Windows Server 2012 R2: Private Cloud Storage and Virtualization

Understanding Storage Architecture

1 SMB Direct

You can improve your cloud deployment storage using a special type of network adapter that has remote direct memory access (RDMA) capability and can function at full speed with very low latency, while using very little CPU. For server roles or applications, this gives a remote file server performance comparable to local storage.

2 SMB Multichannel

This improvement allows aggregation of network bandwidth and network fault tolerance if multiple paths are available between the Server Message Block (SMB) client and the SMB server. Server applications can then take advantage of all available network bandwidth to be more resilient in the event of a network failure.

3 Scale-Out File Server

Scale-Out File Server lets you store server application data (such as Hyper-V virtual machine files) on file shares and obtain a similar level of reliability, availability, manageability, and high performance as you would expect from a storage area network. All file shares are online on all nodes simultaneously. File shares associated with this type of clustered file server are called scale-out file shares. This is an active/active configuration.

4 Cluster Shared Volumes

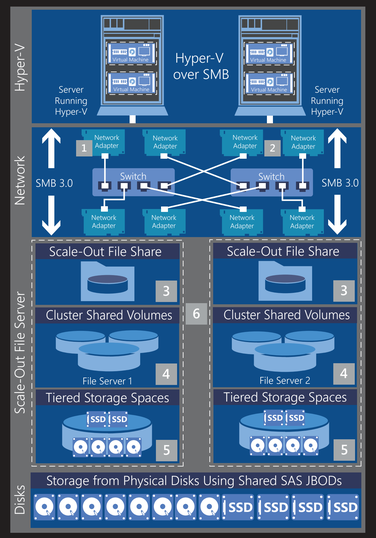
Cluster Shared Volumes (CSV) simplifies the configuration and management of clustered virtual machines. With CSV, multiple clustered virtual machines can use the same LUN (disk) and still live migrate from node to node independently of one another.

5 Tiered Storage Spaces

Storage Spaces delivers storage virtualization capabilities to Windows Server 2012 R2. The storage stack has been enhanced to incorporate two new abstractions, storage pools, and storage spaces. Storage pools are a collection of physical disks that enable you to aggregate disks, expand capacity in a flexible manner, and delegate administration. Storage spaces are virtual disks created from free space in a storage pool, with attributes such as resiliency level, storage tiers, fixed provisioning, and precise administrative control.

6 SMB Transparent Failover

You can easily perform hardware or software maintenance of nodes in a clustered file server by moving file shares between nodes without interrupting server applications that are storing data on these file shares. Also, if a hardware or software failure occurs on a cluster node, SMB 3.0 Transparent Failover lets file shares fail over to another cluster node without interrupting server applications that are storing data on these file shares.

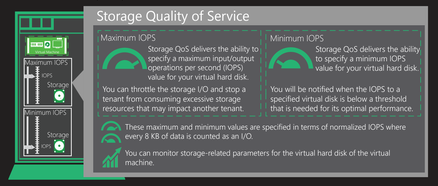


Virtual Hard Disks

Storage Quality of Service

Hyper-V in Windows Server 2012 R2 includes the ability to set certain Quality of Service (QoS) parameters for storage on a virtual machine.

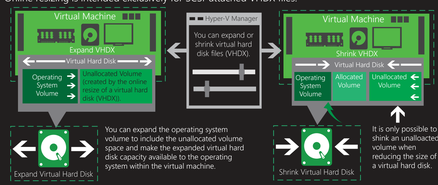
Storage QoS provides storage performance isolation in a multi-tenant environment and mechanisms to notify you when the storage I/O performance does not meet the defined threshold to efficiently run your virtual machine workloads.



Online Virtual Hard Disk Resizing

Windows Server 2012 R2 enhances your capability to manage virtual machine storage resources. You can increase or decrease the size of a virtual hard disk while the virtual machine is still running.

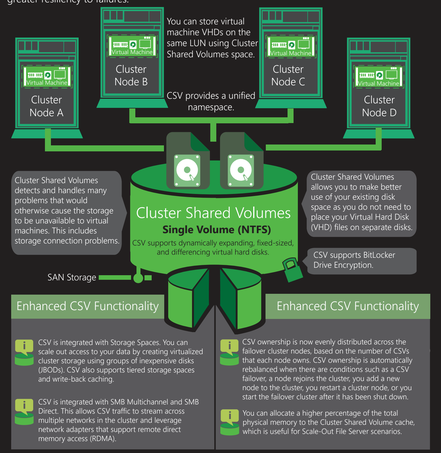
Online resizing is intended exclusively for SCSI-attached VHDX files.



Cluster Shared Volumes

Understanding Cluster Shared Volumes

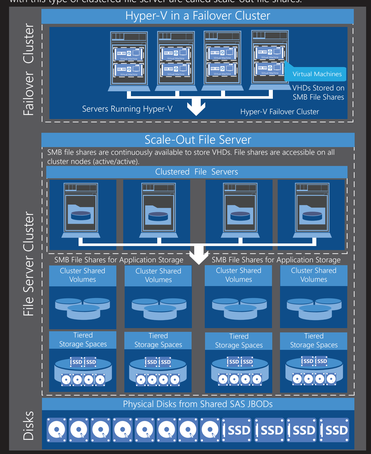
Cluster Shared Volumes (CSV) simplifies the configuration and management of virtual machines that are running on a cluster. With CSV, multiple virtual machines that are running on a cluster can use the same physical disk, while still being able to fail over independently of one another. Cluster Shared Volumes provide multiple benefits, including easier storage management and greater resiliency to failures.



Scale-Out File Server and SMB

Scale-Out File Server for Application Data

A Scale-Out File Server lets you store server application data (such as Hyper-V virtual machine files) on file shares and obtain a similar level of reliability, availability, manageability, and high performance as you would expect from a storage area network. All file shares are online on all nodes simultaneously. File shares associated with this type of clustered file server are called scale-out file shares.

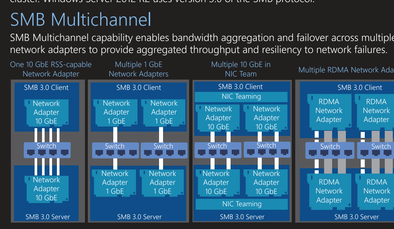


Server Message Block (SMB 3.0)

SMB Direct delivers scalable, fast, and efficient storage access. You can also benefit from fast data transfers and network fault tolerance using SMB Multichannel. SMB Multichannel and SMB Direct improves network communications between your Hyper-V server cluster and your File Server cluster. It also improves internode communications within your File Server cluster. Windows Server 2012 R2 uses version 3.0 of the SMB protocol.

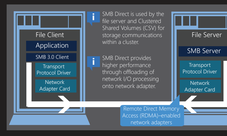
SMB Multichannel

SMB Multichannel capability enables bandwidth aggregation and failover across multiple network adapters to provide aggregated throughput and resiliency to network failures.



SMB Direct

SMB Direct delivers improved and enhanced network performance. SMB Direct supports the use of network adapters that have remote direct memory access (RDMA) capability. Network adapters that have RDMA can function at full speed with very low latency, while using less CPU.



SMB Transparent Failover

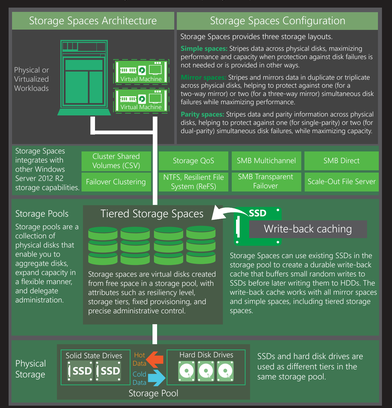
SMB Transparent Failover supports server application workloads that require the connection to the storage infrastructure to be continuously available. The SMB file server and client work togeather to make failover of file server cluster nodes transparent to applications—for all file operations, and for both planned cluster resource moves and unplanned node failures.

Storage Spaces

Tiered Storage Spaces

Storage Spaces is a storage virtualization technology in Windows Server 2012 R2 and Windows Server 2012 that enables you to group industry-standard disks into storage pools and then create virtual disks called storage spaces from free space in the pools.

In Windows Server 2012 R2, you can create tiered storage spaces with a mixture of solid state drives (SSD) (fast tier) and hard disk drives (standard tier). Frequently accessed (hot) data in a tiered storage space gets moved to the SSDs in the fast tier, while infrequently accessed (cold) data is moved to the high-capacity hard disks in the standard tier. This enables you to balance capacity and performance.

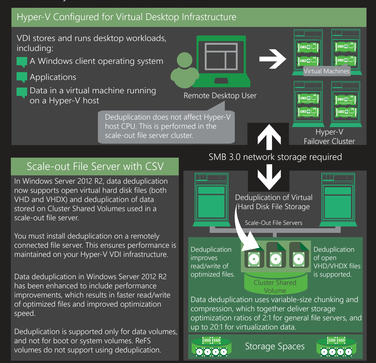


Deduplication

Deduplication for Virtual Desktop Infrastructure

You can significantly reduce your storage capacity requirements by using the data deduplication feature on your Clustered Shared Volume. In Windows Server 2012 R2, data deduplication is supported only in a Scale-Out File Server deployment for Virtual Desktop Infrastructure (VDI) workloads with separate storage and compute nodes. The desktop virtual hard disks (VHDs) are stored on a scale-out file server and accessed using Server Message Block (SMB 3.0).

Data deduplication is a storage efficiency feature in Windows Server 2012 R2 that helps address the growing demand for file storage. Data deduplication can drastically reduce how much disk space your files consume by automatically finding identical parts (chunks) of files and replacing duplicate parts with a reference to the single copy. The chunks are compressed and then organized into special container files in the System Volume Information folder.

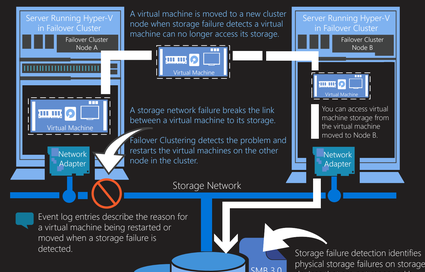


Hyper-V and Failover Clustering

Storage Failure Detection for Virtual Machines

Windows Server has always allowed you to cluster your virtual machines using storage managed by the failover cluster. If a storage failure was detected, the failover cluster responded in an appropriate manner and ensured that your virtual machine maintained access to its storage. In Windows Server 2012 R2, Hyper-V and Failover Clustering have been enhanced to detect physical storage failures on storage devices that are not managed by the failover cluster (for example, SMB 3.0 shares).

Storage failure detection can detect the failure of a virtual machine boot disk or any secondary data disk associated with the virtual machine. If such an event occurs, Failover Clustering ensures that the virtual machine is relocated and restarted on another node in the cluster. This eliminates situations where unmanaged storage failures would not be detected and where virtual machines resources may become unavailable. For example, a SQL data store failing on a secondary drive is now detected.

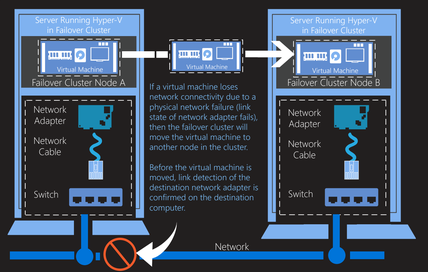


Storage failure detection supports VHD and VHDX file formats, differencing disks, virtual hard disks connected to IDE controllers, virtual hard disks connected to SCSI controllers, virtual machine checkpoints (snapshots), and virtual machines using storage and network resource pools.

Network Failure Detection for Virtual Machines

In previous releases, Failover Clustering has monitored and managed network connectivity among cluster nodes, and between clients and cluster nodes. It detects problems with a network adapter or other network device and takes appropriate action to ensure connectivity is uninterrupted. In Windows Server 2012 R2, Hyper-V and Failover Clustering have been enhanced to detect network connectivity issues for virtual machines. If the physical network assigned to the virtual machine suffers a failure—such as a faulty switch port, network adapter, or a disconnected network cable—then the failover cluster moves the virtual machine to another node in the failover cluster in order to restore network connectivity.

You can use network failure detection to monitor the health of a physical cluster node as well as the health of the virtual machine and ensure that you can provide a robust environment to host private cloud environments.



Network failure detection works with any virtual machine. It supports legacy and software-based network adapters, SR-IOV–enabled network adapters, virtual machine checkpoints, storage or network resource pools, and advanced networking features enabled on virtual machines.

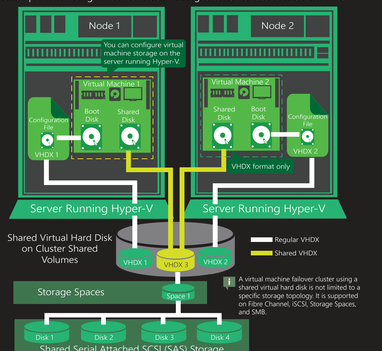
Virtual Hard Disk Sharing

Hyper-V with Virtual Hard Disk Sharing

Windows Server 2012 R2 enables you to share a virtual hard disk file (VHDX format), which provides shared storage for a virtual machine failover cluster (also known as a guest cluster). By making shared storage available to virtual machines, you can can easily use a virtual machine failover cluster to protect your application services (for example, SQL or file server services) running inside your virtual machines.

Virtual Machine Clustering Using Cluster Shared Volumes

One option for using virtual hard disk sharing is to use Cluster Shared Volumes.



Virtual Hard Disk Sharing does not support:

- Hyper-V storage migration
- Hyper-V Replica
- Storage Quality of Service (QoS)

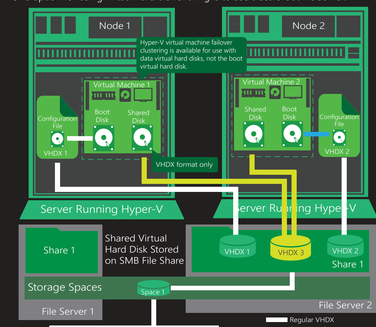
Supported Scenarios for Virtual Hard Disk Sharing

Supported scenarios include:

- Live migration of virtual machines using virtual hard disk sharing.
- Saving and restoring virtual machines (but the shared virtual hard disk file must be excluded from the storage snapshot operation).
- Protecting against the failure of a guest node, Hyper-V host, or file server node.

Virtual Machine Clustering with SMB Storage in a Scale-Out File Server

One option for using virtual hard disk sharing is to use a scale-out file server.



You can get the free Windows 8 app, Server Posterpedia, from the Windows Store

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