

POWERING THE NEW IT GENERATION

VIRTUALIZATION
REVIEW

Hyper-V Sneak Peak

Get a look at the next version of Microsoft's hypervisor and explore new developments in Microsoft's cloud technologies.

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Hyper-V Sneak Peek: Windows Server vNext Edition

The Microsoft hypervisor gets a major makeover. See what's on the way.
By Paul Schnackenburg

Hyper-V has had a versioning for VM configuration files, with the original release in Windows Server 2008 being version 1.

The preview version of Windows Server vNext is out, giving us an indication of some of what's coming in Hyper-V. I'll cover the following features in this article:

- A new configuration file format/version
- A new type of checkpoint
- Mixed-mode clusters that can be upgraded on a rolling basis
- Integration services updated through Windows Update
- Secure Boot for Linux
- Hot-adding NICs and memory

Configuration Files and Version Upgrades

It turns out that Hyper-V has had a versioning for virtual machine (VM) configuration files, with the original release in Windows Server 2008 being version 1, all the way up to Windows Server 2012 R2 (5.0). This was handled by Hyper-V under the covers, and configuration files for VMs were upgraded automatically when the VM moved to a new host, with no administrator input necessary. The next version of

Windows Server (hereafter called vNext) will bring version 6, but it also understands version 4 and 5.

This means you can cross-version live migrate (LM) a VM from a 2012 cluster to a vNext cluster (but not vice versa), similar to how you can LM from 2012 to 2012 R2 today.

The new version also introduces a new VM file format: .VMCX for configuration data, and .VMRS for runtime state data. These new file types should be more resilient to storage issues, compared to the current XML-based files. Converting a VM from version 5 to 6 is easy, but the VM does have to be turned off. Here's the command:

```
Update-VmConfigurationVersion nameofVM
```

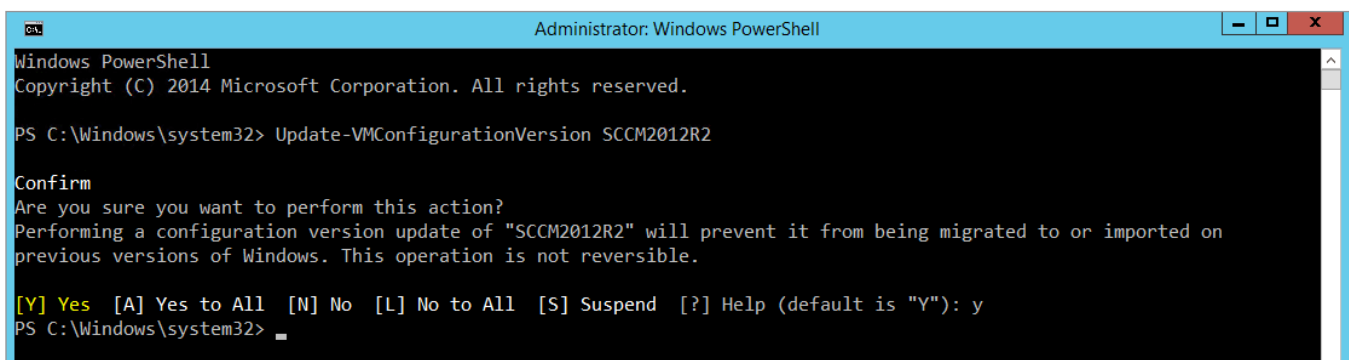
Note that this is a one-way trip; you can't downgrade the configuration files. Once upgraded (as shown in **Figure 1**), the VM will only run in vNext. The upgrade only takes a few seconds. If the VM has online checkpoints, they'll be converted to offline checkpoints as part of the upgrade process.

You can cross-version live migrate a VM from a 2012 cluster to a vNext cluster.

Cluster Rolling Upgrades

Upgrading to take advantage of new functionality is painful, and Microsoft felt your pain. Between the Windows Server 2012 and 2012 R2 versions of Hyper-V, Microsoft attempted to help by offering cross-version live migration. It allowed you to stand a 2012 R2 cluster next to your 2012 cluster and migrate VMs from the old to the new.

This has problems, though. One is that it's one way; if there are issues with the VM after the upgrade, you can't move it back easily. There's also a high availability (HA) gap, as the VM has to be turned



```
Administrator: Windows PowerShell
Windows PowerShell
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PS C:\Windows\system32> Update-VmConfigurationVersion SCCM2012R2

Confirm
Are you sure you want to perform this action?
Performing a configuration version update of "SCCM2012R2" will prevent it from being migrated to or imported on
previous versions of Windows. This operation is not reversible.

[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): y
PS C:\Windows\system32> _
```

Figure 1. Upgrading a VM configuration version only takes a few seconds.

into a non-HA VM before the migration. Finally, the need to have a new cluster next to the old one might necessitate the procurement of new hardware, potentially slowing down the upgrade process.

Going from 2012 R2 to vNext is going to be a much easier process, due to mixed-mode clusters. Active Directory administrators are familiar with this process of gradually introducing new version nodes that pretend to be the old version until all nodes have been upgraded and the functional level updated.

For this to work, all VMs will run with the old version 5 format (and you're blocked from creating version 6 VMs by the cluster) until you've upgraded all cluster nodes and then run this Windows PowerShell cmdlet (functional level 8 is 2012 R2, 9 is vNext):

```
Update-ClusterFunctionalLevel
```

Note that nodes here refers to both Hyper-V hosts and Scale out File Server (SOFS) cluster members. The upgrade requires draining the node of load, evicting it from the cluster, reformatting and clean installing the new OS, then adding the host back into the cluster. There's no way to upgrade the OS in place.

If you're upgrading an SOFS cluster, you'll definitely want to back up your data first. Be aware that some operations, such as provisioning new storage or changing the size of existing storage, aren't recommended while the cluster is in mixed mode. The assumption is that you're only going to be in this in-between stage for a short period of time. Note that only 2012 R2 to vNext is supported for mixed-mode clusters; Microsoft didn't have time to include the code in 2012, but it did prepare the plumbing for this to work in 2012 R2 before it shipped.

You'll still need to shut down each VM to upgrade the configuration files, but as they'll run fine with the old version, this can be scheduled into a change management window. While the cluster is in mixed mode it should be managed from vNext hosts.

Speaking of clusters, there are other improvements such as leaving VMs on a node (if they're still running and have network connectivity) if there's a short network outage, which would cause a failover in a Windows Server 2012 R2 Hyper-V cluster. If there are intermittent

If you're upgrading an SOFS cluster, you'll definitely want to back up your data first.

issues with a host, it will be quarantined and VMs prevented from migrating there. These types of changes are designed to make clusters “smarter” and less likely to cause issues simply because of clustering itself.

There’s a trend in enterprises to separate infrastructure administrators and application/VM administrators.

Integration Services Updating

There’s a trend in enterprises to separate infrastructure administrators and application/VM administrators. With this separation, the former has no rights to the VMs running on top of their hosts, while the application admins don’t even know the details of the underlying fabric. This presents a problem, as each release of Hyper-V mandates an update to the integration services inside each VM.

This issue has been addressed with a change to integration services updating through Windows Update. So whether you’re using Configuration Manager, Windows Server Update Services (WSUS) or Windows Update, you’ll receive any needed updates the same way any other patches reach your VMs. Having the integration services version matching the host Hyper-V version is also no longer a requirement for Microsoft support; you’ll just need the latest version for your VM OS.

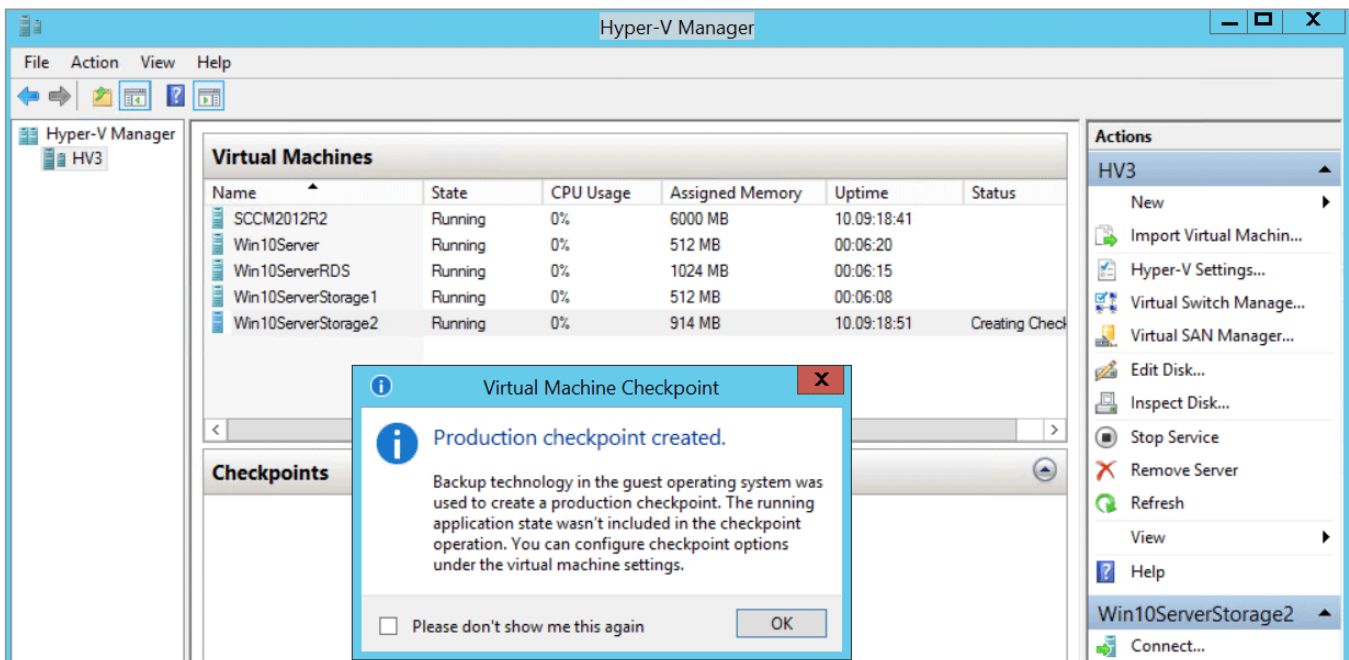


Figure 2. Production Checkpoints also set the stage for the new backup process in Hyper-V.

Anyone with Hyper-V experience knows the convenience of being able to snapshot a VM state before implementing a potentially disruptive change.

Production Checkpoints

Anyone with Hyper-V experience knows the convenience of being able to snapshot a VM state before implementing a potentially disruptive change. But you also know the dangers of snapshotting for workloads such as domain controllers (DCs), Exchange Servers and SQL Servers: If you apply a checkpoint to a VM that's replicating with others, it's effectively sent back in time. That can cause AD corruption, password mismatches, missing group memberships and other data loss.

The issue with DCs was fixed in 2012 with virtualization safeguards, but other workloads are still in danger.

vNext brings new types of snapshots, called Production Checkpoints (Figure 2). It uses the Volume Snapshot Service (VSS) from within the VM (or flushes the file system buffers in Linux VMs); because the VM

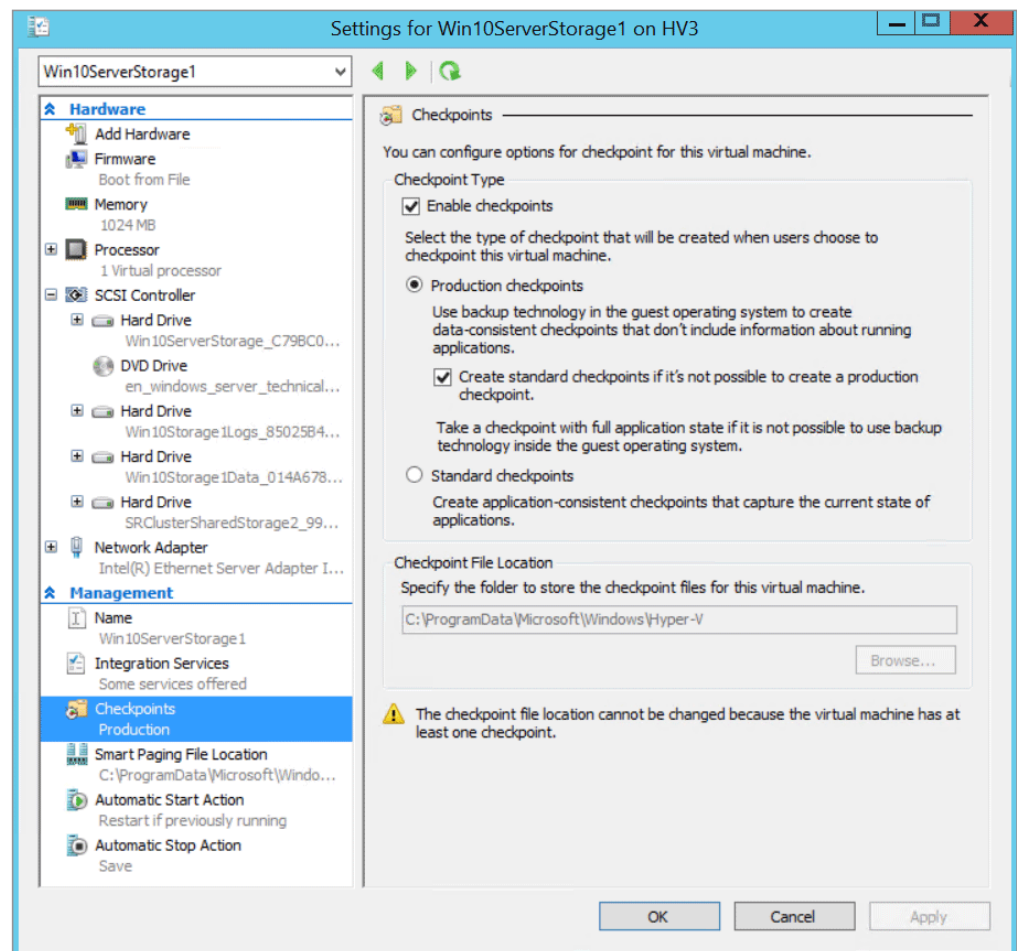


Figure 3. You can revert to the old style of checkpoints if necessary.

is aware that it happened (it's more like a backup operation), applying a checkpoint won't disrupt workloads. Production Checkpoints will be the new default, although you can go back to the traditional type of snapshots on a per-VM basis if needed, as **Figure 3** illustrates.

Linux SecureBoot

It turns out that while Microsoft heard a lot of criticism in the early days of Windows 8 for trying to lock Linux out from even being installed on new computers, it was just biding its time before spreading the security love to the penguin. Generation 2 VMs have virtual UEFI firmware instead of a legacy BIOS; in vNext this can be used to extend Secure Boot to Linux, mitigating the risk of rootkits and other low-level malware. Today this works for Ubuntu 14.04+ and SUSE Linux Enterprise Server 12; you have to enable it before you start the VM the first time using Windows PowerShell:

```
Set-VMFirmware vmname -SecureBootTemplate MicrosoftUEFICertificateAuthority.
```

Other Improvements

Generation 2 VMs were introduced in 2012 R2, doing away with all legacy-emulated hardware; but they were more a pointer to the future, as they weren't supported in System Center Virtual Machine Manager 2012 R2 service templates. In vNext, you can add and remove NICs in a Windows/Linux Generation 2 VM while it's running. You can also change the amount of memory assigned to a VM while it stays online. Second Level Address Translation (SLAT) processors are now a requirement to run Hyper-V; in earlier versions it was recommended, but only required for VDI deployments.

If you add a virtual HDD to a VM that's using Hyper-V Replica, replication will fail in 2012 R2. In vNext, the drive will be added to the VM, but put in a non-replicating set. If you need the drive to be protected, you can manually add it to the replication set. You can replicate a VM from 2012 R2 to vNext and vice versa (unless you upgrade the VM configuration version). This will be a good way to test your upgrade path if you have two sites with VMs being replicated between them; upgrade your secondary site first, do some test failovers and ensure that your VMs run fine on vNext before upgrading your primary site.

Generation 2 VMs were introduced in 2012 R2, doing away with all legacy-emulated hardware.

An irritating issue is when you add several NICs to a VM and then go into the VM to configure them, only to find that you have no way of telling which NIC is which. vNext exposes the name you've given to the virtual switch inside of the VM, making it much easier to pick the right one.

Hyper-V Manager (**Figure 4**) now connects via WinRM to remote servers, making it more resilient to network issues; you can connect to servers via just their IP address. You can also start the Manager with alternate credentials, as shown in **Figure 5**. VMs with statically assigned memory will still be tracked by the engine that manages Dynamic Memory, so you can see in the UI how much memory your VMs are asking for, and make adjustments to your memory settings accordingly.

Hyper-V Manager now connects via WinRM to remote servers.

Speaking of Hyper-V Manager, there's a bug in the Technical Preview that might make some of your VMs disappear from the list (although they're still there and running). This is fixed by running the following:

```
get-vm | ?{$_.heartbeat -eq "OKApplicationsUnknown"} | Disable-VMIntegrationService "Heartbeat"
```

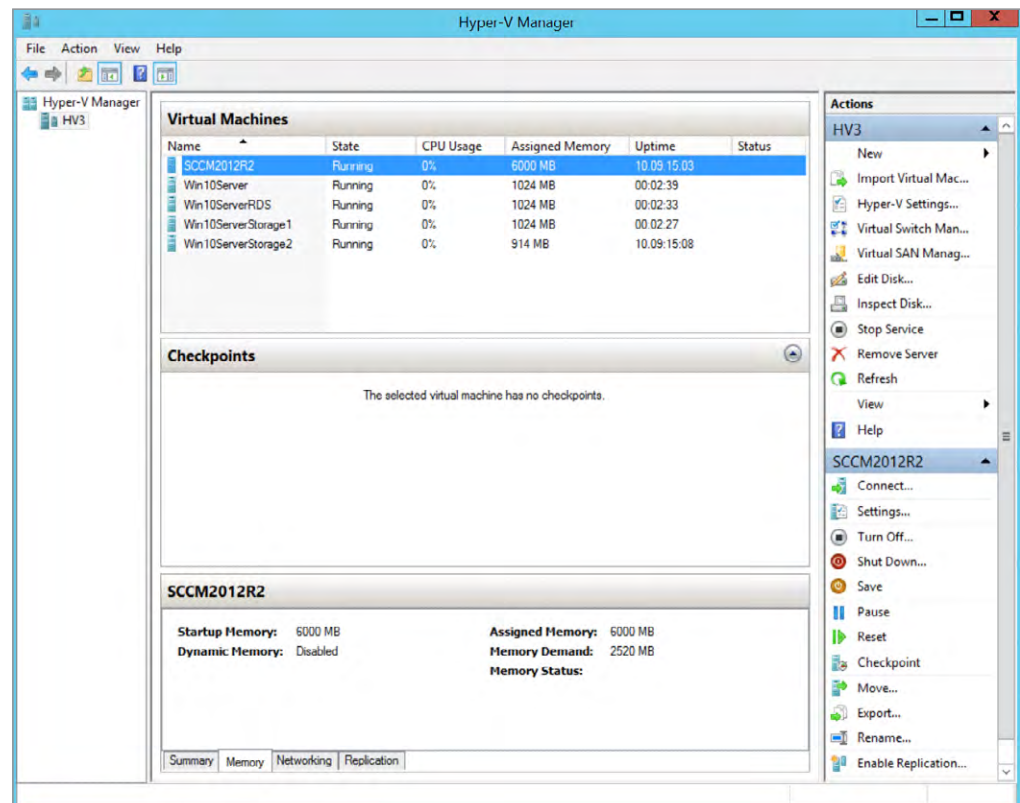


Figure 4. Not much has changed in the overall look of Hyper-V Manager.

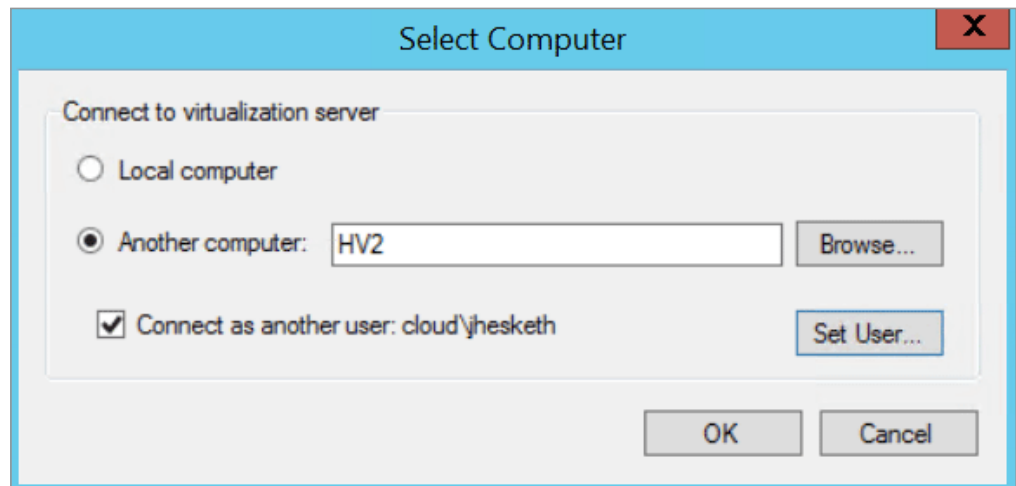


Figure 5. The ability to connect Hyper-V Manager as another user will be very useful.

Windows 8.1 devices lose the advantage of Connected Standby if Hyper-V is enabled.

A very cool approach to managing Hyper-V clusters is viewing a whole cluster as a really big, single, Hyper-V host; this is enabled through WMI, and it's not in the Technology Preview.

Coming Soon: Backup and Storage

Windows 8.1 devices such as Surface Pro lose the advantage of Connected Standby if Hyper-V is enabled; in the Hyper-V client in Windows 10, Connected Standby will work.

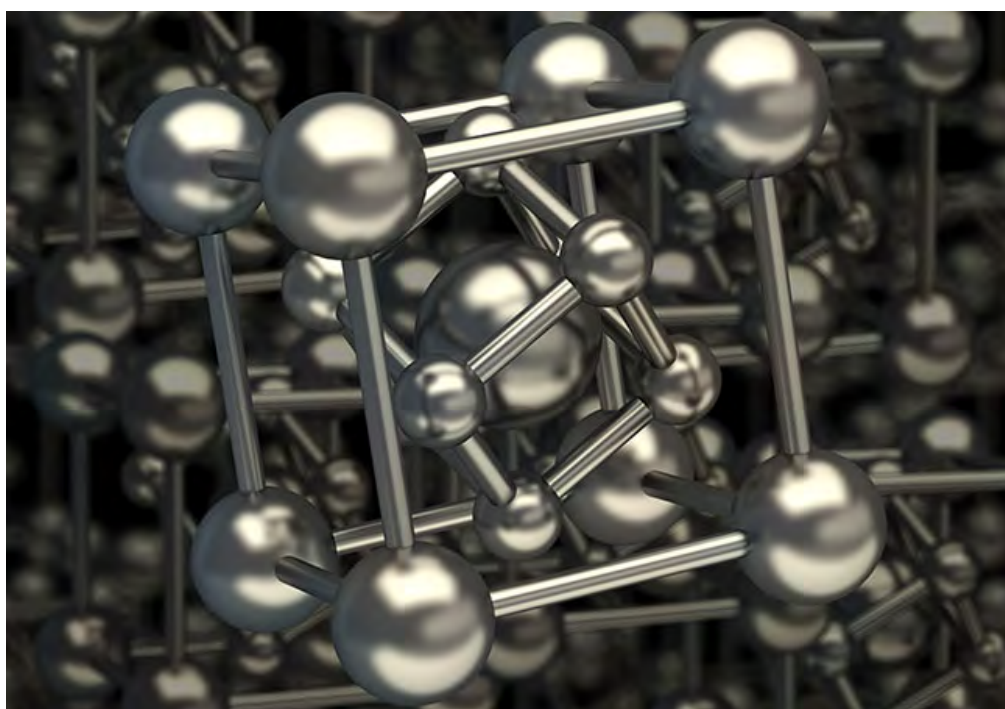
The other side of the Hyper-V coin is backup and storage; there are some really big changes coming in vNext in these areas, which I'll cover in a future article. The improvements in Hyper-V are clearly aimed at making life easier for virtualization administrators, as well as challenging VMware with innovative features. [VR](#)

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Microsoft's Scale-Out File Server Overcomes SAN Cloud Barriers

There are no SANs in the cloud because the venerable storage technology just doesn't scale to that level. But there are ways around it, and Microsoft shops should start with the company's Scale-Out File Server. **By Paul Schnackenburg**

There are three main, underlying technology shifts altering the status quo.



There's a revolution going on in storage. Once the domain of boring but dependable storage-area network (SAN) arrays, there's now a plethora of choice, including all flash storage (with varying different underlying technology) and server-message block (SMB)-based storage. There are three main, underlying technology shifts altering the status quo:

Flash storage, either as the only storage technology for very high performance workloads, or in tandem with hard drives for tiered storage solutions.

The problem with SAN technology is that it wasn't really designed to solve today's problems.

Cloud storage, in many cases implemented as a third tier for long-term archiving of cold data.

Software-defined storage (SDS), closely related to storage virtualization. This technology has all the buzz right now. Microsoft entered the arena with the release of Windows Server 2012, and furthered its position with the release of Windows Server 2012 R2, offering a complete SDS stack.

The problem with SAN technology is that it wasn't really designed to solve today's problems: It's complex and requires specialized skills, it's expensive, and it doesn't scale in today's cloud world. Looking at Amazon Web Services Inc. (AWS), the Google Inc. cloud platform and Microsoft Azure, none of them rely on SAN storage. There's simply no way that the companies could scale their public cloud offerings if they had to wire a SAN switch to two Host Bus Adapters (HBAs) in each server. That's not to say SANs are going away; they'll change and adapt like any technology, but they're no longer the default answer to every enterprise storage question.

Microsoft doesn't just have one iron in this fire; it offers StorSimple, a SAN array with hard-disk drives (HDDs) and solid-state drives (SSDs), as well as Azure storage for long-term storage. Then there's the recent acquisition of InMage, for replication of Linux and Windows virtual machines (VMs) from VMware to Azure.

A recent Microsoft solution for the SAN problem is Scale-Out File Server (SOFS) in Windows Server 2012 R2, which provides clustered, continuously available storage.

SOFS to the Rescue

When Microsoft built its SAN replacement technology in the form of SOFS, it replaced the controllers with Windows Server 2012 R2 file servers, and the connectivity with either ordinary 1 Gbps or 10 Gbps Ethernet NICs, or faster, SMB Direct NICs. The drives are housed in simpler enclosures with no RAID built in; just power supplies and external SAS connectivity. The SOFS role manages the permissions, data protection and data flow if you're using SSDs (the tiering).

There are numerous abilities that make SOFS a killer technology.

Table 1. Windows Scale-Out File Server and Fibre Channel/iSCSI SAN Array Feature Comparisons	
FC/iSCSI SAN array	Windows SOFS Cluster with Storage Spaces
Storage tiering	Storage tiering (new in 2012 R2)
Data deduplication	Data deduplication (improved 2012 R2)
RAID resiliency	Two/three way mirroring, single/dual parity
Disk pooling	Disk pooling (Storage Spaces)
High availability	Continuous availability
Persistent write back cache	Persistent write back cache (new in 2012 R2)
Copy offload	SMB copy offload
Snapshots	Snapshots
FC, FCoE, iSCSI for fast connectivity	10 Gbps, SMB Multichannel, SMB Direct (56 Gbps +)

Table 1. Windows Scale-Out File Server and Fibre Channel/iSCSI SAN Array Feature Comparisons

So Microsoft is matching SAN capabilities, but doing so on commodity hardware, running on Windows Server. **Table 1** shows a feature comparison.

Software Building Blocks

There are numerous abilities that make SOFS such a killer technology. The first is the humble SMB protocol. This has been in Windows Server for many, many years and is how most of us access file shares on servers to work on documents.

In Windows Server 2012, Microsoft set out to produce a new version of the protocol (SMB 3.0), capable of storing not just Word, Excel and CAD documents, but also the huge files associated with databases and VMs.

There also needed to be continuous availability built in—not just high availability (which has some amount of downtime). If Word, for instance, temporarily loses connection to a file on a share, it just keeps working and recovers, as long as the outage isn't too extensive. But for a database or virtual hard drive (VHD), such a disconnection would almost certainly lead to data corruption. SMB 3.0 (and 3.02 in Windows Server 2012 R2) comes with transparent failover, which provides extremely fast shifting of data access from one node to another, in case of a node failure (provided you have at least two nodes in your cluster, of course).

There's also SMB Multichannel, in which SMB automatically takes into account all paths between an application server and the SOFS node, and uses them simultaneously. If one NIC fails, the traffic simply continues over the remaining links. There's no need to configure Multipath I/O (MPIO), because multichannel is automatic. In fact, it's so automatic that you might need to exclude network interfaces where you don't want high loads of storage traffic saturating the link. SMB Scale-Out provides simultaneous access to data files through all nodes in the SOFS cluster, resulting in better load balancing and network bandwidth utilization.

**SMB Direct
builds on newer
(RDMA) network
cards.**

SMB Direct builds on newer Remote Direct Memory Access (RDMA) network cards; these were originally developed for the network needs of high-performance computing clusters used in simulations and manipulation of large datasets. These aren't required for SOFS; ordinary 10 Gbps or 1 Gbps NICs will work just fine. But for exceptional performance, low latency and zero-host CPU impact, they're the answer.

The other fundamental technology in this stack is Storage Spaces. This is a built-in storage virtualization technology that allows you to

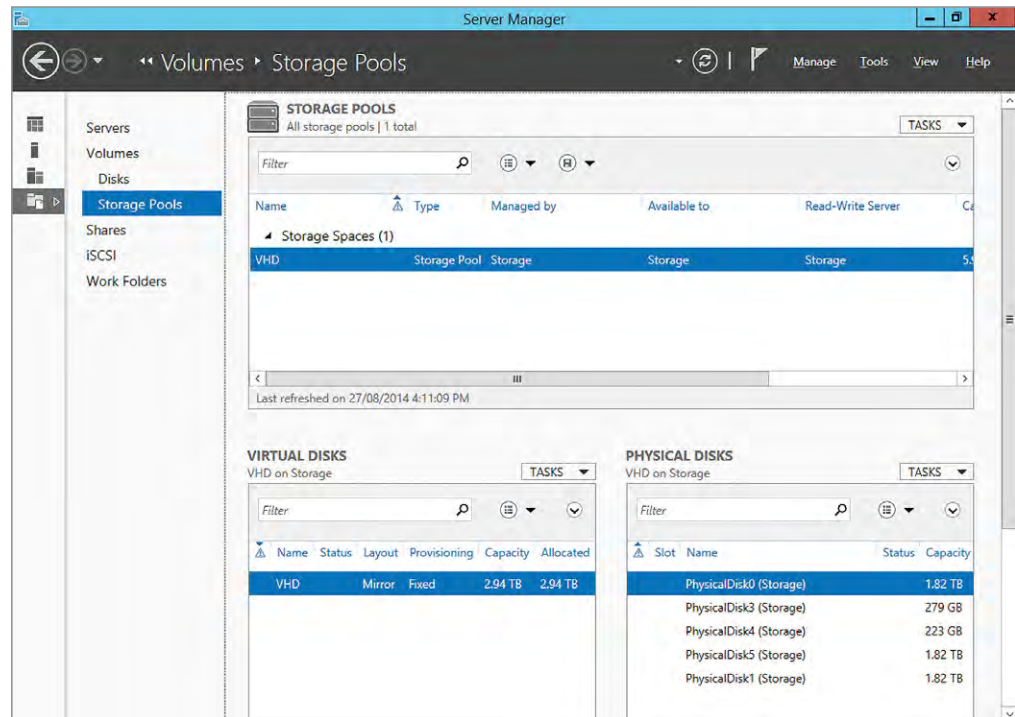


Figure 1. A tiered Storage Space in Windows Server 2012 R2.

pool disks (HDD and SSD) together and then carve out virtual disks from the pools with specific capabilities. An example is shown in **Figure 1**.

One important characteristic of a virtual disk on top of a Storage Space is the data protection scheme: Two- and three-way mirroring, as well as single- and dual-parity, is supported. The latter supports the failure of two disks, whereas three-way mirroring (and dual parity) can support the failure of a whole enclosure, because the data is mirrored to another enclosure.

Storage Spaces divides data into strips, which are spread across several disks so that a single disk failure doesn't lead to data loss.

This isn't the software RAID of yesteryear, which mirrored one drive to another; Storage Spaces divides data into strips, which are spread across several disks so that a single disk failure doesn't lead to data loss. This parallelization of the load is used all through Storage Spaces, using the combined throughput of many drives to provide exceptional performance. See **Figure 2** for an example.

Also new in Windows Server 2012 R2 is the automatic rebalancing of nodes and volumes. If a cluster has three nodes and six cluster shared volumes (CSVs), each node will "own" two. If one node is

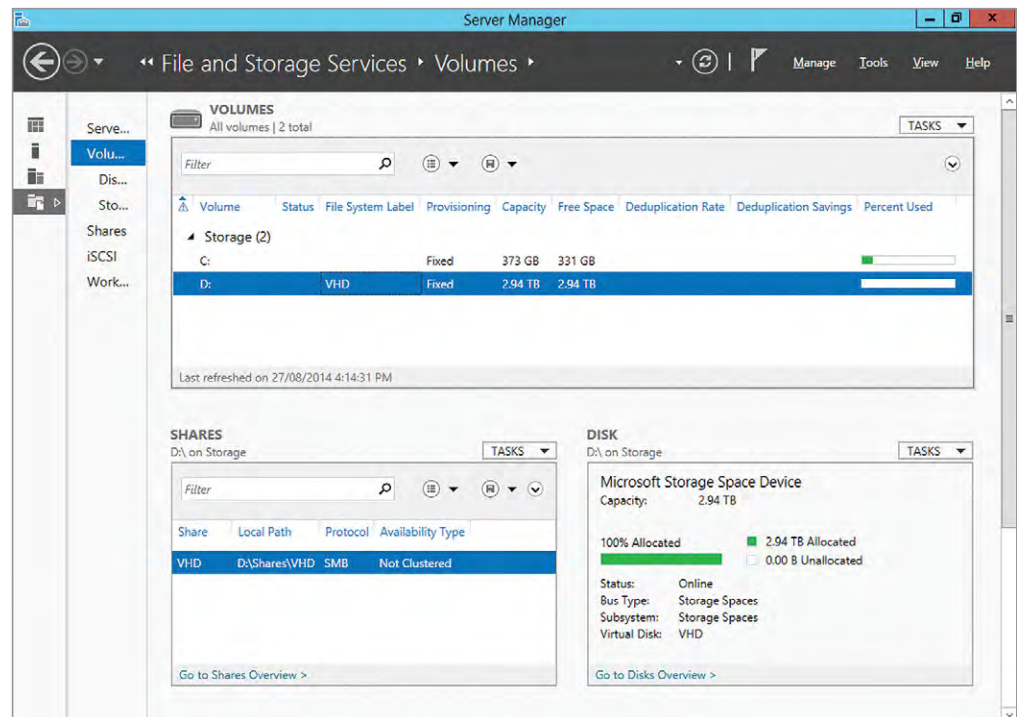


Figure 2. A mirrored virtual disk on top of two solid-state drives and three hard-disk drives.

restarted or crashes, its load will be divided among the remaining nodes; when another node is added, the load is transparently rebalanced again.

Windows Server 2012 introduced data deduplication, which analyzes data at rest, identifies blocks that hold the same information and replaces all but one with a pointer to that copy of the data. Depending on the data type, you can reclaim 40 percent to 50 percent of information worker (IW) documents or up to 90 percent of VHD library disk space.

Windows Server 2012 R2 added a missing feature in the quest to match SAN technology feature-for-feature: tiering.

More important, Windows Server 2012 R2 added the ability to do the deduplication on running Hyper-V VM VHD and VHDX files, but only for virtual desktop infrastructure (VDI) deployments. This curious limitation partly stems from the fact that Microsoft would like to see lots of field testing before allowing ordinary server virtualization to use it. And, partly, it's because deduplication works best in high-read, low-write scenarios. If a lot of data is changing frequently, deduplication won't be very efficient. That said, deduplication works just fine for lab and test environments for any VM workload, not just VDI.

Tiering Up

Windows Server 2012 R2 added a missing feature in the quest to match SAN technology feature-for-feature: tiering. SSD technology provides fantastic read performance and great write performance, but is expensive per gigabyte compared to HDDs. The solution is to fill your bays with mostly large, slow HDDs and add a few SSDs.

Tiering will automatically "heat map" storage blocks, identifying which blocks are hit the most and moving those to the SSD tier, while moving colder data to the HDD tier. In this way you can combine the best of both technologies for overall performance. You can also pin particular files (think the master disk in a VDI implementation) to a tier manually. There's a minimum number of SSDs recommended, depending on your data protection strategy and number of enclosures.

A related technology is write-back cache, which uses some of the SSD storage to absorb intermittent incoming writes to the virtual disk, so as not to interrupt the main workload's data flow.

SAS has experienced slow adoption due to a lack of options.

Another useful feature in Windows Server 2012 is the improvements to the CHKDSK command. Instead of volumes having to be offline for long periods of time (many hours in the case of large volumes), disk checking is now done while the volume is online, followed by a short (offline) phase where problems are repaired. SOFS, together with CSVs, improves on this even further through the fixing phase being performed from one cluster node, while the others can continue accessing the data, resulting in zero downtime CHKDSK.

Finally, CSV, the layer on top of NTFS that allows simultaneous read and write access from multiple nodes to data files, makes it possible to store the disks of many VMs on the same volume, while still allowing individual VMs to live migrate between different Hyper-V hosts.

Hardware Building Blocks

The other part of the overall story is the Serial-Attached SCSI (SAS) enclosures that house the drives. Unlike a SAN or other storage enclosures, these don't have RAID controllers or other complicated smarts; simply a set of SAS (6 Gbps or 12 Gbps) connections and 2.5-inch or 3.5-inch slots. Enclosures are sized from 24 to 84 bays; the full list of enclosures certified to work with Windows Server is available [here](#).

SAS has experienced slow adoption due to a lack of options, as almost none of the major storage vendors have enclosures to offer (exceptions are Dell Inc.—its PowerVaults were recently certified—and Fujitsu). This is most likely because they don't want simpler, more cost-effective solutions encroaching on their high-cost, proprietary solutions. DataON Storage is one vendor with several different sizes and types available.

The connection between Windows Server and the box is enclosure awareness, which allows the OS to understand the state of fans and be able to blink drives for identification and similar tasks. Make sure the enclosure you're looking at supports SCSI Enclosure Services (SES), and that you install the latest hotfix (support.microsoft.com/kb/2913766) to improve Windows Server enclosure support.

If you want to use SMB Direct, you'll need remote direct memory access (RDMA)-capable network cards. Vendors include iWARP (10 Gbps NICs) from Chelsio, and Infiniband (56 Gbps and up) from Mellanox and ROCE.

If your company already has a SAN investment that you want to continue using, SOFS also has its place.

Converged networking, which uses several high-speed NICs for several different types of traffic, is becoming more popular. New in Windows Server 2012 R2 is the ability to prioritize between different types of SMB 3 traffic on the same interface, with settings for Live Migration, Hyper-V and default (any other SMB traffic). The two big Microsoft workloads where SOFS shines: storing Hyper-V VHDs and VHDXes for running VMs; SQL Server.

The latter provides a lot of flexibility because you can simply set up a new database server, connect it to a share on an SOFS cluster, disconnect the old server and connect the database files to the new server. Imagine how much easier disaster recovery and upgrades can be.

If your company already has a SAN investment that you want to continue using, SOFS also has its place. If you need to add more compute capacity—which could be a major investment, because you'd have to purchase new HBAs for each host and maybe even a new FC switch—there's a better way. Put an SOFS cluster with two or three hosts in front of your SAN (so the only wiring needed is between the SOFS nodes and the SAN), then present file shares to your compute nodes. Note that the CSV rebalancing mentioned earlier is turned on by default for Storage Spaces, but turned off by default when the SOFS is backed by a SAN.

SOFS Non-Use Cases

While Storage Spaces and SOFS is definitely a good choice if you're looking to build out storage for SQL Server or Hyper-V, there are some situations where the solution doesn't fit (yet). One is for Exchange storage. It's built around the concept of several copies of your databases on different servers, each housed on large-capacity, 7200 RPM local disks in each server.

Another is storage for IW documents. SOFS is designed for very large files (VHD and SQL databases) that are open continuously and that can't have interruption of the IO flow. Word, Excel and other types of IW apps, on the other hand, have small files that are opened and closed regularly. If you do use SOFS for IW document storage, performance will be worse—around 10 percent worse—than if you stored them on traditional file clusters. A better option is to run virtual file servers, store their VHDX files on the SOFS and present

SOFS is an enterprise technology, disaggregating the storage fabric from the compute fabric.

file shares to the users; the VMs can be clustered using guest clustering for high availability.

SOFS is an enterprise technology, disaggregating the storage fabric from the compute fabric, allowing you to scale each independently for maximum flexibility. If you have a smaller environment, cluster-in-a-box (CiB) solutions should be more suitable. Alternatively, you could connect several Hyper-V hosts to shared SAS storage with CSV, but without the overhead of a separate SOFS cluster.

As with data deduplication, it's very likely that when Storage Spaces, CSV and SOFS have been in widespread use for a few years, additional workloads will be added to the list of recommended and supported ones.

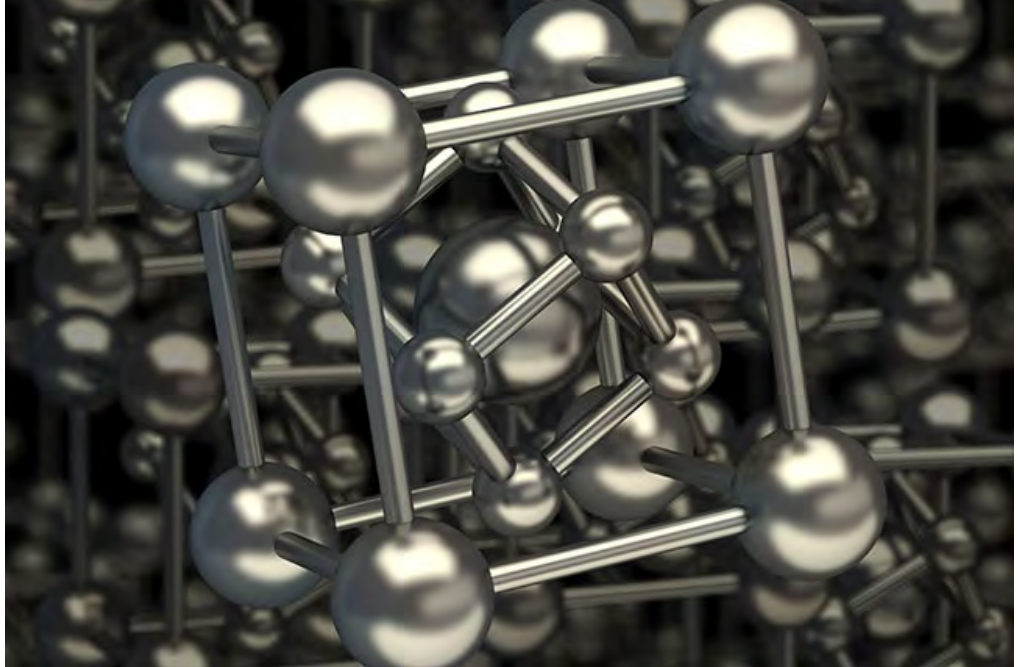
Configuration Tips and Tricks

When planning your SOFS implementation, remember that the maximum number of nodes is eight, with two, three and four nodes being popular choices. You'll also want to create a number of CSVs in a three-node cluster; three or six volumes are good choices. If you only have one CSV, all the SMB clients will be connected through one node, resulting in non-optimized performance.

The other issue that often gets lost in the planning phase is the concept of columns. The number of disks in your pool, along with the data protection scheme selected, affects the number of columns per virtual disk. If at a later stage you attempt to add more disks to your pool to expand capacity, you have to add enough disks to match the number of columns for that particular virtual disk.

If you're looking to build a test lab or proof-of-concept with SOFS and Storage Spaces, make sure you select an enclosure from the hardware control list (HCL), along with certified SAS hard drives and SAS SSDs (if you're going to test tiering). Make sure to update your NIC drivers, as well as the firmware on all networking components, as this will fix many issues. Also, make sure Receive Side Scaling is available and turned on in your NICs.

If two physical servers and a storage enclosure are outside your budget, consider a setup with virtualized nodes and disks on Azure,



System Center Virtual Machine Manager 2012 R2 can provision bare metal machines with an OS, then configure Storage Spaces and SOFS automatically.

which you can find instructions for using [here](#). If you have a Hyper-V host, a setup found [here](#) allows you to test everything on a single machine (neither are supported in production).

Managing Storage

SOFS and Storage Spaces are designed to lower the capex through low-cost enclosures, industry-standard SAS connectivity and cluster nodes running on commodity servers. But the other side of the equation is opex, and here Microsoft's answer is to have one interface to manage all storage. System Center Virtual Machine Manager 2012 R2 can provision bare metal machines with an OS, then configure Storage Spaces and SOFS automatically.

The same interface can be used to manage the storage and the SMB file shares that will house VMs. Virtual Machine Manager can also manage SAN arrays (with the right plug-in), and automatically provision storage and unmask LUNs to virtualization hosts, through Storage Management API.

There's no doubt that if you're a Microsoft shop using SQL Server and/or Hyper-V, you should take a look at SOFS and Storage Spaces. It's easier to manage, definitely cheaper than traditional SANs for capacity, while at the same time providing equal or better performance. [VR](#)

What Admins Need to Know About Azure

If you haven't looked at or used Microsoft Azure lately, you're missing out. See what it offers, and find out if it will benefit your business. **By Paul Schnackenburg**

If you're not in the business of running Web servers, but need a Web site, Azure Web site hosting is a great option.

Microsoft's Azure cloud service is growing quickly; so fast, in fact, that if you haven't been keeping up with it on a regular basis, you'll be far behind after just a few months. That's why I'm here: I'll catch you up on the latest, to help you understand what Azure offers now, as well as provide business and IT context for why you might consider using particular services.

Note that this article will only cover what's new in Azure, and not the basics of what it offers. If you're not familiar with that, you'll need to get up to speed to make the most of this discussion.

Compute Services for Web Sites

If you're not in the business of running Web servers, but need a Web site, Azure Web site hosting is a great option. It's not just for .NET Framework sites, either; the service supports Java as well as MySQL backend databases. A key selling point for Azure over the other multitude of hosting providers out there is the global scale

(permitting multiple copies of your site closer to your customers), the rich development environment (it supports almost all modern languages) and the breadth of the service as a true Web application platform.

There is a new tier to give you plenty of options for how you scale your sites; and you can now connect your Web sites to Infrastructure-as-a-Service (IaaS) virtual machines (VMs) you have running in your virtual network. Background services in the form of scripts can now manage your site using Web jobs, and security can be enhanced using the Modsecurity Web Application Firewall with both free and commercial rule sets.

Azure Search as a Service is a very interesting addition, essentially enabling search on a site with very little coding required.

Azure Search as a Service is a very interesting addition, essentially enabling search on a site (or through a mobile app) with very little coding required. It includes geospatial awareness, auto-complete and scoring profiles to control results. Protecting your Web site content is now easier with Backup and Restore, but the most exciting addition is probably Hybrid Connections.

Hybrid Connections isn't limited to Web sites, and can be used with other Azure services. This essentially makes it possible to host part of your application (the Web front end, for example) in Azure while keeping the back end database on-premises, for regulatory or compliance reasons. It's a secure point-to-point connection requiring no change to the name resolution, and it can transport any HTTP/HTTPS and TCP traffic. I can't emphasize enough how important this simple service could prove to be; it could be the killer app for helping enterprises move to a hybrid cloud model.

Compute Services: Virtual Machines

As expected, running your own VMs in Azure is one of the biggest areas of interest for many businesses. In late September, the new "D" series of VMs were added, which offer up to 800 GB of local SSD storage. Note that this is only for temporary storage on the D: drive, and not persistent data (but that's likely coming soon). There are also two new big VM sizes—A8 and A9—with faster processors, larger amounts of memory and 40 Gb/s RDMA NICs. There's also a new Basic tier of VMs, suitable for dev and test. It's not meant for much more than that, as it doesn't support load balancing and auto scaling.

You'll want to offload long-term archiving of backups to Azure storage instead of housing it on the DPM server.

Business that have adopted System Center Data Protection Manager (DPM) can now have instances of DPM running on Azure VMs, for backing up other VMs in your virtual network. Be aware that there are some limitations, since you don't have access to the underlying fabric. You'll also want to offload long-term archiving of backups to Azure storage instead of housing it on the DPM server(s); it's similar to using Azure storage as a backup destination for your on-premises backups from DPM or Windows Server Backup.

Perhaps the most interesting addition is the Microsoft Migration Accelerator (MA), through the acquisition of InMage in July. This enables easy migration of VMware, Hyper-V and Amazon Web Services (AWS) VMs to Azure. Most importantly, downtime is minimal, as data is written both to the running source VM as well as the new, offline VM until they're in sync and you're ready to swap over. Alternatively, if you're running System Center Virtual Machine Manager (SCVMM) you can use the rebranded Azure Site Recovery as a mechanism to migrate VMs to Azure.

The VM extensions were announced in April, but they've been expanded greatly since then. You can use them to monitor your VMs in Azure as well as protect them from malware (Symantec, Trend Micro and Microsoft solutions are currently available).

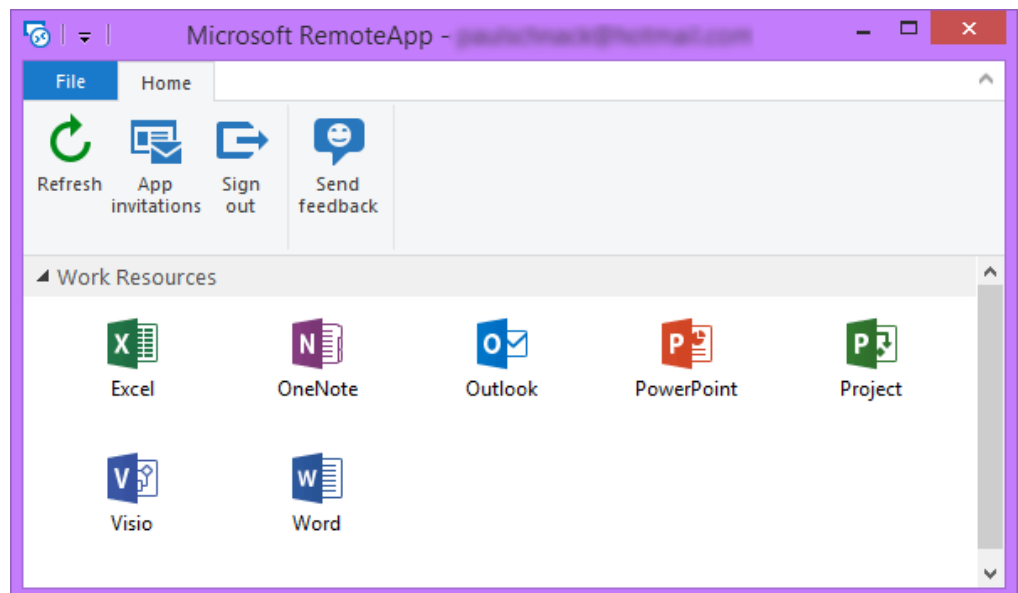


Figure 1. RemoteApp is an interesting option for cloud deployment of LOB (or in this case, Microsoft Office) applications that can be available on any device, anywhere.

The new service lets Azure function as your DR site.

Those with an MSDN subscription can now spin up Windows client VMs in Azure for dev and test; but note that this isn't supported for Desktop-as-a-Service (DaaS) scenarios for end users.

Microsoft doesn't offer full desktops running in a cloud as a service, but does offer RemoteApp, which lets you access applications remotely running in a client VM in the cloud (see **Figure 1**). Most interesting is the ability for IT to prepare its own images with line-of-business (LOB) applications and host these in Azure, providing remote access to the apps on any device.

Desired State Configuration (DSC) is the ability to use PowerShell to define a specific configuration for a system and then push that to one or more systems; recently this was expanded to include Azure.

When it comes to public cloud, security is of course critical. Microsoft understands that, and provides at least two (Cloudlink and Trend Micro) services that can encrypt your Azure VMs with the keys stored outside of Azure.

Azure for Disaster Recovery

Azure Site Recovery (ASR) was mentioned earlier as a mechanism for migrating on-premises VMs to the cloud. But it's much more than that: in previous incarnations, the Azure service was just a management point for the replication of your VMs from one private datacenter to another. The new service lets Azure function as your DR site. This is very powerful technology, although it comes with one major caveat: SCVMM is still required, so you can't simply replicate a VM with Hyper-V Replica. Hopefully this ability will be added in the near future.

Virtual Networks

IaaS VMs depend on network connectivity, and there have been some major updates in this area of Azure. Originally, you could only have a single VPN connection from on-premises to a Virtual Network (VNet) in Azure; now you can have several for redundancy. In the past, each VNet was isolated, so if you had different setups of VMs in different regions (say in the United States and Europe), the VMs could only communicate through the on-premises networks. It's now possible to link VNets together between regions. Previously, VNets, shown in **Figure 2**, were also limited to a single Affinity group within a datacenter; now they're scoped to an entire region.

Traffic Manager is an Azure service that can direct traffic to different IaaS VMs or Platform-as-a-Service (PaaS) Cloud Services or Web sites.

azure

DASHBOARD CONFIGURE CERTIFICATES

virtual network

LAST GATEWAY EVENT Unable to establish the cross-premise tunnel for site 'Cloud'. Previous state: Initializing. Current state: Not Connected. 10/4/2014 2:29:36 PM

DATA IN: 13.76 MB DATA OUT: 944.67 KB GATEWAY IP ADDRESS: 23.101.19.101

NAME	ROLE	IP ADDRESS	SUBNET NAME

quick glance

- Download the 64-bit Client VPN Package
- Download the 32-bit ClientVPN Package
- Download VPN Device Script

Figure 2. Just as you wouldn't set up a branch office without making sure the wiring and switches were in place, you should set up your virtual networks before creating VMs.

Another virtual networking upgrade allows you to reserve your external IP address for VMs and cloud services, which should make DNS and configuration of your on-premises firewall a bit easier. Another interesting recent feature is the Internal Load Balancer (ILB), which provides enhanced security by allowing you to host LOB applications on VMs in Azure in a highly-available manner without exposing them directly.

ExpressRoute, the ability to setup a direct (WAN) connection from your on-premises datacenter to Azure, has now expanded to different regions through partnership with more providers; [here's a good overview](#) comparing Site-to-Site VPN with ExpressRoute.

Traffic Manager is an Azure service that can direct traffic to different IaaS VMs or Platform-as-a-Service (PaaS) Cloud Services or Web sites, depending on load or geographical distance. It can now manage endpoints external to Azure; for on-premises servers or endpoints in other public clouds, you can assign weights to different entries for

Redis cache is an open source cache and data store.

more fine-grained control. If you want to be able to trace traffic from your PaaS or IaaS VMs, you can add reverse DNS records.

Azure Storage

Azure storage is used by many different services; building complex applications on top of these services can make it hard to pinpoint issues, especially since public cloud, by its very nature, hides a lot of the underlying fabric from you. Storage performance can be especially tricky, so you might want to check out this [Microsoft guide](#), with step-by-step instructions for monitoring, diagnosing and troubleshooting. It's worth noting that the size of single BLOB storage has been increased from 200 to 500 TB.

A useful addition to storage is the introduction of Azure files; it's essentially a file share hosted by Azure that you can access from VMs and cloud services. Related to that, Azure backup retention ranges have been significantly increased.

Redis Cache

Redis cache is an open source cache and data store. Microsoft maintains an open source port for Windows Server, and has made it available in Azure, calling it Azure Redis Cache. Microsoft states in its documentation that "Redis Cache helps your application become more responsive even as user load increases and leverages the low latency, high-throughput capabilities of the Redis engine. This separate cache layer allows your data tier to scale independently for more efficient use of compute resources in your application layer."

Automation

The true value of using public cloud becomes apparent when you can automate tasks using scripts and runbooks, as well as global assets. That automation now makes authentication easier if you're using Azure Active Directory, because you can call Service Management Automation (SMA) from Windows PowerShell.

Related to this are Azure Resource Groups and the Azure Resource Manager, which act as containers for several different parts of an Azure service. They can include Web sites, VMs and cloud services that can be deployed and managed as a single unit. An example is a highly available SharePoint 2013 farm with Active Directory and the

SQL back-end that can be deployed with a few clicks in a wizard in the new portal (more on this in a bit). There's also new support in Visual Studio for creating these deployment templates.

SQL in Azure

Microsoft SQL Server 2012 introduced Always On for highly available database services; it was further enhanced in SQL Server 2014. Templates for Azure were recently released that let you easily build an Always On SQL setup in Azure IaaS. Another popular approach is having your active database on-premises with an Availability Group copy running in Azure for disaster recovery.

Microsoft SQL Server 2012 introduced Always On for highly available database services.

If you just want database as a service, it became more attractive with the addition of easy auditing of database activity. For an example of the advantages offered by Azure, note that the Premium tier of database services now offers up to four geo-distributed secondary copies of your databases, along with Geo restore and automatic point-in-time backups of your databases (consider the on-premises infrastructure required for similar functionality).

Azure Active Directory

Azure Active Directory (Azure AD), seen in **Figure 3**, is another crucial (and free) service for IT pros to explore and use. Identity management in today's world of devices and cloud services is possibly the most important skill you can invest in.

You can use directory synchronization or its more capable replacement, Azure Active Directory Synchronization Services (Azure AD Sync), in combination with Active Directory Federation Services, to replicate your on-premises user accounts to Azure. Once there, they can be used to grant access to your in-house Web-based application and other Microsoft SaaS applications such as Office 365, Intune and others. More important, it can be used to enable single sign-on (SSO) to third-party cloud applications such as Salesforce, Box, DropBox and so on. Back in May the list of enabled applications was about 1,200; by late fall, the list had grown to more than 2,400 applications.

But how do you know which SaaS applications your users are actually using? Numerous sources confirm that IT departments regularly underestimate "shadow IT" cloud usage. A free service

REPORT	DESCRIPTION
ANOMALOUS ACTIVITY	
Sign ins from unknown sources	May indicate an attempt to sign in without being traced.
Sign ins after multiple failures	May indicate a successful brute force attack.
Sign ins from multiple geographies	May indicate that multiple users are signing in with the same account.
ERROR REPORTS	
Account provisioning errors	Indicates an impact to users' access to external applications.
PREMIUM REPORTS	
Sign ins from IP addresses with suspicious activity	May indicate a successful sign in after a sustained intrusion attempt.
Sign ins from possibly infected devices	May indicate an attempt to sign in from possibly infected devices.
Irregular sign in activity	May indicate events anomalous to users' sign in patterns.
Users with anomalous sign in activity	Indicates users whose accounts may have been compromised.
Password reset activity	Provides a detailed view of password resets that occur in your organization.
Password reset registration activity	Provides a detailed view of password reset registrations that occur in your organization.
Application usage	Provides a usage summary for all SaaS applications integrated with your directory.

Figure 3. Built-in reports alone are worth the admission price of Azure Active Directory.

from Microsoft called Cloud App Discovery comes with a small agent to install on each PC in your network; as it gathers data, you can run reports to target extensively used applications and bring them under management.

The premium version of Azure AD offers group management.

Using this Azure AD function lets you not only provide SSO to many cloud services, but also provision and deprovision accounts automatically. So when Jane leaves the company, you only need to disable her account in Active Directory on-premises (as you do today—right?); that change is replicated to Azure AD and her access is revoked to all cloud apps for which she'd been authorized. It can also provide access to corporate Twitter and other social media accounts without the users knowing the password.

The premium version of Azure AD offers group management; self-service password reset and self-service group management; multifactor authentication; Forefront Identity Manager licenses and more. There's also a new Basic Azure AD tier that includes features like group-based access management; self-service password reset for cloud applications; a customizable environment for launching enterprise and consumer cloud applications, and an enterprise-level SLA of 99.9 percent uptime.

This platform service for encoding, storing and streaming video from the cloud got its trial by fire during the Sochi Olympics.

Docker

Just when IT pros thought they'd gotten server virtualization down pat, another new technology crops up. Containers, the most famous of which is Docker, encapsulates applications so they can be deployed on any available server, virtualizing the application rather than the application and OS. Microsoft has announced its own forthcoming container technology, but for now Azure fully supports using Docker on Linux VMs.

Media Services

This platform service for encoding, storing and streaming video from the cloud got its trial by fire during the Sochi Olympics, where video footage was encoded and served to millions of viewers (in the United States) in real time. Encryption for content protection is now built-in, live streaming is in preview, and Dynamic Streaming over HTTP (DASH)—an emerging standard for video streaming with virtually every major video provider behind it—is also in preview. The service used to charge for input and output of media; now only output data is charged for.

Mobile Services

Building the back-end application and services for mobile apps (Android, iOS, Windows Phone and others) is now easier in Azure with offline support for Android, as well as SSO in the .NET Framework back-end.

HDInsight: Hadoop on Azure

If your business has any kind of large datasets you want to analyze, using Hadoop for managing that data is the answer. And unless you happen to have a lot of spare servers, enlisting the public cloud to help you is the best way to go. In June, the HDInsight service transitioned to Hadoop 2.4, which can provide up to 100 times the performance improvements over the earlier version for query response times. Apache HBase, a NoSQL distributed database, is now also fully implemented as part of the service.

The New Azure Management Portal

The alternative Web-based GUI for Azure was more primitive, and only a few services were available. This has improved considerably, as you can see in **Figure 4**, with many more services now visible. But

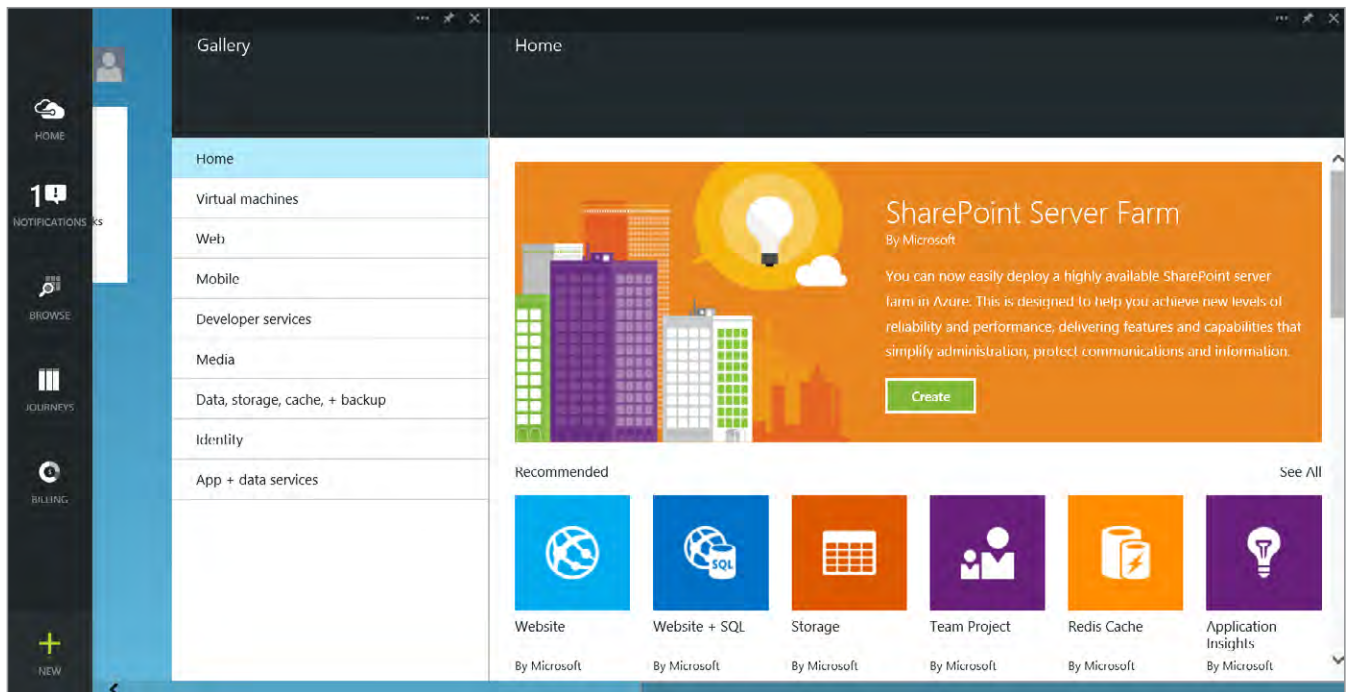


Figure 4. Customizable, dynamic and adaptive, the improved Azure Management Portal is a great way to explore new features.

There's no doubt that Microsoft is taking advantage of its entrenchment in enterprise datacenters to offer a unique roadmap.

the best thing about the new Azure Management Portal is the customization: You can adjust it so that it shows exactly the information you care about most.

The new portal also addresses possibly the single biggest missing feature of Azure when it comes to enterprise adoption: Role Based Access Control. No more, though, as it's now available.

Get Ahead of the Curve

There's no doubt that Microsoft is taking advantage of its entrenchment in enterprise datacenters to offer a unique roadmap where businesses can pick and choose what services to start moving to the cloud on their own terms. This is something that VMware Inc., AWS Inc. and Google Inc. can't offer. But you can't take advantage if you haven't joined the club. Get a trial account to Azure if you haven't already, or make sure to use your MSDN credits and discounts if you have a subscription. Learn what it can do—and start using it. Azure is getting better all the time, and will undoubtedly continue to progress. You don't want to fall any further behind the curve. **VR**

What's New and Cool in Hyper-V

By Rick Vanover

The Windows Server Technical Preview is adding a lot of Hyper-V features I'm really happy to see.

Too many times when a new major Microsoft OS is released, other features or even separate products may overshadow some of the things that really make me excited. Windows 10 Technical Preview (the next client OS after Windows 8.1) and the [Windows Server Technical Preview](#) are hot topics right now. There's also a System Center Technical Preview. That's a lot of software to preview! Also in the mix is Hyper-V Server and the corresponding server role.

I've been playing with the Windows Server Technical Preview on a Hyper-V host for a while, and I'm happy to say that it's worth a look.

The Windows Server Technical Preview is adding a lot of Hyper-V features I'm really happy to see. I felt that the upgrade from

Without question, the biggest and broadest new feature in Hyper-V for the Technical Preview is the Rolling Hyper-V Cluster Upgrade.

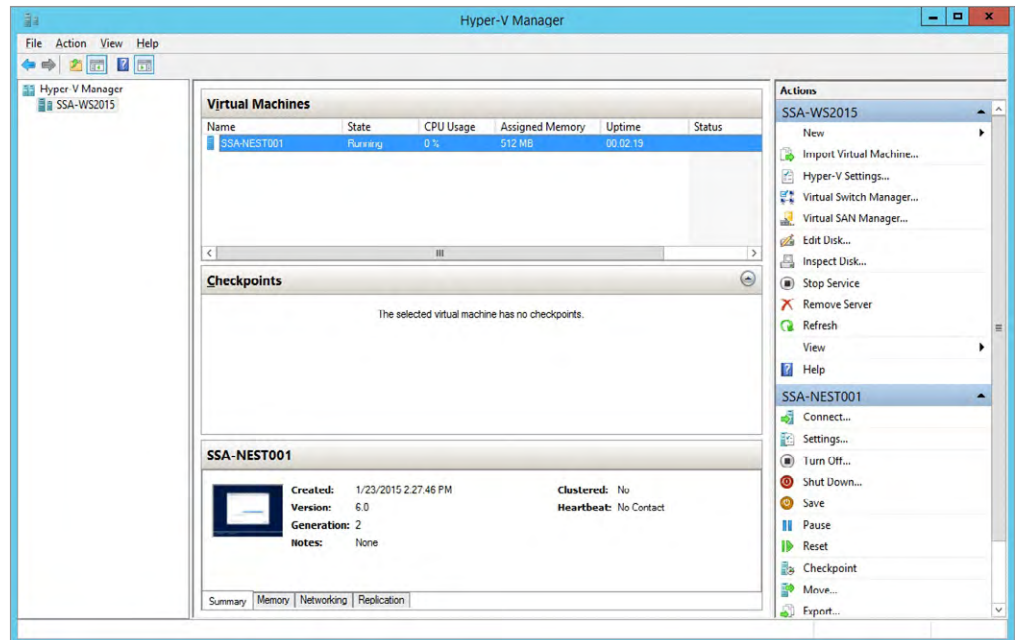


Figure 1. The Hyper-V Manager administration interface is materially unchanged, but now supports password connections for different accounts.

Windows Server 2008 R2 to Windows Server 2012 brought incredible Hyper-V improvements, but didn't feel the same from Windows Server 2012 to Windows Server 2012 R2. You can read the full list of what's new in [Hyper-V on TechNet](#); today, I want to take a look at some of my favorite new features and share why they're important to me.

Rolling Hyper-V Cluster Upgrade

Without question, the biggest and broadest new feature in Hyper-V for the Technical Preview is the Rolling Hyper-V Cluster Upgrade. This capability offers a familiar construct called Cluster Functional Level. This permits a cluster to have a host running the Technical Preview for a Windows Server 2012 R2 Hyper-V cluster and move virtual machines (VMs) to the new hosts, permitting host upgrades of the older hosts. This is meant as a cluster upgrade technique; it's not a broad backward- and forward-compatible administration technique for long-term existence, but rather a framework for how clusters will be upgraded going forward.

There are some improvements in the Hyper-V Manager administration tool, as well. For most of the environments I administer, the Hyper-V installations are small and I'm fine administering with

Hyper-V Manager. For larger environments, System Center Virtual Machine Manager is the way to go. **Figure 1** shows the new Hyper-V Manager.

Integration Services

The final cool feature in the Technical Preview I'm happy to see is that Integration Services are now delivered through Windows Update to the Hyper-V guest VMs. This has been a real pain point in the past. Take, for example, a situation in which there's a Windows Server 2012 R2 host (with no update), and a VM that's created and is running Integration Services. Then assume that the host is updated (via Windows Update) and a subsequent VM is created. The two VMs now have different versions of Integration Services. Troubleshooting in this scenario is no fun.

The final cool feature in the Technical Preview I'm happy to see is that Integration Services are now delivered through Windows Update to the Hyper-V guest VMs.

Additional features, such as hot add of network and memory, are a big deal for critical production VMs running on Hyper-V, and I can't wait to give those a look, as well. If you haven't downloaded the Technical Preview, [you can do so now for free](#). Now is really the time to take a look; the next version of Hyper-V will be here before you know it, and you should be prepared when it reaches general availability.

Have you started playing with the Technical Preview? If so, what Hyper-V features do you like or look forward to most? Share your comments. [VR](#)

Rick Vanover (vExpert, MCITP, VCP) is a product strategy specialist for Veeam Software based in Columbus, Ohio. Rick is a popular blogger, podcaster and active member of the virtualization community. Rick's IT experience includes system administration and IT management; with virtualization being the central theme of his career recently. Follow Rick on Twitter @RickVanover.
