

CiB with Windows 2012 R2 Best practices Guide

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Supermicro Storage Group



# White Paper

Windows Server 2012 R2 on Supermicro Cluster-in-a-Box performance and availability considerations.

## **Executive Summary**

This document introduces Supermicro's SuperStorage bridge bay Cluster-in-a-box (CiB) products and presents a number of considerations/best practices for the System Administrator when deploying the product within a Microsoft Windows 2012 R2 <sup>®</sup> High Availability environment.

A set of guidelines are presented which shows how best to deploy the solution in order to maximize performance and availability in a number of generic usage scenarios. The intent is to show characteristics of the system and any performance figures are not intended to be taken as benchmark metrics but rather to illustrate general behavior under a range of conditions. The true test of performance is dependent on a wide variety of vectors such as infrastructure, I/O load, number of clients and the user's application.

The first section of this guide introduces the CiB and explains how it naturally complements the High Availability features of Windows Server 2012 R2 to bring affordable highly reliable solutions to the SMB market. Particular attention is given to Windows 2012 features such as tiering and write back caching along with the use of network optimization. The CiB has been designed as a complete plug and play solution and the default shipping configuration has been carefully chosen to complement these business critical features. The emphasis in this document is to provide a set of guidelines within a *generic* environment.

The final section presents a number of well documented examples covering configuration examples to show how to configure high availability shares, iSCSI targets and tiered drives.

It is planned at a later date to provide application specific white papers within particular environments such as Microsoft Exchange and MSSQL.



Best practices and tips are highlighted in bold text with a "note icon" throughout the document!



## Disclaimer

The intent of this document is to provide a set of general guidelines for the user deploying the Supermicro CiB product. These guidelines are derived from our internal testing and customer feedback and may not be always be appropriate for individual deployments. The appropriate software vendor should be consulted as the definitive resource. Information contained herein is provided with the best intent, however Supermicro cannot be held responsible for errors or omissions contained in this document.

Feedback is greatly encouraged.

All Trademarks respected and acknowledged.



# Contents

E	ixecutive Summaryi
[	Disclaimerii
1.	System Considerations and Introduction1-1
	Hardware Reliability1-1
	Achieving RAS1-1
2.	Introduction to Cluster-in-a-Box
	Hardware Layout2-2
F	Performance Considerations2-7
۱	Network Considerations2-7
	Enabling Jumbo Packets2-7
	Creating a Teamed Network2-8
3.	Configuration Walkthroughs3-1
	Example 1 - Creating a Storage Pool3-1
	Example 2 - Creating a Virtual Disk
	Example 3 - Creating a Volume3-7
	Example 4 – Creating a File Share Role3-10
	Accessing the share3-17
	Example 5 – Creating an iSCSI Target Role3-17
	Example 6 – Creating a Storage Tier3-22
	Example 7 – Moving Ownership3-26
	Quorum and Ownership3-29
F	urther Resources
4.	References and Glossary4-1
(	Glossary of terms
F	References/Useful Links



Figure 2-1 SSG-6037B-CIB032	
Figure 2-2 SSG-2027B-CIB020H	2-1
Figure 2-3 937R-E2JB JBOD expansion Chassis	
Figure 2-4 Rear View of CiB Models	
Figure 2-5 Rear View of Nodes Showing Ethernet Port Assignment	
Figure 2-6 Default Storage Pool Configuration	
Figure 2-7 (SATADOM) SATA Disk on Module Device	2-4
Figure 2-8 CiB Expansion Capabilities	
Figure 2-9 Top View Showing COA Labels	
Figure 2-10 Tiering within a Virtual Drive	
Figure 2-11 Enabling Jumbo Frames on an Ethernet X540-AT2 NIC	
Figure 2-12 Configuring a New Teamed NIC	
Figure 2-13 Add the New Team	2-9
Figure 2-14 Naming and Selecting the NICs for Teaming	2-9
Figure 2-15 Viewing the New Teamed Network Connection	
Figure 3-1 Starting the Storage Pool Wizard	
Figure 3-2 Selecting and Naming the New Pool	
Figure 3-3 Selecting the Physical Disk to be Added to the New Pool	
Figure 3-4 Pool Creation Confirmation Screen	3-3
Figure 3-5 Newly Created Storage Pool	3-4
Figure 3-6 Starting the Virtual Disk Wizard	
Figure 3-7 Selecting the Virtual Disk Layout	
Figure 3-8 Selecting the Virtual Drive's Capacity	
Figure 3-9 Confirming the Virtual Disk Configuration	3-7
Figure 3-10 Selecting the Server and Disk for the New Virtual Volume	
Figure 3-11 Selecting the Volume's Capacity	3-8
Figure 3-12 Assigning a Volume's Drive Letter	3-9
Figure 3-13 Confirmation of Volume Creation	3-9
Figure 3-14 Configuring a High Availability Role	3-11
Figure 3-15 Selecting the High Availability Role	3-11
Figure 3-16 Selecting the File Server Type	3-12
Figure 3-17 Naming the Role for Clients	3-12
Figure 3-18 Selecting Storage for the Share	3-13
Figure 3-19 Confirming the Clustered Role Selection	3-13
Figure 3-20 File Server Summary Screen	3-14
Figure 3-21 Showing the Newly Added File Server Role	3-14
Figure 3-22 Selecting the File Share Location	3-15
Figure 3-23 Selecting the Share Setting	3-16
Figure 3-24 Confirming the SMB Share Creation	3-16
Figure 3-25 Entering the File Share IP Address	3-17
Figure 3-26 Viewing the Newly Created Share	3-17
Figure 3-27 Bringing up the Failover Cluster Manager	3-18

Supermicro Cluster-in-a-Box with Windows 2012 R2 Best Practices Guide



3-18
3-19
3-19
3-20
3-20
3-21
3-21
3-22
3-23
3-24
3-25
3-25
3-26
3-26
3-27
3-27
3-28
3-28
3-19 3-20 3-20 3-21 3-21 3-22 3-22 3-25 3-26 3-26 3-26 3-27 3-27 3-28

## Tables

Table 1 Add-on Board Options	2-1	
Table 2 CiB Specifications at a Glance	2-2	





# 1. System Considerations and Introduction

When implementing a high availability solution it is important to understand the system as a whole from a hardware, software, application and environment perspective. All aspects need to be considered carefully in order to derive an optimum tradeoff between cost, performance and reliability. Hardware must be reliable, cost effective and able to deliver data in a timely fashion. This has been the design objectives for Supermicro's Cluster-in-a-Box product

## Hardware Reliability

Obviously all physical components are subject to failure, but the key issue for the implementer with a High Availability design is to ensure that the system delivers data in a continuous fashion (although it may be at reduced delivery rates) with no impact on data availability to the clients. Ideally the frequency of component failure should be a rare event and from a hardware perspective this goal is met by implementing a high quality system without any single point of failure. A well designed system such as the Supermicro CiB product features highly reliable, redundant components which will significantly reduce the likelihood of any system downtime occurring. In addition to avoiding this downtime it is also desirable that failed components should be easily serviceable by using replaceable "on the fly" modules thus avoiding having to schedule offline/downtime time. These factors are measured using *Reliability*, *Availability* and *Serviceability* metrics collectively known as *RAS*.

## **Achieving RAS**

Supermicro's CiB product incorporates full system redundancy and tolerates infrastructure failures within Microsoft's 2012 cluster environment since the cluster will automatically reroute clients should a host fail.

- *Reliability* is accomplished by the use of Supermicro's redundant component design.
- Availability is achieved through the synergy of Microsoft Windows and Supermicro's CiB design.
- *Serviceability* is met by the use of the innovative Super SBB modules.

The next section of this paper introduces the hardware components of the CiB and shows how it has been designed to meet these challenges.



## 2. Introduction to Cluster-in-a-Box

Supermicro currently offers two major CiB products. The first, SSG-6037B-CIB032, is a 16 bay 3U product supporting 3.5" hot-swap SAS drives. JBOD expansion ports are included to support an additional 64 drives in 4 expansion enclosures.



#### Figure 2-1 SSG-6037B-CIB032

The second model is the SSG-2027B-CIB020H, which is a 24 bay 2U product supporting 2.5" hot-swap SAS drives. This system can also support 4 expansion enclosures.



#### Figure 2-2 SSG-2027B-CIB020H

The JBOD expansion enclosure is shown in Figure 2-3.



Figure 2-3 937R-E2JB JBOD expansion Chassis

There are a number of add-on modules offered for Ethernet connectivity as shown in the table below.

Table 1 Add-on Board Options

Description	Part Number
Quad-port 1G	AOC-SG-i4
Dual-port 10G Base-T	AOC-STG-i2T
Dual-port 10G SFP+	AOC-STGN-i2S



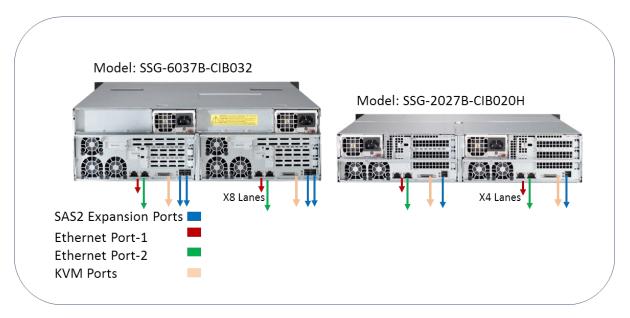
#### Table 2 CiB Specifications at a Glance

Part Number / Datasheet	SSG-6037B-CIB032	SSG-2027B-CIB020H
Form Factor	3U / 16x 3.5" Hot-swap Bays	2U / 24x 2.5" Hot-swap Bays
Server Node	2	2
Processors per Node	Dual Intel Xeon E5-2403 v2	Dual Intel Xeon E5-2403 v2
Memory per Node	32GB	64GB
Hard Drives	8x 4TB Nearline SAS Drives	20x 1TB Nearline SAS Drives
SSD	-	4x 200GB SSD
JBOD Expansion Ports/per Node	Dual SAS2 ports	Single SAS2 port

The Super SBB design provides hot-swappable canisters for active components.

## **Hardware Layout**

Figure 2-4 shows a rear view of both models. Node locations in this document are left-to-right when the system is viewed from the front. Each system features a number of vacant PCI-e slots for additional functionality.



#### Figure 2-4 Rear View of CiB Models



Note node names may be swapped if server modules are relocated in another slot. Cluster-N1 and Cluster-N2 names are not bound to left or right server locations.

Ethernet port 1 on the nodes is set for DHCP by default and should be connected to the public network and port 2 is set for heartbeat communications, as shown in Figure 2-5. In addition, there is an option to add 10 Gigabit Ethernet cards, as listed in Table 1 earlier.



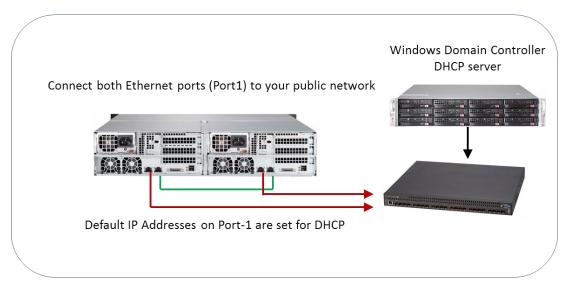
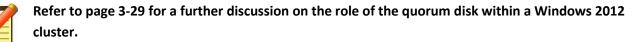
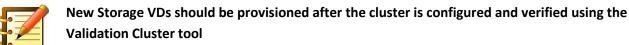
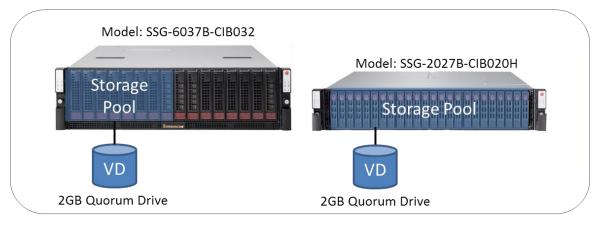


Figure 2-5 Rear View of Nodes Showing Ethernet Port Assignment

The CiB ships with a pre-configured storage pool and pre-provisioned quorum disk to simplify installation.







#### Figure 2-6 Default Storage Pool Configuration

The 3U model ships with 8 x HDDs and the 2U model ships with 4 x SSDs and 20 X HDDs. All disks are configured as a single pool by default along with a small capacity quorum disk.

Each node within the CiB has its own boot disk which is private and not sharable. This boot disk is not part of the removable front bay disks and is a SATADOM (SATA Disk on Module) device as shown below.



The DOM is located internally on the mother board and is preinstalled for ease of deployment. The SATADOM provides better performance and lower power consumption than an HDD device.



Figure 2-7 (SATADOM) SATA Disk on Module Device

Figure 2-8 shows that either of the systems can be expanded through the mini SAS HD connector to 4 x 16 bay expansion enclosures, giving a total of 384 TB of additional storage.



Figure 2-8 CiB Expansion Capabilities

Figure 2-9 shows where the Certificate of Authenticity labels are placed. Note this in case the Operating System has to be re-installed.



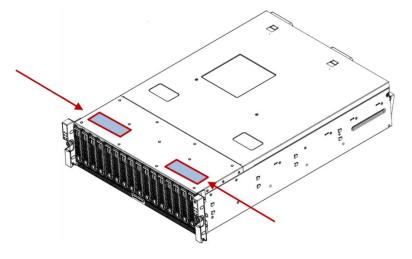


Figure 2-9 Top View Showing COA Labels

For further information refer to the references listed in this document.

## **Storage Spaces**

Storage Spaces from Microsoft virtualizes physical disks into pools which in turn can be divided into virtual disks. These virtual disks feature improved resilience, performance and ease of management compared to their physical counterparts and are an aggregation of the physical disks.

## Layout and Resiliency Options

Storage Spaces provides a number of layout options -

- Simple requires at least one disk and is optimized for performance and capacity, however it provides no additional protection in that there is only one copy of the data.
- Mirrored requires a minimum of two disks and will duplicate the data. In this case a catastrophic disk failure will still be able to deliver the data to the clients since the remaining disk has a full copy. In this instance only half of the physical drive capacity is available due to the mirroring function.
- Parity stripes data and redundancy information across several disks. This improves capacity
  utilization when compared to the mirrored configuration described above. Single disk failure
  protection can be achieved with three disks and dual disk failure protection can be achieved
  with seven disks.
- Storage Spaces can automatically rebuild mirror and parity spaces in which a disk fails by using dedicated disks that are reserved for replacing failed disks (hot spares), or more rapidly by using spare capacity on other drives in the pool. Storage Spaces also includes background scrubbing and intelligent error correction to provide continuous service availability despite storage component failures. In the event of a power failure or cluster failover, data integrity is preserved so that recovery happens quickly and does not result in data loss. (Microsoft, 2014).



## **Performance Enhancements**

## Tiering

In addition to data protection, Storage Spaces also provides enhanced performance by the use of tiered storage. When a combination of Hard Disk Drives (HDDs) and Solid State Drives (SSDs) are used together, the system will automatically move "hot" data onto the SSDs. The improved access times of the SSDs ensure that frequently accessed data is delivered more efficiently to the clients. This is done transparently by the system. Tiering can be selected at virtual disk creation time and the ratio of SSD to HDD storage space can be selected as shown in Figure 2-10. In this example the ratio is 1:10.

Before You Begin	Free space in this storage pool: 9.44 TB			
Storage Pool	Specify how big the two tiers of your virte	ual disk should be.		
Virtual Disk Name				
Storage Layout	Faster Tier (SSD)	Standard Tier (HDD)		
Resiliency Settings	Free space: 368 GB	Free space: 9,296 GB		
Size	Specify size:	Specify size:		
Confirmation	50 GB 🔻	500 GB 🔻		

#### Figure 2-10 Tiering within a Virtual Drive

Data is dynamically moved at a sub-file level between both tiers.

Although the benefits of tiering are highly dependent on the application, in general it is well suited for *transient* hot data. Hot data is also termed the *working set*.



The goal of tiering is that frequently accessed files are located on the SSD with less frequently accessed files being located on the HDDs. This way the performance benefits of SSD can be realized without suffering the cost disadvantages.



The default shipping configuration of the Supermicro SSG-2027B-CIB020H (described on page 2-1) uses 4 x SSDs and 20 x HDDs in a single pool and with the ratio of SSD to HDD designed to ensure good use of the tiering feature. In addition, a quorum disk is used within this shared storage pool.

## Write-back Cache.

Storage Spaces can use a write-back cache on SSDs in pool-to-buffer write operations. Once the data has been written to the SSD, an acknowledgement is sent back to the issuer of the I/O. The data is then subsequently written to the HDD. In general this works well for small size block write operations which are common in many applications such as transaction processing. It will also help "smooth out" short bursts of activity.

## **Provisioning**

Volumes may be fixed or thin provisioned. The advantage of thin provisioning is that the capacity presented can be larger than the actual physical capacity. Storage can be added as required at a later stage when needed rather than having to purchase it at deployment time. Thin provisioning exhibits *allocation on demand* behavior.





For cluster shared volumes, use fixed provisioned disks. The test configurations used in this document all used fixed provisioning.

## **Performance Considerations**

The CiB system is usually deployed as a High Availability Storage Server in that it will be accessed by a number of clients via a network interface. Clients may access the storage using block or file based protocols. Block protocols are normally implemented with iSCSI and SMB can be used as the file protocol. The system may also provide a location for number of Hyper-V Virtualized Machines. Drives will be configured using Windows Storage Spaces, which provides ease of storage management along with data protection features.



Simple spaces are suitable for high performance where data resiliency is less important. Examples include high speed static lookups, video rendering or temporary data storage where the job can be rerun. Mirrored spaces provide good performance with general purpose file shares.

Mirrored spaces are used for general purpose file shares.

Parity based drives can be used for archival or data streaming services. With the initial release of Windows 2012, parity spaces were not supported in clustered pools. This is no longer the case with Windows 2012 R2.



Thin provisioning can impact performance as it may have to allocate storage and integrate it within the device in real time. This is not normally a consideration with traditional business oriented applications but may cause an interruption to critical real-time transfers. In addition since the Operating System is presented with virtual capacity rather than physical capacity, the onus is on the administrator to ensure that storage is added to the thinly provisioned volume in time. The system will, however, flag events ahead of time when there is not enough capacity to perform a write. In addition the storage space will be taken offline if it runs out of capacity to mitigate any chance of data loss.

## **Network Considerations**

The standard configuration uses Gigabit Ethernet, which is suitable and commonplace on the client side. If a large number of clients are serviced or if higher throughput is required then it is recommended to use 10GigE for the CiB server connections.



Network interfaces should also be *teamed* for *to address performance and resiliency* issues. In addition, *Jumbo frames* can be configured for performance reasons.

## **Enabling Jumbo Packets**

Jumbo frames can be enabled by selecting the network interface card and then using the <Advanced> tab to change the value as shown in Figure 2-11.



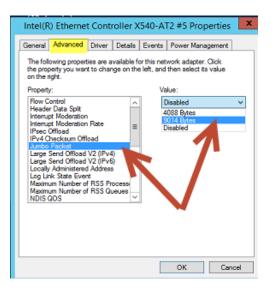


Figure 2-11 Enabling Jumbo Frames on an Ethernet X540-AT2 NIC

## **Creating a Teamed Network**

To create a teamed network, select a server from the server manager screen and then right click to select <Configure NIC teaming> to form a combined network team.

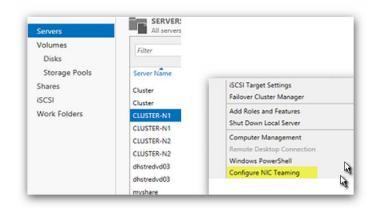


Figure 2-12 Configuring a New Teamed NIC

At the next screen select <Add to New Team>.



Serv	-		DVEDC				NIC	Teaming	
Volu Dis	SERV	VERS						<u> </u>	
Sto Shar	Name	*	Status	Server Type	Operating System Version	Teams			
iSCS	cluster-N1.C	lusterNetwork.co	m 🛈 Online	Physical	Microsoft Windows Storage Server 2012 R2	Standard 0			
Worl									
	Trans							ADADTEDE A	ND INTERFACES
	TEAMS All Teams   0	total					TASKS 👻	ADAPTERS A	ND INTERFACES
	All Teams   0		orda Load Balancing	Adaptare			TASKS		
	All Teams   0		ode Load Balancing	g Adapters			TASKS 💌	Network Adap	ters Team Interfaces
	All Teams   0		ode <sup>-</sup> Load Balancing	a Adapters			TASKS 🔻		ters Team Interfaces
	All Teams   0		ode Load Balancing	Adapters			TASKS 🔻	Network Adapt	ters Team Interfaces
	All Teams   0		ode Load Balancing	g Adapters			TASKS	Network Adapt	ters Team Interfaces Speed State le to be added to a team
	All Teams   0		ode <sup>®</sup> Load Balancing	9 Adapters			TASKS •	Network Adap Adapter	ters Team Interfaces Speed State le to be added to a team
	All Teams   0		ode <sup>-</sup> Load Balancing	Adapters			TASKS 💌	Network Adapt Adapter Availabl Cluster_Heartb Ethernet S	ters Team Interfaces Speed State le to be added to a team peat 1 Gbps 10 Gbps
	All Teams   0		ode Load Balancing	Adapters			TASKS •	Network Adapt Adapter Availabl Cluster_Heartb Ethernet 5 Ethernet	ters Team Interfaces Speed State le to be added to a team peat 1 Gbps 10 Gbps Add to New Team
	All Teams   0		ode <sup>†</sup> Load Balancing	Adapters			TAGKS •	Network Adapt Adapter Availabl Cluster_Heartb Ethernet S	ters Team Interfaces Speed State le to be added to a team oceat 1 Gbps 10 Gbps

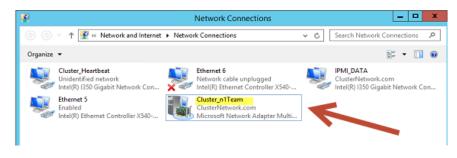
#### Figure 2-13 Add the New Team

Name the team as shown below.

Feam	
apters: Adapter Speed State Reason Cluster_Heartbeat 1 Gbps Ethernet 5 10 Gbps Ethernet 6 Disconnected IPMI_DATA 1 Gbps	

Figure 2-14 Naming and Selecting the NICs for Teaming

The teamed NIC will now show up as a new Network Connection.







# 3. Configuration Walkthroughs

## **Example 1 - Creating a Storage Pool**

From the Server Manager screen – select <Tools> - <Failover Cluster Manager>. Expand the Storage branch on the left and select <New Storage Pool> as shown to bring up the Storage Pool Wizard.

· 4월		Faild	over Cluster Man	ager				- 0	x
File Action View Help									
🗢 🄿 🖄 📰 🚺									
📲 Failover Cluster Manager	Pools (1)					Act	ions		
⊿ CLUSTER.ClusterNetwork. Roles	C Search			P Querie	es 🔻 🔛 🔻 👽	Po	ols		
Nodes	Name	Status	Health Status	Owner Node	Operational Status	\$	Add Storage Pool		
⊿ 📇 Storage	Cluster Pool 1	Online	Healthy	cluster-N1	OK		New Storage Pool		
🧾 Disks		0				1°	View		<u> </u>
Pool-	rage Pool					Q	Refresh		
The free work	prage Pool					-			
View						?	Help		
	•					Clu	uster Pool 1		•
Refresh						<b>1</b>	Bring Online		
Help							Take Offline		
							Information Details		
							Show Critical Events		
							Move		•
						4	Add Virtual Disk		
	<		1		>				
			1				More Actions		•
	V Cluster Pool 1					×	Remove		_
	Status:	Online			^		Properties		
	Pool Id:	24b2f8c3f112-11e	3-80bc-0025906cf009			?	Help		
	Pool Name:	CIB Storage Pool			=				
	Pool Description:								
	Physical Disk Number(s): Health Status:	<ol> <li>6, 18, 20, 1, 13, 12</li> <li>Healthy</li> </ol>	, 0, 2, 3, 21, 10, 7, 8, 1	9, 17, 22, 15, 16, 4, 9,	5, 23, 11, 14				
	Operational Status:	OK							
	Free Space:	16.7 TB			~				
< 111 >	Summary Virtual Disks Ph	ysical Disks							

Figure 3-1 Starting the Storage Pool Wizard

In this example, three drives have been added to the optional JBOD enclosure. Microsoft uses the term *primordial* for a set of disks that have not yet been configured as a storage pool. Next the pool needs to be named.



		New Storage Pool Wiza	-	
oecifv a storad	ge pool name an	d subsystem		
		)		
Before You Begin	Name: JBODPool			
Storage Pool Name	Description:			
Physical Disks				
	Select the group of avail	able disks (also known as a primor	dial pool) that you want to use:	
	Managed by	Available to	Subsystem	Primordial Pool
	CLUSTER	CLUSTER	Clustered Storage Sp	aces Primordial

#### Figure 3-2 Selecting and Naming the New Pool

Select the available disks and then select <Next>.

<b>a</b>			١	lew Stora	ge P	ool W	zard			-	□ X
Select physical dis Before You Begin Storage Pool Name	Selec disks	t physi	ical disks for the st	1	and cl	noose w	hether any disks sho	ould be allocated a	is hot spares that	replace	failed
Physical Disks		_	Name	Capacity	Bus	RPM	Model	Allocation	Chassis		
Confirmation Results		0	PhysicalDisk24	3.64 TB	SAS		ST4000NM0023	Automatic 🔻	SES Enclosure	5003048	0037FA9
Results		1	PhysicalDisk25	3.64 TB	SAS		ST4000NM0023	Automatic 🔻	SES Enclosure	5003048	0037FA9
		2	PhysicalDisk26	3.64 TB	SAS		ST4000NM0023	Automatic 🔻	SES Enclosure	5003048	0037FA9
				9 TB eate a pool	on the	III e follow	ing cluster: CLUSTER				>
							< <u>P</u> revious	<u>N</u> ext >	<u>C</u> reate	С	ancel

#### Figure 3-3 Selecting the Physical Disk to be Added to the New Pool

In this case, three physical disks are available. Select them all and then select <Next>. The wizard then shows a confirmation screen.



	Ne	w Storage Pool Wizard	_ <b>_</b> ×
Before You Begin Storage Pool Name Physical Disks Confirmation Results	ns	are the correct settings, and then click Create. cluster-N2 Cluster Node Clustered Storage Spaces JBODPool	
	Capacity: PHYSICAL DISKS PhysicalDisk25 (cluster-N1) PhysicalDisk26 (cluster-N1) PhysicalDisk24 (cluster-N1)	10.9 TB Automatic Automatic Automatic	
		< <u>P</u> revious <u>N</u> ext >	<u>C</u> reate Cancel

#### Figure 3-4 Pool Creation Confirmation Screen



It is also possible to designate the disks as *hot spares* where they would automatically be selected as candidates for rebuild operations should a disk fail. In this case though, they are left at the default settings of <Automatic>. In general, as a best practice it is recommended to have a hot spare available within the cluster.



The next screen shows the newly created storage pool, which is Online and Healthy. With the pool selected, the bottom of Figure 3-5 shows the physical disks that make up the pool. It can also be seen that both pools are *owned* by cluster node Cluster-N1. To achieve better utilization, it is recommended to balance the load by changing ownership such that each node owns one of the pools. Note that clustered storage spaces still allow access from each of the nodes. The Move function can be accessed from the right hand side of Figure 3-5. The system allows an automatic choice or it will allow you to select the node to be used.

Ownership is covered in more detail on page 3-26.





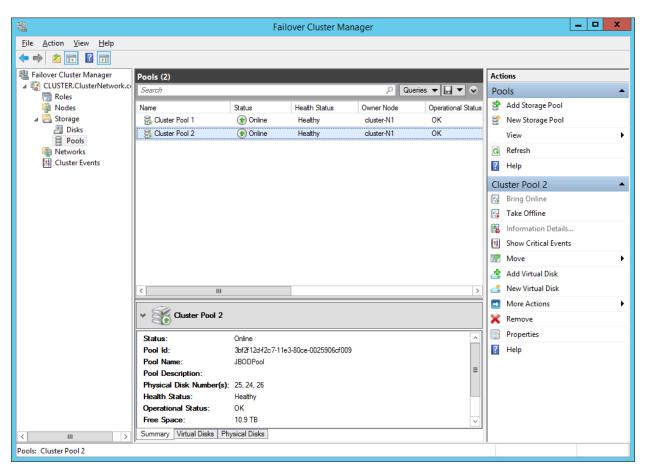


Figure 3-5 Newly Created Storage Pool

After the pool has been created there is a prompt to configure a new virtual disk.

## **Example 2 - Creating a Virtual Disk**

The CiB as delivered comes with a pre-configured storage pool. The virtual disk will be created from the newly added pool.

Either accept the offer to create the new virtual disk from the storage pool wizard or, from the server manager screen with <Storage Pool> selected, right click to start the New Virtual Disk Wizard.

Select the pool (JBODPool) to start the virtual disk creation.

Pool Name					
roorivanic	Managed by	Available to	Capacity	Free Space	Subsystem
CIB Storage Pool	CLUSTER	CLUSTER	18.9 TB	16.7 TB	Clustered Stora
JBODPool	CLUSTER	CLUSTER	10.9 TB	10.9 TB	Clustered Stora
	-	-		5	5

Name the virtual disk (in this case JBODVD01).

		New Virtual Disk Wizard		D X	
Specify the virtua	l disk nar	me			
Before You Begin	N <u>a</u> me:	JBODVD01			
Storage Pool					
Virtual Disk Name	Description:				
Storage Layout					
Size					
Confirmation		orage tiers on this virtual disk			
Results	Storage t storage.	tiers enable automatic movement of the most frequently accessed files	to faster	(SSD)	
		orage tiers, the storage pool requires a minimum of one automatically a disk of each media type (SSD and HDD).	allocated		
		< <u>Previous</u> <u>Next &gt;</u>	Ca	ncel	

#### Figure 3-6 Starting the Virtual Disk Wizard



Note that tiering is not an option here and is greyed out with this pool since it contains only HDDs. A tiering example is covered on page 3-24.

The next stage is to select the resiliency option. Refer to page 2-7 to review layout options from a performance perspective.



L. States	New	v Virtual Disk Wizard
Select the stora	ge layout	
Before You Begin	Layout:	Description:
Storage Pool	Simple	Data is duplicated on two or three physical disks, increasing
Virtual Disk Name	Mirror	reliability, but reducing capacity. This storage layout requires at least two disks to protect you from a single disk failure, or at
Storage Layout	Parity	least five disks to protect you from two simultaneous disk
Size		failures.
		< Previous Next > Create Cancel
		Greate Greate

Figure 3-7 Selecting the Virtual Disk Layout

In this example <Mirror> has been selected as the layout.



Note that the three physical disks used here are enough for single parity protection; however seven drives are necessary for dual disk protection. In the interests of performance it is recommended to have a minimum of five drives for single parity based layout schemes.

After the layout has been selected, the next choice is to decide what capacity of the pool should be configured for the virtual drive.



<b>a</b>	New Virtual Disk Wizard
Specify the size	of the virtual disk
Before You Begin Storage Pool Virtual Disk Name Storage Layout	Free space in this storage pool: 5.46 TB Specify size: 25 GB •
Size Confirmation Results	O Maximum size
	1 The virtual disk might take additional space to create a write-back cache.
	< <u>P</u> revious <u>N</u> ext > <u>Create</u> Cancel

Figure 3-8 Selecting the Virtual Drive's Capacity

Finally, accept the confirmation screen.

-	New Vir	tual Disk Wizard	_ <b>_</b> ×
Confirm selection Before You Begin Storage Pool Virtual Disk Name Storage Layout Size Confirmation	S Confirm that the follo VIRTUAL DISK LOCATIO Server: Subsystem: Storage pool name: Status:	owing are the correct settings, and th ON cluster-N2 Clustered Storage Spaces	
Results	Free space: VIRTUAL DISK PROPER Name: Storage tiers: Storage layout: Provisioning type: Requested size:	TIES JBODVD01 Disabled Mirror Fixed	
		< <u>P</u> revious <u>N</u> ext >	<u>C</u> reate Cancel

Figure 3-9 Confirming the Virtual Disk Configuration

## **Example 3 - Creating a Volume**

Users will interact at the volume level. The volume is the entity that can be formatted and assigned a drive letter when required. A volume can be created from a physical disk or a virtual disk and is seen as a Logical Unit (LUN).



By default, the only physical device used as a volume in the CiB is the boot volume.



	Server:					
re You Begin er and Disk	Provision to	51	atus	Cluster R	ole	Destination
a Disk	CLUSTER		nline	Cluster N		Cluster Available Storage
	cluster-N1	0	nline	Cluster N	lode	Local
	cluster-N2	0	nline	Cluster N	lode	Local
	testa	0	nline	iSCSI Tar	get S	Resource Group
	testb	0	nline	iSCSI Tar	get S	Resource Group
	Disk:					Re <u>f</u> resh <u>R</u> escan
	 Disk	Virtual Disk	Capacity	Free Space	Subsyst	tem
	Disk 29	JBODVD01				
	Disk 29	JBODVD01	25.0 GB	25.0 GB		ed Storage Spaces

Figure 3-10 Selecting the Server and Disk for the New Virtual Volume

The first screen presents two choices – Server and Disk. The new volume is to be provisioned to the "Cluster" server as shown in the top of Figure 3-10. The new virtual disk to be used is shown as available with the 25GB of capacity that was created earlier shown in Figure 3-8.

	١	lew Volume Wizard				x
Specify the size o	f the volume					
Before You Begin	Available Capacity:	25.0 GB				
Server and Disk	Minimum size:	8.00 MB				
Size	Volume <u>s</u> ize:	25.0 GB 🔻				
Drive Letter or Folder	-					
File System Settings						
Confirmation						
Results						
						_
		< <u>P</u> reviou	IS <u>N</u> ext >	<u>C</u> reate	Cancel	

Figure 3-11 Selecting the Volume's Capacity

Use all or a portion of the available virtual disk capacity and assign a drive letter.



<b>a</b>	New Volume Wizard
Assign to a drive Before You Begin	Select whether to assign the volume to a drive letter or a folder. When you assign a volume to a folder, the volume appears as a folder within a drive, such as D:\UserData.
Server and Disk	Assign to:
Size Drive Letter or Folder	● Drive letter: J
File System Settings Confirmation Results	The following folder:  Don't assign to a drive letter or folder.
	< Previous Next > Create Cancel

Figure 3-12 Assigning a Volume's Drive Letter

The next stage is to decide on the file system type.



Note: NTFS is shown here as the default file system; however Microsoft has recently introduced the ReFS (Resilient File System), which uses a checksum to provide enhanced data integrity. In addition, it will not overwrite a previous edition of a file until the new version has been safely written to disk.

Finally, confirm the choices.

Confirm selectior	15	
Before You Begin	Confirm that the followir	ng are the correct settings, and then click Create.
Server and Disk Size Drive Letter or Folder File System Settings Confirmation Results	VOLUME LOCATION Server: Subsystem: Virtual disk: Disk: Free space: VOLUME PROPERTIES Volume size: Drive letter or folder:	CLUSTER Clustered Storage Spaces JBODVD01 Disk 29 25.0 GB 25.0 GB
	Volume label: FILE SYSTEM SETTINGS File system: Short file name creation: Allocation unit size:	New Volume

Figure 3-13 Confirmation of Volume Creation



	New Vo	lume Wizard		I X
Completion				
	Task	Progress	Status	
	Gather information		Completed	
	Create new partition		Completed	
	Format volume		Running	
	Add access path Update cache		Pending Pending	
	opdate cache		Pending	
Results				
		< Previous Nex	t > Create Can	

## **Example 4 - Creating a File Share Role**

The next example will show how to create an SMB file share. The first stage is to add a new role. There are two existing iSCSI target roles and a third role will be added.



Note: A number of high availability roles can be configured using Microsoft's failover cluster such as DHCP. The use of these high availability roles is in general much easier to configure in a clustered environment.

From the Failover Cluster Manager screen select <Roles> and <Configure Role>.



瓔		Faile	over Cluster Manag	ger			_ <b>D</b> X
<u>File Action View H</u> elp							
Hailover Cluster Manager	Roles (2)					Acti	
Roles	Search			P Queries	▼ ▼	Ro	
Modes	Name	Status	Туре	Owner Node	Priority I	2	Configure Role
⊿ 📇 Storage ∄ Disks	testa	💿 Running	iSCSI Target Server	cluster-N2	Medium		Virtual Machines >
Pools	📸 testb	Running	iSCSI Target Server	cluster-N2	Medium		Create Empty Role
Networks							View 🕨
🔢 Cluster Events						Q	Refresh
						?	Help
	<	ш			>		
	*						
< III >							
This action enables you to select a ro	ole that you can configure for	high availability.					



Select the desired role (in this case File Server) from the drop down choices.

<b>8</b> 0	High Availability Wizard	x
Select Ro	ble	
Before You Begin Select Role File Server Type Client Access Point Select Storage Confirmation Configure High Availability Summary	Select the role that you want to configure for high availability: DFS Namespace Server DHCP Server Distributed Transaction Coordinator (DTC) File Server Generic Application Generic Service Hyper-V Replica Broker VISCSI Target Server	
	< <u>Previous</u> <u>N</u> ext > Cancel	



Choose the <File Server for general use> option.





Note that the scale out file server is used for distributed applications where clients can access files across multiple nodes. This is only appropriate for the SMB protocol.

80	High Availability Wizard
File Serv	ver Type
Before You Begin Select Role File Server Type Client Access Point Select Storage Configure High Availability Summary	<ul> <li>Select an option for a clustered file server:</li> <li> <i>E</i> [le Server for general use                  Use this option to provide a central location on your network for users to share files or for server                  applications that open and close files frequently. This option supports both the Server Message Block                  (SMB) and Network file System (NFS) protocols. It also supports Data Deduplication, File Server                  Resource Manager, DFS Replication, and other File Services role services.      </li> <li> <u>Scale-Out File Server for application data         </u></li>             Use this option to provide storage for server applications or virtual machines that leave files open for             extended periods of time. Scale-Out File Server Clent connections are distributed across nodes in the                 cluster for better throughput. This option supports the SMB protocol. It does not support the NFS                 protocol, DFS Replication, or File Server Resource Manager.  </ul>
	< <u>P</u> revious <u>N</u> ext > Cancel

Figure 3-16 Selecting the File Server Type

Name the role that will be accessed by the clients. NETBIOS names will be truncated and an IP address will be created for client access.

- <b>2</b> 2	High Availability Wizard	x
Client Ac	cess Point	
Before You Begin Select Role File Server Type Client Access Point Select Storage Confirmation Configure High Availability Summary	Type the name that clients will use when accessing this clustered role:         Ngme:       JBODVDShare         Image:       JBODVDShare         Image:	
	< Previous Next > Cancel	

Figure 3-17 Naming the Role for Clients

Select the virtual disk created earlier; also note that the selection has been expanded to show the volumes that "belong" to this virtual disk.



<b>8</b> 0	High Availability	Wizard	×
Select St	orage		
Before You Begin Select Role	Select only the storage volumes that you want to You can assign additional storage to this clustered	a assign to this clustered role. ed role after you complete this v	vizard.
File Server Type	Name	Status	
Client Access Point	🔽 🖃 📇 Cluster Virtual Disk (JBODVD01)	🕥 Online	
Select Storage	Volume: (J)	File System: NTFS	24.9 GB free of 25.0
Confirmation			
Configure High Availability			
Summary			
	<	1	>
		·	
		< <u>P</u> revious <u>N</u>	lext > Cancel

#### Figure 3-18 Selecting Storage for the Share

Finally, confirm to accept the selection.

刻	H	igh Availability Wizard	x
Confirma	tion		
Before You Begin Select Role	You are ready to configure	high availability for a File Server.	
File Server Type Client Access Point Select Storage Configure High Availability Summary	Storage: Network Name: OU: IP Address:	Cluster Virtual Disk (JBODVD01) JBODVDShare CN=Computers,DC=ClusterNetwork,DC=com DHCP address on 192.168.4.0/24	< v
	] To continue, click Next.	< <u>P</u> revious <u>N</u> ext >	Cancel

Figure 3-19 Confirming the Clustered Role Selection

The summary screen is shown in Figure 3-20 below.



ès -	H	igh Availability Wizard	x
Summary			
Before You Begin Select Role	High availability wa	s successfully configured for the role.	
File Server Type Client Access Point Select Storage		File Server	^
Confirmation Configure High Availability Summary	Storage: Network Name: OU: IP Address:	Cluster Virtual Disk (JBODVD01) JBODVDShare CN=Computers,DC=ClusterNetwork,DC=com DHCP address on 192.168.4.0/24	
			~
	To view the report created I To close this wizard, click F	by the wizard, click View Report. View inish.	Report
			<u>F</u> inish

Figure 3-20 File Server Summary Screen

Returning to the main Failover Cluster Manager screen, the new role shows the following information: it is owned by node cluster-N1, the status is running and an IP address of 192.168.4.177 has been allocated.

电		Fai	lover Cluster Mana	ger		_
<u>F</u> ile <u>A</u> ction <u>V</u> iew <u>H</u> elp						
🗢 🄿 🙍 🖬 🚺						
📲 Failover Cluster Manager	Roles (3)					Actions
CLUSTER.ClusterNetwork.com Roles	Search			P Quer	ies 🔻 🔛 🔻 👻	Roles
Nodes	Name	Status	Туре	Owner Node	Priority I	🦣 Configure Role
⊿ <u>[]</u> Storage	BODVDShare	🕐 Running	File Server	cluster-N1	Medium	Virtual Machines
Disks Pools	🇞 testa	Running	iSCSI Target Server	cluster-N2	Medium	Create Empty Role
Networks	💑 testb	Running	iSCSI Target Server	cluster-N2	Medium	View
📕 Cluster Events						Refresh
						Help
						JBODVDShare
						Start Role
						🗘 Stop Role
						Add File Share
						Move
						Change Startup Priority
	<	ш			>	hformation Details
				Destand	0	Bow Critical Events
	V JBODVDShare	•		Preferred	Owners: <u>Any node</u>	🛓 Add Storage
		_				🚰 Add Resource
		Running Medium				More Actions
		duster-N1				🗙 Remove
	Client Access Name:	JBODVDShare				Properties
	IP Addresses:	192.168.4.117				P Help

Figure 3-21 Showing the Newly Added File Server Role



Now that the role has been added, the next step is to create a file share for client access. From the right hand side of the screen select <Add File Share>.

-	New Share Wi	izard	- <b>x</b>
Select the profile Share Location Share Name Other Settings Permissions Confirmation Results		Description: This basic profile represents the fastest SMB file share, typically used to share fil Windows-based computers. • Suitable for general file sharing • Advanced options can be configu using the Properties dialog	les with
	<	Previous Next > Create	Cancel

Both NFS and SMB file are supported. Users can select the <Advanced> options for greater degrees of granularity or simply select the *Quick* option.

The next screen requests the share location.

	Ne	w Share Wizard		_ 0
Select the serv	er and path for th	nis share		
Select the Selv		no share		
Select Profile	Server:			
Share Location	Server Name	Status	Cluster Role	Owner Node
Share Name	JBODVDShare	Online	File Server	
Other Settings	testa	Online	iSCSI Target S	
	testb	Online	iSCSI Target S	
	Share location:			
	<ul> <li>Select by volume:</li> </ul>			
	Volume	Free Space	Capacity File Sys	tam
	J:	14.5 GB	25.0 GB NTFS	tem
	5.	14.5 65	25.0 65 11115	
	The location of the volume.	file share will be a new fold	der in the \Shares di	rectory on the selected
	<ul> <li><u>Type a custom path</u></li> </ul>	:		
				Browse
		< <u>P</u> revious	<u>N</u> ext >	Create Cancel

Figure 3-22 Selecting the File Share Location



Select the appropriate settings for the share and then select <Next>. This is where access control can be implemented.

<b>a</b>	New Share Wizard
Configure share	settings
Select Profile Share Location Share Name Other Settings Permissions Confirmation Results	<ul> <li>☐ Enable access-based enumeration</li> <li>Access-based enumeration displays only the files and folders that a user has permissions to access. If a user does not have Read (or equivalent) permissions for a folder, Windows hides the folder from the user's view.</li> <li>✓ Enable continuous availability</li> <li>Continuous availability for a nother node of the cluster without interruption.</li> <li>✓ Allow caching of share</li> <li>Caching makes the contents of the share available to offline users. If the BranchCache for Network Files role service is installed, you can enable BranchCache on the share.</li> <li>☐ Enable BranchCache on the file share</li> <li>BranchCache enables computers in a branch office to cache files downloaded from this share, and then allows the files to be securely available to other computers in the branch.</li> <li>☐ Encrypt data access</li> <li>When enabled, remote file access to this share will be encrypted. This secures the data against unauthorized access while the data is transferred to and from the share. If this box is checked and grayed out, an administrator has turned on encryption for the entire server.</li> </ul>
	< <u>Previous</u> <u>Next &gt;</u> <u>Create</u> Cancel

#### Figure 3-23 Selecting the Share Setting

## Finally, confirm the action.

-	New Share	Wizard	_ 🗆 X
Confirm selections Select Profile Share Location Share Name Other Settings Permissions Confirmation Results		are the correct settings, and JBODVDShare File Server JAShares/JBODVD01 JBODVD01 SMB Disabled Enabled Disabled Disabled	
		< Previous Next >	Create Cancel
		< <u>P</u> revious <u>N</u> ext >	<u>C</u> reate Cancel

Figure 3-24 Confirming the SMB Share Creation



## Accessing the share

Invoke the run command <Windows key + r) and enter the IP address (as shown at the bottom of Figure 3-21) of the share into the dialog box.

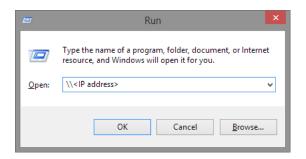


Figure 3-25 Entering the File Share IP Address

The share should now appear as shown below.

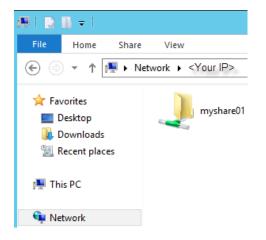


Figure 3-26 Viewing the Newly Created Share

## Example 5 - Creating an iSCSI Target Role

From the Server Manager main screen, select <Tools> - <Failover Cluster Manager>.



ervers	VOLUMES All volumes   8 total							Active Directory Domains and Trusts Active Directory Sites and Services
olumes Disks Storage Pools nares	Filter	tus File System Label		Capacity	Free Space	Deduplication Rate	Deduplication Savings	Active Directory Users and Computers ADSI Edit Cluster-Aware Updating Component Services Computer Management Defragment and Optimize Drives
CSI ork Folders	\\?92f	iSCSIHA1	Fixed	550 GB	550 GB			Event Viewer
	<ul> <li><cluster (cluste<br="">Q;</cluster></li> <li>cluster-N1 (3) \\?\Volume[bfc</li> <li>C;</li> <li>\\?\Volume[bfc</li> <li>cluster-N2 (3) \\?\Volume[1b</li> <li>C;</li> <li>\\?\Volume[1b</li> <li>Last refreshed on 6/12/20</li> </ul>	Quorum SVSTEM WINDOWS Recovery SVSTEM WINDOWS Recovery	) Fixed Fixed Fixed Fixed Fixed Fixed	2.00 GB 350 MB 49.5 GB 9.77 GB 350 MB 49.5 GB 9.77 GB	302 MB 8.12 GB 5.42 GB 302 MB 31.5 GB			Failover Cluster Manager iSCSI Initiator Local Security Policy MPIO ODBC Data Sources (32-bit) ODBC Data Sources (64-bit) Performance Monitor Resource Monitor Security Configuration Wizard Services System Configuration System Information Task Scheduler Windows Firewall with Advanced Security
	SHARES No related shares are availa	ble.		1	asks 🔻	DISK \\?92fa7	359-28a6-4b70-996c-a1	Windows Memory Diagnostic Windows PowerShell Windows PowerShell (x86) Windows PowerShell ISE

Figure 3-27 Bringing up the Failover Cluster Manager

#### Select <Roles>

븳			Fa	ailover Cluster M	anager				_ 0 ×	
File Action View Help										
🗢 🄿 🙍 📰 🚺										
Hailover Cluster Manager								Actions		
∠ W CLUSTER.ClusterNetwork.co Roles	Search P Queries V 🔒 V							Roles		
Nodes	Name	Status	Туре	Owner Node	Priority	Information		len Konfigure Role		
Storage								Virtual Machines	•	
Networks								📑 Create Empty Role	:	
								View	•	
								Refresh		
								Help		

Figure 3-28 Selecting a High Availability Role

From the drop down choices select <iSCSI Target Server> and then <Next>.



<b>8</b> 7	High Availability Wizard						
Select Ro	le						
Before You Begin Select Role	Select the role that you want to configure for high availability:						
	Distributed Transaction Coordinator (DTC)     File Server     Generic Application     Generic Script     Generic Service     Hyper-V Replica Broker						
	CFiSCSI Target Server						
	< <u>P</u> revious <u>N</u> ext > Cance	el					

Figure 3-29 Selecting a Highly Available iSCSI Target Server Role

Name the role.

- <b>u</b>	Failover Cluster Manager							-		x
<u>File Action V</u> iew <u>H</u> elp										
🗢 🔿 🞽 🖬 👔										
🝓 Failover Cluster Manager	Roles (2)					Actions				
∠ CLUSTER.ClusterNetwork.cr Roles	Search P Queries V 🔒 V					Roles				. ^
Roles	Name	Status	Туре	Owner Node	Priority In	20	Configure Role			
Storage	iscsiTargetHARole1	Running	iSCSI Target Server	cluster-N1	Medium		Virtual Machines		•	
Networks	iscsTargetHARole2	Z Pending	iSCSI Target Server	cluster-N2	Medium		Create Empty Role			
Cluster Events							View		•	
						a	Refresh			
						?	Help			-
							нер			≡
							sTargetHARole2		-	
						G	Start Role			
	<	ш			>	Ġ	Stop Role			
	inga Tamat HAPolo 2				Preferred Owners: Any node		Add File Share			
	V iscsTargetHARole2			Thereared	owners. <u>Any node</u>		Move		•	
	Status: P	ending			^	۵	Change Startup Prio	ority	•	
		ledium			=		Information Details			
		uster-N2					Show Critical Event	5		
Client Access Name: iscsTargetHARole2					1	Add Storage				
< III >	Summary Resources						-		•	. 🗸
Roles: iscsTargetHARole2										

#### Figure 3-30 Naming the iSCSI Target Server Role

Select the virtual disk to host the iSCSI server.



- <b>8</b>	High Availability Wizard							
Select St	orage							
Before You Begin Select Role	Select only the storage volumes that you want to assign You can assign additional storage to this clustered role a							
Client Access Point	Name	Status						
Select Storage	🗹 🖃 🔠 Cluster Virtual Disk (iSCSItargetVD)	🕑 Online						
Confirmation	Volume: (\\?92fa7359-28a6 F	File System: NTFS	550 GB free of 55					
Configure High Availability								
Summary								
	< 111		>					
		< Previous <u>N</u> ext >	Cancel					

Figure 3-31 Selecting the Virtual Disk for the iSCSI Role

#### Confirm the selection.

<b>8</b> 0	Hi	gh Availability Wizard	x
Confirma	tion		
Before You Begin Select Role	You are ready to configure h	igh availability for a iSCSI Target Server.	
Select Hole Client Access Point Select Storage Configure High Availability Summary	Storage: Network Name: OU: IP Address:	Cluster Virtual Disk (iSCSItargetVD) iscsiTargetHARole1 CN=Computers,DC=ClusterNetwork,DC=com DHCP address on 192.168.4.0/24	< >
	To continue, click Next.		
		< Previous Next >	Cancel

Figure 3-32 Confirming the iSCSI Target Server Selection

After the server has been created a report of all the steps can be shown by selecting the <View Report> button if desired.



刻	Hi	igh Availability Wizard	X
to Summary			
Before You Begin Select Role	High availability wa	s successfully configured for the role.	
Client Access Point Select Storage Confirmation	is	SCSI Target Server	^
Configure High Availability Summary	Storage: Network Name: OU: IP Address:	Cluster Virtual Disk (iSCSItargetVD) iscsiTargetHARole1 CN=Computers,DC=ClusterNetwork,DC= DHCP address on 192.168.4.0/24	com
	To view the report created I To close this wizard, click F	by the wizard, click View Report. inish.	View Report
			<u>Fi</u> nish

Figure 3-33 Summary Screen of the iSCSI Server Role Creation

The role shows that it has been allocated an IP address of 192.168.4.115. Clients using their local iSCSI initiators will use this address in their discovery portal of the initiator. Since it is a high availability role nodes can fail over seamlessly as either node can respond to this IP.

뤏		Failover Cluster Manager						-		x
<u>File Action View H</u> elp										
🗢 🏟 🙎 🖬 👔										
📲 Failover Cluster Manager	Roles (1)					Act	ions			_
⊿ CLUSTER.ClusterNetwork.ci Roles	Search			P Queries	s 🔻 🔒 🗶 👻	Ro	les			. ^
Nodes	Name	Status	Туре	Owner Node	Priority In	20	Configure Role			
þ 📇 Storage	🚯 iscsiTargetHARole1	Running	iSCSI Target Server	cluster-N2	Medium		Virtual Machines		•	
Networks Cluster Events							Create Empty Role			
		Ш		1		-	View		•	
						Q	Refresh			-
	🔹 🚺 iscsiTargetH	ARole1		Preferred O	wners: <u>Any node</u>	?	Help			=
						isc	siTargetHARole1		-	
	Status:	Running Medium				â	Start Role			
	Priority: Owner Node:	cluster-N2				0	Stop Role			
	Client Access Name:						Add File Share			
	IP Addresses:	192.168.4.115					Move		•	
						1	Change Startup Prio	ority	•	
						8	Information Details			
							Show Critical Event	s		
						3	Add Storage			
< III >	Summary Resources						Add Resource		•	. 🗸



Storage can be added to this role and now shared out to clients.



## Example 6 – Creating a Storage Tier

This example shows the creation of an iSCSI based storage tier. In Figure 3-35 below, the option to create a storage tier is checked.

7			
		New Virtual Disk Wizard	_ <b>D</b> X
Specify the virtua Before You Begin		1CSItargetVD	
Storage Pool			
Virtual Disk Name Storage Layout Size	Description:		
	Storage tie storage.	rage tiers on this virtual disk ers enable automatic movement of the most frequently accessed f t remove storage tiers from a virtual disk after it is created.	les to faster (SSD)
		< Previous Next > Create	Cancel

#### Figure 3-35 Creating a Tiered Virtual Disk

Select <Next> to configure the capacity. Since the storage tiering option was selected, the ratio of SSD space to HDD space can be selected on a later screen. Again, this is highly dependent on the nature of the application.



Backup or large streaming applications where the data is not regularly revisited are in general less attractive candidates for tiering. A backup application may write the data once and then perform a verify pass and afterwards this data might never be accessed again. A transaction oriented application can in many cases perform well if the data is such that it is shared among many users and exhibits locality of reference as briefly described on page 2-6.

The next stage is to configure the storage layout. In this example a mirrored layout will be selected to provide a degree of data resiliency.



		Server Manager
- Server Manage	er • File and Storage	e Services • Volumes • Storage Pools
<b>a</b>	New Virtual [	Disk Wizard 📃 🗖 🗙
Select the storage	e layout	
Before You Begin	Layout:	Description:
Storage Pool	Simple	Data is duplicated on two or three physical disks, increasing reliability, but reducing capacity. This storage layout requires at
Virtual Disk Name	Mirror	least two disks to protect you from a single disk failure, or at
Storage Layout		least five disks to protect you from two simultaneous disk failures.
Resiliency Settings		
Size		
Results		
		< Previous Next > Create Cancel

Figure 3-36 Selecting the Storage Layout

Next, configure the resiliency settings. Refer to page 2-5 for a description of resiliency options and requirements.



A two way mirror will be used here, in that it represents a good tradeoff between performance, capacity and cost in a file sharing application. Essentially 50% of the capacity is used for resiliency. Three way mirroring can be used for increased data availability, and parity based spaces can be deployed for better capacity usage.



	Server Manager
<ul> <li>Server Manage</li> </ul>	er • File and Storage Services • Volumes • Storage Pools
<b>B</b>	New Virtual Disk Wizard
Configure the res Before You Begin Storage Pool Virtual Disk Name Storage Layout Resiliency Settings Size Confirmation Results	<ul> <li>iliency settings</li> <li>Resiliency type:         <ul> <li>Two-way mirror</li> <li>Stores two copies of your data, helping to protect you from a single disk failure. This option requires at least two disks.</li> <li>Three-way mirror</li> <li>Stores three copies of your data, helping to protect you from two simultaneous disk failures. This option requires at least five disks.</li> </ul> </li> </ul>
	< Previous Next > Create Cancel



The next screen is used to select the tiering ratio.

A reasonable rule of thumb is to allocate 10% of capacity to SSD. However it is also possible to *pin* files to an SSD using powershell commands. Pinning has the effect of moving a file from an HDD to an SSD immediately. These types of files then will always be accessed from the fast media.



It is recommended to let the system handle tiering automatically, however *power users* may wish to investigate the pinning function. One of the pitfalls with pinning is that a file that has manually been pinned in the past is that it may no longer require frequent access. This could limit the available SSD space for automatic tiering and caching.



2	New Virtual Disk V	Vizard 📃 🗖 🗙
Specify the size	of the virtual disk	
Before You Begin Storage Pool	Free space in this storage pool: 9.44 The Specify how big the two tiers of your v	
Virtual Disk Name Storage Layout Resiliency Settings Size Confirmation Results	Faster Tier (SSD) Free space: 368 GB • Specify size: 50 GB •	Standard Tier (HDD) Free space: 9,296 GB Specify size: 500 GB •
	O Maximum size Virtual disk size: 550 GB	O Maximum size
	1 The virtual disk might take addition	al space to create a write-back cache.
	< P	revious Next > Create Cancel

### Figure 3-38 Selecting the Capacity and SSD to HDD Ratio for the VD

Finally, create the virtual disk.

		Server Manager
<ul> <li>Server Manage</li> </ul>	r • File and Stora	ge Services • Volumes • Storage Pools
<b>a</b>	New Virtual	Disk Wizard
Confirm selections		
Before You Begin	Confirm that the following	g are the correct settings, and then click Create.
Storage Pool	VIRTUAL DISK LOCATION	
Virtual Disk Name	Server:	cluster-N2
Storage Layout	Subsystem:	Clustered Storage Spaces
Resiliency Settings	Storage pool name:	CIB Storage Pool
Size	Status:	OK CONTRACTOR
Confirmation	Free space:	18.9 TB
Results	VIRTUAL DISK PROPERTIES	
	Name:	iSCSITargetVD1
	Storage tiers:	Enabled
	Storage layout:	Mirror
	Resiliency type:	Two-way mirror
	Provisioning type:	Fixed
	Requested size:	550 GB 50.0 GB
	Faster (SSD) tier size: Standard (HDD) tier size:	500 GB
	Standard (HDD) tiel Size:	00.00
		< Previous Next > Create Cancel

Figure 3-39 Virtual Disk Creation Confirmation



## **Example 7 – Moving Ownership**

Windows 2012 R2 allows Clustered Shared Volumes (CSVs) to have simultaneous read/write access from multiple nodes. A major benefit is that a failover can occur efficiently without the volume being dismounted and remounted. A CSV is *owned* by a particular node at any one time, which coordinates access. This ownership is balanced across the nodes automatically to ensure optimum performance. There are times however when the administrator may want to manually change ownership. This could be to prepare a node for maintenance, conduct tests or to do some fine tuning with regards to throughput.

Failover Cluster Manager \_ 🗆 X File Action View Help 🧇 🔿 🖄 📰 👔 Failover Cluster Manager Roles (2) Actions CLUSTER.ClusterNe - .... • Roles 📑 Roles 🏺 Nodes le.. Configure Role.. Statue Туре Owner Nod Priority Virtual Machines. b 📙 Storage 🚲 iscsi Target HARole 1 Running iSCSI Target Server duster-N1 Medium Networks iscsTargetHARole2 Running iSCSI Target Server cluster-N1 Medium 👩 Create Empty Role View Refresh ? Help Ш

The screenshot below shows that both roles are owned by cluster-N1.

#### Figure 3-40 Changing Node Ownership - Screen 1

The ownership can be changed by selecting <Move> from the right hand pane and then choosing either <Best Possible Node> or <Select Node>.

1 1		Fail	lover Cluster Mana	ger					_		x
File Action View Help											
🗢 🄿 🙍 📰 🚺											
Failover Cluster Manager	Roles (2)						Actions				
⊿ CLUSTER.ClusterNetwork.ci Roles	Search			,Ρ (	Queries 🔻 🛃 🔻	•	Roles				• ^
Nodes	Name	Status	Туре	Owner Node	Priority	In	la Configu	re Role			
Storage	🗞 iscsiTargetHARole1	Running	iSCSI Target Server	cluster-N1	Medium		Virtual N	Aachines			•
Networks	🗞 iscsTargetHARole2	Running	iSCSI Target Server	cluster-N1	Medium		📑 Cranta E	mpty Role			
is Cluster Events					G Start Role						•
					🔅 Stop Role						-
					Add File Shar	re					-
					Move		•	😨 🛛 Be	t Possil	ble No	de
					() Change Start	tup Pr	iority 🕨	😰 Se	ect Noo	le	
	<				Information I	Detail	s	1			
					Show Critical	l Even	ts	È			-
	- IN							Share			



There is a choice to select <Best Possible Node> or to manually select a node. In this example the node will be selected, so select <Move> - <Select Node>. This will bring up the screen shown in Figure 3-42.



Мо	ve Clustered Role	×
'cluster-N1'.	ode for moving 'iscsTargetHAF	Role2' from
Look for: Search		Cl <u>e</u> ar
Cluster nodes:		Cigar
Name	Status	
cluster-N2	💽 Up	
	OK	Cancel

Figure 3-42 Changing Node Ownership - Screen 3

Select <cluster-N2> - <OK>.

붭		Fail	lover Cluster Mana	ger					×	¢
<u>File Action View H</u> elp										
						_				
📲 Failover Cluster Manager	Roles (2)					Act	tions			
CLUSTER.ClusterNetwork.co	Search			🔎 Querie	es 🔻 🔛 🔻 🗸	Ro	oles		•	^
Nodes	Name	Status	Туре	Owner Node	Priority In	80	Configure Role			
Storage	👬 iscsiTargetHARole1	Running	iSCSI Target Server	cluster-N1	Medium		Virtual Machines		•	
Networks	iscsTargetHARole2	🛛 Pending	iSCSI Target Server	cluster-N2	Medium	1	Create Empty Role			
							View		•	
						a	Refresh			
						?	Help			≡
						isc	sTargetHARole2		•	
						Ĝ	Start Role			
	<	ш			>	Ģ	Stop Role			
	✓ iscsTargetHA	Pole2		Preferred (	Owners: Any node	1	Add File Share			
	iscs raiget in					1	Move		►	
	Status:	Pending			_	۲	Change Startup Prio	rity	►	
	Priority:	Medium			=	8	Information Details			
	Owner Node:	cluster-N2					Show Critical Events			
	Client Access Name:	iscsTargetHARole2			~	1.2	Add Storage			
< III >	Summary Resources						-		•	~
Roles: iscsTargetHARole2										

Figure 3-43 Changing Node Ownership - Screen 4

Figure 3-43 shows the second iSCSI role in a *pending* state. The change of ownership role should only take a few seconds. Finally, Figure 3-44 shows each role being owned by a different node.



題		Fai	lover Cluster Mana	ger			_		¢
<u>File Action View H</u> elp									
<ul> <li>Failover Cluster Manager</li> <li>Roles</li> <li>Nodes</li> <li>Storage</li> <li>Networks</li> <li>Cluster Events</li> </ul>	Roles (2) Search Name SessTargetHARole1	Status	Type iSCSI Target Server iSCSI Target Server	P Querie Owner Node cluster-N1 cluster-N2	es V V V Priority Ir Medium Medium	Ro	ions Configure Role Virtual Machines Create Empty Role View Refresh	•	^
	<				>		Help sTargetHARole2 Start Role Stop Role	•	=
	v iscsTargetH/	NRole2		Preferred C	wners: <u>Any node</u>		Add File Share	•	
	Owner Node: Client Access Name:	Running Medium cluster-N2 iscsTargetHARole2			< III >		Change Startup Priority Information Details Show Critical Events Add Storage	•	
< III >	Summary Resources						Add Resource	•	~

#### Figure 3-44 Changing Node Ownership - Screen 5

To designate a particular role with a preferred node, select the role and then from the right hand screen select <Properties> and check the preferred node.

📑 myshare	(1) Running	File Server	cluster-N1 Medium	Create Empty Role
🚔 myshare02	Running	File Server	cluster-N2 Medium	View
				Refresh
				🛛 Help
			myshare02 Properties	myshare02
			General Failover	Start Role Stop Role
			myshare02	Add File Share
			Name:	Move
			myshare02	🔞 Change Startup Priority
			Preferred Owners	🚯 Information Details
			Select the preferred owners for this clustered role. Use the buttons to list them in order from most preferred at the top to least preferred	Show Critical Events
			at the bottom.	Add Storage
				Add Resource
			cluster-N2 Up	More Actions
			Down	🔀 Remove
				Properties
			Priority: Medium v	🛛 Help
			Status: Running	
v 🔥 myshare02			Node: cluster-N2 writers: User Settings	
Priority: M	unning edium		OK Cancel Apply	

Figure 3-45 Selecting a Role's Preferred Owner



Prior to deployment in a production role, it is recommended that freshly created resources be failed over to each node in turn and back again to verify that both nodes can service clients in the event of a failed node situation.



## **Quorum and Ownership**

Ownership plays a key role in the *quorum* function. The idea behind quorum is to avoid uncoordinated access to resources. In this situation each node is unaware of the other and data corruption can occur. This is commonly known as *split brain syndrome*. To avoid this, the concept of quorum is introduced. In a two node cluster such as Supermicro's CiB product, each node is allotted a single vote and a third resource – the quorum disk is also given a vote. For the cluster to function normally at least of two votes must be met. If there is uncoordinated access one node will own the quorum resource and therefore hold two votes. The other node will have no access to the quorum disk and will only hold one vote. Since one vote is not enough to maintain a cluster, cluster services will be stopped and the node will not be able to access the cluster resources. When the source of the issue is found the node without the necessary number of votes will be allowed to join the cluster in a controlled, coordinated fashion.



The quorum disk must be a shared volume so that it can be accessed by either node. The CiB comes with a pre-configured quorum disk within a pool. Refer to Figure 2-6 to show the disk configuration as shipped with the CiB. (Microsoft, 2013).

### **Further Resources**

Please refer to the references for further information relating to the CiB and Windows Server 2012 R2.



# 4. References and Glossary

# **Glossary of terms**

Term	Description	
CSV	A Clustered Shared Volume is available to <i>all</i> nodes in a Windows Failover Cluster for read/write access.	
Volume	An addressable storage entity, which can be physical or virtual, normally takes a drive letter in a Windows environment.	
SMB	This is a file protocol (Server Message Block) that provides file access to clients over a network.	
Quorum Disk	A shared disk resource that can be used to prevent partitioned (split-brain) clusters.	
Cluster	A collection of computers that are interconnected (typically at high speeds) for the purpose of improving reliability, availability, serviceability, load balancing and/or performance. (Storage Networking Industry Association, 2013)	
JBOD	A disk enclosure using the acronym <b>J</b> ust a <b>B</b> unch <b>O</b> f <b>D</b> isks.	
RAS	Reliability, Availability and Serviceability.	
Storage Pool	A collection of physical disks that enables you to aggregate disks, expand capacity in a flexible manner and delegate administration (Microsoft, 2014).	
Storage Space	Virtual disks created from a storage pool.	
Tiering	Automatically placing "hot data" to an SSD and placing "cold data" back to an HDD.	
Virtual disk	A disk aggregated from the capacity within the storage pool.	
Write back cache (spaces)	Data is written to low latency SSDs first, and then migrated to a secondary volume.	



## **References/Useful Links**

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