StarWind Virtual SAN for Hyper-V: 2-Node Hyperconverged Scenario with Windows Server 2016

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TECHNICAL PAPERS
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StarWind is a pioneer in virtualization and a company that participated in the development of this technology from its earliest days. Now the company is among the leading vendors of software and hardware hyper-converged solutions. The company’s core product is the years-proven StarWind Virtual SAN, which allows SMB and ROBO to benefit from cost-efficient hyperconverged IT infrastructure. Having earned a reputation of reliability, StarWind created a hardware product line and is actively tapping into hyperconverged and storage appliances market. In 2016, Gartner named StarWind “Cool Vendor for Compute Platforms” following the success and popularity of StarWind HyperConverged Appliance. StarWind partners with world-known companies: Microsoft, VMware, Veeam, Intel, Dell, Mellanox, Citrix, Western Digital, etc.

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Introduction To Starwind Virtual San For Hyper-V

StarWind Virtual SAN® is a native Windows hypervisor-centric hardware-less VM storage solution. It creates a fully fault-tolerant and high performing storage pool built for the virtualization workloads by mirroring the existing server’s storage and RAM between the participating storage cluster nodes. The mirrored storage resources are then connected to all cluster nodes and treated just as a local storage by all hypervisors and clustered applications. High Availability (HA) is achieved by providing multipath access to all storage nodes. StarWind Virtual SAN® delivers supreme performance compared to any dedicated SAN solution since it runs locally on the hypervisor and all I/O is processed by local RAM, SSD cache, and disks. This way it never gets bottlenecked by storage fabric.

Starwind Vsan For Hyper-V System Requirements

Prior to installing StarWind Virtual SAN for Hyper-V, please make sure that the system meets the following requirements:

Hardware Requirements:

CPU:
Minimum one physical 1.7 GHz processor

RAM
The minimum RAM amount is 4GB. In case of implementing StarWind High Speed caching, an appropriate RAM amount should be installed additionally. The cache-dedicated RAM amount should be equal to/or higher than the one reserved for iSCSI targets caching;
In-line deduplication with LSFS requires 7.6 GB of RAM per 1 TB of deduplicated storage.
IMPORTANT NOTICE: Always reserve at least 4 GB RAM for Windows internal processes and the StarWind Virtual SAN engine.

Storage:
3 GB disk space reserved for installation and logging;
Hardware RAID controller is highly recommended;
StarWind Virtual SAN supports Microsoft Storage Spaces.
IMPORTANT NOTICE: Software RAID implementations are NOT supported.

HDD
For HHD-based RAID arrays, it is recommended to configure RAID 10 with the following settings:
Disk cache policy: Default (disabled by default);
Write policy: Write Back;
Read policy: Read ahead;
Stripe Size: 64K.

SSD
For SSD-based RAID arrays, it is recommended to configure RAID1 for 2x SSDs; RAID5 for
3x and more SSDs, or RAID10 for 4x and more pair SSD with the following settings:  
Disk cache policy: Default (enabled by default);  
Write policy: Write Through;  
Read policy: No read ahead;  
Stripe Size: 64K.

**Network Requirements:**

Minimum of 2 x 1GbE physical NICs;  
The minimum supported bandwidth is 1 GbE. In case of an intensive workload, the scaling to the 10 GbE or 40 GbE infrastructure should be considered. In order to maximize the SAN environment performance, it is highly recommended to use 9K Jumbo frame capable network equipment.

**Software Requirements:**

Please make sure, that one of the supported Windows Server editions is installed.

**Supported Microsoft Windows Server editions with GUI**

- Windows Server 2008 R2 (partial support)  
- Windows Server 2012  
- Windows Server 2012 R2  
- Windows Server 2016

**Supported Microsoft Windows Server GUI-less editions**

- Windows Server Core 2008 R2 (partial support);  
- Windows Server Core 2012;  
- Windows Server Core 2012 R2;  
- Hyper-V Server 2008 R2 (partial support);  
- Hyper-V Server 2012;  
- Hyper-V Server 2012 R2;  
- Hyper-V Server 2016.

**IMPORTANT NOTICE:** The use of Windows Server Core or Microsoft Hyper-V Server as a base OS is incompatible with StarWind Management Console local installation. In this case, the StarWind Management console should be installed on any other computer. Please note that for remote management, port 3261 has to be open in both machines’ firewalls.

**Microsoft Windows Desktop editions compatible with StarWind Management Console**

- Windows 7;  
- Windows 8;  
- Windows 8.1;  
- Windows 10.
Pre-Configuring The Windows Server 2016 Hosts

The network interconnection diagram is demonstrated below:

1. Make sure that a domain controller is configured and the servers are added to the domain.
2. Install Failover Clustering and Multipath I/O features, as well as the Hyper-V role on both servers. This can be done through Server Manager (Add Roles and Features menu item).
3. Configure network interfaces on each node to make sure that Synchronization and iSCSI/StarWind heartbeat interfaces are in different subnets and connected according to the network diagram above. In this document, 172.16.10.x subnet is used for iSCSI/StarWind heartbeat traffic, while 172.16.20.x subnet is used for the Synchronization traffic.
4. In order to allow iSCSI Initiators discover all StarWind Virtual SAN interfaces, the StarWind configuration file (StarWind.cfg) should be changed after stopping the StarWind service on the node where it will be edited. Locate the StarWind Virtual SAN configuration file (the default path is “C:\Program Files\StarWind Software\StarWind\StarWind.cfg”) and open it via WordPad as Administrator. Find
Enabling Multipath Support

5. Open the MPIO Properties manager: Start -> Windows Administrative Tools -> MPIO. Alternatively, run the following PowerShell command:

```powerShell
mpioctl
```

6. In the Discover Multi-Paths tab, select the Add support for iSCSI devices checkbox and click Add.

7. When prompted to restart the server, click Yes to proceed.

8. Repeat the same procedure on the other server.
**Installing Starwind Vsan For Hyper-V**

1. Download the StarWind setup executable file from the StarWind website: https://www.starwind.com/registration-starwind-virtual-san

   **NOTE:** The setup file is the same for x86 and x64 systems, as well as for all Virtual SAN deployment scenarios.

2. Launch the downloaded setup file on the server to install StarWind Virtual SAN or one of its components. The Setup wizard will appear. Read and accept the License Agreement.

3. Carefully read the information about the new features and improvements. Red text indicates warnings for users that are updating the existing software installations.

4. Select **Browse** to modify the installation path if necessary. Click **Next** to continue.
5. 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 as well as share virtual and physical devices. The service can be managed from StarWind Management Console on any Windows computer that is on the same network. Alternatively, the service can be managed from StarWind Web Console deployed separately.

- **StarWind Management Console.** 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 StarWind Virtual SAN servers connected to the network).

**NOTE:** To manage StarWind Virtual SAN installed on a Windows Server Core edition with no GUI, StarWind Management Console should be installed on a different computer running the GUI-enabled Windows edition.
6. Specify **Start Menu Folder**.

7. Enable the checkbox if a desktop icon needs to be created. Click **Next** to continue.
8. When the license key prompt appears, choose the appropriate option:

   - Request time-limited fully functional evaluation key.
9. Click the **Browse** button to locate the license file.
10. Review the licensing information.
11. Verify the installation settings. Click **Back** to make any changes or **Install** to proceed with the installation.
12. Enable the appropriate checkbox to launch **StarWind Management Console** right after the setup wizard is closed and click **Finish**.
13. Repeat the installation steps on the partner node.

### Creating Starwind Ha Devices

1. Open **Add Device (advanced) Wizard**.
2. Select **Hard Disk Device** as the type of device to be created.
3. Select **Virtual Disk**.
4. Specify a virtual disk **Name**, **Location**, and **Size**.
5. Select the **Thick provisioned** disk type.
6. Define a caching policy and specify a cache size (in MB). Also, the maximum available cache size can be specified by selecting the appropriate checkbox. Optionally, define the L2 caching policy and cache size.
7. Specify **Target Parameters**. Select the **Target Name** checkbox to enter a custom target name. Otherwise, the name is generated automatically in accordance with the specified target alias.
8. Click **Create** to add a new device and attach it to the target.
9. Click **Close** to finish the device creation.
10. Right-click the recently created device and select **Replication Manager** from the shortcut menu.
11. Select the **Add Replica** button in the top menu.

### Select The Required Replication Mode

The replication can be configured in one of two modes:

**Synchronous “Two-Way” Replication**

Synchronous or active-active replication ensures real-time synchronization and load balancing of data between two or three cluster nodes. Such a configuration tolerates the failure of two out of three storage nodes and enables the creation of an effective business continuity plan. With synchronous mirroring, each write operation requires control confirmation from both storage nodes. It guarantees the reliability of data transfers but is demanding in bandwidth since mirroring will not work on high-latency networks.
Asynchronous “One-Way” Replication
Asynchronous Replication is used to copy data over a WAN to a separate location from the main storage system. With asynchronous replication, confirmation from each storage node is not required during the data transfer. Asynchronous replication does not guarantee data integrity in case of storage or network failure; hence, some data loss may occur, which makes asynchronous replication a better fit for backup and disaster recovery purposes where some data loss is acceptable. The Replication process can be scheduled in order to prevent the main storage system and network channels overloads. Please select the required option:

Synchronous “Two-Way” Replication
1. Select Synchronous “Two-Way” replication as a replication mode.

2. Specify a partner Host name or IP address and Port Number.

Asynchronous "one-Way" Replication
NOTE: Asynchronous replication requires minimum 100 MbE network bandwidth or higher. The Asynchronous node uses the LSFS device by design. Please, make sure that
the Asynchronous node meets the LSFS device requirements:
https://knowledgebase.starwindsoftware.com/explanation/lsfs-container-technical-description/


2. Enter Host name or IP address of the Asynchronous node.
3. Choose the Create New Partner Device option.
4. Specify the partner device Location. Optionally, modify the target name by clicking the appropriate button.
5. Click Change Network Settings.
6. Specify the network for asynchronous replication between the nodes. Click OK and then click Next.
7. In Select Partner Device Initialization Mode, select Synchronize from existing Device and click Next.
8. Specify Scheduler Settings and click Next.

**NOTE:** The size of journal files and number of snapshots depends on the settings specified in this step.
9. Specify the path for journal files and click Next.

**NOTE:** By default, the journal files will be located on the node with the original device. However, it is highly recommended not to store journal files on the same drive where the original device is located. Additionally, the C:\ drive should not be used as the path for journal files to avoid any issues with Windows OS.
If the same drive where the StarWind device is located is selected, the warning message about possible performance issues will pop up. If there is no additional volume available for storing the journals, click I understand the potential problem. Use the selected path.
10. Press the **Create Replica** button.
11. Wait until StarWind service creates a device and click **Close** to complete the device creation.

### Selecting The Failover Strategy

StarWind provides 2 options for configuring a failover strategy:

**Heartbeat**
The Heartbeat failover strategy allows avoiding the “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 the replica creation to improve system stability and avoid the “split-brain” issue.

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

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

The main requirement for keeping the node operational is an active connection with more than 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 requires the addition of the third Witness node which participates in the nodes
count for the majority, but neither contains data on it nor is involved in processing clients’ requests. In case an HA device is replicated between 3 nodes, no Witness node is required.

With Node Majority failover strategy, failure of only one node can be tolerated. If two nodes fail, the third node will also become unavailable to clients’ requests. Please select the required option:

**Heartbeat**

1. Select **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 split brain issue, so it’s recommended to use client iSCSI 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.

2. Select **Create new Partner Device** and click Next.
3. Select a partner device **Location**.
4. Click **Change Network Settings**.
5. Specify the interfaces for Synchronization and Heartbeat Channels. Click **OK** and then click **Next**.
6. In **Select Partner Device Initialization Mode**, select **Synchronize from existing Device** and click **Next**.

7. Click **Create Replica**. Click **Finish** to close the wizard.

The successfully added device appears in **StarWind Management Console**.

8. Follow the similar procedure for the creation of other virtual disks that will be used as storage repositories.

**Node Majority**

1. Select the **Node Majority** failover strategy and click **Next**.
2. Choose Create new Partner Device and click Next.
3. Specify the partner device Location and modify the target name if necessary. Click Next.
4. In Network Options for Replication, press the Change network settings button and select the synchronization channel for the HA device.
5. In Specify Interfaces for Synchronization Channels, select the checkboxes with the appropriate networks and click OK. Then click Next.
6. Select Synchronize from existing Device as the partner device initialization mode.
7. Press the Create Replica button and close the wizard.
8. The added devices will appear in StarWind Management Console. Repeat the steps above to create other virtual disks if necessary.

Adding Witness Node
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.
1. Open 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.
2. Right-click on the HA device with the configured Node Majority failover policy and select Replication Manager and press the Add Replica button.

4. Specify the Witness node Host Name or IP address. The default Port Number is 3261.
5. In **Partner Device Setup**, specify the Witness device **Location**. Optionally, modify the target name by clicking the appropriate button.

6. In **Network Options for Replication**, select the synchronization channel with the Witness node by clicking the **Change Network Settings** button.

7. Specify the interface for **Synchronization and Heartbeat** and click **OK**.

8. Click **Create Replica** and then close the wizard.

9. Repeat the steps above to create other virtual disks if necessary.

### Provisioning Starwind Ha Storage To Windows Server Hosts

1. Launch **Microsoft iSCSI Initiator**: Start -> Windows Administrative Tools -> iSCSI Initiator. Alternatively, launch it using the command below in the command line interface:

   `iscsicpl`

2. Navigate to the **Discovery** tab.
3. Click the **Discover Portal** button. The **Discover Target Portal** dialog appears. Type 127.0.0.1.
4. Click the **Advanced** button. Select **Microsoft iSCSI Initiator** as a **Local adapter** and select **Initiator IP** (leave default for 127.0.0.1). Confirm the actions to complete the Target Portal discovery.
5. Click the Discover Portal... button once again.

6. In Discover Target Portal dialog, type in the iSCSI interface IP address of the partner node that will be used to connect the StarWind provisioned targets. Click Advanced.
7. Select **Microsoft iSCSI Initiator** as the **Local adapter**, select the **Initiator IP** in the same subnet as the IP address of the partner server from the previous step. Confirm the actions to complete the Target Portal discovery.
8. Now, all the target portals are added on the first node.
9. Repeat the steps 1-8 on the partner node.

**Connecting Targets**

1. Click the **Targets** tab. The previously created targets are listed in the **Discovered Targets** section.

   **NOTE:** If the created targets are not listed, check the firewall settings of the StarWind Server as well as the list of networks served by the StarWind Server (go to **StarWind Management Console -> Configuration -> Network**). Alternatively, check the **Access Rights** tab on the corresponding StarWind VSAN server in StarWind Management Console for any restrictions.
2. Select the **Witness** target from the local server and click **Connect**.
3. Enable checkboxes as shown in the image below. Click **Advanced**.
4. Select **Microsoft iSCSI Initiator** in the **Local adapter** dropdown menu. In **Target portal IP**, select **127.0.0.1**. Confirm the actions.
NOTE: It is recommended to connect the **Witness** device only by loopback (127.0.0.1) address. Do not connect the target to the **Witness** device from the partner StarWind node.

5. Select the **CSV1** target discovered from the local server and click **Connect**.
6. Enable checkboxes as shown in the image below. Click **Advanced**.
7. Select Microsoft iSCSI Initiator in the Local adapter dropdown menu. In Target portal IP, select 127.0.0.1. Confirm the actions.
8. Select the partner target from the other StarWind node and click Connect.
10. Select Microsoft iSCSI Initiator in the Local adapter dropdown menu. In the Initiator IP field, select the IP address for the iSCSI channel. In the Target portal IP, select the corresponding portal IP from the same subnet. Confirm the actions.
11. Repeat the steps 1-10 for all remaining HA device targets.
12. Repeat the steps 1-11 on the other StarWind node, specifying corresponding local and data channel IP addresses.

**Configuring Multipath**

**NOTE:** It is recommended to configure the different MPIO policies depending on iSCSI channel throughput. For 1 Gbps iSCSI channel throughput, it is recommended to set Failover Only or Least Queue Depth MPIO load balancing policy. For 10 Gbps iSCSI channel throughput, it is recommended to set Round Robin or Least Queue Depth MPIO load balancing policy.

1. Configure the MPIO policy for each target except for Witness with the load balance policy of choice. Select the **Target** located on the local server and click **Devices**.
2. In the **Devices** dialog, click **MPIO**.

3. Select the appropriate load balancing policy.
4. For the Witness target, set the load balance policy to **Failover Only**.
5. Repeat the steps 1-4 for configuring the MPIO policy for each remaining device on the current node and on the partner node.

**NOTE:** In case the Failover Only MPIO policy is used, make sure to check that the local path (127.0.0.1) is set to **Active**, while the partner connection is set to **Standby**.

**Connecting Disks to Servers**

1. Open the **Disk Management** snap-in. The StarWind disks will appear as unallocated and offline.
2. Bring the disks online by right-clicking on them and selecting the **Online** menu option.
3. Select the CSV disk (check the disk size to be sure) and right-click on it to initialize.
4. By default, the system will offer to initialize all non-initialized disks. Use the **Select Disks** area to choose the disks. Select **GPT (GUID Partition Style)** for the partition style to be applied to the disks. Press **OK** to confirm.
5. Right-click on the selected disk and choose **New Simple Volume**.
6. In **New Simple Volume Wizard**, indicate the volume size. Click **Next**.
7. Assign a drive letter to the disk. Click **Next**.

**New Simple Volume Wizard**

**Assign Drive Letter or Path**

For easier access, you can assign a drive letter or drive path to your partition.

- Assign the following drive letter: [E]
- Mount in the following empty NTFS folder: [Browse...]
- Do not assign a drive letter or drive path

8. Select **NTFS** in the **File System** dropdown menu. Keep **Allocation unit size** as **Default**. Set the **Volume Label** of choice. Click **Next**.
9. Press Finish to complete.

10. Complete the steps 1-9 for the Witness disk. Do not assign any drive letter or drive path for it.

11. On the
partner node, open the **Disk Management** snap-in. All StarWind disks will appear offline. If the status is different from the one shown below, click **Action->Refresh** in the top menu to update the information about the disks.

**12.** Repeat step 2 to bring all the remaining StarWind disks online.

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**Creating A Failover Cluster In Windows Server 2016**

**NOTE:** To avoid issues during the cluster validation configuration, it is recommended to install the latest Microsoft updates on each node.

1. Open **Server Manager**. Select the **Failover Cluster Manager** item from the **Tools** menu.

2. Click the **Create Cluster** link in the **Actions** section of Failover Cluster Manager.
3. Specify the servers to be added to the cluster. Click **Next** to continue.
4. Validate the configuration by running the cluster validation tests: select Yes... and click Next to continue.

5. Specify the cluster name.
**NOTE:** If the cluster servers get IP addresses over DHCP, the cluster also gets its IP address over DHCP. If the IP addresses are set statically, set the cluster IP address manually.

6. Make sure that all settings are correct. Click **Previous** to make any changes or **Next** to proceed.
NOTE: If checkbox **Add all eligible storage to the cluster** is selected, the wizard will add all disks to the cluster automatically. The device with the smallest storage volume will be assigned as a Witness. It is recommended to uncheck this option before clicking **Next** and add cluster disks and the Witness drive manually.

7. The process of the cluster creation starts. Upon the completion, the system displays the summary with the detailed information. Click **Finish** to close the wizard.
Adding Storage to the Cluster

1. In Failover Cluster Manager, navigate to Cluster -> Storage -> Disks. Click Add Disk in the Actions panel, choose StarWind disks from the list and confirm the selection.

2. To configure the cluster witness disk, right-click on Cluster and proceed to More Actions -> Configure Cluster Quorum Settings.
3. Follow the wizard and use the **Select the quorum witness** option. Click **Next**.
4. Select **Configure a disk witness**. Click **Next**.

5. Select the Witness disk to be assigned as the cluster witness disk. Click **Next** and
6. In Failover Cluster Manager, Right-click the disk and select **Add to Cluster Shared Volumes**.

7. If renaming of the cluster shared volume is required, right-click on the disk and select **Properties**. Type the new name for the disk and click **Apply** followed by **OK**.
8. Perform the steps 6-7 for any other disk in Failover Cluster Manager. The resulting list of disks will look similar to the screenshot below.

Configuring Cluster Network Preferences
1. In the **Networks** section of the Failover Cluster Manager, right-click on the network from the list. Set its new name if required to identify the network by its subnet. **Apply** the change and press **OK**.
**NOTE:** Do not allow cluster network communication on either iSCSI or synchronization network.
2. Rename other networks as described above, if required.

3. In the **Actions** tab, click **Live Migration Settings**. Uncheck the synchronization network only if the iSCSI network is 10+ Gbps. **Apply** the changes and click **OK**.
Contacts

<table>
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<tr>
<th>US Headquarters</th>
<th>EMEA and APAC</th>
</tr>
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<tbody>
<tr>
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<td>1-866-790-26 46</td>
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</tbody>
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