StarWind Virtual SAN® 2-node Compute and Storage Separated Scenario with Windows Server 2012 R2

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TECHNICAL PAPERS
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About StarWind

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 requirements, which are available via the following link:
https://www.starwindsoftware.com/system-requirements

Please read StarWind Virtual SAN Best Practices document for additional information:

Pre-Configuring The Windows Server 2012 R2 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.

**NOTE:** Please follow the recommendation in **KB article** on how to place a DC in case of StarWind Virtual SAN usage.

2. Install **Failover Clustering** and **Multipath I/O** features, as well as the **Hyper-V** role on both servers. This can be done through the **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, the subnets used are 172.16.10.x and 172.16.20.x for Synchronization traffic, while 172.16.30.x and 172.16.40.x for iSCSI/StarWind heartbeat traffic.

4. In order to allow iSCSI Initiators to 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”)

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**Diagram:**

- **Cluster Node 1**
  - StarWind iSCSI Heartbeat (172.16.40.x)
  - Synchronization (172.16.30.x)
- **Cluster Node 2**
  - StarWind iSCSI Heartbeat (172.16.40.x)
  - Synchronization (172.16.30.x)

**Network Diagram:**

- Management
- Witness
- CSV
- iSCSI/Heartbeat
- Synchronization

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*StarWind Virtual SAN ® 2-node Compute and Storage Separated Scenario with Windows Server 2012 R2*
Software\StarWind\StarWind.cfg”) and open it via WordPad as Administrator. Find the <iScsiDiscoveryListInterfaces value="0"/> string and change the value from 0 to 1 (should look as follows: <iScsiDiscoveryListInterfaces value="1"/>). Save the changes and exit Wordpad. Once StarWind.cfg is changed and saved, the StarWind service can be restarted.

**Enabling Multipath Support**

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

```bash
mpiocpl
```

6. In the **Discover Multi-Paths** tab, choose 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**


**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 who 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 or VSA 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 the Start Menu Folder.

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

- Request time-limited fully functional evaluation key.
- Request FREE version key.
- Select the previously purchased commercial license key.
9. Click **Browse** to locate the license file. Click **Next** to continue.

- **License key**
  - Get your license key

  Now when you have installed StarWind Virtual SAN you need to apply either evaluation key or FREE version key or commercial license key you’ve got with your purchase. If you don’t have any key it’s time to request one now!

  - Request time-limited fully functional evaluation key
  - Request FREE version key
  - I already have a key

10. Review the licensing information. Click **Next** to continue.
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 Devices**

1. In the **StarWind Management Console** click to **Add Device (advanced)** button and 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.
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.


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/

1. Select **Asynchronous “One-Way” Replication**.

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.

<table>
<thead>
<tr>
<th>Interfaces</th>
<th>Networks</th>
<th>Synchronization and Heartbeat</th>
</tr>
</thead>
<tbody>
<tr>
<td>172.16.10.10</td>
<td>172.16.10.0</td>
<td>✔ ✔</td>
</tr>
<tr>
<td>172.16.20.10</td>
<td>172.16.20.0</td>
<td>✔ ✔</td>
</tr>
<tr>
<td>172.16.30.10</td>
<td>172.16.30.0</td>
<td>✔ ✔</td>
</tr>
<tr>
<td>172.16.40.10</td>
<td>172.16.40.0</td>
<td>✔ ✔</td>
</tr>
<tr>
<td>192.168.12.10</td>
<td>192.168.12.0</td>
<td>✔ ✔</td>
</tr>
</tbody>
</table>

6. In Select Partner Device Initialization Mode, select Synchronize from existing Device and...
7. Click **Create Replica**. Click **Finish** to close the wizard. The successfully added device appears in **StarWind Management Console**.
8. Follow a 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**.

![Replication Wizard](image)

- **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. 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.

3. Select **Witness Node**.

4. Specify the Witness node **Host Name or IP address**. The default Port Number is
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.

NOTE: To extend an Image File or a StarWind HA device to the required size, please check the article below:

How to extend Image File or High Availability device

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 **172.16.30.10** and click the **Advanced** button.

4. Select **Microsoft iSCSI Initiator** as **Local adapter** and select **Cluster Node 1** initiator IP address from the same subnet. Click **OK** twice to add the Portal.
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**.

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. To Discover Targets Portals from the second StarWind node, click the Discover Portal button once again, enter iSCSI IP address for the second StarWind Node (172.16.30.20). Click the Advanced button.
10. Select **Microsoft iSCSI Initiator** as **Local adapter** and select **Cluster Node 1** initiator IP address from the same subnet. Click **OK** twice to add the Portal.
11. Click the Discover Portal button once again. In Discover Target Portal dialog, enter another iSCSI IP address of the second StarWind Node (172.16.40.20). Click the Advanced button.
12. Select **Microsoft iSCSI Initiator** as **Local adapter** and select the **Cluster Node 1** initiator IP address from the same subnet. Click **OK** twice to add the Portal.
13. All target portals are successfully added to the **Cluster Node 1**.
14. Repeat the steps 1-13 on the partner node.

**Connecting Targets**

1. Launch Microsoft iSCSI Initiator on Cluster Node 1 and click on the Targets tab. The previously created targets should be 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 Server).
2. Select a target discovered from the first StarWind Node 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 the Target portal IP, select the IP address of the first StarWind Node and Initiator IP address from the same subnet. Click OK twice to connect the target.
5. To connect the same target via another subnet, select it once again and click **Connect**.
6. Enable checkboxes like in the image below and click **Advanced**.

7. Select **Microsoft**
iSCSI Initiator in the Local adapter text field.
8. In the Target portal IP select another IP address of the first StarWind Node and Initiator IP address from the same subnet. Click OK twice to connect the target.

9. Select the partner target discovered from the second StarWind node and click Connect.
10. Enable checkboxes like in the image below and click **Advanced**.
11. Select Microsoft iSCSI Initiator in the Local adapter text field.
12. In Target portal IP, select the IP address of the second StarWind Node and Initiator IP address from the same subnet. Click OK twice to connect the
13. To connect the same target via another subnet, select it once again and click **Connect**.

14. Enable checkboxes like in the screenshot below and click **Advanced**.

15. In the **Target**
portal IP select another IP address of the second StarWind Node and Initiator IP address from the same subnet. Click OK twice to connect the target.

16. Repeat steps 1-15 for all HA device targets. After that, repeat the steps 1-17 on the Cluster node 2, specifying corresponding IP addresses. The result should look like in the picture below.
17. Initialize the disks and create partitions on them using the **Disk Management** snap-in. To create the cluster, the disk devices must be initialized and formatted on both nodes. **NOTE:** it is recommended to initialize the disks as GPT.

**Creating A Failover Cluster In Windows Server 2012**
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.

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. In Confirmation, 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 select 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
press **Finish** to complete the operation.

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
Configuring Cluster Network Preferences

1. In the Networks section of the Failover Cluster Manager, right-click on the network from the list. If required, set its new name 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>
<thead>
<tr>
<th>US Headquarters</th>
<th>EMEA and APAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-617-449-77 17</td>
<td>+44 203 769 18 57 (UK)</td>
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<tr>
<td>1-617-507-58 45</td>
<td>+34 629 03 07 17</td>
</tr>
<tr>
<td>1-866-790-26 46</td>
<td>(Spain and Portugal)</td>
</tr>
</tbody>
</table>

Customer Support Portal: [https://www.starwind.com/support](https://www.starwind.com/support)
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