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valuable information regarding PowerShell, SCOM, SQL Server and Virtualization. This Quick Reference contains a lot of information I got when using and implementing Hyper-V and teaching it at Microsoft Learning partners sites like Global Knowledge, CompuTrain, Twice, New Horizons and Centric. Although this document is best used as a quick reference in practice, it can also be used as a great preparation for Exam **70-659** TS: Windows Server 2008 R2, Server Virtualization.

## Hyper-V requirements, limits and what's new

**Hyper-V (jul 2008):** requirements: x64, Intel XD (eXcute Disable) or AMD NX (No eXecute), Intel-VT/AMD-V.

**Hyper-V R2 (sep 2009):** features: live migration, CSV, QSM, SLAT: Intel EPT or AMD NPT, CPU Core Parking (power management), Jumbo frames, VM-Chimney (TCP Offload), VMQ. Limits: max 8 sockets, max 64 cores, max 384 VMs, max 512 vCPUs, max 1 TB Ram per host.

**Hyper-V R2 SP1 (feb 2011, KB 976932):** RemoteFX, Dynamic Memory.

**Hyper-V Server R2 SP1:** CSV. Max 1 TB Ram. Max 64 VMs per host.

**Windows 8 Hyper-V (tbd):** Requirements: SLAT CPU? Limits: host: max 2 TB Ram, max 160 logical CPUs, max 1024 virtual CPUs, max 1024 active VMs, max 4000 active VMs per failover cluster. Per VM: max 32 CPUs, max 512 GB Ram. What's new: Network virtualization, Extensible Virtual Switch, Multi-tenancy, NIC teaming as part of OS, Storage Resource Pools, VHDX: max 16 TB with power failure resiliency, Virtual Fibre Channel, Offloaded data transfer, Hyper-V replica, Cross-premise connectivity, Cloud backup.

## Pricing

- Hyper-V Server, \$0 (it's free!), buy a license per VM (when required)
- W2008 Standard Edition ca. \$1210/host. One virtual instance of Windows included.
- W2008 Enterprise Edition ca. \$4000/host. Four virtual instances of Windows included.
- W2008 Datacenter Edition ca. \$3000/CPU. Unlimited virtual instances of Windows included.

## Setup

- "start /w ocsetup Microsoft-Hyper-V" **Note:** sometimes Hyper-V is installed without registering under Server Roles. De-install using "ocsetup Microsoft-Hyper-V /uninstall" and run setup from GUI.

Or using PowerShell:

- Import-Module ServerManager
- Add-WindowsFeature Hyper-V

Configure Hyper-V on a **core server**: use Sconfig.cmd (R2) or hvconfig.cmd (not available in R2 anymore) to

## Managing Virtual Machines

### Guest operating systems

**Supported** (enlightened I/O available when using Integration Services): Windows Server 2008/R2, Windows 2000 Server SP4, Windows Server 2003 SP2/R2, XP SP3, Vista SP1, W7, RHEL 5.2 - 6.1, SUSE 10 SP1/11, CentOS 5.2 - 6.0.

Hyper-V paravirtualization when running Linux Kernel 2.6.32.

**Hyper-V capable**, without Integration Services: NT Server 4, Ubuntu, Suse 9, Solaris, RHEL 2-4, Netware 5.1 - 6.x

**Max 4 CPU per VM** for most guest operating systems. Max 1CPU per VM: Windows 2000 Server, Max 2 CPU per VM: Windows Server 2003, Windows XP and Windows Vista.

**Dynamic Memory:** adjusts the amount of memory available to a virtual machine based on changes in memory demand and values that you specify. Configure startup ram and maximum ram in properties of the VM.

## Files

XML: VM configuration file. VHD: VM disk. AVHD: Differencing disk. VSV: Snapshot. BIN: Memory.

## VM actions

<b>Pause</b>	VM is temporarily not allowed to execute. State is not saved to disk but kept in memory.
<b>Save</b>	state is saved to disk. Hyper-V host can be shut down.
<b>Shut down</b>	VM is gracefully shut down.
<b>Turn off</b>	like pulling the power cable. VM is turned off “ungracefully”.

Default Automatic Stop action: save state.

Default Automatic Start Action: start if it was running.

**Cloning** a VM on the same host: Hyper-V automatically assigns a different name.

## Snapshots (Hyper-V) / Checkpoints (Virtual Machine Manager)

Snapshots are read-only, point-in-time images of a virtual machine. You can manage snapshots using Hyper-V Manager, VMM or VMC. You can specify a custom snapshot name when using Virtual Machine Connection application. Changes to a VHD are safed in an AVHD-file.

## RemoteFX

Network bandwidth recommendation: 10Mbps per user (i.e. per VM).

1. Host: Windows Server 2008 R2 SP1, GPU: DirectX 9.0c & 10.0. Enable RemoteFX in Server Manager\Roles.
2. VM: Windows 7 SP1 VM: Power Off. Add RemoteFX videocard. Power On.
3. Remote client: RDP 7.1 (part of Windows 7 SP1).

## Storage

**IDE:** 4 ports. Required for the startup disk! Perfomance identical to SCSI virtual disks.

**SCSI:** Max 4 controllers x 64 disks = 256. Integration Services required.

<b>Fixed-size VHD</b>	Max 2040 GB.
<b>Dynamically expanding VHD</b>	Max 2040 GB.
<b>Differencing VHD (AVHD)</b>	Stores changes to an associated parent VHD.
<b>Pass-through / Physical</b>	Must be offline in host os. Snapshots not supported! No size limit.
<b>Undo</b>	Virtual Server, not supported in Hyper-V.

Hot-add disks: SCSI or pass-through only. Integration services required.

Pass-through disks: keep offline in the host operating system.

## Networking

### VM NICs

- Legacy Network Adapter: compatible with most operating systems. Use it when performing network-based operating system installation.
- (Synthetic) Network Adapter, part of Integration Services: much better performance, not available in VM when OS hasn't booted yet.

### Network types

<b>External</b>	virtual switch connected to external NIC
<b>Private</b>	VMs can communicate with each other
<b>Internal</b>	VMs can communicate with each other and the host operating system

### Other features

When using NLB: enable MAC Spoofing on properties of the VM.

VM Queue (VMQ): enables physical network adapters to use direct memory access (DMA) to place the contents of data packets directly into virtual machine memory, which increases I/O performance.

## Ports

<b>22</b>	SFTP (when using VMware)
<b>80</b>	VMM traffic to agents on hosts and library servers
<b>443</b>	VMM file transfers to agents and library servers
<b>2179</b>	Virtual Machine Connection Application (RDP ActiveX control)
<b>3389</b>	Remote Desktop Protocol
<b>5900</b>	VMRC
<b>8100</b>	VMM Administration console

## High Availability

### Migration types

Type	Requires	How it works
<b>Quick migration</b>	Hyper-V v1 in a failover cluster	VM State is saved, copied and resumed. Downtime perceived by user! This depends on size of VM Ram.
<b>Live migration</b>	Hyper-V R2 in a failover cluster or VMware ESX 3.0/3.5 (vMotion)	No perceived downtime
<b>SAN migration</b>	VMM, Virtual Disk Service (VDS) driver provided by SAN manufacturer. NPIV for FibreChannel. Max one VM per LUN.	VM State is saved. LUN is detached and attached between hosts or hosts and library servers.
<b>Network / LAN migration</b>	VMM. SFTP for VMware ESX.	Copy files between servers using BITS (Hyper-V) or SFTP (VMware). VM State is saved and copied when using Hyper-V v1. VM can keep running for almost entire duration when using Hyper-V R2. Only brief interruption when state is saved, copied and resumed at end of the transfer.
<b>Quick Storage Migration</b>	Hyper-V R2, VMM 2008 R2	Moves VHD files between SANs using BITS. VM can remain running for almost entire duration of the transfer. VM is put into save-state for a brief interval to migrate its memory state and associated differencing disks.

## CSV

Cluster Shared Volumes operates by orchestrating metadata I/O operations between the nodes in the cluster via the Server Message Block protocol. Coordinator Node: node with ownership of the LUN orchestrating metadata updates to the NTFS volume. Read / Write operations are passed directly to the shared storage via block based protocols.

Create a CSV by using Failover Manager. Folder created: %SystemDrive%\ClusterStorage.

## SCOM Integration

Implement Performance and Resource Optimization (PRO) Tips: VMs are distributed automatically across the hosts, and can automatically fail over to the most appropriate host server.

Placement goal: Resource maximization (consolidate VMs on fewest possible host) or Load balancing (spread VMs).

## HA Trouble

LUN appears twice in the Disk Management console: Install Multipath I/O (MPIO).

Unsupported Cluster Configuration:

- All VHD's need to be on shared storage.
- Detach any media images from the VM.

## Virtual Machine Manager 2008 R2

VMware products supported: VMware ESX 3.0, 3.5, 4.0, VC 2.5.

Add Virtual Center servers first to VMM. Then add VMware hosts servers.

## Mapping Hyper-V terminology to VMware

Microsoft	VMware
Host group	Cluster
Hyper-V Server / Hyper-V Role on Windows Core	ESXi
Hyper-V Role on Full Installation of Windows	ESX (not available anymore)
Hyper-V Manager	Virtual Infrastructure Client
Self Service Portal	Web Access
Performance and Resource Optimization (PRO)	Distributed Resource Scheduler (DRS)
System Center Virtual Machine Manager (SCVMM)	vCenter Server (Virtual Center)
System Center Data Protection Manager (DPM)	Consolidated Backup
<b>Virtual Machines</b>	
Integration Services / Components	VMware Tools
Dynamic Memory	Memory Overcommit
Parent Partition	Service Console
Core Parking (per CPU) & Dynamic Optimization	Distributed Power Management (per host)
P2V / V2V Using SCVMM	P2V / V2V Using VMware Converter
Virtual Machine Servicing Tool (VMST)	Update Manager
<b>Storage</b>	
VHD (Virtual Hard Disk)	VMDK (Virtual Machine Disk)
Pass-Through Disk	Raw Device Mapping (RDM)
Quick Storage Migration (with SCVMM R2)	Storage vMotion
Dynamic Disk	Thin Provisioning
Expand Disk / Volume	Volume/Extent Grow
<b>High-Availability</b>	
Live Migration (not Quick Migration)	vMotion
CPU Migration Support	Enhanced vMotion Compatibility (EVC)
Failover Clustering	VMware HA (High-Availability)
Cluster Shared Volumes (CSV)	VMFS
Coordinator Node	Primary Node

## Virtual Machine Manager 2012

**System Requirements:** 2 GB Ram, WAIK, Windows Server 2008 R2 (SP1 preferred).

**Setup:** WinRM 2.0 & .NET Framework 3.5.1, member of Active Directory.

**Database server:** 2 GB Ram, SQL Server 2008 Service Pack 2, SQL Server 2008 R2 Service Pack 1.

**VMM Console:** 512 MB Ram, W2008R2, W7 (x86 and x64), .NET Framework 3.5.1, PowerShell 2.0

**Hosts:** Hyper-V, VMware ESX, Citrix XenServer

## Internet

**Hyper-V Survival Guide:** <http://social.technet.microsoft.com/wiki/contents/articles/125.aspx>

**Hyper-V Forum:** <http://social.technet.microsoft.com/forums/en-US/winserverhyperv/threads/>

**Windows Virtualization Team Blog:** <http://blogs.technet.com/b/virtualization/>

**VMM 2012 Documentation:** <http://technet.microsoft.com/en-us/library/gg610610.aspx>

**Windows Server 2008 R2: Hyper-V Component Architecture**

<http://www.microsoft.com/download/en/details.aspx?id=3501>

**MCITP Virtualization Administrator: 70-659/70-652 + 70-669 + 70-693**

<http://www.microsoft.com/learning/en/us/certification/cert-virtualization.aspx>

<http://www.microsoft.com/learning/en/us/Exam.aspx?ID=70-659>

<http://www.microsoft.com/learning/en/us/Course.aspx?ID=10215A&Locale=en-us>