

High Availability Configuration

on

FlashNAS ZFS Systems

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FlashNAS ZFS Series

FlashNAS ZFS series systems deliver consolidated storage for application server and file server deployment. They are available in a variety of hardware configurations, including high availability active-active dual controllers for assured redundancy and fast failover. Power supplies are also redundant and energy-efficient. In all situations, FlashNAS ZFS products protect data and your continued ability to work and provide services to your customers. Additionally, controllers, power supplies, and cooling modules use a modular cable-free design that makes installation, maintenance, and upgrades simple and quick.

FlashNAS ZFS products are enhanced by the ZFS file system, which has sophisticated data corruption prevention and healing capabilities built in. You gain access to features such as unlimited snapshot, remote replication, and pool mirror. Powerful computing components and up to 1.5PB in storage via JBOD make FlashNAS ZFS series systems highly scalable and capable solutions for every enterprise and organization.

Active/Active redundant controller configuration:



Figure 1: high availability architecture

The FlashNAS ZFS series features active/active controller architecture instead of active/standby, as shown by figure 1. Employing a so-called internal heartbeat mechanism, each controller is aware of the status of its twin controller. Both sync with the quorum disk to ascertain pool ownership.

This architecture nearly doubles performance and offers high availability protection. In real world applications such as iSCSI volume access or share folders, the FlashNAS ZFS series provides better data integrity and higher availability than those delivered by comparable products, as explained below.



Figure 2: iSCSI volume data integrity

As figure 2 shows, the host receives a commit message when the I/O writes to block storage. The FlashNAS ZFS series uses write-through mode to protect iSCSI volume data.



Figure 3 : iSCSI volume high availability

As figure 3-1 shows, the FlashNAS ZFS series leverages MPIO to provide connections from controller A and controller B for to the host. In figure 3-2, we unplug controller A to see how the FlashNAS ZFS series provides high availability. Figure 3-3 shows controller A cannot sync the quorum drive immediately, while figure 3-4 indicates that when controller B notices controller A has failed, controller B becomes the owner of Pool-1. I/O from the host passes through controller B rather than controller A in this case, ensuring continuous availability.



Figure 4: share-folder data integrity

The FlashNAS ZFS series leverages ZFS Intent Log (ZIL) to ensure share folder data integrity. ZIL records data and whether that data has been written onto disk or not.



Figure 5: share folder high availability

Figure 5-1 shows how the FlashNAS ZFS series provides two share folders belonging to controller A and controller B, respectively. In figure 5-2, we unplug controller A to see how the FlashNAS ZFS series delivers high availability in more scenarios. As figure 5-3 shows, the first share folder path is \\10.10.10.1\File1. The share folder becomes lost initially once the IP disappears. Also, controller A cannot sync the quorum drive immediately. In figure 5-4, we see an IP that belongs to controller A executing failover to controller B. Once IP failover completes, \\10.10.10.1\File1 becomes accessible again.

Comprehensive GUI: with the detailed GUI that ships with the FlashNAS ZFS series, customers gain clear insight into all configurations.

tem Informat	ion					
System / Components	/ Peripheral De	wices Status				
/ the model name, vers	ion information,	and profiles of hardware com	ponents.			
Device Information :						
Model Name:	Fla	shNAS 3000				
Software Version	n: 3.3	8				
Service ID:	848	7975				
CDIL						
Controller	CPU ID	Manufacturer		Speed	Family	
A	CPU 0	Intel(R) Corporation		3300MHz	Intel(R) Core(TM) i3-2120) CPU @ 3.30GHz
В	CPU 0	Intel(R) Corporation		3300MHz	Intel(R) Core(TM) i3-2120	CPU @ 3.30GHz
				10255230566233		
Memory :						
Controller	N	lemory ID	Туре	I	ocation	Size
A	N	1em O	DDR3	(ChannelA-DIMM0	8192MB
A	N	lem 1	DDR3	(ChannelA-DIMM1	8192MB
A	N	1em 2	DDR3	(ChannelB-DIMM0	8192MB
A	N	1em 3	DDR3	(ChannelB-DIMM1	8192MB
В	N	lem O	DDR3	(ChannelA-DIMM0	8192MB
В	N	lem 1	DDR3	(ChannelA-DIMM1	8192MB
В	N	lem 2	DDR3	(ChannelB-DIMM0	8192MB
В	N	1em 3	DDR3	(ChannelB-DIMM1	8192MB
Network						
Interface	IP Addres	ss		Subnet	Mask	MAC Address
Mgmt1	(A - Prima	rry) 192.168.150.95		255.255	5.255.0 5.255.0	00:21:3a:11:84:27 00:21:3a:19:84:27
CH0	(A) 0.0.0.0)		255.0.0	.0	00:21:3a:51:84:27
0114	(B) 0.0.0.0 (A) 0.0.0.0)		255.0.0	.0	00:21:3a:59:84:27 00:21:3a:61:84:27
CH1	(B) 0.0.0.0)		255.0.0	.0	00:21:3a:69:84:27
CH2	(A) 192.16 (B) 192.16	58.150.80 58.150.117		255.255	5.255.0 5.255.0	00:21:3a:79:84:27 00:21:3a:79:84:27
СНЗ	(A) 192.10	58.150.74		255.255	.255.0	00:21:3a:81:84:27



Maintenance System High Availability		Welcome admin	👆 Logout	📑 Links 🔻
Gatus Gonfiguration	High Availability			?
* Storage	High Availability System Management			
🗉 🥪 Folder	View and manage the controller status. Power off your NAS system or reboot the system.			
III 👶 Account				
🗉 🧾 Backup	System Management			
🗆 💥 Maintenance	© Shuddown System			
🗆 🄡 System				
System Snapshot	© Reboot System			
Software Update				
Backup System Setting	Controller Management			
High Availability				
Lug	Controller A Active (Primary)			
	© Deactivate © Shutdown			
	Controller B Adive			
	O Deactivate O Shutdown			
				ок

Scenarios without I/O running

We use two methods to illustrate the high availability FlashNAS ZFS series products provide.

Method 1: ping management port IP

Step 1: ping management port IP (controller A): 172.24.110.32

Network			
Interface	IP Address	Subnet Mask	MAC Address
Mgmt0	(A - Primary) 172.24.110.32 (B - Secondary) 172.24.110.58	255.255.254.0 255.255.254.0	0:D0:23:06:79:46 0:D0:23:0E:79:46
CH0	(A) 172.24.110.53 (B) 172.24.110.51	255.255.254.0 255.255.254.0	0:D0:23:36:79:46 0:D0:23:3E:79:46
CH1	(A) Offline (B) Offline		0:D0:23:46:79:46 0:D0:23:4E:79:46
CH2	(A) Offline (B) Offline		0:D0:23:56:79:46 0:D0:23:5E:79:46
СНЗ	(A) Offline (B) Offline		0:D0:23:66:79:46 0:D0:23:6E:79:46



Step 2: unplug controller A

Step 3: check the echo package

Reply from 172.24.110.32:	bytes=32 time=1ms TTL=255
Reply from 172.24.110.32:	bytes=32 time<1ms TTL=255
Reply from 172.24.110.32:	bytes=32 time<1ms TTL=255
Reply from 172.24.110.32:	bytes=32 time<1ms TTL=255
Reply from 172.24.110.32:	bytes=32 time<1ms TTL=255
Reply from 172.24.110.32:	bytes=32 time<1ms TTL=255
Reply from 172.24.110.32:	bytes=32 time<1ms TTL=255
Reply from 172.24.110.32:	bytes=32 time<1ms TTL=255
Request timed out.	
Reply from 172.24.110.86:	Destination host unreachable.
Reply from 172.24.110.86:	Destination host unreachable.
Reply from 172.24.110.32:	bytes=32 time=2279ms TTL=255
Reply from 172.24.110.32:	bytes=32 time<1ms TTL=255
Reply from 172.24.110.32:	bytes=32 time<1ms TTL=255
Reply from 172.24.110.32:	bytes=32 time<1ms TTL=255
Reply from 172.24.110.32:	bytes=32 time<1ms TTL=255
Reply from 172.24.110.32:	bytes=32 time<1ms TTL=255

Only a few requests timed out, and clients can still receive echo packages from the same management IP.

Step 4: customers can access the management GUI from the same management port IP



Method 2: FTP

Step 1: check Network Summary

Network

Interface	IP Address	Subnet Mask	MAC Address
Mgmt0	(A - Primary) 172.24.110.32 (B - Secondary) 172.24.110.58	255.255.254.0 255.255.254.0	0:D0:23:06:79:46 0:D0:23:0E:79:46
CH0	(A) 172.24.110.53 (B) 172.24.110.51	255.255.254.0 255.255.254.0	0:D0:23:36:79:46 0:D0:23:3E:79:46
CH1	(A) Offline (B) Offline		0:D0:23:46:79:46 0:D0:23:4E:79:46
CH2	(A) Offline (B) Offline		0:D0:23:56:79:46 0:D0:23:5E:79:46
СНЗ	(A) Offline (B) Offline		0:D0:23:66:79:46 0:D0:23:6E:79:46

Step 2: use FTP client software to connect a share folder

admin@172.24.110.53 - FileZilla							
File Edit View Transfer Server Bookmarks Help New version available!							
M ♥ 9 N = 1 ♥ # 1 ♥ \$ 1 N \$ M							
Host: 172.24.110.53 Username: admin Password: ••••• Port: Quickconnect V							
Response: 227 Entering Passive Mode (172,24,110,53,215,34). Command: LIST Response: 150 Here comes the directory listing. Response: 226 Directory send OK. Status: Directory listing successful Local site: \ Image: Posktop Image: Posktop Image: Posktop	✓ Remote site: // ✓						
Filename Filesize Filetype Last modified	Filename Filesize Filetype Last modified Permissions Ov						
A: Floppy Disk Dri C: Local Disk	Pool-1 File folder 8/27/2013 9:36: drwxr-xr-x ftp						
2 directories	1 directory						

Step 3: prepare a file and upload to the share folder

Security	De	tails	Previous Versio		
General	Comp	atibility	Digital Signatu		
I	/Mware-worksta	tion-full-8.0.0-	471780		
Type of file: A	pplication (.exe)				
Description: V	Mware <mark>Works</mark> ta	tion Installer			
Location: C	:\Users\Adminis	strator.CAD\De	esktop		
Size: 4	473 MB (496,150,016 bytes)				
Size on disk: 4	473 MB (496,152,576 bytes)				
Created: T	oday, Septembe	er 3, 2013, 17	minutes <mark>a</mark> go		
Modified: T	Thursday, October 27, 2011, 2:29:01 PM				
Accessed: T	oday, Septembe	er 3, 2013, 17	minutes ago		
Attributes:	<u>R</u> ead-only	<u>H</u> idden	Advanced		

E		admin@172.24	.110.53 - F	ileZilla		_	. 🗆 X
File Edit View Trans	fer Server Bookmarks He	elp New version a	available!				
1 - 7 - 7	1 🗱 🕅 🙀 🖉 🗐	R 😤 🖪					
Host: 172.24.110.53	Username: admin	Password:	••••	Port:	Quid	ckconnect 👻	
Response: 200 Swite	hing to Binary mode.						^
Command: PASV							
Response: 227 Entering Passive Mode (1/2,24,110,53,208,168).							
Command: STOR VMware-workstabon-rull-8.0.0-4/1/80.exe							
Response. 150 OK d	senu uata.						Y
admin@172.24.110.53	× admin@172.24.110.53	X admin@172	2.24.110.53	X			-
Local site: \		~	Remote si	te: /Pool-1/cif	s		~
C:		1		ifs	F 1 -	1	
Filename	Filesize Filetype	Last modified	ename	Filesize	Filetype	Last modified	Permissions
C:	Local Disk		 ClusterSt		File folder	8/27/2013 8:42:	drwxr-xr-x
<	Ш	>	<		Ш		>
2 directories			1 directory	X			
Server/Local file Direction Remote file Size Priority Status admin@172.24.110.53 C:\Users\Administrator.CA >> /Pool-1/cifs/VMware-worksta 496.150.016 Normal Transferring							
00:00:01 elapsed 00:00:05 left 24.8% 123,404,288 bytes (117.7 MiB/s)							
Queued files (1)	Failed transfers (13)	Successful transfer	rs (866)				
					F.	🚥 Queue: 473.2 M	liB 🛛 🔍 🕘 📑

Step 4: unplug controller A

E	admin@172.24.110.53 - FileZilla					
File E	Edit View Transfer Server Bookmarks Help New version available!					
过 •						
Host	172.24.110.53 Username: admin Password: ••••• Port: Quickconnect 🔻					
Error:	Connection timed out			^		
Error:	Could not connect to server					
Status:	Delaying connection for 5 seconds due to previously failed connection attempt					
Status:	atus: Connecting to 172.24.110.53:21					
Status:	Connecting to 172.24.110.53:21			~		

The FTP client software automatically reconnects to the share folder and continues previously started file transmission.

File Edit View Transfer Server Bookmarks Help New version available! Image: Server Bookmarks Help New version available Help New version available? Image: Server Bookmarks Help New version availa	E	â	admin@172.24.1	10.53 - FileZi	illa			D X
Image: Starting upload of C:\Users\Administrator.CAD\Desktop\VMware-workstation-full-8.0.0-471780.exe Command: PASV Response: 227 Entering Passive Mode (172,24,110,53,211,178). Command: STOR VMware-workstation-full-8.0.0-471780.exe Response: 150 Ok to send data. Index of C: Image: Store Full Passive Mode (172,24,110,53,211,178). Command: STOR VMware-workstation-full-8.0.0-471780.exe Response: 150 Ok to send data. Index of C: Image: Store Full Passive Mode (172,24,110,53,211,178). Command: STOR VMware-workstation-full-8.0.0-471780.exe Response: 150 Ok to send data. Index of C: Image: Store Full Passive Mode (172,24,110,53,211,178). Construction Image: Store Full Passive Mode (172,24,110,53,211,178). Command: STOR VMware-workstation-full-8.0.0-471780.exe Remote site: /Pool-1/105 Index of C: Image: Store Full Passive Mode (172,24,110,53,211,178). Index of C: Image: Store Full Passive Mode (172,24,110,53,211,178). Index of C: Image: Store Full Passive Mode (172,24,110,53,211,178). Index of C: Image: Store Full Passive Mode (172,24,110,53,211,178). Index of C: Image: Store Full Passive Mode (172,24,110,53,211,178). Index of C: Image: Store Full Passive Mode (172,24,110,53,211,178). Index of C: Image: Store Full Passive Mode (172,24,110,53,211,178). Index of C: Image: Store Full Passive Mode (172,24,110,53,211,178). Index of C: Image: Store Full Passiv	File Edit View Transfe	er Server Bookmarks He	Ip New version av	ailable!				
Host: 172.24.110.53 Username: admin Password: Port: Quickconnect Status: Starting upload of C:\Users\Administrator.CAD\Desktop\VMware-workstation-full-8.0.0-471780.exe A Command: PASV Port: Quickconnect A Response: 120 Characteristics Port: Quickconnect A admin@172.24.110.53 x admin@172.24.110.53 x A admin@172.24.110.53 x admin@172.24.110.53 x A Image: The status of the send data. v Remote site: / Pool-1/cifs v Image: The sender status of the send data. v Remote site: / Pool-1/cifs v Image: The sender status of the sender	▓╶Іℤ≞Ҁ╤	🔁 🚺 🌬 🖉 🗐	R 😤 🖪					
Status: Starting upload of C:\Users\Administrator.CAD\Desktop\VMware-workstation-full-8.0.0-471780.exe Command: PASV Response: 227 Entering Passive Mode (172,24,110,53,211,178). Command: STOR VMware-workstation-full-8.0.0-471780.exe Response: 150 Ok to send data. admin@172.24.110.53 × admin@172.24.110.53 × Image: Command: Computer admin@172.24.110.53 × admin@172.24.110.53 × Pesktop Pool-1 My Documents Image: Ci A: Filesize Filename * Filesize Filesize Filesize File of der 8/27/2013 8:42 dimin@172.24.110.53 Image: Ci Genver/Local file Direction Remote file Size Priority Status Genver/Local file Direction Remote file Server/Local file Direction Remote file Size Priority Status Idirectory Genver/Local file Direction Remote file Size Size Priority Status Idirectory Genver/Local file Direction Remote file Size Priority Status Gueued files (1) Failed transfers (15) Successful transfers (872)	Host: 172.24.110.53	Username: admin	Password:	••••	Port:	Quickco	nnect 💌	
admin@172.24.110.53 × admin@172.24.110.53 × Local site: \ Desktop My Documents Computer A: C: Filename Filesize Filetype Last modified Filename Filesize Filetype Last modified Local Disk Filename Filesize Filetype Last modified Pool-1 C: Local Disk C: Local Disk C: Users/Local file Direction Remote file Size Priority Status Output: Output: Output: Output: Pool-1 Pool-	Status: Starting up Command: PASV Response: 227 Enterin Command: STOR VMw Response: 150 Ok to	oload of C:\Users\Administrat ng Passive Mode (172,24,11) vare-workstation-full-8.0.0-47 send data.	or.CAD\Desktop\VM 0,53,211,178). /1780.exe	1ware-workstatio	on-full-8.0.0-4	71780.exe		~
Local site: Name Desktop My Documents My Documents Pool-1 A: C: Filename* Filesize Filename* Filesize <t< td=""><td>admin@172.24.110.53</td><td>× admin@172.24.110.53</td><td>× admin@172.</td><td>24.110.53 ×</td><td></td><td></td><td></td><td>Ŧ</td></t<>	admin@172.24.110.53	× admin@172.24.110.53	× admin@172.	24.110.53 ×				Ŧ
Incluine Inclu	Local site: \ Desktop My Documents Computer A: C: Eilename	Filesize Filetyne	V Last modified	Remote site: /	/Pool-1/cifs II-1 cifs	Filetyne	Last modified	Permissio
Image: Constraint of the second se	A:	Floppy Disk Dri Local Disk	Last mouned	Intenanie I ClusterSt	T IIESIZE	File folder	8/27/2013 8:42:	drwxr-xr-x
2 directories 1 directory Server/Local file Direction Remote file Size Priority Status admin@172.24.110.53 C:\Users\Administrator.CA >> /Pool-1/cifs/VMware-worksta 496,150,016 Normal Transferring 00:00:15 elapsed 00:00:27 left 34.4% 171,114,496 bytes (12.2 MiB/s) Transferring Queued files (1) Failed transfers (15) Successful transfers (872) Image: 0.00000000000000000000000000000000000	<	Ш	>	<		W		>
Server/Local file Direction Remote file Size Priority Status admin@172.24.110.53 C:\Users\Administrator.CA >> /Pool-1/cifs/VMware-worksta 496,150,016 Normal Transferring 00:00:15 elapsed 00:00:27 left 34.4% 171,114,496 bytes (12.2 MiB/s) Transferring Queued files (1) Failed transfers (15) Successful transfers (872) Cueure 472 2 MiB	2 directories			1 directory				1.55
Queued files (1) Failed transfers (15) Successful transfers (872)	Server/Local file admin@172.24.110.53 C:\Users\Administrato 00:00:15 elapsed	Direction Remote fil r.CA>> /Pool-1/ci 00:00:27 left 34.	e fs/VMware-worksta 4% 171,11	Siz 496,150,01 4,496 bytes (12.2	e Priority 6 Normal ! MiB/s)	Status Transferring		
💌 📖 Vueue: 4/3.2 Wid	Queued files (1)	Failed transfers (15)	Successful transfers	(872)		A BAR	Oueue: 473,2 MiB	• •

Scenarios with I/O running

We also test high availability under I/O running conditions to establish the length of time required to complete the failover process. Based on this test, failover takes less than 100 seconds even with I/O running. In other words, the FlashNAS ZFS series offers high availability during "live" circumstances, with data transiting across the network as failover occurs. High availability is not limited to "off" or passive conditions (no I/O running).

Test Item	Configuration	Time (sec)	Remark
CIFS Share Folder	A: 4(CIFS) B: 4(CIFS)	35	 Create 4 CIFS share folders for controller A and create another 4 CIFS share folders for controller B. Running IOMeter on all CIFS share folders. During the I/O, unplug controller A directly. Create 8 CIFS share folders for controller A and
	A: 8(CIFS) B: 8(CIFS)	35	 create another 8 CIFS share folders for controller B. Running IOMeter on all CIFS share folders. During the I/O, unplug controller A directly.
iscsi Volume	A: 4(ISCSI) B: 4(ISCSI)	92	 Create 4 iSCSI volumes for controller A and create another 4 iSCSI volumes for controller B. Running IOMeter on all iSCSI volumes. During the I/O, unplug controller A directly.
	A: 8(ISCSI) B: 8(ISCSI)	97	 Create 8 iSCSI volumes for controller A and create another 8 iSCSI volumes for controller B. Running IOMeter on all iSCSI volumes. During the I/O, unplug controller A directly.
CIES Share Folder + iSCSI Volume	A: 4(ISCSI), 4(CIFS) B: 4(ISCSI), 4(CIFS)	92	 Create 4 CIFS share folders and 4 iSCSI volume for controller A and create another 4 CIFS share folders and another 4 iSCSI volumes for controller B. Running IOMeter on all CIFS share folders and all iSCSI volumes. During the I/O, unplug controller A directly.
	A: 8(iSCSI), 8(CIFS) B: 8(iSCSI), 8(CIFS)		 Create 8 CIFS share folders and 8 iSCSI volume for controller A and create another 8 CIFS share folders and another 8 iSCSI volumes for controller B. Running IOMeter on all CIFS share folders and all iSCSI volumes. During the I/O, unplug controller A directly.

Conclusions

In the above scenarios, the FlashNAS ZFS series shows that it provides customers the benefits of a redundant design. When encountering single controller failure, users do not need to worry about data loss or lack of access. FlashNAS ZFS series systems carry out failover of all IP and pool ownership information to the other controller in order to ensure business continuity and uninterrupted productivity. In terms of data safety and service integrity, the FlashNAS ZFS series provides a greatly enhanced environment to customers.

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