Instructions for Virtual Machine Compute Optimizer

Last revised: 4/29/2021

VMCO Version: 3.x

Contents

Summary

Understanding Virtual Machine vCPU and vNUMA Rightsizing and Host Power Management Policies for Best Performance

Virtual Machine vNUMA configuration and Host Management Power Policies can have a dramatic effect on individual and overall VM performance on a host. The effects of a physical host's NUMA architecture on virtual machines' vNUMA configuration has been covered in-depth in Mark Achtemichuk's Blog Virtual Machine vCPU and vNUMA Rightsizing –Guidelines. The Host Power Management in ESXi is covered in Performance Best Practices for VMware vSphere 7.0. These are applicable to any supported version of ESXi currently available.

What Is the Virtual Machine Compute Optimizer?

The Virtual Machine Computer Optimizer (VMCO) is a Powershell script and module that uses the PowerCLI module to capture information about the Hosts and VMS running in your vSphere environment, and reports back on whether the VMs are configured optimally based on the Host CPU and memory. It will flag a VM as "TRUE" if it is optimized and "FALSE" if it is not. For non-optimized VMs, a recommendation is made that will keep the same number of vCPUs currently configured, with the optimal number of virtual cores and sockets.

Note that the VMCO will not analyze whether your VMs are configured with the correct number of vCPUs based on the VM's workload. A more in-depth analysis tool such as VMware vRealize Operations Manager can make right-sizing determinations based on workload and actual performance.

Running the Virtual Machine Compute Optimizer

Requirements

In order to run the Virtual Machine Compute Optimizer, you will need the following:

- Powershell v5 or higher
- The PowerCLI and VMCO modules will be installed via this script if they are not currently, and updated to the latest version if they are installed.
- A user account with Read-Only rights assigned at the vCenter level with 'Propogate to children' enabled. These rights will be needed on each vCenter that will be analyzed.

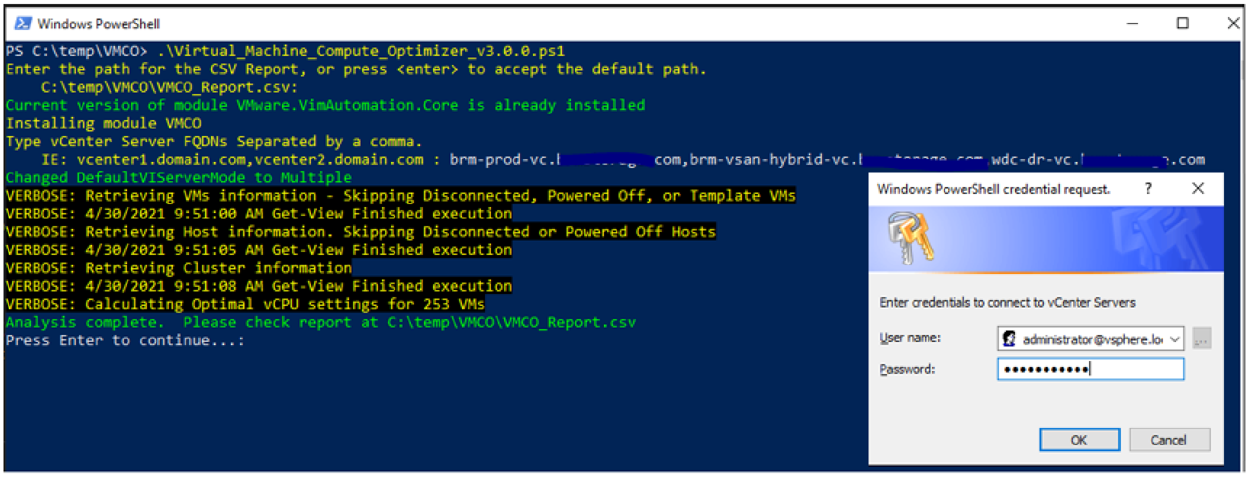
Running the VMCO

1. There are a few ways you can launch a Powershell script.
    a. Right click the "Virtual_Machine_Compute_Optimizer_v3.0.0.ps1" file and choose "Run with Powershell"
    b. Open Powershell, navigate to the folder containing the Virtual_Machine_Compute_Optimizer_v3.0.0.ps1 file, and type ***.\Virtual_Machine_Compute_Optimizer_v3.0.0.ps1***
2. When prompted, type in the full path to a csv file where you would like to store the report results. By hitting enter, the path will default to the folder where you launched the script from.

If the file already exists, it will attempt to merge the new report data into it. This could be helpful to combine other vCenter reports that might have been run separately.

3. The Core PowerCLI and VMCO Modules are installed or updated as necessary.
4. When prompted, enter the FQDN or the vCenter(s) you would like to analyze. Separate the names with a comma “,”. IE, *vcenter1.domain.com,vcenter2.domain.com,vcenter3.domain.com*
5. You will be prompted to enter credentials to connect to the vCenter(s). The user account must have the rights defined under the Requirements section. You cannot specify different credentials per vCenter at this time.

Once authenticated, the progress will show on the screen. When the analysis is complete, it will indicate the location of the report file.



```
PS C:\temp\VMCO> .\Virtual_Machine_Compute_Optimizer_v3.0.0.ps1
Enter the path for the CSV Report, or press <enter> to accept the default path.
    C:\temp\VMCO\VMCO_Report.csv:
Current version of module VMware.VimAutomation.Core is already installed
Installing module VMCO
Type vCenter Server FQDNs Separated by a comma.
    IE: vcenter1.domain.com,vcenter2.domain.com : brm-prod-vc.[redacted]com,brm-vsan-hybrid-vc.[redacted]wdc-dr-vc.[redacted].com
Changed DefaultVIServerMode to Multiple
VERBOSE: Retrieving VMs information - Skipping Disconnected, Powered Off, or Template VMs
VERBOSE: 4/30/2021 9:51:00 AM Get-View Finished execution
VERBOSE: Retrieving Host information. Skipping Disconnected or Powered Off Hosts
VERBOSE: 4/30/2021 9:51:05 AM Get-View Finished execution
VERBOSE: Retrieving Cluster information
VERBOSE: 4/30/2021 9:51:08 AM Get-View Finished execution
VERBOSE: Calculating Optimal vCPU settings for 253 VMs
Analysis complete.  Please check report at C:\temp\VMCO\VMCO_Report.csv
Press Enter to continue...:
```

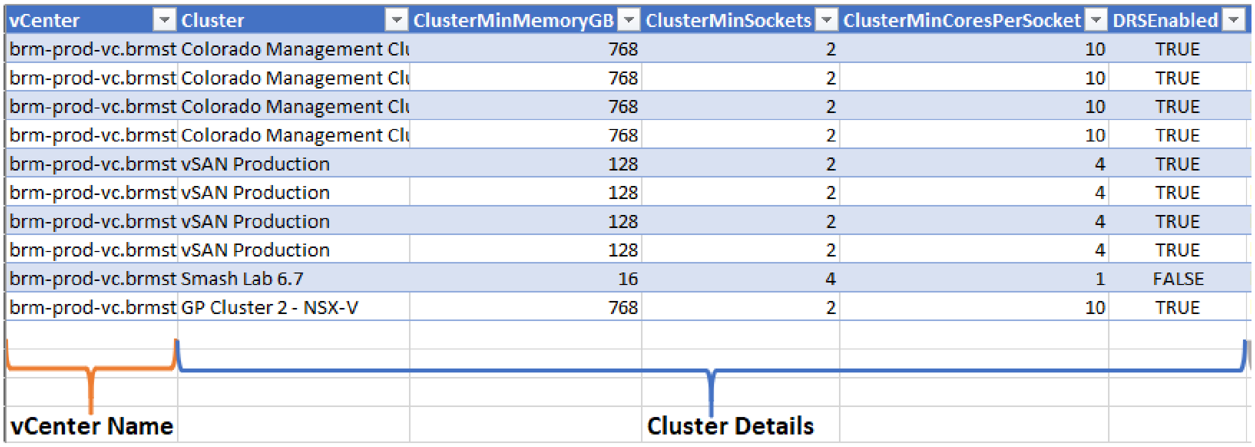
Enter credentials to connect to vCenter Servers

User name: administrator@vsphere.lo

Password: ●●●●●●●●●●●●

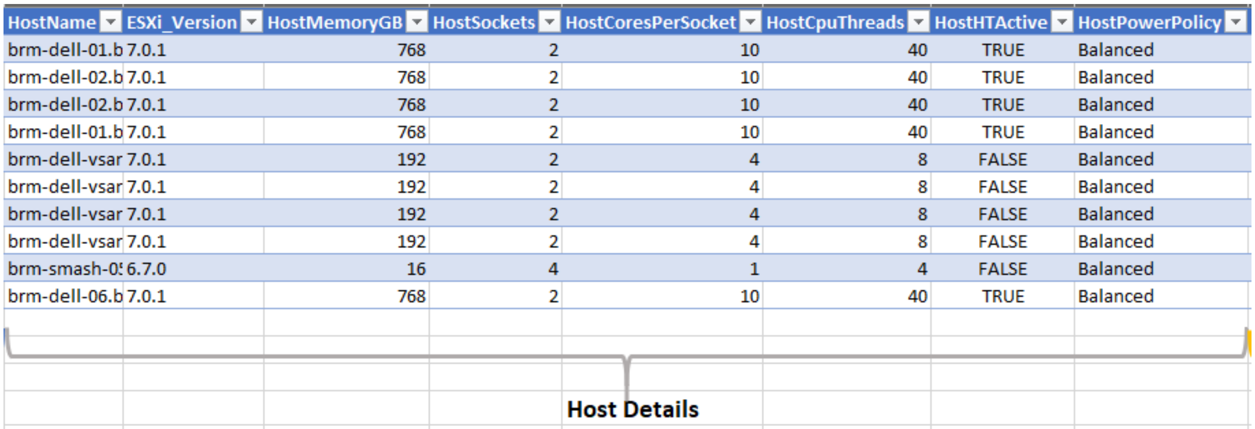
Interpreting the Results

The report that is generated is a CSV file. In order to clarify the data, it is formatted below to highlight what is being presented, and broken into components



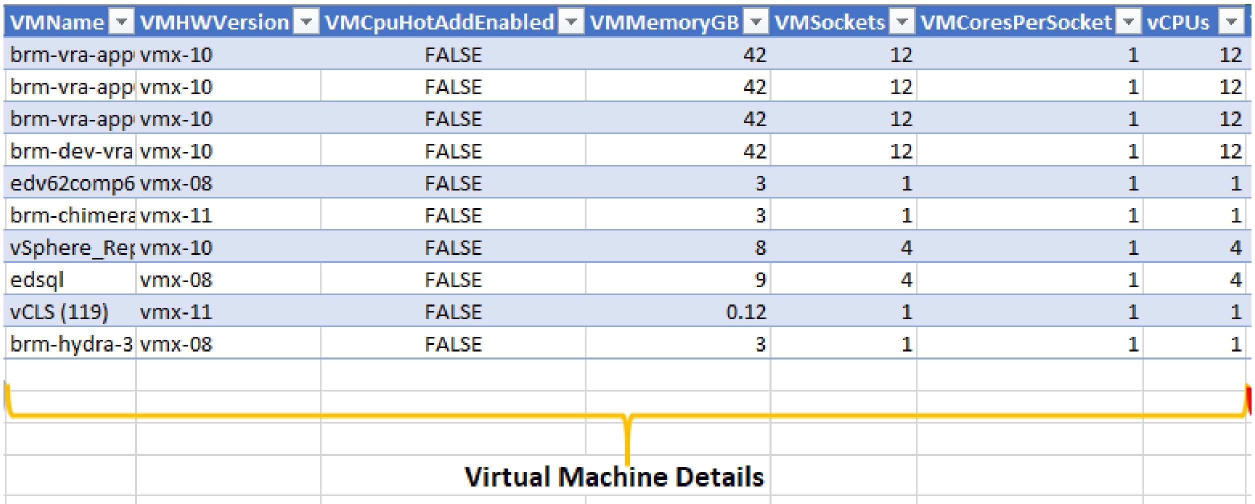
vCenter	Cluster	ClusterMinMemoryGB	ClusterMinSockets	ClusterMinCoresPerSocket	DRSEnabled
brm-prod-vc.brmst	Colorado Management Clu	768	2	10	TRUE
brm-prod-vc.brmst	Colorado Management Clu	768	2	10	TRUE
brm-prod-vc.brmst	Colorado Management Clu	768	2	10	TRUE
brm-prod-vc.brmst	Colorado Management Clu	768	2	10	TRUE
brm-prod-vc.brmst	vSAN Production	128	2	4	TRUE
brm-prod-vc.brmst	vSAN Production	128	2	4	TRUE
brm-prod-vc.brmst	vSAN Production	128	2	4	TRUE
brm-prod-vc.brmst	vSAN Production	128	2	4	TRUE
brm-prod-vc.brmst	Smash Lab 6.7	16	4	1	FALSE
brm-prod-vc.brmst	GP Cluster 2 - NSX-V	768	2	10	TRUE

- **vCenter Name**
- **Cluster Details:** Shows the minimum amount of memory, CPU sockets, and cores per socket on a host in the cluster. This is used in calculating if a VM would be not be optimal if vMotioned to that host.



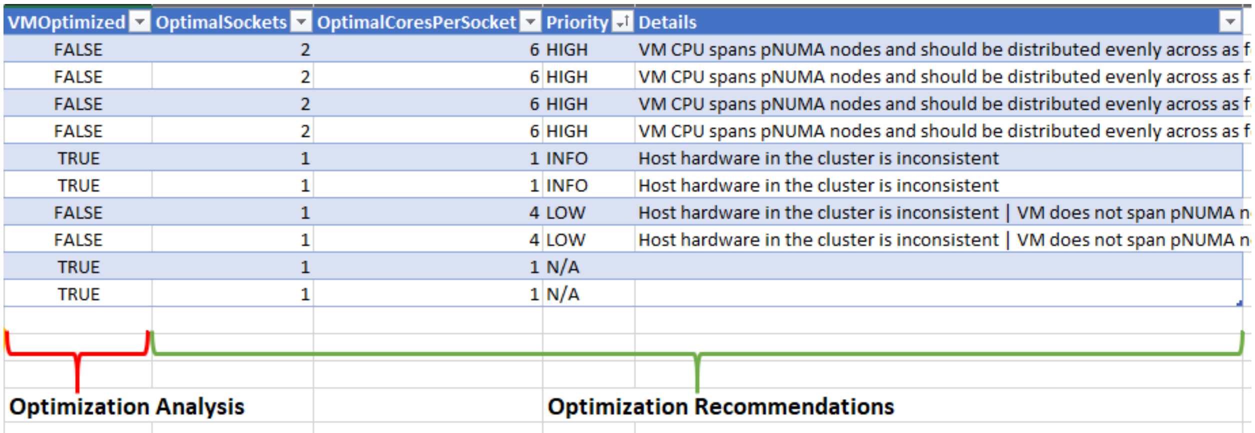
HostName	ESXi_Version	HostMemoryGB	HostSockets	HostCoresPerSocket	HostCpuThreads	HostHTActive	HostPowerPolicy
brm-dell-01.b	7.0.1	768	2	10	40	TRUE	Balanced
brm-dell-02.b	7.0.1	768	2	10	40	TRUE	Balanced
brm-dell-02.b	7.0.1	768	2	10	40	TRUE	Balanced
brm-dell-01.b	7.0.1	768	2	10	40	TRUE	Balanced
brm-dell-vsar	7.0.1	192	2	4	8	FALSE	Balanced
brm-dell-vsar	7.0.1	192	2	4	8	FALSE	Balanced
brm-dell-vsar	7.0.1	192	2	4	8	FALSE	Balanced
brm-dell-vsar	7.0.1	192	2	4	8	FALSE	Balanced
brm-smash-0	6.7.0	16	4	1	4	FALSE	Balanced
brm-dell-06.b	7.0.1	768	2	10	40	TRUE	Balanced

- **Host Details:** Information on the current host the VM is running on. Used to calculate the physical NUMA topology. The Host Power Policy is recommended to be set to High Performance for VMs with more than 8 vCPUs.



VMName	VMHWVersion	VMCpuHotAddEnabled	VMMemoryGB	VMSockets	VMCoresPerSocket	vCPUs
brm-vra-app	vmx-10	FALSE	42	12	1	12
brm-vra-app	vmx-10	FALSE	42	12	1	12
brm-vra-app	vmx-10	FALSE	42	12	1	12
brm-dev-vra	vmx-10	FALSE	42	12	1	12
edv62comp6	vmx-08	FALSE	3	1	1	1
brm-chimera	vmx-11	FALSE	3	1	1	1
vSphere_Re	vmx-10	FALSE	8	4	1	4
edsql	vmx-08	FALSE	9	4	1	4
vCLS (119)	vmx-11	FALSE	0.12	1	1	1
brm-hydra-3	vmx-08	FALSE	3	1	1	1

- **Virtual Machine Details:** Information from the VM that is used in calculating optimization

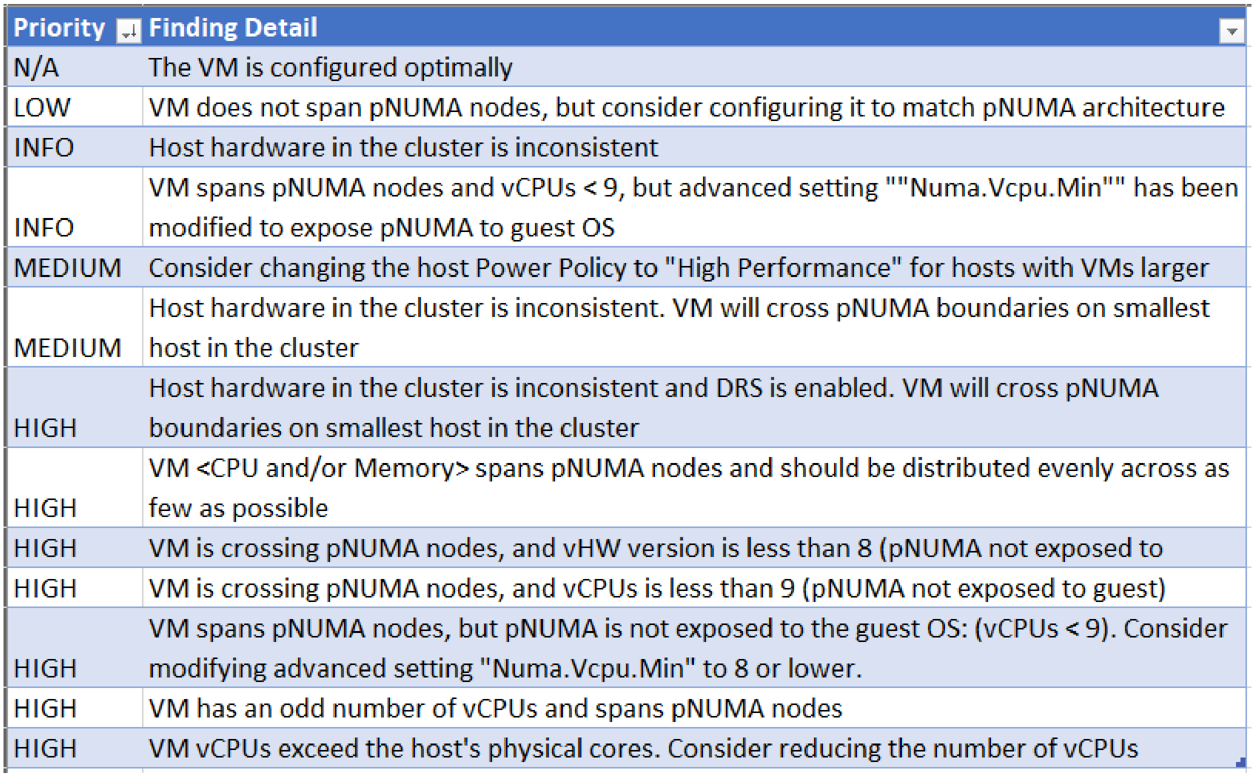


VMOptimized	OptimalSockets	OptimalCoresPerSocket	Priority	Details
FALSE	2	6	HIGH	VM CPU spans pNUMA nodes and should be distributed evenly across as f
FALSE	2	6	HIGH	VM CPU spans pNUMA nodes and should be distributed evenly across as f
FALSE	2	6	HIGH	VM CPU spans pNUMA nodes and should be distributed evenly across as f
FALSE	2	6	HIGH	VM CPU spans pNUMA nodes and should be distributed evenly across as f
TRUE	1	1	INFO	Host hardware in the cluster is inconsistent
TRUE	1	1	INFO	Host hardware in the cluster is inconsistent
FALSE	1	4	LOW	Host hardware in the cluster is inconsistent | VM does not span pNUMA n
FALSE	1	4	LOW	Host hardware in the cluster is inconsistent | VM does not span pNUMA n
TRUE	1	1	N/A	
TRUE	1	1	N/A	

- **Optimization Analysis:** Reports on whether the VM is optimized based on the host and VM information that was returned.
- **Recommendation for Optimization:** If the Analysis returned “TRUE,” then the recommendation will match the current VM configuration. If it returned “FALSE,” then OptimalSockets and OptimalCores will show how you should configure this VM to optimize performance. The Details will include why the recommendations were made.

Possible Priorities and Results

Note that a VM can have multiple findings, and the priority will be calculated on the highest finding.



Priority	Finding Detail
N/A	The VM is configured optimally
LOW	VM does not span pNUMA nodes, but consider configuring it to match pNUMA architecture
INFO	Host hardware in the cluster is inconsistent
INFO	VM spans pNUMA nodes and vCPUs < 9, but advanced setting ""Numa.Vcpu.Min"" has been modified to expose pNUMA to guest OS
MEDIUM	Consider changing the host Power Policy to "High Performance" for hosts with VMs larger
MEDIUM	Host hardware in the cluster is inconsistent. VM will cross pNUMA boundaries on smallest host in the cluster
HIGH	Host hardware in the cluster is inconsistent and DRS is enabled. VM will cross pNUMA boundaries on smallest host in the cluster
HIGH	VM <CPU and/or Memory> spans pNUMA nodes and should be distributed evenly across as few as possible
HIGH	VM is crossing pNUMA nodes, and vHW version is less than 8 (pNUMA not exposed to
HIGH	VM is crossing pNUMA nodes, and vCPUs is less than 9 (pNUMA not exposed to guest)
HIGH	VM spans pNUMA nodes, but pNUMA is not exposed to the guest OS: (vCPUs < 9). Consider modifying advanced setting "Numa.Vcpu.Min" to 8 or lower.
HIGH	VM has an odd number of vCPUs and spans pNUMA nodes
HIGH	VM vCPUs exceed the host's physical cores. Consider reducing the number of vCPUs

Running the VMCO Module Stand Alone

The script “Virtual_Machine_Computer_Optimizer.ps1” is intended to be the easy button for those that are not familiar with Powershell; Specifically installing Powershell Modules and exporting the resulting objects to a CSV or other consumable format. You can also install the module directly and have more flexibility in how you use it. To install the module from the Powershell Gallery, simply type the following at a Powershell prompt:

Install-Module -Name VMCO -Scope CurrentUser

Using VMCO this way assumes some knowledge of Powershell, and will require the following:

- Powershell version 5 or higher
- The PowerCLI Module installed (VMware.VimAutomation.Core)
- A connection to a vCenter server prior to running

Installing the VMCO module enables the function Get-OptimalvCPU. Details on how to run it can be seen by typing the following command:

```
Get-Help Get-OptimalvCPU
```

Examples:

Gets all VMs from currently connected vCenters

```
Get-OptimalvCPU
```

Exports results to csv

```
Get-OptimalvCPU | Export-CSV -path "c:\temp\vNUMA.csv" -NoTypeInformation
```

Opens results in a grid window - Windows OS only

```
Get-OptimalvCPU | Out-GridView
```

#Gets results on only the VM named "MyVmName"

```
Get-OptimalvCPU -vmName "MyVmName"
```

#Gets results on any VM with "NY-DC" in its name

```
Get-OptimalvCPU -vmName (Get-VM -Name "*NY-DC*")
```

#Returns all vCenter, Cluster, and VMHost information

```
Get-OptimalvCPU -full
```

Generates report based on VMware TAM TDM reports in JSON format

```
Get-OptimalvCPU -tdmJsonFile <FilePath> | Export-CSV -Path "c:\temp\VMCO_Report.csv" -NoTypeInformation
```