

Using FlashNAS ZFS

with

Microsoft Hyper-V Server 2012

and

Live Migration

Abstract:

This application note provides step-by-step instructions to help you configure FlashNAS ZFS systems for use with Microsoft Hyper-V and enable simpler virtual machine live migration. All FlashNAS ZFS systems are tested and certified compatible with a wide range of virtualization technologies to help users maximize utility through virtualized environments. They allow more productivity with less hardware, increasing organizational effectiveness while helping reduce costs.

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FlashNAS ZFS Series NAS

FlashNAS ZFS is a mid-range to high performance NAS solution for organizations and enterprises of all sizes, with a focus on SMBs and individual or SOHO users. The FlashNAS ZFS series delivers unified storage, consolidating file and block-based app server duties. It employs the ZFS file system to boost data integrity and enable features such as remote replication/access, unlimited snapshot, secure pool mirror, and efficient compression. All FlashNAS ZFS products are compatible with Windows Server, VMware, and Citrix, and are very user-friendly. They ensure high availability through redundant hardware components, including dual controllers and power supplies. In addition to better reliability, their modular build promotes faster and simpler maintenance and upgrades. Usability is improved via Global Namespace support, which brings streamlined yet intricate management, while for scalability the future-proof FlashNAS ZFS series can grow to 256 drives and 1.5PB via JBOD.

Windows Server 2012 and Hyper-V

Microsoft Hyper-V Server virtualization technology works with Microsoft Server 2012, but can be used standalone thanks to compatibility with non-Windows operating systems. Hyper-V is a compact software suite, with low system requirements. It is very useful for storage server consolidation, and a common solution for virtual desktop infrastructure (VDI) setup. It allows users to run Windows on a host of virtual desktops, with easy access and clear management. Hyper-V supports multiple live migration operations across physical storage, all in a secure environment that automatically prioritizes data movement by importance or frequency of access. Hyper-V works well on FlashNAS ZFS series products since it is very scalable, and capable of virtualizing nearly any workload. With FlashNAS ZFS and Hyper-V, you get more utility out of hardware with minimal effort, as the familiar Windows Server environment does not require new advanced skills.

Using FlashNAS ZFS with Hyper-V

To ensure host high availability and fast failover performance, we leverage Windows clustering with two hosts as the operating environment for our Hyper-V demonstration configurations.

System Topology



Figure 1: topology

The FlashNAS ZFS series provides storage with high availability to clustered servers. We then create a virtual machine on each cluster server, and perform live migration to transfer a virtual machine from the N1 cluster server to the N2 cluster server. Figure 1 shows the complete topology. In addition, the FlashNAS ZFS series also provides great performance with dual controllers on select models. To maintain stable load balancing, we recommend having pool 1 managed by controller A for the quorum disk, and pool 2 managed by controller B for the cluster shared volume as figure 2 shows.



Figure 2: load balancing

Adding Hyper-V Server Role in Windows Server 2012

Step 1: enter the host motherboard BIOS -> enable virtualization-related features Step 2: launch the Windows Server 2012 Server Manager Dashboard, and then click Add Roles and Features

a	Add Roles and Features Wizard	
Before you begin	DESTINATIO N This wizard helps you install roles, role services, or features. You determine which roles, role se	ON SERVER N1.cad.com ervices. or
Installation Type Server Selection	features to install based on the computing needs of your organization, such as sharing docum hosting a website. To remove roles, role services, or features:	nents, or
Features Confirmation Results	Start the Remove Roles and Features Wizard Before you continue, verify that the following tasks have been completed: • The Administrator account has a strong password • Network settings, such as static IP addresses, are configured • The most current security updates from Windows Update are installed	
	If you must verify that any of the preceding prerequisites have been completed, close the wize complete the steps, and then run the wizard again. To continue, click Next.	ard,
	□ Skip this page by default	
1		
	< Previous Next > Install	Cancel

Step 3: select the Hyper-V role

Select server roles Destination server not server Before You Begin Select one or more roles to install on the selected server. Installation Type Select one or more roles to install on the selected server. Server Roles Roles Features Active Directory Certificate Services Hyper-V Active Directory Federation Services Active Directory Federation Services Active Directory Rights Management Services Migration DHCP Server	b	Add Roles and Features Wizard	_ _ ×
DHCP Server	Before You Begin Installation Type Server Selection Server Roles Features Hyper-V Virtual Switches Migration	Add Roles and Features Wizard Select one or more roles to install on the selected server. Roles Active Directory Certificate Services Active Directory Pederation Services Active Directory Lightweight Directory Services Active Directory Rights Management Services Application Server	Description Description Hyper-V provides the services that you can use to create and manage wirtual machines and their resources. Each virtual machine is a virtualized computer system that operates in an isolated execution environment. This allows you to run multiple operating systems simultaneously.
Derault stores Confirmation Results DNS Server Fax Server ✓ File And Storage Services (Installed) ✓ Hyper-V Network Policy and Access Services Print and Document Services Remote Access Remote Desktop Services ✓	Migration Default Stores Confirmation Results	Application Server DHCP Server DNS Server Fax Server Fax Server File And Storage Services (Installed) Print and Document Services Remote Access Remote Desktop Services	systems simultaneously.

Step 4: select Virtual Switches

a	Add Roles and Fea	tures Wizard	_ 🗆 🗙
Create Virtual Swi Before You Begin	itches Virtual machines require virtual switch	ies to communicate with other computers. Aft	DESTINATION SERVER N1.CAD.com
Installation Type Server Selection Server Roles Features	One virtual switch will be created for at least one virtual switch now to pro can add, remove, and modify your vir	each network adapter you select. We recomm ride virtual machines with connectivity to a ph cual switches later by using the Virtual Switch	end that you create ysical network. You Manager.
Hyper-V	Name	Description	
Virtual Switches Migration Default Stores Confirmation Results	 We recommend that you reserve network adapter, do not select it 	Intel(R) 82575EB Gigabit Network Connection one network adapter for remote access to thi for use with a virtual switch.	on s server. To reserve a
		< Previous Next > Insta	ll Cancel

Step 5: check "Allow this server to send and receive live migration of virtual machines"

B	Add Roles and Features Wizard	_ □ ×
Virtual Machine I Before You Begin Installation Type Server Selection Server Roles Features Hyper-V Virtual Switches Migration Default Stores Confirmation Results	Add Roles and Features Wizard ✓igration Hyper-V can be configured to send and receive live migrations of virtual machine: Configuring Hyper-V now enables any available network on this server to be used you want to dedicate specific networks for live migration, use Hyper-V settings aff ✓ Allow this server to send and receive live migrations of virtual machines Authentication protocol Select the protocol you want to use to authenticate live migrations. ● Use Credential Security Support Provider (CredSSP) This protocol is less secure than Kerberos, but does not require you to set u delegation. To perform a live migration, you must be logged on to the source ○ Use Kerberos This protocol is more secure but requires you to set up constrained delegati environment to perform tasks such as live migration when managing this set ▲ If this server will be part of a cluster, do not enable migration now. Instead, yo server for live migration, including specifying networks, when you create the output of the security	DESTINATION SERVER N1.cad.com s on this server. for live migrations. If ter you install the role. p constrained ce server. ion in your erver remotely.
	< Previous Next > Ins	tall Cancel

Step 6: restart your computer

Adding Virtual Machines in Hyper-V

Step 1: launch New Virtual Machine role

ح		Failover Cluste	r Manager			_	x
File Action V	iew Help						
🗢 🏟 🙎 💽	?						
📲 Failover Cluste	r Manager Roles (0)			Ac	tions		
⊿ 🎲 SRLV.cad.c	om Search		🔎 Queries 🔻 🛃 💌	🗢 R	oles		-
Þ 🍯 Noc	Configure Role	Status Type	Owner Node	Prio	Configure Role		
Stol	Virtual Machines 🕨	New Virtual Machine.			Virtual Machines		•
E Clu	Create Empty Role	New Hard Disk			Create Empty Role		
	View +				View		•
	Refresh			G	Refresh		
8.	Heln			?	Help		
		No items found.					

Step 2: choose one cluster node

	New Virtual Machine
Select the target clu	ister node for Virtual Machine creation.
Look for:	
🔎 Search	Clear
Cluster nodes:	
Name	Status
🗎 N1	🕑 Up
📓 N2	💿 Up
	OK Cancel

Step 3: in the New Virtual Machine wizard, specify a name for the virtual machine and the location you would like to store it

3 .	New Virtual Machine Wizard	x
Specify Na	ame and Location	
Before You Begin Specify Name and Location Assign Memory Configure Networking Connect Virtual Hard Disk Installation Options Summary	 Choose a name and location for this virtual machine. The name is displayed in Hyper-V Manager. We recommend that you use a name that helps you exidentify this virtual machine, such as the name of the guest operating system or workload. Name: VM1 You can create a folder or use an existing folder to store the virtual machine. If you don't select a folder, the virtual machine is stored in the default folder configured for this server. ✓ Store the virtual machine in a different location Location: C:\ClusterStorage\Volume1\ If you plan to take snapshots of this virtual machine, select a location that has enough free space. Snapshots include virtual machine data and may require a large amount of space. 	usily
	< Previous Next > Finish Cance	el

Step 4: specify the memory you would like to allocate to the virtual machine

3e	New Virtual Machine Wizard	x
Assign Me	nory	
Before You Begin Specify Name and Location Assign Memory Configure Networking Connect Virtual Hard Disk Installation Options Summary	Specify the amount of memory to allocate to this virtual machine. You can specify an amount from 8 MB through 11190 MB. To improve performance, specify more than the minimum amount recommender for the operating system. Startup memory: 1024 MB Use Dynamic Memory for this virtual machine. When you decide how much memory to assign to a virtual machine, consider how you intend to use the virtual machine and the operating system that it will run.	۶đ
	< Previous Next > Finish Cancel	

Step 5: configure networking

b :	New Virtual Machine Wizard
Configure N	Networking
Before You Begin Specify Name and Location Assign Memory Configure Networking Connect Virtual Hard Disk Installation Options Summary	Each new virtual machine includes a network adapter. You can configure the network adapter to use a virtual switch, or it can remain disconnected.
	< Previous Next > Finish Cancel

Step 6: specify the name, location, and size of the virtual hard disk you would like to create to store the operating system of the virtual machine

8	New Virtual Machine Wizard	x
Connect Vi	rtual Hard Disk	
Before You Begin Specify Name and Location Assign Memory Configure Networking	A virtual machine requires storage so that you can install an operating system. You can specify the storage now or configure it later by modifying the virtual machine's properties. Create a virtual hard disk Use this option to create a dynamically expanding virtual hard disk with the default format (VHC) 	x).
Connect Virtual Hard Disk Installation Options Summary	Name: VM1.vhdx Location: C:\ClusterStorage\Volume1\VM1\Virtual Hard Disks\ Size: 20 GB (Maximum: 64 TB) Use an existing virtual hard disk Use this option to attach an existing virtual hard disk, either VHD or VHDX format.	
	Location: C:\Users\Public\Documents\Hyper-V\Virtual Hard Disks\ Browse O Attach a virtual hard disk later Use this option to skip this step now and attach an existing virtual hard disk later.	
	< Previous Next > Finish Cance	:

Step 7: select physical CD/DVD or image file installation of the operating system

84	New Virtual Machine Wizard	x
	Options	
Before You Begin Specify Name and Location Assign Memory Configure Networking Connect Virtual Hard Disk Installation Options Summary	You can install an operating system now if you have access to the setup media, or you can install it later. Install an operating system later Install an operating system from a boot CD/DVD-ROM Media Physical CD/DVD drive: Image file (.iso): Install an operating system from a boot floppy disk Media Virtual floppy disk (.vfd): Install an operating system from a network-based installation server	
	< Previous Next > Finish Cance	1

Step 8: complete the new virtual machine and view wizard summary

k	New Virtual Machine Wizard					
Completing) the New Virtual Machine Wizard					
Before You Begin Specify Name and Location Assign Memory Configure Networking	You have successfully completed the New Virtual Machine Wizard. You are about to create the following virtual machine. Description: Name: VM1					
Connect Virtual Hard Disk Installation Options	Memory: 1024 MB Network: Intel(R) 82575EB Gigabit Network Connection - Virtual Switch Hard Disk: C:\ClusterStorage\Volume1\VM1\Virtual Hard Disks\VM1.vhdx (VHDX, dynamically					
Summary	Operating System: Will be installed from D:					
	< III >					
	To create the virtual machine and close the wizard, click Finish.					
	< Previous Next > Finish Cancel					

Step 9: complete the creation process, and the virtual machine is ready. Click the Start action to begin operating system installation

Roles (2)					
Search					
Name	Status	Туре	Owner Node	Priority	Information
🛃 VM1	💽 Off 📑	Connect		Medium	
■ VM1	 Runni <l< td=""><td>Start Save Shut Down Turn Off Settings Manage Replication Move Cancel Live Migration</td><td>• •</td><td colspan="2">Medium</td></l<>	Start Save Shut Down Turn Off Settings Manage Replication Move Cancel Live Migration	• •	Medium	
		Change Startup Priority Information Details Show Critical Events	y •		
		Add Storage Add Resource	•		
<		More Actions	•		
🗸 🎆 УМ1	×	Remove			
		Properties			

Step 10: configure virtual machine failover/failback. Begin by right clicking on the virtual machine you just created and select Properties

					Faile	over Cluster Manager						
File Action View Help												
le 🔿 🖄 📰 🛛 🗊												
Hailover Cluster Manager	Roles (2)	Roles (2)										
Roles	Search P Queries V											
Nodes	Name	Status	Туре	Owner Node	Priority	Information						
Networks	🛃 VM1	A Damaian	al Machine	N1	Medium							
p ⊂ actives	₽ , VM2	Connect Start Start Save Shut Down Turn Off Manage Replication Move Cancel Live Migration Change Startup Priority Information Details Show Critical Events Add Storage Add Storage	al Machine	N2	Medium							
	<	Mars Astions			III		>					
		wore Actions	-									
	v 🚺 vi	Remove					Preferred Owners: Any mode					
		Properties										
	Name	N	Status h	nformation								

Step 11: in the General tab of the Properties page, select Auto Start if you want the virtual machine to automatically start operating after failover occurs

VM1 Properties	x
General Failover	
Г VM1	
Name:	,
VM1	
Preterred Owners Select the <u>preferred owners</u> for this clustered role. Use the buttons to list them in order from most preferred at the top to least preferred at the bottom.	
N1 Up N2 Down	
Priority: Medium 🗸	
Status: Running	_
Node: N1	
OK Cancel Apply	

Step 12: in the Failover tab, you can set the proper failover/failback policy for the virtual machine

VM1 Proj	perties X								
General Failover									
Failover									
Specify the number of times the Cluster service will attempt to restart or fail over the clustered role in the specified period.									
If the clustered role fails more than the maximum in the specified period, it will be left in the failed state.									
Maximum failures in the specified period :									
Period (hours):	6								
Failback Specify whether the clustered role will automatically fail back to the most preferred owner (which is set on the General tab).									
Prevent failback									
O Allow failback									
 Immediately 									
 Failback between: 	0 🔶 and								
	0 🔷 hours								
More about failover and failback									
OK	Cancel Apply								

Performing Live Migration

Live migration allows you to quickly and transparently move operational virtual machines from one node of the failover cluster to another node in the same cluster without a dropped network connection or downtime. In other words, the migration is live because the virtual machines continue working as it takes place, preventing impact on your productivity. After completing failover clustering and clustered shared volume (CSV) configuration as above, simply follow the steps below to perform live migration.



Figure 3: virtual machine live migration steps

For our demonstration, we are migrating VM1 from the N1 clustered server to the N2 clustered server as figure 3 shows.

Verification of Live Migration

We use the ping method to verify live migration. For example, we have the network IP address for a specific virtual machine, like VM1 from our demonstration, which is found at IP 172.24.110.31.

Network Connection Details					
Network Connection Details:					
Property	Value		~		
Physical Address	00-15-5D-6E-55-01				
DHCP Enabled	Yes				
IPv4 Address	172.24.110.31				
IPv4 Subnet Mask	255.255.254.0				
Lease Obtained	Friday, September 13, 2013	4:29:15 P			
Lease Expires	Saturday, September 14, 201	3 4:29:4			
IPv4 Default Gateway	172.24.111.254				
IPv4 DHCP Server	192.168.99.12				
IPv4 DNS Servers	192.168.99.11		≡		
	192.168.99.12				
IPv4 WINS Servers	192.168.99.11				
	192.168.99.12				
NetBIOS over Tcpip En	Yes				
Link-local IPv6 Address	fe80::4d68:af61:22cb:b88c%	19			
IPv6 Default Gateway					
IPv6 DNS Server					
			×		
<	III	>			
			_		
		Close			

We can then check virtual machine status via the ping command during the live migration process.

C4 .	Administrator: Command Prompt	
C:\Users\Administr	ator.CAD>ping 172.24.110.31	<u>^</u>
Pinging 172.24.110 Reply from 172.24. Reply from 172.24. Reply from 172.24. Reply from 172.24. Reply from 172.24.	1.31 with 32 bytes of data: 110.31: bytes=32 time<1ms TTL=128 110.31: bytes=32 time<1ms TTL=128 110.31: bytes=32 time<1ms TTL=128 110.31: bytes=32 time<1ms TTL=128	
Ping statistics fo Packets: Sent Approximate round Minimum = Oms,	or 172.24.110.31: = 4, Received = 4, Lost = 0 (0% loss), trip times in milli-seconds: . Maximum = Oms, Average = Oms	
C:\Users\Administr	vator.CAD>_	

Step 1: in the Failover Cluster Manager, select the virtual machine you would like to migrate and right click on it, then select Move -> Live Migration -> Select Node

<u>الله</u>								Failo	ver Cluster Mana	ger			
File Action View Help													
🗢 🏟 🙋 🖬 🚺 🖬													
Hailover Cluster Manager	Roles (2)	Roles (2)											
koles ▷ 🎲 Nodes ▷ 🥰 Storage	Name		Status	1	Гуре	Owner Node	Priori	ty	Information				
▷ 🏪 Networks 🔣 Cluster Events	∎® 7141 ∎® 7141	0 0 0	Connect Start Save Shut Down		Virtual Machine	N2	Med	ium					
			Turn Off Settings Manage Replication	•									
		100 C	Move Cancel Live Migration Change Startup Priority	•	 Live Migration Quick Migration Virtual Mach 	on Filon Fil	• 😿 E	est Po elect i	ssible Node lode				
		5	Information Details Show Critical Events										
	4		Add Resource	•									>
	• 1)	₽	More Actions Remove	•				_				Preferred	Owners: <u>Any mode</u>
	Name		Properties	Sta	dus In	formation							

Step 2: we only have the other node to look at, since as noted before we are using a two-node cluster

Me	ove Virtual Machine	×
Select the destination	node for live migration of 'VM1	' from 'N1'.
Look for:		
🔎 Search		Clear
Cluster nodes:		
Name	Status	
N2	💽 Up	
	ОК	Cancel

Step 3: after live migration is complete, verify the Owner Node of the virtual machine has changed

Roles (2)						
Search						👂 Queries 🔻 🖬 👻 😪
Name	Status	Туре	Owner Node	Priority	Information	
🛃 УМ1	🚔 Live Migrat…	Virtual Machine	N1	Medium	Live Migrating, 3% completed	
🛃 VM2	🛞 Running	Virtual Machine	N2	Medium		
-						
Roles (2)						
Search						🔎 Queries 🔻 🖬 👻 오
Name	Status	Туре	Owner Node	Priority	Information	
🐌 VM1	🕥 Running	Virtual Machine	N2	Medium		
🛃 VM2	🕜 Running	Virtual Machine	N2	Medium		

Step 4: check the package receiving status via the ping command

Administrator: Command Prompt - ping 172.24.110.31 -t	
C:\Users\Administrator.CAD>ping 172.24.110.31 -t	^
Pinging 172.24.110.31 with 32 bytes of data: Reply from 172.24.110.31: bytes=32 time<1ms TTL=128 Reply from 172.24.110.31: bytes=32 time<1ms TTL=128	≡
Reply from 172.24.110.31: bytes=32 time(1ms TTL=128 Reply from 172.24.110.31: bytes=32 time(1ms TTL=128 Reply from 172.24.110.31: bytes=32 time(1ms TTL=128	
Reply from 172.24.110.31: bytes=32 time<1ms TTL=128 Reply from 172.24.110.31: bytes=32 time<1ms TTL=128 Reply from 172.24.110.31: bytes=32 time=1ms TTL=128	
Reply from 172.24.110.31: bytes=32 time=1ms TTL=128 Reply from 172.24.110.31: bytes=32 time<1ms TTL=128 Reply from 172.24.110.31: bytes=32 time<1ms TTL=128	
Reply from 172.24.110.31: bytes=32 time=1ms TTL=128 Request timed out. Request timed out.	
Keply from 172.24.110.31: bytes=32 time<1ms TTL=128 Reply from 172.24.110.31: bytes=32 time<1ms TTL=128 Reply from 172.24.110.31: bytes=32 time<1ms TTL=128 Reply from 172.24.110.31: bytes=32 time<1ms TTL=128	

As shown in the screenshot above, the virtual machine returned two timeout requests during live migration.

Conclusion

With FlashNAS ZFS series systems and their assured virtualization support, making the most of the new features and capabilities of Windows Server 2012 is easy and reliable. Functions such as CSV and Hyper-V live migration are simplified and convenient, and can be achieved by many team members other than IT experts. FlashNAS ZFS series solutions also provide the high performance and availability required to sustain smooth and stable shared storage with extensive virtualization. Like all FlashNAS, the new models were designed as a platform for Windows Server 2012 environments, as well as virtualization using other operating systems. They allow you to fully realize your IT infrastructure potential to gain utmost benefit from hardware investment while helping keep costs under control. Winchester Systems will continue to develop virtualization-centric solutions, and our support network means systems are regularly updated to stay compatible with new software.

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