show up in **Synology High Availability > Storage > HDD/SSD**. You can check the status of the active or passive servers by selecting them from the drop-down menu in the top-right corner of the page.

Expand storage capacity with Storage Manager

1. Go to **Storage Manager** to complete the final steps. Please note that the **switchover** function will not be available at any time during these processes.
2. Do one of the following depending on your situation:
 - Expand an existing storage pool by adding drives. Refer to the respective help articles for [DSM 7.0](#) and [DSM 6.2](#) for instructions.
 - Create a new storage pool. Refer to the respective help articles for [DSM 7.0](#) and [DSM 6.2](#) for instructions.

Expand the storage capacity by replacing the drives with larger ones

Before you start

1. Make sure that your implemented RAID type allows drives to be replaced without causing data corruption. Refer to the **Choose a RAID Type** help articles for [DSM 7.0](#) and [DSM 6.2](#) for more information.
2. Check the items for **Before you start** in the **Expand the storage capacity by adding new drives** section above.

Replace drives to expand storage capacity on the active server

Start with the active server. **Do not** remove the drives from both the active and the passive servers at the same time. This will cause both servers' storage spaces to become degraded. If you plan to replace multiple drives, make sure to replace them one-by-one. After replacing one drive, you must repair the storage pool before replacing the next one.^{2 3}

1. Go to **Storage Manager > Storage > Storage Pool** to see which of the existing drives is the smallest.
2. Remove a drive from the active server and replace it with one of a larger size. To avoid injury or damaging your Synology NAS, make sure to follow the drive installation instructions found in the **Hardware Installation Guide** for your Synology device.¹
3. Go to **Storage Manager > HDD/SSD** to make sure the newly added drive has been recognized.
4. Go to **Storage Pool** and select the storage pool. At this point, its status should be **Degraded**.
5. Repair the degraded storage pool.
 - DSM 7.0 and above: Click **...** and select **Repair**.
 - DSM 6.2 and earlier: Click **Action > Repair**.
6. Select the replacement drive to add to the storage pool. Follow the instructions in the wizard to complete this step.
7. Repeat the process above one-by-one on the active server until all desired drives have been replaced with larger ones.

Replace drives to expand storage capacity on the passive server

When replacing drives to expand the storage capacity of the **passive** server, make sure to follow the same order and configurations performed on the active server.

1. Remove a corresponding drive from the passive server and replace it with one of a larger size.
2. Go to **Synology High Availability > Storage > HDD/SSD** to make sure the newly added drive has been recognized.
3. Go to the **Volume** tab. At this point, the status should be **Degraded**.
4. Select the degraded volume and then click the **Repair** button.
5. Repeat the process above until the drive configurations of the passive server and active server are the same.

Expand storage capacity with Storage Manager

Once all of the desired drives on both active and passive servers have been replaced and repaired, go back to **Storage Manager** to complete the final steps.

- Go to the **Storage Pool** tab and select the storage pool to be expanded.
 - DSM 7.0 and above: Click **⋮** and select **Expand**.
 - DSM 6.2 and earlier: Click **Action** > **Expand**.
- Click **Apply** to confirm the settings.

Notes:

- Your device's **Hardware Installation Guide** can be found in the Synology [Download Center](#) under **Documents**.
- When replacing drives of RAID 5 / RAID 6 / RAID 10 / RAID F1 storage pools, the smallest drive should always be replaced first in order to maximize drive usage. The storage capacity of each RAID type is as follows:
 - RAID 5: (number of drives - 1) x (smallest drive size)
 - RAID 6: (number of drives - 2) x (smallest drive size)
 - RAID 10: (number of drives / 2) x (smallest drive size)
 - RAID F1: (number of drives - 1) x (smallest drive size)
- Do not initiate a switchover at any time during this process.

Expand the storage capacity with Synology expansion units

Synology expansion units are designed for pairing with specific expansion-ready NAS products to increase their internal volume or form independent volumes for backup or additional storage. When you use two expansion-ready NAS in a high-availability cluster, you will be able to expand its storage capacity with expansion units. Refer to [this article](#) to see if your servers are compatible with Synology expansion units.

This section provides steps on pairing expansion units with your high-availability cluster. To do this, you must have two identical expansion units for both the active and passive servers. For example, we will use two DS1621+ (active and passive servers) and two DX517 (expansion units).

- Install your drives on the two DX517 models. The drive capacities, number of drives, and the slot positions must be identical on each device.
- Plug both DX517 devices into power outlets.
- Connect the Synology eSATA expansion cables to the expansion ports of the DX517 and DS1621+ devices. We strongly recommend using Synology expansion cables. We do not recommend using other expansion cables.
- Once the connections are made, the DX517 devices will turn on automatically whenever their connected NAS powers on. Do not remove the expansion cable while the host device is powered on. Doing this may result in data loss.
- Sign in to your high-availability cluster and go to **Storage Manager** > **Overview** to see if the expansion unit has been successfully connected.

6. You can now do the following:

- Create a storage pool on the expansion units. Refer to the respective articles for [DSM 7.0](#) and [DSM 6.2](#) for instructions.
- Create a volume. Refer to the respective articles for [DSM 7.0](#) and [DSM 6.2](#) for instructions.

5.5 Memory expansion


Overall Synology server performance, such as data transmission speed and system response when multi-tasking, can be enhanced by expanding the memory capacity. Refer to [this article](#) for more information on Synology NAS memory expansion. This section briefly introduces two methods that you can use to expand the memory of your high-availability cluster.

Before you start

- Make sure that the memory capacity of the two servers is exactly the same to ensure that services can be properly transferred and to maintain consistent system performance.
- Go to the [Download Center](#) and download the **Hardware Installation Guide** for your Synology NAS.


Method 1: Shut down the cluster

You can expand the memory capacity on your active and passive servers, but you will need to shutdown the cluster for a short period of time.

1. Sign in to your high-availability cluster and go to **Synology High Availability > Cluster**.
2. Click the power  button and select **Shut down cluster**.
3. Refer to the information in the **Hardware Installation Guide** to install memory modules on both servers.
4. Power on each device in the cluster by pressing their power buttons.
5. Sign in to your high-availability cluster.
6. Go to **Synology High Availability > Host** to confirm that the memory modules have been expanded on both servers.

Method 2: Switchover

You can reduce service downtime when installing memory modules by utilizing the **switchover** function.

1. Sign in to your high-availability cluster and go to **Synology High Availability > Host**.
2. On the **passive** server, click the power  button and select **Shut Down**.
3. Refer to the information in the **Hardware Installation Guide** to install the memory module on the passive server.

4. Power on the **passive** server by pressing its power button.
5. Sign in to your high-availability cluster.
6. Go to **Synology High Availability > Host** to confirm that the memory modules on the passive server have been expanded.
7. On the **Cluster** page, click **Manage > Switchover**.
8. Perform **steps 1-6** again on the other server to install the memory module.

Note: If you've configured an SSD cache, Synology High Availability may encounter memory inconsistency during the expansion process. This is a normal phenomenon. Once the subsequent steps are completed, the memory capacity will be consistent again and the status will return to normal. For more details, refer to **Chapter 2: SHA Troubleshooting** in the [Synology High Availability \(SHA\) Troubleshooting Guide](#).

5.6 M.2 SSD installation

SSD caches can achieve better performance on Synology NAS by leveraging the advantages of SSDs. By storing frequently accessed data in an SSD cache, you can reduce I/O latency and improve the system performance of your Synology NAS. Refer to [this article](#) to see if you can install M.2 SSDs on your active and passive servers. This section introduces two methods that you can use to install M.2 SSDs on your high-availability cluster.

Before you start

- Make sure that the M.2 SSD capacity of the two servers is exactly the same to ensure that services can be properly transferred and to maintain consistent system performance.
- Go to the [Download Center](#) and download the **Hardware Installation Guide** for your Synology NAS.


Method 1: Shut down the cluster

You can install M.2 SSDs on your active and passive servers, but you will need to shutdown the cluster for a short period of time.

1. Sign in to your high-availability cluster and go to **Synology High Availability > Cluster**.
2. Click the power  button and select **Shut down cluster**.
3. Refer to the information in the **Hardware Installation Guide** to install the M.2 SSDs on both servers. Make sure you install the M.2 SSDs in identical slots on both servers.
4. Power on each device in the cluster by pressing their power buttons.
5. Sign in to your high-availability cluster.
6. Go to **Synology High Availability > Storage > HDD/SSD** to confirm that the M.2 SSDs have been successfully installed.

Method 2: Switchover

You can also reduce the service downtime when installing M.2 SSDs by utilizing the **switchover** function.

1. Sign in to your high-availability cluster and go to **Synology High Availability > Host**.
2. On the passive server, click the power  button and select **Shut Down**.
3. Refer to the information in the **Hardware Installation Guide** to install the M.2 SSDs on the passive server. Make sure that you install the M.2 SSDs in identical slots on both servers.
4. Power on the **passive** server by pressing its power button.
5. Sign in to your high-availability cluster.
6. Go to **Synology High Availability > Storage > HDD/SSD** to confirm that the M.2 SSDs have been successfully installed on the passive server.
7. On the **Cluster** page, click **Manage > Switchover**.
8. Perform **steps 1-6** again on the other server to install the M.2 SSDs.

5.7 Network interface card installation


This section provides two methods that can be used to install a network interface card.

Before you start

- Go to the [Download Center](#) and download the **Hardware Installation Guide** and **Datasheet** for your Synology NAS. Then, check the following:
 - Make sure that the PCIe slot is supported on your Synology NAS.
 - Confirm that the network interface card you want to use is listed on [Synology Products Compatibility List](#).
- Make sure that the number of network ports on both servers is the same.


Method 1: Shut down the cluster

You can install network interface cards on your active and passive server, but you will need to shut down the cluster for a short period of time.

1. Sign in to your high-availability cluster and go to **Synology High Availability > Cluster**.
2. Click the power  button and select **Shut down cluster**.
3. Refer to the **Hardware Installation Guide** for instructions on how to install the network interface cards on both servers.
4. Power on each device in the cluster by pressing their power buttons.
5. Sign in to your high-availability cluster.
6. Go to **Synology High Availability > Network > Hosts** to confirm that the network interface cards have been successfully installed.

Method 2: Switchover

You can also reduce the service downtime when installing network interface cards by utilizing the **switchover** function.

1. Sign in to your high-availability cluster and go to **Synology High Availability > Host**.
2. On the passive server, click the power  button and select **Shut Down**.
3. Refer to the **Hardware Installation Guide** for instructions on how to install the network interface card on the passive server.
4. Power on the **passive** server by pressing its power button.
5. Sign in to your high-availability cluster.
6. Go to **Synology High Availability > Network > Hosts** to confirm that the network interface card has been successfully installed.
7. On the **Cluster** page, click **Manage > Switchover**.
8. Perform **steps 1-6** again on the other server to install the network interface card.

5.8 Data migration

If you purchase a new Synology NAS, your existing data can be moved from an old Synology NAS to the new one via a process called **migration**. This section introduces data migration methods that can be used in a high-availability cluster. These methods allow you to replace the servers in the cluster without losing the original cluster data.

Before you start


- Performing migration moves data and drives from one Synology NAS to another. In this section, the following terms are used:
 - **Source Synology NAS:** The original Synology NAS from which data is moved.
 - **Destination Synology NAS:** The Synology NAS to which data is moved.
- Make sure both the source and destination Synology NAS are running the same version of DSM.
- Make sure that the drives and Ethernet cable configurations are the same on the source and destination Synology NAS.
- Make sure that the two servers are the same models or are supported hybrid high-availability models after being migrated to the new Synology NAS. Refer to [this article](#) for supported **hybrid high availability** model combinations.

Refer to the table below for some examples of different model combinations.

Original Model Combination	Migration	New Model Combination
<ul style="list-style-type: none"> Active Server: DS918+ Passive Server: DS918+ 	<p>Migrate active server data</p> <ul style="list-style-type: none"> Migrate the active server from DS918+ to DS920+. 	<ul style="list-style-type: none"> Active Server: DS920+ Passive Server: DS918+
<ul style="list-style-type: none"> Active Server: DS920+ Passive Server: DS918+ 	<p>Migrate passive server data</p> <ul style="list-style-type: none"> Migrate the passive server from DS918+ to DS920+. 	<ul style="list-style-type: none"> Active Server: DS920+ Passive Server: DS920+
<ul style="list-style-type: none"> Active Server: DS920+ Passive Server: DS918+ 	<p>Migrate cluster (active and passive server) data</p> <ul style="list-style-type: none"> Migrate the active server from DS920+ to RS3621xs+. Migrate the passive server from DS918+ to RS3617xs+. 	<ul style="list-style-type: none"> Active Server: RS3621xs+ Passive Server: RS3617xs+

Migrate passive server data

This section outlines the process of migrating data from the passive server. You can refer to [this article](#) for detailed information on DSM migration.

1. Go to **Synology High Availability > Host**. Click the power  button for the passive server and select **Shut down**.
2. Remove the drives and disconnect the Ethernet cables from the source Synology NAS.
3. Install the drives on the destination Synology NAS. Drives must be installed in the same order as they were installed on the source Synology NAS.
4. Connect the Ethernet cables to the destination Synology NAS. Ethernet cables must be connected to the same ports as they were on the source Synology NAS.
5. Power on the destination Synology NAS (new passive server).
6. Open a web browser on your computer and go to **find.synology.com**.
7. Find the destination Synology NAS. Its status should be **Migratable** or **Recoverable**.
8. Double-click on the destination Synology NAS to start the migration process.
9. Follow the wizard to complete the migration process. Make sure that you install the same DSM version as the one used on the active server.
10. Once the migration is complete, the destination Synology NAS will automatically be restarted and added to the cluster as the passive server. If you need to modify the new IP address, refer to the **Network management** section of **Chapter 5: Maintain your High-availability Cluster** for instructions.


Migrate active server data

As long as the status of the cluster is **Healthy**, you can follow the steps below to migrate data and replace the active server in your high-availability cluster. If the status of the cluster is **Abnormal**, please troubleshoot the issue before you migrate your data and replace the server.

1. Go to **Synology High Availability > Cluster**, and click **Manage > Switchover**. This exchanges the roles of the active and passive servers.
2. Perform steps in **Migrate passive server data** section on the original active server (passive server after completing step 1).
3. To make the destination Synology NAS the new active server, go to **Synology High Availability > Cluster**, and click **Manage > Switchover** again.

Migrate cluster (active and passive server) data

This section outlines the process of migrating data from both the active and the passive servers in the cluster. You can refer to [this article](#) for detailed information on DSM migration.

1. Sign in to your high-availability cluster and go to **Synology High Availability > Cluster**.
2. Click the power  button and select **Shut down cluster**.
3. Remove the drives and disconnect the Ethernet cables from both source Synology NAS devices.
4. Install the drives on the destination Synology NAS devices. Drives must be installed in the same order as they were installed on the source Synology NAS devices.
5. Connect the Ethernet cables on the destination Synology NAS devices. Ethernet cables must be connected to the same ports as they were on the source Synology NAS devices.
6. Power on the destination Synology NAS for the new active server.
7. Open a web browser on your computer and go to **find.synology.com**.
8. Find the destination Synology NAS for the new active server. Its status should be **Migratable** or **Recoverable**.
9. Double-click on the destination Synology NAS to start the migration process.
10. Follow the wizard to recover the active server first. Make sure to install the same DSM version as was used on the source Synology NAS.
11. Once the migration is complete, the destination Synology NAS will automatically be restarted and added to the cluster as the active server.
12. Perform **steps 7-10** again for the passive server.
13. If you need to modify the new IP addresses, refer to the **Network Management** section of **Chapter 5: Maintain your High-availability Cluster** for instructions.

Note: If the cluster is in an abnormal state before migration, refer to **Chapter 2: SHA Troubleshooting** in the **Synology High Availability (SHA) Troubleshooting Guide** to fix the issue before continuing.



Learn More

Related articles

- [Can I create a high-availability cluster with two different Synology NAS servers?](#)
- [What should I know when creating a Heartbeat connection for a Synology High Availability cluster?](#)
- [How long does it take to synchronize high-availability clusters?](#)
- [What is the purpose of setting up a quorum server in a high-availability cluster?](#)
- [Can I move the hard drives after setting up high-availability clusters?](#)
- [Why do I have to access the cluster via the high-availability cluster IP?](#)
- [How long does it take to coordinate the switchover of high-availability clusters?](#)
- [How do I simultaneously shut down the active server and passive server in a high-availability cluster?](#)
- [How can I repair a degraded storage space in a high-availability cluster?](#)
- [Frequently asked questions about Synology High Availability cluster](#)

Software specs

Refer to the Synology High Availability software specifications for [DSM 7.0](#) and [DSM 6.2](#) to learn more about the package's features, components, and limitations.

Other resources

For more step-by-step tutorials and visual information, feel free to also check out [Synology's YouTube channel](#). There, you can find related videos by searching for "Synology High Availability".

You can also find more FAQs, tutorials, admin guides, brochures, technical specifications, user guides, whitepapers, and more for Synology High Availability in [Synology Knowledge Center](#).



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