The science behind the report:

DataCore vFilO lets users locate files across multiple NAS systems with a single search

This document describes what we tested, how we tested, and what we found. To learn how these facts translate into real-world benefits, read the report DataCore vFilO lets users locate files across multiple NAS systems with a single search.

We concluded our hands-on testing on May 8, 2020. During testing, we determined the appropriate hardware and software configurations and applied updates as they became available. The results in this report reflect configurations that we finalized on March 31, 2020 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears.

System configuration information

Server configuration information	DataCore vFilO metadata servers (2)	DataCore vFilO data services (DSX) server	Windows file server	Windows application server
Server	Lenovo™ ThinkServer™ RD550	Lenovo ThinkServer RD550	Supermicro® X10SRH-CF	Supermicro X10SRH-CF
BIOS name and version	ThinkServer RD550 BIOS 4.93.0	ThinkServer RD550 BIOS 4.93.0	SMBIOS version 2.8	SMBIOS version 2.8
Operating system name and version number	DataCore vFilO version 4.3 update 1, 4.3.0-87	DataCore vFilO version 4.3 update 1, 4.3.0-87	Microsoft Windows Server 2019 Datacenter Version 10.0.17763 Build 17763	Microsoft Windows Server 2019 Datacenter Version 10.0.17763 Build 17763
Processor				
Number of processors	2	2	2	2
Vendor and model	Intel® Xeon® E5-2690 v3	Intel Xeon E5-2660 v3	Intel Xeon E3-1650 v3	Intel Xeon E3-1650 v3
Core count (per processor)	12	10	6	6
Core frequency (GHz)	2.60	2.60	3.50	3.50
Memory module(s)				
Total memory in system (GB)	128	128	128	128
Number of memory modules	4	8	8	8
Vendor and model	Samsung® M393A4K40BB1-CRC	Samsung M393A4K40BB1-CRC	SK Hynix HMA42GR7AFR4N	Crucial CT 16G4RFD4213.36FA2
Size (GB)	32	16	16	16
Type	PC4-2133	PC4-2133	PC4-2133	PC4-2133
Speed (MHz)	2,133	2,133	2,133	2,133
Speed running in the server (MHz)	2,133	2,133	2,133	2,133
Local storage (type 1)				
Number of drives	3	1	3	3
Drive vendor and model	Intel SSDSC2BB800G6R	Intel SSDSC2BB240G4L	Seagate® ST1000NM0033-9ZM	Seagate ST1000NM0033-9ZM
Drive size	800 GB	240 GB	1 TB	1 TB
Drive information (speed, interface, type)	6 Gb/s, SATA, SSD	6 Gb/s, SATA, SSD	6 Gb/s, SATA, HDD	6 Gb/s, SATA, HDD
Local storage (type 2)				
Number of drives	N/A	2	2	2
Drive vendor and model	N/A	Seagate ST600MM0006	Seagate ST3600057SS	Seagate ST3600057SS
Drive size (GB)	N/A	600	600	600
Drive information (speed, interface, type)	N/A	6 Gb/s, SAS, 10K HDD	6 Gb/s, SAS, HDD	6 Gb/s, SAS, HDD

Server configuration information	DataCore vFilO metadata servers (2)	DataCore vFilO data services (DSX) server	Windows file server	Windows application server
Local storage (type 3)				
Number of drives	N/A	N/A	1	1
Drive vendor and model	N/A	N/A	Samsung SSD 850 PRO	Samsung SSD 850 PRO
Drive size (GB)	N/A	N/A	512	512
Drive information (speed, interface, type)	N/A	N/A	6 Gb/s, SATA, SSD	6 Gb/s, SATA, SSD
Network adapter (type 1)				
Vendor and model	Intel X540	Intel X540	Mellanox® ConnectX-3	Chelsio® T520-CR
Number and type of ports	2x 10GbE	2x 10GbE	2x 10GbE	2x 10GbE
Driver version	cxgb4	cxgb4	mlx4eth63.sys version 5.50.14643.0	chnetx64.sys version 6.14.2.0
Network adapter (type 2)				
Vendor and model	Chelsio T6225-LL-CR	Emulex P008827	N/A	N/A
Number of power supplies	2x 10GbE	2x 10GbE	N/A	N/A
Driver version	cxgb4	cxgb4	N/A	N/A

Table 2: Detailed information on the Linux server virtual machine we used in our testing.

Virtual machine configuration information	Linux server (virtual machine)
Hypervisor	Microsoft Windows Hyper-V (running on Windows application server)
Number of vCPUs	4 @ 3.5 GHz
Memory	16 GB
Boot drive	Virtual hard disk (VHDX format), 80 GB
Pass-through drives for local storage	3x physical disk drives, 931.51 GB each
Virtual switch	10Gb virtual switch
Guest OS	CentOS Linux release 8.1.1911 (Core)
Linux kernel	4.18.0-147.el8.x86_64

Table 3: Detailed information on the storage system we used in our testing.

Storage system configuration information	Storage array
Storage system	NetApp FAS2552
Software version	NetApp release 9.7
Number of storage shelves	2
Number of data drives	24
Drive part number	X423_TAL13900
Drive size (GB)	838

How we tested

About the environment

Our DataCore vFilO deployment consisted of three mid-range dual-socket servers on which we installed the DataCore vFilO software. Our file servers were a NetApp filer, a Windows file server, and a Linux NFS server virtual machine. We used an additional Windows Server running Hyper-V to host an Active Directory VM and our Linux NFS VM, and to run benchmark tools. DataCore vFilO requires a Windows Active Directory domain to mount file shares from Windows file servers.

DataCore vFilO environment in our testing
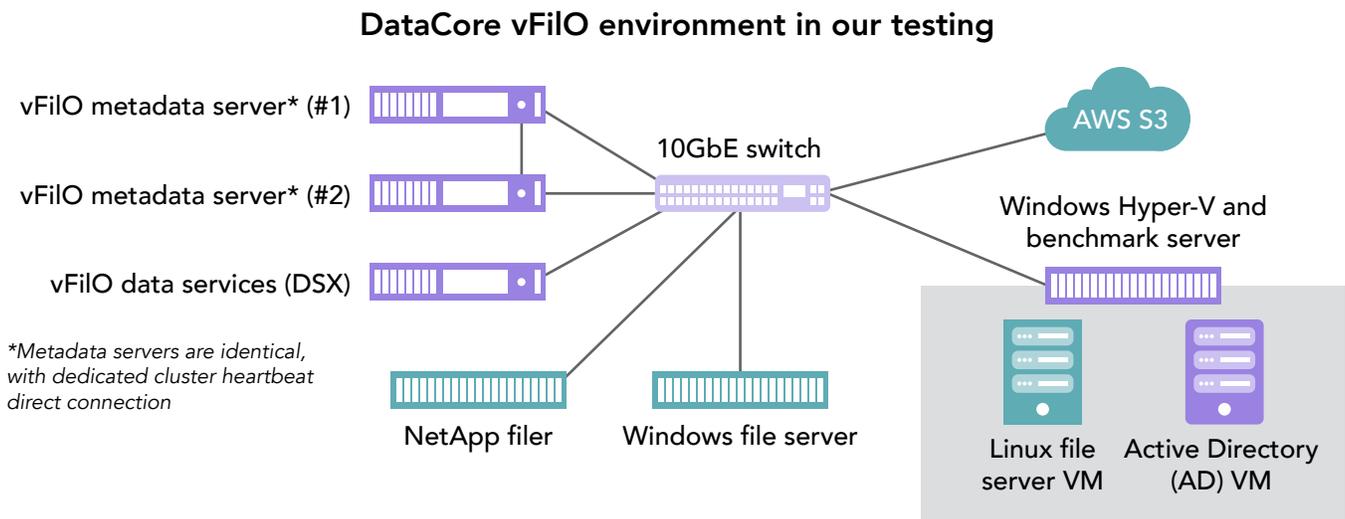
Figure 1: Our test environment. Source: Principled Technologies

Installing and configuring DataCore vFilO

DataCore provides installation documentation to customers who purchase vFilO. We followed the step-by-step instructions provided in the DataCore vFilO Installation Guide, which includes detailed screenshots for each step of the installation process.

See pages 5 through 8 for the configuration steps we performed before setting up vFilO.

Testing DataCore vFilO

Testing the vFilO Mobility feature

1. On the left side of the vFilO management console, click Infrastructure & Data.
2. Click the Volumes tab.
3. For each volume listed, click the Edit pencil icon on the right.
4. When the Volume Properties window appears, click Edit.
5. Adjust the capacity by either using the mouse to adjust the slider or entering the desired percentage amount in the text box. The default is 75%.
6. Observe the changes to the percentage used indicator on each volume over a 24-hour period.
7. Adjust the mobility percentage targets, and repeat as needed.

Testing the vFilO search feature

We used a simple "find" command to search for files in the file folder hierarchy.

```
cd /mnt/nfs/main
echo date
find -iname "*9998.txt"
echo date
```

Configuring the supporting environment

Note: For our testing, we installed the surrounding environment and include those instructions here. However, most organizations would likely be integrating DataCore vFilO into an existing environment.

Installing Windows Server 2019 on the application server with Hyper-V

1. Insert the installation media into the CD/DVD drive, and restart the server.
2. When the option appears, press the key to enter the Boot Manager.
3. Select Boot Menu.
4. Select the boot media, and press Enter.
5. When prompted to boot from DVD, press any key.
6. When the installation screen appears, leave language, time/currency format, and input method as default, and click Next.
7. Click Install now.
8. When the installation prompts you, enter the product key.
9. Select Windows Server 2019 Datacenter Edition (Server with a GUI), and click Next.
10. Check I accept the license terms, and click Next.
11. Click Custom: Install Windows only (advanced).
12. Select Drive 0 Unallocated Space, and click Next. Windows will begin and restart automatically.
13. When the Settings page appears, fill in the Password and Reenter Password fields with the same password.
14. Log in with the password you set up in the previous step.
15. Using Windows Update, download and install all updates.
16. Once all updates are installed, disable the Windows Update service to ensure no new updates are applied during testing.
17. Install the File and Storage Services role with the following items selected:

    - File Server
    - Server for NFS

18. Set a static IP address for the 10GbE NIC.
19. Select a name for this server, replacing the random computer name generated by the operating system installation process.
20. Open the Server Manager.
21. Click Manage → Add Roles and Features.
22. At the Before You Begin screen, click Next.
23. Choose Role-based or feature-based installation, and click Next.
24. Choose the local server, and click Next.
25. Choose Hyper-V, click Add Features when prompted, and click Next.
26. At the Hyper-V Things to note screen, click Next.
27. Choose a port (10GbE NIC in this case) for the virtual switch, and click Next.
28. Choose whether or not you want to add live migration capabilities, and click Next.
29. Set your default storage, and click Next.
30. Check the box for automatic restart, and click Install.
31. Choose Hyper-V and click Add Features when prompted. Click Next.
32. At the Hyper-V Things to note screen, click Next.
33. Open Hyper-V Manager.
34. Select Virtual Switch Manager.
35. Select the virtual switch you created during the Hyper-V installation above.
36. Check the box beside Allow management operating system to share this network adapter.
37. Click OK.

Installing Windows Server 2019 virtual machine for Active Directory

1. Open Hyper-V Manager on the Windows Server 2019 you created above.
2. Select New virtual machine.
3. Provide a name for this virtual machine.
4. Select Generation 1.
5. For memory size, select 8192.
6. In the connection drop-down box, choose 10Gb virtual switch.
7. Create a virtual hard disk using the default size in the default location.
8. Install an operating system from a bootable CD/DVD-ROM, and choose the image file (.iso) option, providing the location of the ISO file for Windows 2019 Server.

9. To create the virtual machine, click Finish.
10. When the new VM appears in the list, right-click Start to begin the installation process.
11. Double-click the window with the VM image for the virtual machine, and install Windows Server 2019 following all the standard prompts.
12. Set a static IP address for the NIC.
13. Select a name for this server, replacing the random computer name generated by the operating system installation process.
14. Install the Active Directory Domain Services role, and follow the standard prompts. For this project, we named the Active Domain `DM01.local`

Installing Windows Server 2019 and enabling file services on the Windows file server

1. Insert the installation media into the CD/DVD drive, and restart the server.
2. When the option appears, press the key to enter the Boot Manager.
3. Select Boot Menu.
4. Select the boot media, and press Enter.
5. When prompted to boot from DVD, press any key.
6. When the installation screen appears, leave language, time/currency format, and input method as default, and click Next.
7. Click Install now.
8. When the installation prompts you, enter the product key.
9. Select Windows Server 2019 Datacenter Edition (Server with a GUI), and click Next.
10. Check I accept the license terms, and click Next.
11. Click Custom: Install Windows only (advanced).
12. Select Drive 0 Unallocated Space, and click Next. Windows will begin and restart automatically.
13. When the Settings page appears, fill in the Password and Reenter Password fields with the same password.
14. Log in with the password you set up in the previous step.
15. Using Windows update, download and install all updates.
16. Once all updates are installed, disable the Windows Update service to ensure no new updates are applied during testing.
17. Install the File and Storage Services role with the following items selected:

   • File Server
   • File Server Resource Manager
   • Server for NFS

18. Set a static IP address for the 10GbE NIC.
19. Select a name for this server, replacing the random computer name generated by the operating system installation process.
20. Join this Windows file server to the Active Directory domain (DM01.local) using the standard method of changing from a workgroup to a domain.

Installing the Linux virtual machine

1. Open Hyper-V Manager on the first Windows Server 2019 you created above.
2. Select New virtual machine.
3. Provide a name for this virtual machine.
4. Select Generation 1.
5. For memory size, select 16384.
6. In the connection drop-down box, choose 10Gb virtual switch.
7. Create a virtual hard disk using the default size in the default location.
8. Install an operating system from a bootable CD/DVD-ROM and choose the image file (.iso) option, providing the location of the ISO file for CentOS 8.1.
9. To create the virtual machine, click Finish.
10. Highlight that VM in Hyper-V Manager, and right-click Settings.
11. Click Add hardware. Note: We will allocate three physical hard disk drives from the parent server as "pass-through" hardware disks directly to this VM, giving this VM direct access to three physical hard disk drives for storage.
12. Choose SCSI controller.
13. Select Hard drive, and choose Add.
14. Click the button beside Physical hard disk, choose one of the three physical disks in this system from the drop-down box, and click OK.
15. Repeat the above step two more times to allocate the other two physical disks to this VM.
16. To close the Settings window, click OK.
17. When the new VM appears in the list, right-click Start to begin the installation process.
18. Double-click the window with the VM image for the virtual machine, and install CentOS.
19. Select Install CentOS Linux 8.

20. Choose English, and click Continue.
21. Under Installation Destination, select the desired disk to install the OS.
22. Click the desired boot drive.
23. Click Done.
24. Click Accept Changes.
25. Select Kdump.
26. Uncheck Enable kdump, and click Done.
27. Select Network & Hostname.
28. Enter the desired hostname for the system.
29. Turn on the desired network ports, and click Configure.
30. On the General tab, select Connect automatically with priority.
31. On the IPv4 Settings tab, choose the drop-down named Method, and select Manual.
32. Under Addresses, click Add, and enter the desired static IP information for the server.
33. Enter the desired DNS information.
34. Click Save, and click Done.
35. Select Date & Time, and ensure the correct date, time, and time zone are set.
36. Click the cog beside the Network Time On/Off switch to add your NTP server.
37. Add the IP address of your NTP server, and click +.
38. Uncheck all other NTP servers.
39. Click OK.
40. Click Done.
41. Click Software Selection.
42. Choose the Base Environment of Server with GUI.
43. Click Done.
44. Click Begin Installation.
45. Select Root Password.
46. Enter the desired root password, and click Done.
47. When the installation completes, select Reboot to restart the virtual machine.
48. Click Licensing Information.
49. Check I accept the license agreement, and click Done.
50. Click Finish Configuration.
51. At the Welcome screen, click Next.
52. At the Privacy screen, click Next.
53. At the Online Accounts screen, click Skip.
54. At the About You screen, add a user, and click Next.
55. At the Password screen, add a password, and click Next.
56. Click Start Using CentOS Linux.
57. Log onto the server GUI as the user you created during the setup.
58. Close the Getting Started window.
59. Reboot the system.

Configuring the NetApp filer

We used an existing NetApp FAS2552 filer. We configured one storage VM with two aggregates, one allocated to each cluster. We enabled NFS and SMB/CIFS protocols for the storage VM. We created eight volumes on this array, each with an initial size of at least 1 TB with the option to grow to 2 TB. We disabled data-deduplication and compression for these volumes, as we needed only simple file space for this project.

Generating the data

We wrote a Python program to generate a structure of files and folders with many files. The program generated unique folder and file names and a variable number of lines of unique text for each file. We ran this program multiple times, once for each file share that we mounted from the application server. We ran this program from the application server to generate millions of files on each of the shares of the NetApp filer. We ran this program directly on the Windows file server and the Linux file server to generate files locally. We generated a total of approximately 5.5 million files across the three file servers, with most of these on the NetApp filer. These files varied in size from 50 KB to 50 MB.

We also included other large files we copied from our internal network. These files included Microsoft Word documents, spreadsheets, presentations, PDF files, videos, photos, ISO images, VHD files, and ZIP files. These larger files included MP4 and VHD files as large as 29 GB each.

Read the report at http://facts.pt/4vlem7y ▶

This project was commissioned by DataCore.

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