

# How to configure Automated Storage Tiering using Microsoft Storage Spaces

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StarWind Documents





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## Description

In case of using **Automated Storage Tiering**, the individual spinning disks and flash drives can be either connected into OS directly in Pass-Through mode or preconfigured into separate virtual "SSD" and "HDD" LUNs, and then attached into the host OS. **NOTE:** Please make sure that the final configuration which is expected to be put into production is fully supported by either the software vendor (i.e., StarWind, Microsoft, VMware, etc.) or particular MSP/ISV who is in charge of the whole project. Please ensure that specific workload expectations can be met with both existing and future deployments. Depending on the configuration it can be either self-supported, partially supported, or fully supported. **NOTE:** Simple Tier has no redundancy built-in, so in case of either individual spinning disk and/or flash drive failure there is a risk of losing the data. It is recommended to configure resilient storage to be used as the underlying storage for the Tier. Please make sure that such a configuration is supported by either the software vendor (i.e., StarWind, Microsoft, VMware, etc.) or/and MSP/ISV. Automated Storage Tier creation There are two ways to configure Automated Storage Tiering. It can be done via Server Manager and via the PowerShell console. The first level of **Storage Tier** is **Storage pools**. At this level, separate physical disks are united into a single pool, providing the ability to flexibly expand the capacity and delegate administration. The upper level is **Storage Spaces**. At this level, virtual disks are created using the available capacity of a storage pool. Storage Spaces feature the following characteristics: resiliency level, storage tiers, fixed provisioning, and precise administrative control. 1. Launch Server Manager->File and Storage

Services->Volumes->Storage Pools. All disks available for Storage Pool are listed in Physical Disks. Click New Storage Pool.



🚵 Server	Manager													- 0	×
E	∋ - Server M	anager • File a	nd Storage	Services	<ul> <li>Volu</li> </ul>	mes • Storaç	ge Pc	pols	S		©	Man	age Took	: View	Help
	Servers	All storage pools	DLS   1 total											TASKS	•
i. I	Volumes Disks	Filter	Q	. •	•										
ina⊳ Ba	Storage Pools	📩 Name	Туре	Managed by		Available to		Rea	ad-Write Server	Capacity	Free Space	Percent Al	located	Status	
		<ul> <li>Windows Storag</li> </ul>	ge (1)												_
		Primordial	Available Dis	iks sw1		sw1		sw1	1						- 1
					New Stor	age Pool al Dick									
		Last refreshed on 7/10/	(2020 9-27-01 AM	_	Add Phon	ical Dirk									
		Last relieshed on 77 to	2020 0.27.01 MM		Upgrade	Storage Pool Version									
					Delete Storage Pool										
		VIRTUAL DISKS No related data is availab	ble.		Properties	5	H	nordia	CAL DISKS ial on sw1					TASKS	•
			No related	l virtual disks exis	st.		1	Filter		Q	(ii) <b>•</b>				•
		To	create a virtual disk, s	tart the New Virt	ual Disk Wizar	rd.	A	∆ Sk	lot Name	Status	Capacity	Bus	Usage	C	Nassi
								6	ATA MK000480GWTT		447 GB	SAS	Automatic	SI	ot 6
								7	ATA MK000480GWTT		447 GB	SAS	Automatic	SI	xt 7
								4	ATA MK000480GWTT		447 GB	SAS	Automatic	SI	xt 4
								5	ATA MK000480GWTT		447 GB	SAS	Automatic	SI	ot 5
								1	HP EG002400JWJNT (		2.18 TB	SAS	Automatic	SI	xt 1
								3	HP EG002400JWJNT (.		2.18 TB	SAS	Automatic	SI	xt 3
								2	HP EG002400JWJNT (.	-	2.18 18	5A5	Automatic	SI	л∠
															v

#### NOTE:

Get-PhysicalDisk

is a **PowerShell** command that allows checking the disks available for Storage Pool.

```
Get-PhysicalDisk | sort-object SlotNumber | select SlotNumber,
FriendlyName, Manufacturer, Model, PhysicalSectorSize,
LogicalSectorSize | ft
```

is a **PowerShell** command that allows checking the parameters of physical disks. **2.** Specify a Storage Pool name: **3.** Select the disks for Storage Pool and then press **Next**. In case of using Storage Tiers with both **SSDs** and **HDDs**, all these disks need to be added into the **Storage Pool**.



🕋 New Storage Pool Wizard									_		×
Select physical dis	sks fo	or th	ie storage	pool							
Before You Begin	On se	lect st	orage subsystems	you can ad	ditionally all	ocate disks as hot spar	es that can repla	ce failed d	isks.		
Storage Pool Name	Physic	cal <u>d</u> isl	(5:								
Physical Disks	V	Slot	Name	Capacity	Bus RPM	Model	Allocation	Chassis	Media Typ	e	
Confirmation	✓	6	ATA MK00048	447 GB	SAS	MK000480GWTTH	Automatic 👻	Slot 6	SSD		
	✓	7	ATA MK00048	447 GB	SAS	MK000480GWTTH	Automatic 👻	Slot 7	SSD		
	✓	4	ATA MK00048	447 GB	SAS	MK000480GWTTH	Automatic 👻	Slot 4	SSD		
	<b>V</b>	5	ATA MK00048	447 GB	SAS	MK000480GWTTH	Automatic 👻	Slot 5	SSD		
	~	1	HP EG002400J	2.18 TB	SAS	EG002400JWJNT	Automatic 👻	Slot 1	HDD		
	~	3	HP EG002400J	2.18 TB	SAS	EG002400JWJNT	Automatic 👻	Slot 3	HDD		
	~	2	HP EG002400J	2.18 TB	SAS	EG002400JWJNT	Automatic 👻	Slot 2	HDD		
	Total : i Se	selecte	d capacity: 8.30 these disks will cr	) TB eate a local	pool.						
						< <u>P</u> revious	<u>N</u> ext >	Cr	reate	Cance	!

#### 4. Confirm the correct settings and click **Create** to create **Storage Pool**.

🔁 New Storage Pool Wizard					-		×
Confirm selections							
Before You Begin	Confirm that the following a	are the correct settir	ngs, and then	click Create.			
Storage Pool Name Physical Disks	STORAGE POOL LOCATION						
Confirmation	Server:	sw1					
Results	Storage subsystem:	Windows Storage					
	STORAGE POOL PROPERTIES						
	Name:	MainPool					
	Capacity:	8.30 TB					
	PHYSICAL DISKS						
	ATA MK000480GWTTH (sw1)	Automatic					
	HP EG002400JWJNT (sw1)	Automatic					
	ATA MK000480GWTTH (sw1)	Automatic					
	ATA MK000480GWTTH (sw1)	Automatic					
	ATA MK000480GWTTH (sw1)	Automatic					
	HP EG002400JWJNT (sw1)	Automatic					
	HP EG002400JWJNT (sw1)	Automatic					
1	h			*****			
			< <u>P</u> revious	<u>N</u> ext >	<u>C</u> reate	Ca	ancel

**NOTE:** There might be cases when the MediaType parameter should be changed



manually. It can be done with the following **PowerShell** commands: Assign **SSD** MediaType for the disk with size less than []GB:

Get-PhysicalDisk | where Size -lt [ ]GB | Set-PhysicalDisk -MediaType SSD

Assign **HDD** MediaType for the disk with size more than []GB:

```
Get-PhysicalDisk | where Size -gt [ ]GB | Set-PhysicalDisk -
MediaType HDD
```

Additionally, the following commands can be used:

```
Get-PhysicalDisk | ft FriendlyName,CanPool,Size,MediaType
Set-PhysicalDisk -FriendlyName [disk name] -MediaType [SSD or HDD]
```

or

```
Get-PhysicalDisk | ft FriendlyName,CanPool,Size,MediaType
Get-PhysicalDisk | Where Size -EQ [disk size] | Set-PhysicalDisk -
MediaType [SSD or HDD]
```

**5.** The next step is to create a virtual disk on the storage pool. It is possible to create multiple virtual disks that exist in the storage pool and then create multiple volumes that exist in each virtual disk. Create new virtual disk by right-clicking on the storage pool and selecting **New Virtual Disk.** 

Servers Volumes Disks	STORAGE POO All storage pools	LS 1 total		•								TASKS	•
Storage Pools	▲ Name ▲ Windows Storag	Type e (1)	Managed by	Available to		Read-	Write Server	Capacity	Free Space	Percent Al	located	Status	
	MainPool Storage Pool Last refreshed on 7/10/2020 8:28:18 AM	sw1	w1 New Storage Pool New Virtual Disk Add Physical Disk Upgrade Storage Pool Version		sw1		8.29 TB 8.29 TB						
	VIRTUAL DISKS No related data is availab	le. No related	virtual disks exist.	Delete Storage Pool Properties	Fi	<b>/SICAI</b> Pool of	L DISKS in sw1	Q	(ii) <b>•</b>			TASKS	•
	To c	reate a virtual disk, si	tart the New Virtual	Disk Wizard.	Δ	Slot	Name	Status	Capacity	Bus	Usage	C	Chas
						6 7 4 5 1 3	ATA MK000480GWTT           ATA MK000480GWTT           ATA MK000480GWTT           ATA MK000480GWTT           HP EG002400JWJNT (           HP EG002400JWJNT (		447 GB 447 GB 447 GB 447 GB 2.18 TB 2.18 TB	SAS SAS SAS SAS SAS SAS	Automatic Automatic Automatic Automatic Automatic Automatic	s s s s s s	Slot Slot Slot Slot Slot Slot Slot Slot

6. For Automated Storage Tiering, both HDD- and SSD-based disks or storage arrays

should be in the storage pool to make use of Storage Tiers. In case of using Storage Tiers, Storage Layout can be only Simple and Mirror. Specify Virtual Disk Name and select **Create storage tiers on this virtual disk**.

눰 New Virtual Disk Wizard			_		$\times$
Specify the virtual	disk nar	ne			
Before You Begin	N <u>a</u> me:	TieredSpace			
Virtual Disk Name	Description:				
Enclosure Awareness					
Storage Layout					
Provisioning					
Size	✓ <u>C</u> reate st	orage tiers on this virtual disk			
Confirmation	Storage t storage.	iers enable automatic movement of the most frequently accesse	d files to f	faster	
Results					
	1 You canno	ot remove storage tiers from a virtual disk after it is created.			
		< <u>P</u> revious <u>N</u> ext > <u>C</u> re	ate	Cancel	

**NOTE:** Simple Tier has no redundancy built-in, so in case of either individual spinning disk and/or flash drive failure there is a risk of losing the data. It is recommended to configure resilient storage to be used as the underlying storage for the Tier. Please make sure that such a configuration is supported by either the software vendor (i.e., StarWind, Microsoft, VMware, etc.) or/and MSP/ISV. **7. Select the storage layout** type. Under the **Simple** layout, the data is striped across physical disks. This would be equivalent to a RAID-0 configuration. In case of using at least two disks, the **Mirror** configuration can be configured. The Mirror is equivalent to RAID-1. Once done, click next.



🖕 New Virtual Disk Wizard		- 🗆 X
Select the storag	ge layout	
Before You Beain	Layout:	Description:
Virtual Disk Name	Simple	Data is striped across physical disks, creating two or three
Enclosure Awareness	Mirror	copies of your data. This increases reliability, but reduces capacity. To protect against a single disk failure, use at least two
Storage Layout		disks (three if you're using a cluster); to protect against two
Provisioning		disk failures, use at least five disks.
Confirmation		
		< Previous Next > Create Cancel

**8.** Specify the provisioning type. **Fixed.** This provision type means that virtual disk cannot exceed the actual storage pool capacity. **Thin.** This provision type means that there is a possibility to create a volume with a size exceeding the storage pool capacity and then add physical disks later. Choose **fixed** disk provisioning since this type is required by Storage Tiers. Click **Next. 9.** Specify the size of the **Virtual Disk.** 



🔁 New Virtual Disk Wizard		- 🗆 X
Specify the size of	the virtual disk	
Before You Begin	Free space in this storage pool: 4.14 TB	
Virtual Disk Name	Specify how big the two tiers of your virtual of	lisk should be.
Enclosure Awareness Storage Layout	Faster Tier	Standard Tier
Resiliency Settings	Free space: 891 GB	Free space: 3,349 GB
Provisioning	Specify size:	Specify size:
Size	880 GB ~	3300 GB ~
Confirmation		
Results	○ Maximum size	<ul> <li>Maximum size</li> </ul>
	Virtual disk size: 4.08 TB	
	1 The virtual disk might take additional space	e to create a write-back cache.
	< <u>P</u> revious	<u>N</u> ext > <u>C</u> reate Cancel

**NOTE:** At least 8 GB of free space on each Tier should be provisioned to allow Automated Storage rebuilding in case of the disk loss. **10.** Confirm the settings and click **Create** to create Virtual Disk.



🚡 New Virtual Disk Wizard			_		×
Confirm selection	S				
Before You Begin	Confirm that the follo	wing are the correct settings	, and then click Cre	eate.	
Virtual Disk Name	VIRTUAL DISK LOCATIO	N			
Enclosure Awareness	Server:	sw1			
Storage Layout	Subsystem:	Windows Storage			
Resiliency Settings	Storage pool name:	MainPool			
Provisionina	Status:	ОК			
Size	Free space:	8.29 TB			
Confirmation	VIRTUAL DISK PROPERT	TES			
Results	Name:	TieredSpace			
	Storage tiers:	Enabled			
	Storage layout:	Mirror			
	Resiliency type:	Two-way mirror			
	Provisioning type:	Fixed			
	Total requested size:	4.08 TB			
	Faster tier size:	880 GB			
	Standard tier size:	3.22 TB			
	Enclosure awareness:	None			
		< <u>P</u> revious <u>N</u> ext >	Create	Cance	el

**NOTE:** In case of using both SSD and HDD disks or virtual LUNs, automated Storage Tier consists of the so-called "hot" and "cold" Tiers. Automated Storage Tier elaborates a data map taking into account how often the certain data is used, thus defining how hot separate data blocks are. During the process of optimization that is launched automatically every day, the hot data, i.e. data that is used on the most frequent basis, is transferred to the fast SSD tier, with the data used less frequently, the so-called cold data, being transferred to the slower HDD tier. As the SSD tier-based data gets updated only once a day, it is possible to manually optimize it with the help of the following CMD one-liner:

#### defrag.exe /C /H /K /G

This command should be run on all cluster nodes, as it optimizes only those virtual disks the owner node for which is the one where the command is running. For certain files, it can be optimal to permanently stay on the SSD tier. An example is a VHDX file that is accessed frequently and requires minimum latency and high performance. Such a result can be achieved by pinning the file to the SSD tier. The following recommendations should be taken into account before running the command:

• the command should be run from the node owning the storage (Cluster Shared



Volume) with the file stored on it.

• local path to the storage (Cluster Shared Volume) on the node should be used.

After a file is pinned, it will stay in the tier until the next optimization process triggered either automatically or manually. To pin files to the SSD tier, run the following PowerShell command:

```
Set-FileStorageTier -FilePath <localFilePath> -
DesiredStorageTierFriendlyName<ssdTierName>
```

To unpin files from the SSD tier, run the following PowerShell command:

```
Set-FileStorageTier -FilePath <localFilePath>
```

The below PowerShell command lists all files that are currently pinned:

```
Get-FileStorageTier -VolumePath <csvVolumePath>
```

# **11.** Create a **New Volume** using **New Volume Wizard**: **12.** Select the server and disk and click **Next**.

Server:				
Provision to	Status	Cluster F	Role Destinati	on
sw1	Online	Not Clus	stered Local	
			Re <u>f</u> resh	<u>R</u> esca
<u>D</u> isk:				
Disk	Virtual Disk Capa	city Free Space	Subsystem	
Disk 9	TieredSpace 4.08	TB 4.08 TB	Windows Storage	
	Server: Provision to sw1 Disk: Disk Disk Disk 9	Server:          Provision to       Status         sw1       Online         Disk:       Disk         Disk       Virtual Disk         Capa       Disk 9         TieredSpace       4.08	Server:       Provision to       Status       Cluster F         sw1       Online       Not Cluster         Disk:       Disk:       Disk       Virtual Disk       Capacity       Free Space         Disk 9       TieredSpace       4.08 TB       4.08 TB	Server:       Provision to       Status       Cluster Role       Destinati         sw1       Online       Not Clustered       Local         Refresh       Disk:       Disk:       Disk       Virtual Disk       Capacity       Free Space       Subsystem         Disk 9       TieredSpace       4.08 TB       Windows Storage

**13.** Select the file system settings and click **Next** to proceed.



📥 New Volume Wizard			_		×
Select file system	settings				
Before You Begin Server and Disk Size Drive Letter or Folder File System Settings Confirmation Results	Eile system: Allocation unit size: Volume Label: Generate short file n Short file names (8 c applications running	NTFS   Default   New Volume  names (not recommended)  characters with 3-character extension g on client computers, but make file c	s) are required for some perations slower.	16-bit	
		< <u>P</u> revious <u>N</u> ext >	Create	Cance	:1

**NOTE:** The steps described above can be performed with help of **PowerShell** commands. Also, with help of **PowerShell**, additional parameters can be configured for better performance: Set 64K size of interleave: *-Interleave 65536*. Set *LogicalSectorSizeDefault 4096* instead of default *512*. The cache size can be changed with the help of *-WriteCacheSize [ ]GB* parameter. It is possible to set cache size only via PowerShell commands for creating Automated Storage Tier. Set **SSD** tier in two-way mirror: *ResiliencySettingName Mirror -NumberOfDataCopies 2* The number of threads can be set with *-NumberOfColumns parameter*. The recommended number is the number of SSDs divided by 2. **Disclaimer:** StarWind Support does not write scripts on demand. Custom script troubleshooting is not supported. The script provided in this article is as an example and can be customized by the end-user according to his needs. The example of the **PowerShell** commands for Storage Pool and Virtual Disk with Tiered Storage creation is provided below:

Get-StorageSubsystem — check the storage subsystem name before running the commands below.

Get-PhysicalDisk

\$disks = Get-PhysicalDisk |? {\$\_.CanPool -eq \$true}

New-StoragePool -StorageSubSystemFriendlyName "[ ]\*" -FriendlyName
[ ] -PhysicalDisks \$disks -LogicalSectorSizeDefault 4096

Get-PhysicalDisk | where Size -lt [ ]GB | Set-PhysicalDisk -MediaType SSD

Get-PhysicalDisk | where Size -gt [ ]GB | Set-PhysicalDisk -MediaType HDD

Get-StoragePool -FriendlyName [ ]

New-StorageTier -MediaType SSD -StoragePoolFriendlyName [ ] FriendlyName SSDTier -ResiliencySettingName [Simple, Mirror or
Parity] -NumberOfDataCopies 2 -NumberOfColumns [ ] -Interleave
65536

New-StorageTier -MediaType HDD -StoragePoolFriendlyName [ ] FriendlyName HDDTier -ResiliencySettingName [Simple, Mirror or
Parity] -Interleave 65536

\$SSD = Get-StorageTier -FriendlyName SSDTier

\$HDD = Get-StorageTier -FriendlyName HDDTier

New-VirtualDisk -FriendlyName "[ ]" -StoragePoolFriendlyName [ ] -StorageTiers \$SSD, \$HDD -StorageTierSizes [ ]GB, [ ]Gb -ResiliencySettingName [Simple, Mirror or Parity] -ProvisioningType fixed -WriteCacheSize [ ]GB

**IMPORTANT NOTE:** The virtual storage configuration created with PowerShell script must be reviewed by the software vendor (i.e., StarWind, Microsoft, VMware, etc.) for compliance and is fully supported and validated by either software vendor or MSP / ISV to satisfy and match the existing and future workload requirements and expectations of the specific production environment. The operations specified in this section should be performed on each server.



# **Useful Links**

The recent StarWind Virtual SAN build can be downloaded here: <u>https://www.starwindsoftware.com/starwind-virtual-san#download</u> The complete Release Notes can be viewed by following this link: <u>https://www.starwindsoftware.com/release-notes-build</u>

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