StarWind Virtual SAN®
Creating HA device using Node Majority Failover Strategy
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TECHNICAL PAPER
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Contents

Introduction ....................................................................................................................................... 4
StarWind Failover Strategies .......................................................................................................... 5
Downloading, Installing, and Registering the Software ........................................................... 6
Configuring Shared Storage ......................................................................................................... 13
Adding Witness Node .................................................................................................................... 24
Conclusion ....................................................................................................................................... 30
Contacts............................................................................................................................................ 31
Introduction

When the connection between nodes with synchronous replication is lost, it is important to decide which nodes should continue to serve client’s requests, and which ones should disconnect and stop working with the client. The loss of communication can occur either due to problems with the link between the nodes or due to problems with a node itself.

In case communication loss is caused by network connection problems between HA nodes, there is a danger of the “split brain” state in the HA device. This situation is possible if both nodes lose all synchronization and heartbeat connections between them simultaneously and are unable to communicate anymore to define the synchronization state of each other. Each node decides that it is the only synchronized and operational one, and thus continues to proceed clients’ requests for read and write operations independently. When the synchronization link finally is restored, differences in data written to the disk on each node will lead to data corruption, as different information is attempted to get synchronized. To avoid this, users can choose the failover strategy when creating an HA device. The available options are heartbeat and node majority failover strategies.

This guide is intended for server administrators. It provides detailed instructions on how to set up an HA device using the Node Majority Failover strategy with the Witness Node based on StarWind Virtual SAN as a storage provider.

A full set of up-to-date technical documentation can always be found here.

For any technical inquiries, please, visit our online community, Frequently Asked Questions page, or use the support form to contact our technical support department.
StarWind Failover Strategies

Selection of the failover strategy is done during the device creation and cannot be changed afterward. StarWind Virtual SAN provides two options: Heartbeat failover strategy and Node Majority failover strategy.

Heartbeat Failover Strategy

Heartbeat is a technology that allows avoiding the so-called “split-brain” scenario when the HA cluster nodes are unable to synchronize but continue to accept write commands from the initiators independently. It can occur when all synchronization and heartbeat channels disconnect simultaneously, and the partner nodes do not respond to the node’s requests. As a result, StarWind service assumes the partner nodes to be offline and continues operations on a single-node mode using data written to it.

If at least one heartbeat link is online, StarWind services can communicate with each other via this link. The device with the lowest priority will be marked as not synchronized and get subsequently blocked for the further read and write operations until the synchronization channel resumption. At the same time, the partner device on the synchronized node flushes data from the cache to the disk to preserve data integrity in case the node goes down unexpectedly. It is recommended to assign more independent heartbeat channels during replica creation to improve system stability and avoid the “split-brain” issue.

With heartbeat failover strategy, the storage cluster will continue working with only one StarWind node available.

You can find a configuration guide for creating HA storage with Heartbeat Failover Strategy here.

Node Majority Failover Strategy

This strategy ensures synchronization connection without any additional heartbeat links. The failure-handling process occurs when the node has detected the absence of connection with the partner.

The main requirement for keeping the node operational is an active connection with more than a half of the HA device’s nodes. Calculation of the available partners is based on their "votes". In case of a two-node HA storage, all nodes will be disconnected if there is a problem on the node itself, or in communication between them. Therefore, the Node Majority failover strategy does not work in case of just two synchronous nodes. To resolve this issue, it is necessary to add the third Witness node, which participates the nodes count for the majority, but neither contains data on it nor is involved in processing clients’ requests.

With Node Majority failover strategy, failure of only one node can be tolerated. If two nodes fail, the third one will also become unavailable to clients’ requests.
The Witness node should be additionally configured for an HA device that uses Node Majority failover strategy if it is replicated between 2 nodes. In case an HA device is replicated between 3 nodes, no Witness node is required.

**Downloading, Installing, and Registering the Software**

1. Download the StarWind setup executable file from our website by following the link: [https://www.starwind.com/registration-starwind-virtual-san](https://www.starwind.com/registration-starwind-virtual-san)

2. Launch the downloaded setup file on the server where you wish to install StarWind Virtual SAN or one of its components. The setup wizard will appear.

3. Read and accept the License Agreement and click Next to continue.
4. Carefully read the information about new features and improvements. Red text indicating warnings for users who update the existing software installations.

Click Next to continue.

5. Click Browse to modify the installation path if necessary.

Click Next to continue.
6. Select the following components for the minimum setup:

- **StarWind Virtual SAN Service**
  StarWind Service is the core of the software. It can create iSCSI targets and share virtual and physical devices. The service can be managed from StarWind Management Console on any Windows computer or VSA that is on the network. Alternatively, the service can be managed from StarWind Web Console, deployed separately.

- **StarWind Management Console**
  The Management Console is the Graphic User Interface (GUI) part of the software that controls and monitors all storage-related operations (e.g., allows users to create targets and devices on connected to the network StarWind Virtual SAN servers).

Click **Next** to continue.
7. Specify the Start Menu folder.

Click **Next** to continue.

8. Enable the checkbox if you want to create a desktop icon.

Click **Next** to continue.
9. You will be prompted to request a time-limited fully functional evaluation key, a FREE version key, or a fully commercial license key sent to you with the purchase of StarWind Virtual SAN. Select the appropriate option.

![License key selection](image)

Click **Next** to continue.

10. Click **Browse** to locate the license file.

![Select license file](image)

Click **Next** to continue.
11. Review the licensing information.

   ![License Key Image]

   Click **Next** to apply the license key.

12. Verify the installation settings. Click **Back** to make any changes or **Install** to continue.

   ![Installation Settings Image]
13. Select the appropriate checkbox to launch the StarWind Management Console immediately after the setup wizard is closed.

Click Finish to close the wizard.

14. Repeat installation steps on the other StarWind nodes, including the Witness node.
Configuring Shared Storage

NOTE: StarWind Management Console cannot be installed on an operating system without a GUI. You can install it on Windows Desktop 7, 8, 8.1, 10 and Windows Server 2008R2, 2012, 2012 R2, 2016 editions including the desktop versions of Windows.

If StarWind Service and Management Console are installed on the same server, Management Console will automatically add the local StarWind node to the Console tree after the first launch. To add remote StarWind servers to the console, use the Add Server button on the control panel.

Launch the StarWind Management Console by double-clicking the StarWind tray icon.
15. StarWind Management console will ask you to specify the default storage pool on the
server you are connecting to for the first time. Please configure the default storage pool
to use one of the volumes you have prepared earlier. All the devices created through the
Add Device wizard will be stored on it. Should you decide to use an alternative storage
path for your StarWind virtual disks, please, use the Add Device (advanced) menu item
to specify it.

StarWind Management Console

⚠️ Storage pool is not configured!
Would you like to set the default location of the storage pool to My Computer\D?

[Yes] [Choose path...] [Disconnect]

Press the Yes button to configure the storage pool. If you need to change the storage
pool destination, press Choose path... and point the browser to the necessary disk.

**NOTE**: Each array used by StarWind Virtual SAN to store virtual disk images should meet the
following requirements:

- initialized as GPT
- Have a single NTFS-formatted partition
- Have a drive letter assigned

16. Select the StarWind server where you wish to create the device.

17. Press the Add Device (advanced) button on the toolbar.


19. Select Virtual disk and click Next.
20. Specify the virtual disk location, the name, and the size and click **Next**.

![Virtual Disk Location](image1)

21. Choose the type of StarWind device, specify the virtual block size, and click **Next**

![Virtual Disk Options](image2)
22. Define the caching policy and specify the cache size, if necessary, and click **Next**.

**NOTE**: It is recommended to assign 1 GB of the L1 cache in Write-Back or Write-Through mode per 1 TB storage capacity if necessary.
23. Define the **Flash Cache Parameters** policy and size if necessary. Choose an SSD location in the wizard. Click **Next** to continue.

**NOTE:** The recommended size of the L2 cache is 10% of the initial StarWind device capacity.

```
< Add Device Wizard

Specify Flash Cache Parameters

- **Use Flash Cache**
  - Name: Flash-Storage1
  - Location: My Computer [\]
  - Size: 1 GB

Next  Cancel
```

24. Specify the target parameters.

Select the **Target Name** checkbox to enter a custom target name. Otherwise, the name will be generated automatically based on the target alias. Click **Next** to continue.

```
< Add Device Wizard

Target Parameters

- Choose a Target Attachment Method
  - Create new Target
- Target Alias
  - Storage1
- Target Name
  - False
- Allow multiple concurrent iSCSI Connections

Next  Cancel
```
25. Click **Create** to add a new device and attach it to the target. Then, click **Close** to close the wizard.

26. Right-click the servers field and press the **Add Server** button. Add a new StarWind Server, which will be used as the second HA node.

![Add new StarWind Server](image)

Click **OK** and **Connect** button to continue.

27. Right-click the recently created device and select **Replication Manager**.

![Replication Manager](image)

**Replication Manager** window will appear. Press the **Add Replica** button.
28. Select the **Synchronous two-way** replication. Click **Next** to proceed.

- **Replication Mode**
  - **Synchronous “Two-Way” Replication**
    Replication Partner must be connected to Client as Source Device as well, MP10 on Client must be enabled, needs dedicated high Performance Network Connection for Synchronization
  - **Asynchronous “One-Way” Replication**
    Replicas is used to store replicated Data. Data is stored as Snapshots. Client cannot connect to Replication Partner, mount Snapshot from Replica to get Access to replicated Data
  - **Witness Node**
    Witness node doesn’t contain user data. In case when Node Majority policy is set for Synchronous replication device and there are two storage nodes, Witness Node must be added to cluster to make number of nodes odd number and enable proper functioning of Node Majority policy.

29. Specify the partner server name or IP address.
30. Select the **Node Majority** Failover Strategy and click **Next**.

![Replication Wizard](image)

**Failover Strategy**

- **Heartbeat**
  Process node and communication failures using additional communication channel (heartbeat). At least one synchronization or heartbeat channel must be functional for proper failover processing. Loss of all communication channels may lead to soft brain issue, so it's recommended to use client SCsi connection interfaces as heartbeat channel.

- **Node Majority**
  Process node and communication failures using majority policy: node stays active while it sees more than half of nodes including itself. In case of 2 storage nodes, requires configuring additional witness node. Does not require additional heartbeat channel.

31. Choose **Create new Partner Device** and click **Next**.

![Replication Wizard](image)

**Partner Device Setup**

- **Create new Partner Device**
  Existing Device Parameters would be used as a Template

- **Select existing Device**
  Select existing Device on Partner Server

![Next, Cancel buttons](image)
32. Specify the partner device location and its target name if necessary. Click **Next**.

   Partner Device Setup

   Location: My Computer'D:\n
   Modify Target Name...

33. Select the synchronization channel for the HA device by pressing the **Change network settings** button.

   Network Options for Replication

   Networks for Synchronization and Heartbeat:
   172.16.20.0

   Networks for Heartbeat

   Change Network Settings

   ALUA preferred SW-NODE1 STARWIND LOCAL, 192.168.0.133
   Change ALUA Settings...
34. Specify the interface for Synchronization. Click **OK**. Then click **Next**.

![Specify Interfaces for Synchronization Channels](image)

35. Select **Synchronize from existing Device** as partner device initialization mode and click **Next**.

![Select Partner Device Initialization Mode](image)

36. Press the **Create Replica** button. Then click **Close** to close the wizard.
The added devices will appear in **StarWind Management Console**.

Repeat the steps above to create other virtual disks if necessary.
Adding Witness Node

This section describes adding the Witness node that takes part in counting the nodes for the majority, but neither contains data nor is involved in processing requests from clients. Witness node can be configured on a separate host, or as a virtual machine in a cloud. It requires StarWind Virtual SAN service installed on it.

**NOTE:** Since the device created in this guide is replicated between 2 active nodes with the Node Majority failover strategy, a Witness node must be added to it. For devices that have the heartbeat failover strategy or the ones replicated between 3 active nodes, no Witness node is required.

38. Open the StarWind Management Console, right-click on the Servers field and press the Add Server button. Add a new StarWind Server which will be used as the Witness node and click OK.

39. Right-click on the HA device with the configured Node Majority failover policy and select Replication Manager. The Replication Manager window will appear. Press the Add Replica button.
40. **Select Witness Node and click Next**

Replication Mode

- **Synchronous “Two-Way” Replication**
  Replication Partner must be connected to Client as Source Device as well, MPSO on Client must be enabled, needs dedicated high Performance Network Connection for Synchronization

- **Asynchronous “One-Way” Replication**
  Replicate is used to store replicated Data, Data is stored as Snapshots, Client cannot connect to Replication Partner, mount Snapshot from Replica to get Access to replicated Data

- **Witness Node**
  Witness node doesn’t contain user data. In case when Node Majority policy is set for Synchronous replication device and there are two storage nodes, Witness Node must be added to cluster to make number of nodes odd number and enable proper functioning of Node Majority policy.

41. **Specify the Witness node name or its IP address.**
42. Specify the Witness device location and its target name if necessary. Click **Next**.

43. For the HA device, select the synchronization channel with the Witness node by clicking on the **Change network settings** button.
44. Specify the interface for synchronization, confirm, and click **Next**.
45. Click **Create Replica**, then close the Wizard by pressing the **Close** button.

46. Repeat the steps above to create other virtual disks if necessary.
Once all devices are created, the StarWind Management Console should look as follows:
Conclusion

**Node Majority Failover Strategy** can be implemented with StarWind Virtual SAN as an alternative to **Heartbeat Failover Strategy**.

Witness node doesn't contain user data. It must be added to make the number of nodes odd if Node Majority failover policy is set for the device with the synchronous replication between two nodes. The odd number of nodes grants the proper functioning of the Node Majority failover policy.

**Benefits:**

- Possibility of a “split brain” is completely excluded;
- An additional communication channel for the heartbeat is NOT required.

**Disadvantages:**

- In a configuration with two storage nodes, a third node is required;
- If an HA device consists of three storage nodes, or two storage nodes and one witness node, failure of only one node can be tolerated. In case two nodes fail, the third node will also become unavailable to clients' requests.
## Contacts

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