



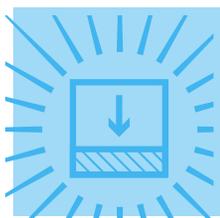
Upgrading to Windows Server 2019 on Dell EMC PowerEdge servers: A simple process that can dramatically reduce your storage footprint

Using Dell EMC PowerEdge R740xd servers with Intel Xeon Scalable processors, we upgraded from Windows Server 2016 and saw data compression ratios of up to 9.8:1 thanks to new Storage Spaces Direct features

Some IT admins who manage Dell EMC™ PowerEdge™ R740xd servers with Intel® Xeon® Scalable processors in a Microsoft® Storage Spaces Direct environment are considering upgrading to the Microsoft Windows Server® 2019 operating system. The potential space savings from storage deduplication could lead to consolidation and cost savings.

In the Principled Technologies data center, we performed hands-on testing to measure the benefit of performing this upgrade—a reduced storage footprint resulting from the deduplication features in the Windows Server 2019 version of Storage Spaces Direct. To quantify the amount of work required to get this benefit, we also noted the time and steps necessary to carry out the upgrade.

In this combination test report and migration guide, we show what we learned: The new OS let the server store data in dramatically less space, and the upgrade process was simple and quick. Together, these findings suggest that upgrading to Windows Server 2019 would yield proven results.



Save by storing data in less space

Deduplication enabled compression ratios up to

- **9.8:1** in a virtual desktop infrastructure environment
- **2.4:1** on a file server

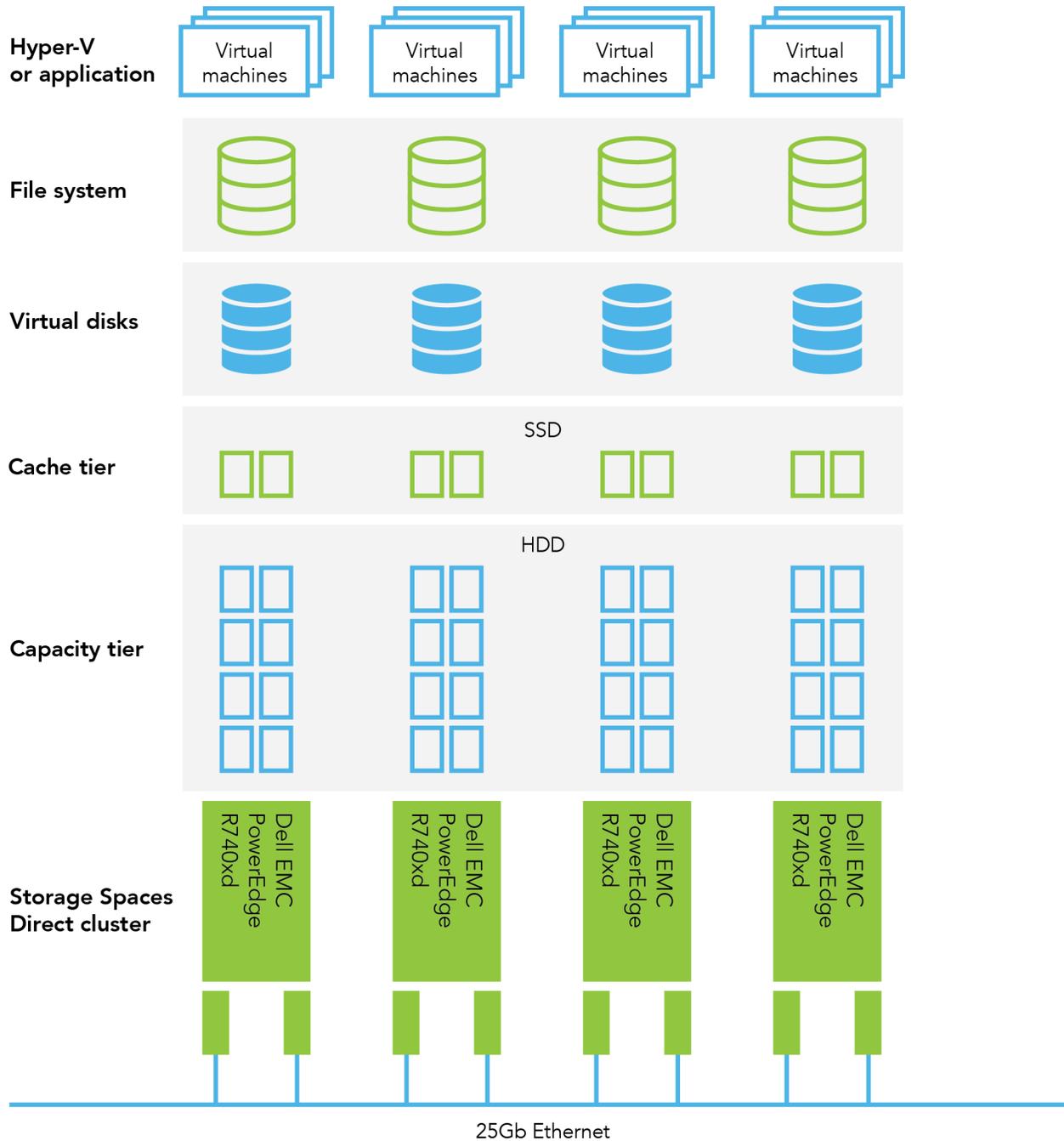


Upgrading is a simple process

- Only 25 steps to upgrade
- Took less than 3 hours

Our test environment

The figure below illustrates the components of the test environment we used to explore the data storage space savings that Windows Server 2019 makes possible on the Dell EMC PowerEdge R740xd in an Storage Spaces Direct environment.



Upgrading to Windows Server 2019 improved storage utilization through deduplication

Like any data center resource, storage capacity is something you strive to use efficiently. Deduplication technologies work by identifying files—or parts of files—that occur multiple times across your company's environment. Once they find these duplicate chunks of data, they store a single copy of each. By eliminating unnecessary copies, these technologies let you store the equivalent of a much larger volume of data on your hardware. The effective cost per GB of data decreases, and you can save by delaying future storage investments even as your company grows.

Windows Server 2019 supports deduplication on Storage Spaces Direct ReFS volumes. When enabling deduplication for your volume, you can choose from three built-in modes that reflect the types of data that are typically prime candidates for deduplication:

- General purpose
- Virtual desktop infrastructure (VDI)
- Virtualized backup

The general purpose mode is suited well to file servers, which frequently contain multiple copies of the same chunks of data. Deduplicating these files is an easy way to save space. Similarly, VDI environments typically host many VMs that are nearly identical. When it comes to daily backups, changes from the previous day are often minimal. Rather than storing a completely new version each time you make a change, deduplication is a way to essentially save only the changes.

To measure the potential benefits of the deduplication capabilities of Storage Spaces Direct, we conducted hands-on testing of all three modes. If you're unsure which mode is best for your workload, Microsoft recommends sticking with the default general-purpose mode.² Note that when you enable deduplication, you also enable compression, which would also contribute to space savings.

Microsoft Storage Spaces Direct, now part of Microsoft Azure Stack HCI

According to Microsoft, "Azure Stack HCI is a hyper-converged Windows Server 2019 cluster that uses validated hardware to run virtualized workloads on-premises."¹ Azure Stack HCI includes the following technologies: Hyper-V, Storage Spaces Direct, Software Defined Networking, and Failover Clustering. Learn more at <https://docs.microsoft.com/en-us/azure-stack/operator/azure-stack-hci-overview>.

About Dell EMC PowerEdge R740xd servers

The 2U Dell EMC PowerEdge R740xd is powered by Intel® Xeon® Scalable processors. It includes the iDRAC9 management tool, SupportAssist for proactive customer support, and an out-of-band management architecture. Learn more at <https://www.dell.com/en-us/work/shop/povw/poweredge-r740xd>.

General purpose mode for file servers

For this test, we set up virtual machines and populated them two ways: first with ISO image files and then with a mix of Microsoft Office files—Word, Excel, and PowerPoint. We set the server to run deduplication using the general-purpose mode. As we illustrate below, in both scenarios, deduplication caused storage requirements to shrink dramatically. The ISO image files used less than half the space and the Microsoft Office files used just over half the space.

ISO image files



Size before deduplication: **764 GB**

Size after deduplication: **312 GB**

Deduplication ratio: **2.4:1**

Storage requirements decreased by **59.2%**

Microsoft Office files



Size before deduplication: **304 GB**

Size after deduplication: **158 GB**

Deduplication ratio: **1.9:1**

Storage requirements decreased by **48.2%**

About the Intel Xeon Scalable processor family

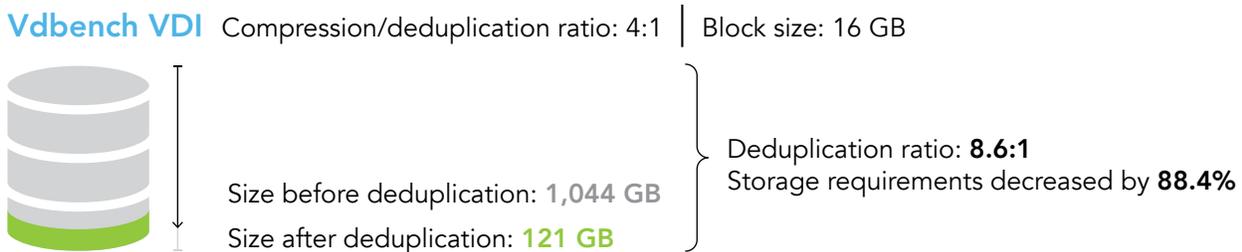
The Dell EMC PowerEdge R740xd features the Intel Xeon Scalable processor platform, which provide high per-core performance, up to 48 lanes of PCIe 3.0 bandwidth, and Intel Ultra Path Interconnect (Intel UPO) channels to increase scalability. In this study, we tested the Intel Xeon Gold 6130 processor, which offers 16 cores, 32 threads, and 22MB L3 cache. To learn more, visit: <https://www.intel.com/content/dam/www/public/us/en/documents/product-briefs/xeon-scalable-platform-brief.pdf>.

About Dell EMC Microsoft Storage Spaces Direct Ready Nodes

Dell EMC has another offering that can further simplify your Microsoft Storage Spaces Direct environment. According to Dell EMC, Microsoft Storage Spaces Direct Ready Nodes are preconfigured to provide the storage density and compute power necessary to meet the demands of a dynamic enterprise environment.³

Virtual desktop infrastructure

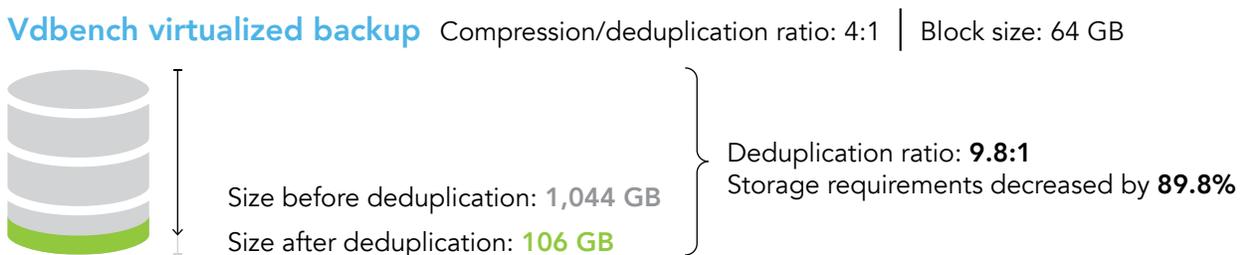
For this test, we used the Vdbench storage benchmarking tool, which allows you to create a data set that is compressible to a specific compression/deduplication ratio. We experimented with different block sizes and compression/deduplication ratios. We include complete results in the [science behind the report](#), but below we show the test conditions that yielded the highest compression ratio. The deduplication capabilities you'd get by upgrading to the new OS would let you store your virtual desktop data using less than one-eighth the amount of your server's capacity. It's easy to see how this would be beneficial—you could add many new VDI users before needing to invest in more gear.



Virtualized backup

For this test, we again used the Vdbench test tool, but instead of a VDI use case, we used a scenario that simulates the kind of backups that many companies regularly perform. As in the VDI scenario, we experimented with different block sizes and compression/deduplication ratios and show the combination that produced the highest compression ratio.

As we see, deduplication would allow a company that upgraded to Windows Server 2019 to store their backup data using less than one-ninth the amount of storage space.



Upgrading from Windows Server 2016 to Windows Server 2019: A straightforward process

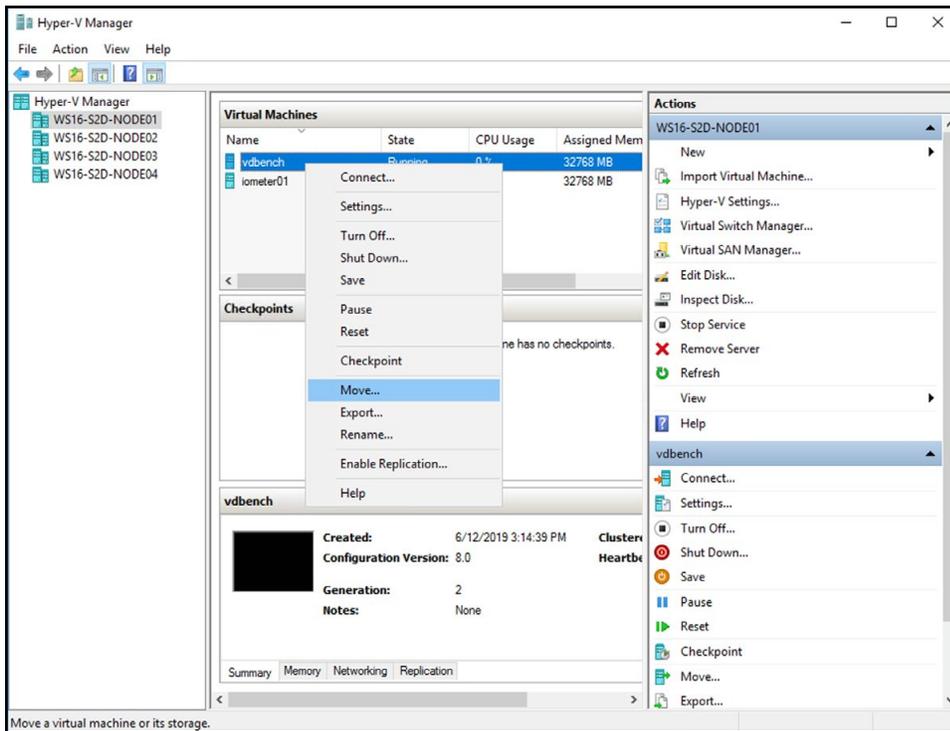
In this section, we provide the steps we took to perform an in-place upgrade while VMs were running. We include some screenshots to give you a sense of the graphical user interface. In the [science behind the report](#), we provide all screenshots.

Note: It took our technician 2 hours and 46 minutes to perform this process.

1. Check that the servers are running version 14393.2828 or newer of Windows Server 2016.
2. If you're using a SET software-defined networking switch, run the following command in an elevated PowerShell session:

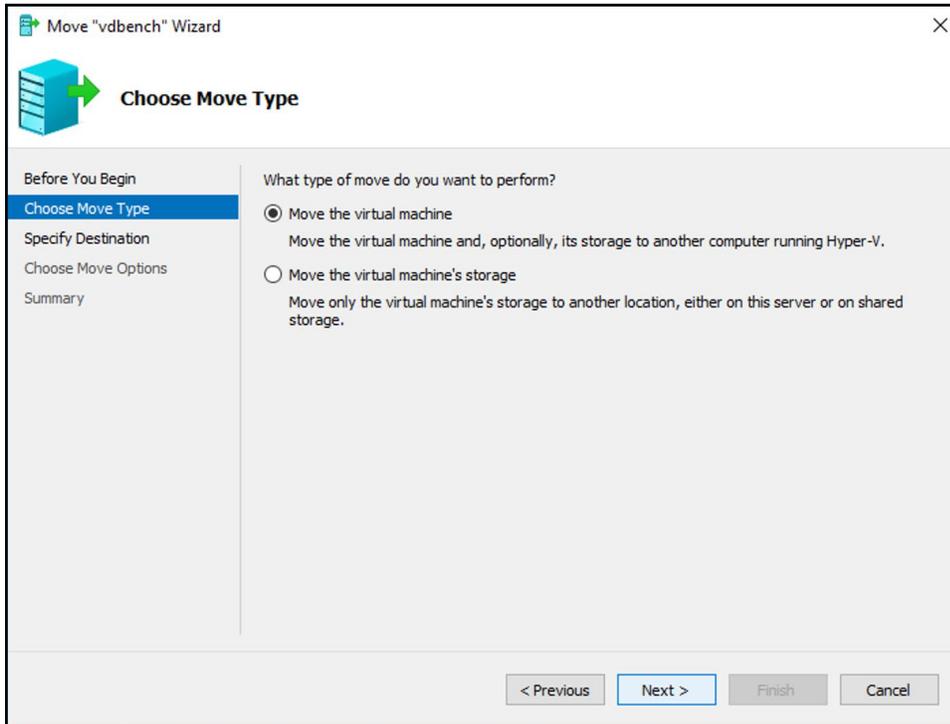
```
Get-ClusterResourceType -Cluster {clusterName} -Name "Virtual Machine" |  
Set-ClusterParameter -Create SkipMigrationDestinationCheck -Value 1
```

3. Use Hyper-V VM live migration to move the running VM from the server:
 - a. Right-click the VM you wish to migrate, and select Move.

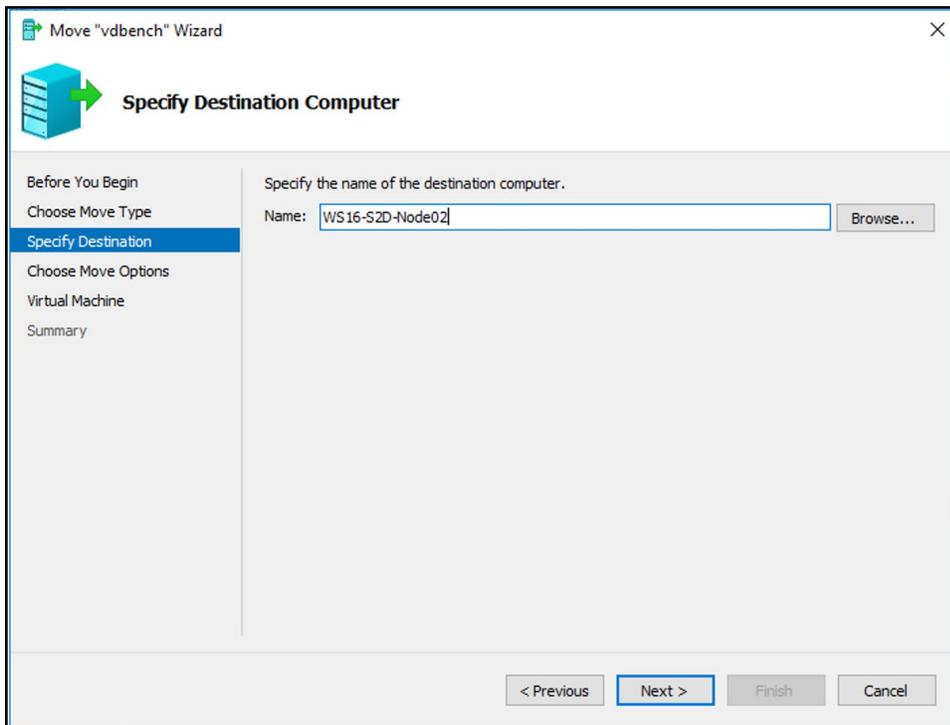


- b. At the splash screen, click Next.

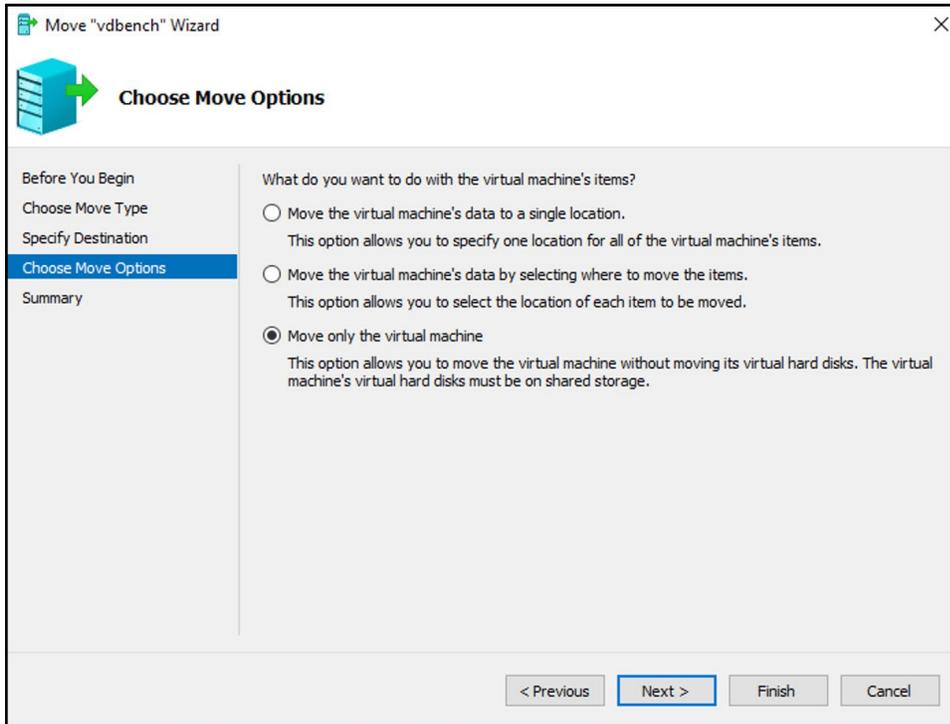
c. Select Move the virtual machine, and click Next.



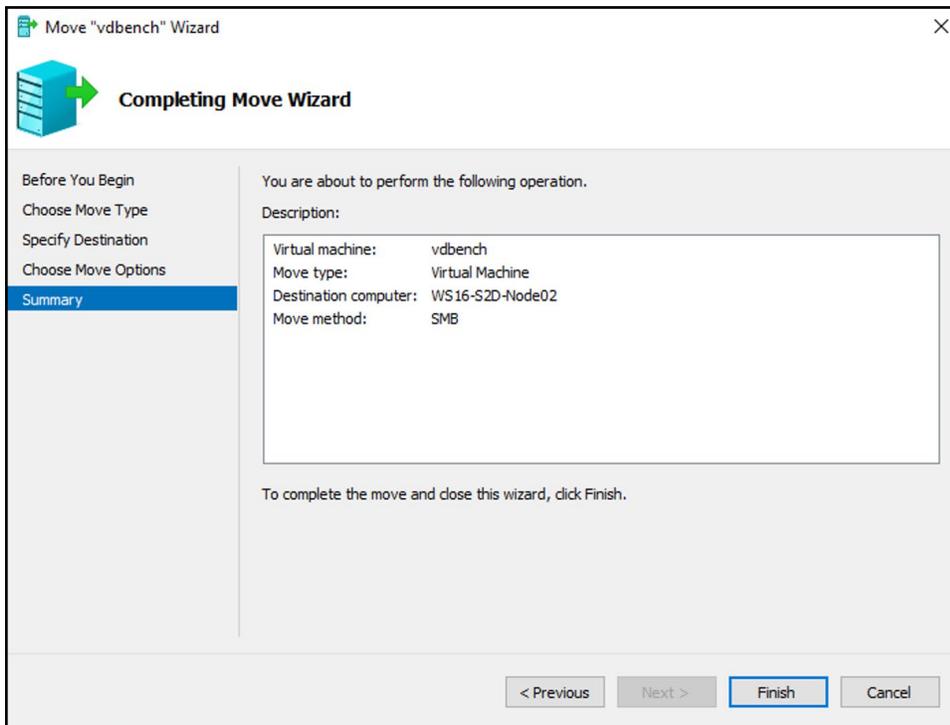
d. Specify a name for the destination server, and click Next.



e. Select Move only the virtual machine, and click Next.



f. Review the move details, and click Finish.



4. Pause the cluster service by running the following PowerShell command:
`Suspend-ClusterNode -Drain`

5. Place the server in storage maintenance mode by running the following PowerShell command:

```
Get-StorageFaultDomain -type StorageScaleUnit | Where FriendlyName -Eq <ServerName> | Enable-StorageMaintenanceMode
```
6. To make sure all of the disks are in maintenance mode, run the following command:

```
Get-PhysicalDisk
```
7. Double-click a Windows Server 2019 ISO to mount the image.
8. Change directories to the Windows Server 2019 mounted volume.
9. Run setup.exe.
10. On the Windows Server 2019 Setup screen, select Download updates, drivers and optional features (recommended), and click Next.
11. Enter the product key, and click Next.
12. Select Windows Server 2019 Datacenter (Desktop Experience), and click Next.
13. On the EULA screen, click Accept.
14. Select Keep personal files and apps, and click Next.
15. Click Install.
16. After the install has finished, log into the host.
17. Open an elevated PowerShell session.
18. To remove the node from storage maintenance mode, run the following command:

```
Get-StorageFaultDomain -type StorageScaleUnit | Where FriendlyName -Eq <ServerName> | Disable-StorageMaintenanceMode
```
19. To resume the cluster service, run the following PowerShell command:

```
Resume-ClusterNode
```
20. Wait for the storage jobs to finish before moving to the next server in the cluster.
21. To check the state of the storage repair, run the following commands:

```
Get-StorageJob  
Get-VirtualDisk
```
22. Once the storage job is complete and all virtual disks are returned to a healthy state, repeat steps 3 through 21 on the remaining nodes in the cluster.
23. To update the cluster functional level, run the following PowerShell command:

```
Update-ClusterFunctionalLevel
```
24. To update the storage pool, run the following PowerShell command:

```
Get-StoragePool -FriendlyName S2D* | Update-StoragePool
```
25. To set the live migration check back, run the following PowerShell command:

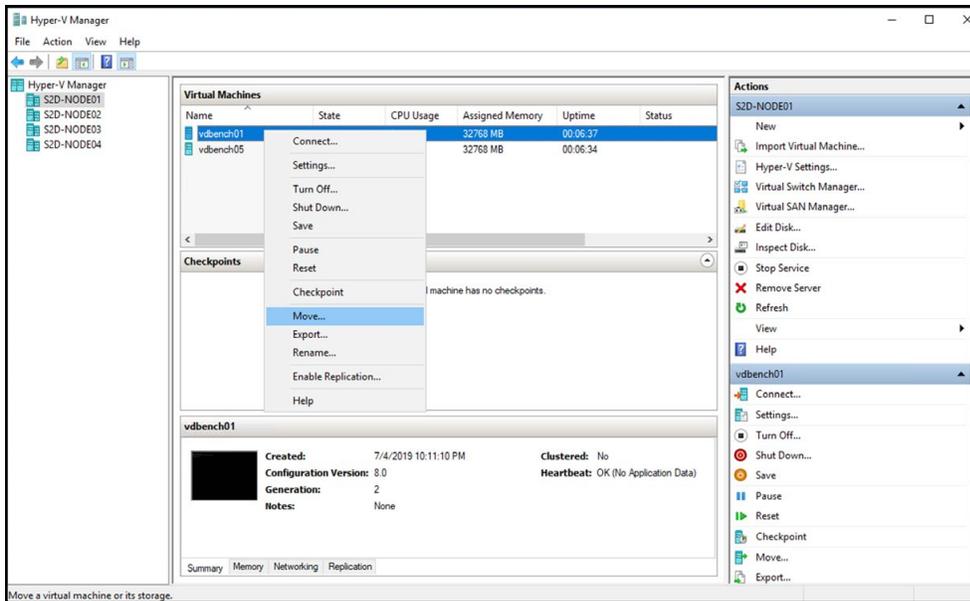
```
Get-ClusterResourceType -Cluster {clusterName} -Name "Virtual Machine" |  
Set-ClusterParameter SkipMigrationDestinationCheck -Value 0
```

Live migrating a VM to the newly created volume

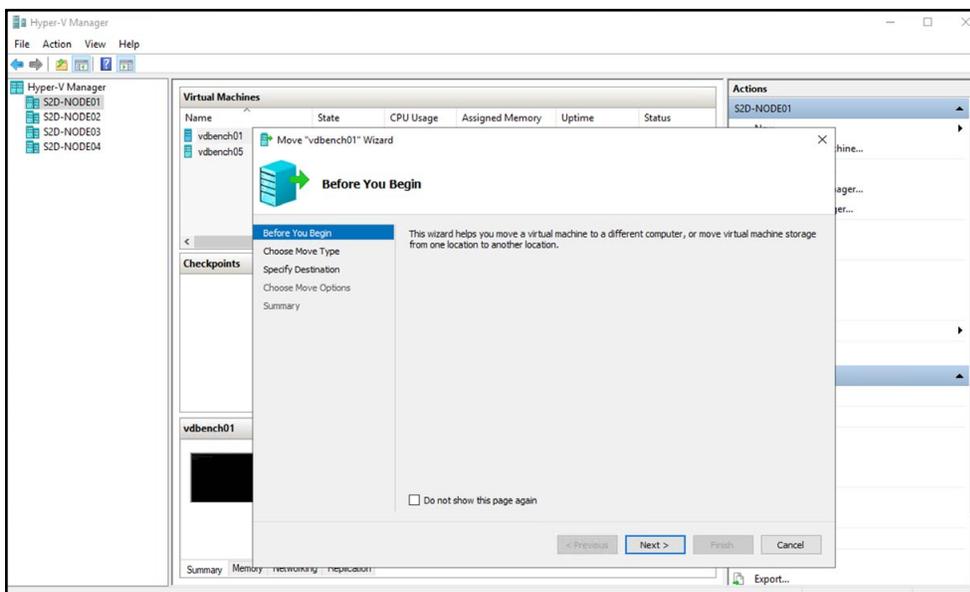
In this section, we provide the steps we took to live migrate a VM to the newly created volume. We include some screenshots to give you a sense of the graphical user interface. In the [science behind the report](#), we provide all screenshots.

Note: It took our technician 1 hour and 34 minutes to perform this process.

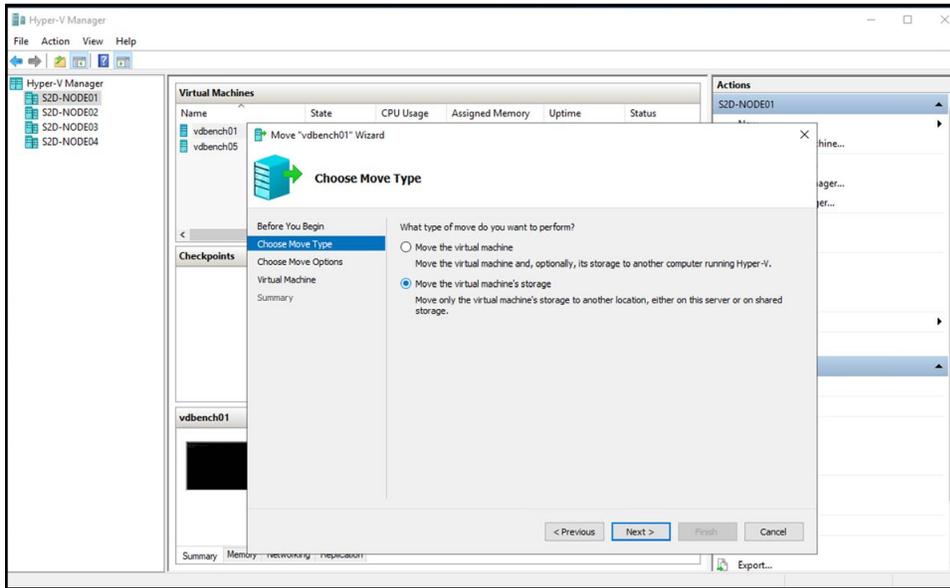
1. Open the Hyper-V Manager GUI.
2. Right-click the VM, and select Move.



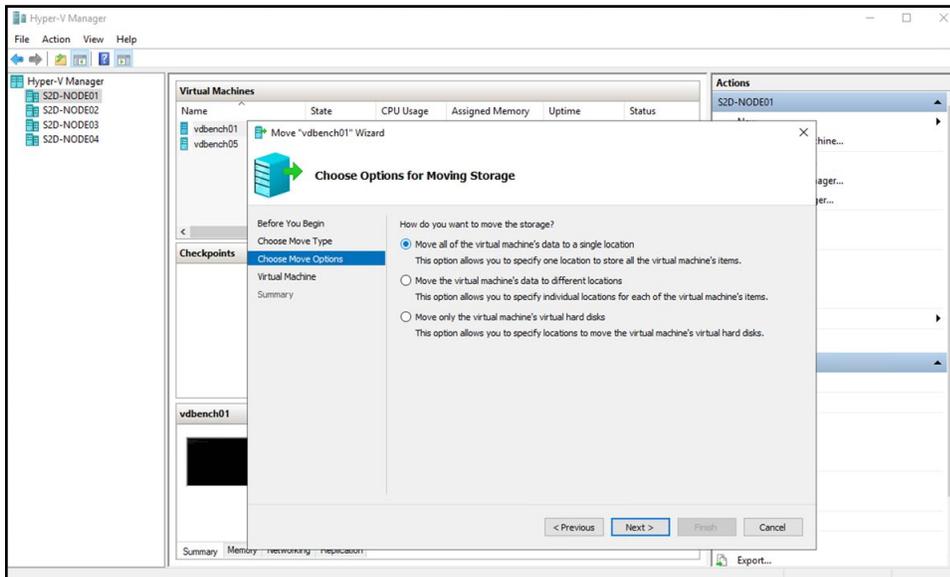
3. Click Next.



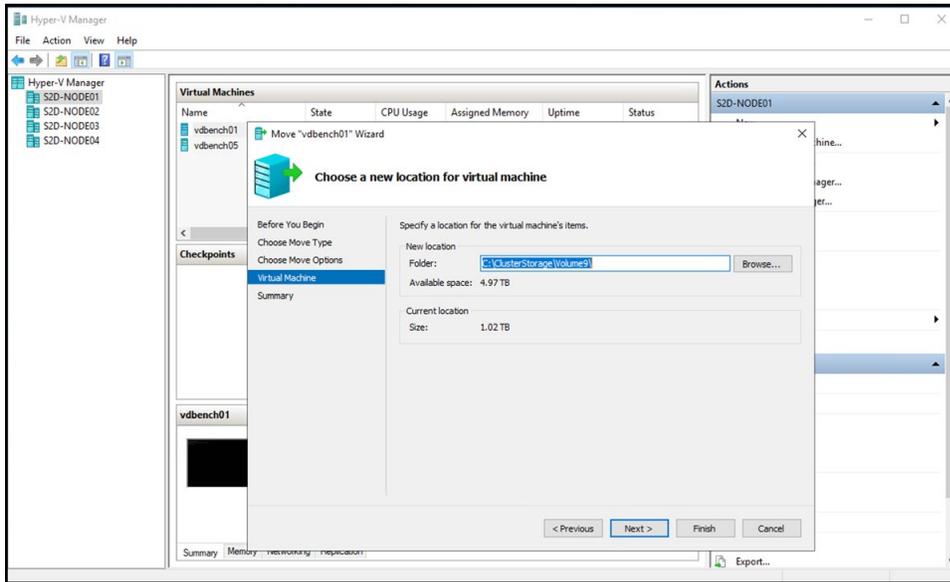
4. Select Move the virtual machine's storage, and click Next.



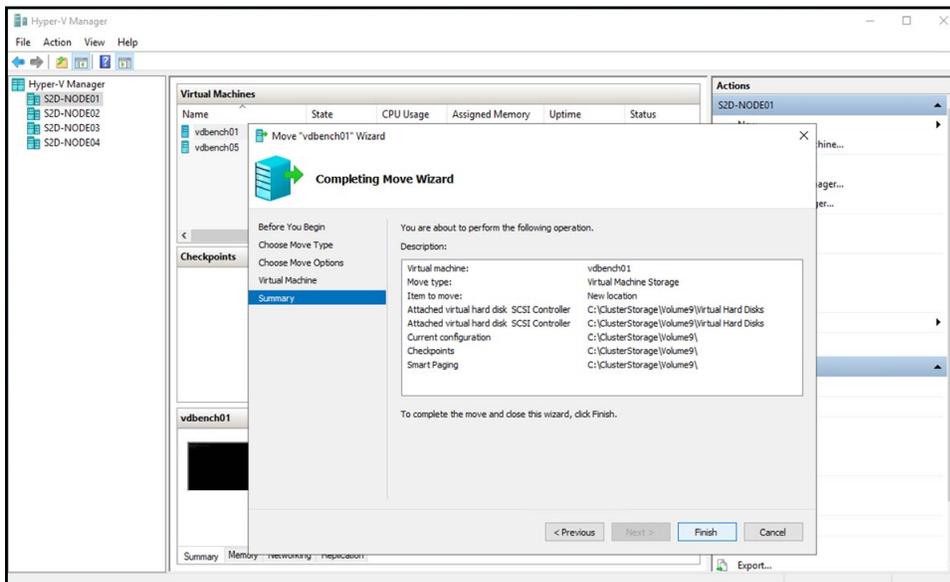
5. Select Move all of the virtual machine's data to a single location, and click Next.



6. Browse to the location of the newly created volume, and click Next.



7. Review the move summary, and click Finish.



Even though it's very easy to upgrade, help is available!

Customers who prefer not to do their own upgrades have the option of using the Dell Technologies Windows Server 2019 Custom Upgrade Service. According to Dell Technologies, "For Dell EMC customers who are interested in upgrading their S2D Ready Nodes from Windows Server 2016 datacenter edition to 2019 datacenter edition and looking for assistance, Dell EMC is proud to offer the industry's first tested, validated, and globally available Upgrade Service. This service will be a custom offering as there are many variable details which must be considered when planning and executing a successful upgrade."⁴

Learn more at https://downloads.dell.com/manuals/common/microsoft-storage-ready-node-r640_referenceguide_en-us.pdf.

Conclusion

Dell EMC Power R740xd servers with Intel Xeon Scalable processors and Microsoft Storage Spaces Direct offer customers an optimized platform that can lower costs with software-defined storage. We upgraded to Windows Server 2019 to evaluate the gains in storage savings using deduplication and compression. Our tests show data duplication and compression ratios ranging from 1.9:1 to 9.8:1, which for many customers could lead to the following benefits:

- Being able to store more data on existing storage
- Being able to delay the investment in additional storage

Upgrading to Windows Server 2019, was a quick and simple process that we were able to execute in less than 3 hours. Between the space savings made possible by deduplication and the simplicity of performing the upgrade, customers have much to gain by moving their Storage Spaces Direct environments to the new OS.

Learn more about Dell EMC PowerEdge R740xd servers at <https://www.dell.com/en-us/work/shop/poww/poweredge-r740xd>.

- 1 "Azure Stack HCI overview," accessed July 23, 2019, <https://docs.microsoft.com/en-us/azure-stack/operator/azure-stack-hci-overview>
- 2 "Creating volumes in Storage Spaces Direct," accessed July 25, 2019, <https://docs.microsoft.com/en-us/windows-server/storage/storage-spaces/create-volumes>
- 3 "Dell EMC Microsoft Storage Spaces Direct Ready Nodes - Solution overview," accessed August 6, 2019, <https://www.dell.com/learn/us/en/04/shared-content~data-sheets~en/documents~microsoft-storage-spaces-direct-ready-nodes-solution-overview-en.pdf>.
- 4 "Storage Spaces Direct Ready Nodes Upgrade Guidance from Windows Server 2016 to 2019," accessed July 23, 2019, https://downloads.dell.com/manuals/common/microsoft-storage-ready-node-r640_referenceguide_en-us.pdf

Read the science behind this report at <http://facts.pt/u6gzkdr> ►



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