How to choose a GPU for your environment with the game Skyrim

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university of groningen / center for information technology

NVIDIA

The Elder Scrolls V SKYRIM

About me

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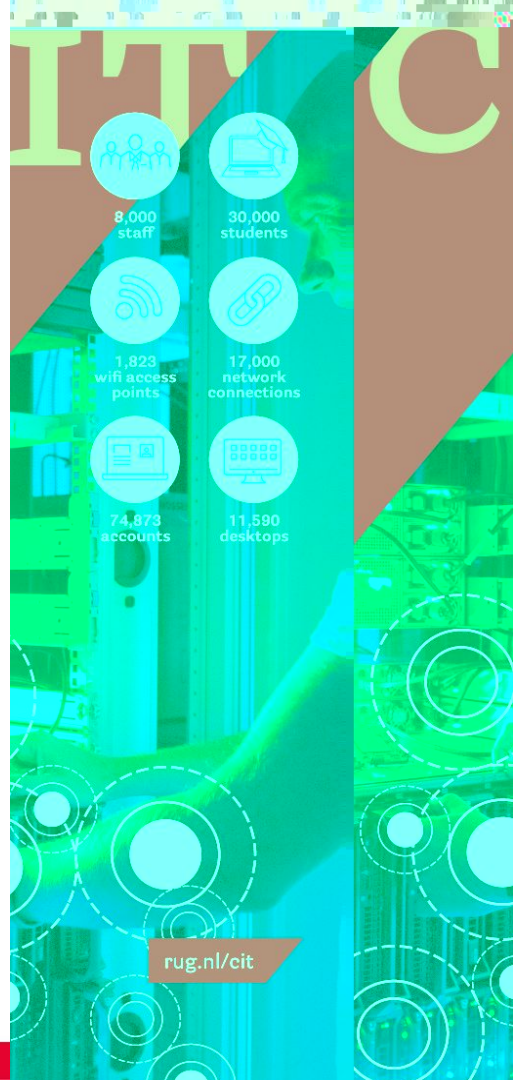
About the University

I'm working at the CIT (Center for Information Technology)

- Virtual Reality and Visualisation
- High Performance Computing
- Geo Services
- Data Science

And of course we have an amazing VMware environment



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Overview

- Create a baseline
- Tools to use
- Set up a benchmark
- The fun part, playing Skyrim
- Collect and review the results

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NVIDIA-cards and use cases

NVIDIA Virtual GPU Hardware

Recommended GPUs for Different Use Cases	
High-end professional graphics users; includes use for double-precision compute workloads (e.g., running 3D models and design workflows, intensive computer-aided engineering [CAE] simulations)	P100, V100
Mid-level to high-end professional graphics users; includes use for single-precision compute workloads (e.g., rendering and creating complex designs)	P40
Entry to mid-level professional graphics users, including deep learning inference workloads and Pascal features	P4
Entry to mid-level professional graphics users, including support for heterogeneous profiles and a larger number of original equipment manufacturer (OEM) server certifications	M60
Best for blade form factor	M6, P6
Best Density and Performance for the Knowledge Worker	M10

V100 support only available with NVIDIA virtual GPU software March 2018 release (version 6.0).

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My playground

Dell PowerEdge R720
2x Intel Xeon CPU E5-2660 0 @ 2.20GHz
384 GB memory
10 GBit network
VMware ESXi, 6.7.0, 8169922

NVIDIA P40
NVIDIA M10
Driver version: 390.57 (GRID 6.2)

The VM

Windows 10 Enterprise
Version: 1709

Horizon View
7.3.2 build-7161118

Skyrim: The Elder Scrolls V

But why Skyrim …

NVIDIA-SMI

```
[root@lRED01:~] nvidia-smi dmon -s puct
# gpu    pwr gtemp mtemp     sm    mem    enc    dec   mclk   pclk rxpci txpci
# Idx      W     C     C      %      %      %      %    MHz    MHz   MB/s   MB/s
    0     60     44     -     25     11      8      0   3615    898    281     35
    0     58     44     -     23     11      8      0   3615    898    231     49
    0     57     44     -     25     12      8      0   3615    898    385     32
    0     60     44     -     27     12      8      0   3615    898    293     33
    0     60     44     -     29     12      8      0   3615    898    404     46
    0     56     44     -     27     11      8      0   3615    898    430     61
    0     56     44     -     25      9      7      0   3615    898    509     50
    0     59     44     -     23      8      7      0   3615    898    644     55
    0     55     44     -     22      8      7      0   3615    898    476     79
    0     59     44     -     26     11      8      0   3615    898    499     63
    0     61     44     -     25     11      8      0   3615    898    274     58
    0     60     44     -     24     11      8      0   3615    898    217     30
    0     58     44     -     22      9      6      0   3615    898    244     34
```

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NVIDIA-SMI

Monitor the GPU engines: nvidia-smi vgpu -u

statistic	column
3D/Compute	sm
Memory controller Bandwidth	mem
Video encoder	enc
Video decoder	dec

```
[root@1RED01:~] nvidia-smi vgpu -u
# GPU        vGPU     sm    mem    enc    dec
# Idx          Id      %      %      %      %
    0     2103556     17     13      7      3
    0     2103556     13     11      7      2
    0     2103556     13     10      7      3
    0     2103556     12     10      6      2
    0     2103556     12     10      6      2
    0     2103556     12     10      6      3
    0     2103556     12     10      6      2
    0     2103556     12     10      6      2
    0     2103556     13     10      7      2
    0     2103556     13     10      7      2
```

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NVIDIA-SMI

nvidia-smi --loop=2 --query-gpu=timestamp,pstate,temperature.gpu,utilization.gpu,utilization.memory --format=csv

```
timestamp, pstate, temperature.gpu, utilization.gpu [%], utilization.memory [%]
2018/09/20 19:21:02.924, P8, 33, 38 %, 24 %
2018/09/20 19:21:04.926, P8, 33, 31 %, 19 %
2018/09/20 19:21:06.927, P8, 33, 32 %, 20 %
2018/09/20 19:21:08.929, P8, 33, 27 %, 20 %
2018/09/20 19:21:10.932, P8, 33, 33 %, 26 %
2018/09/20 19:21:12.935, P8, 33, 27 %, 20 %
2018/09/20 19:21:14.937, P8, 33, 28 %, 22 %
2018/09/20 19:21:16.940, P8, 33, 27 %, 21 %
2018/09/20 19:21:18.943, P8, 33, 30 %, 22 %
2018/09/20 19:21:20.945, P8, 33, 30 %, 23 %
2018/09/20 19:21:22.947, P8, 33, 30 %, 22 %
```

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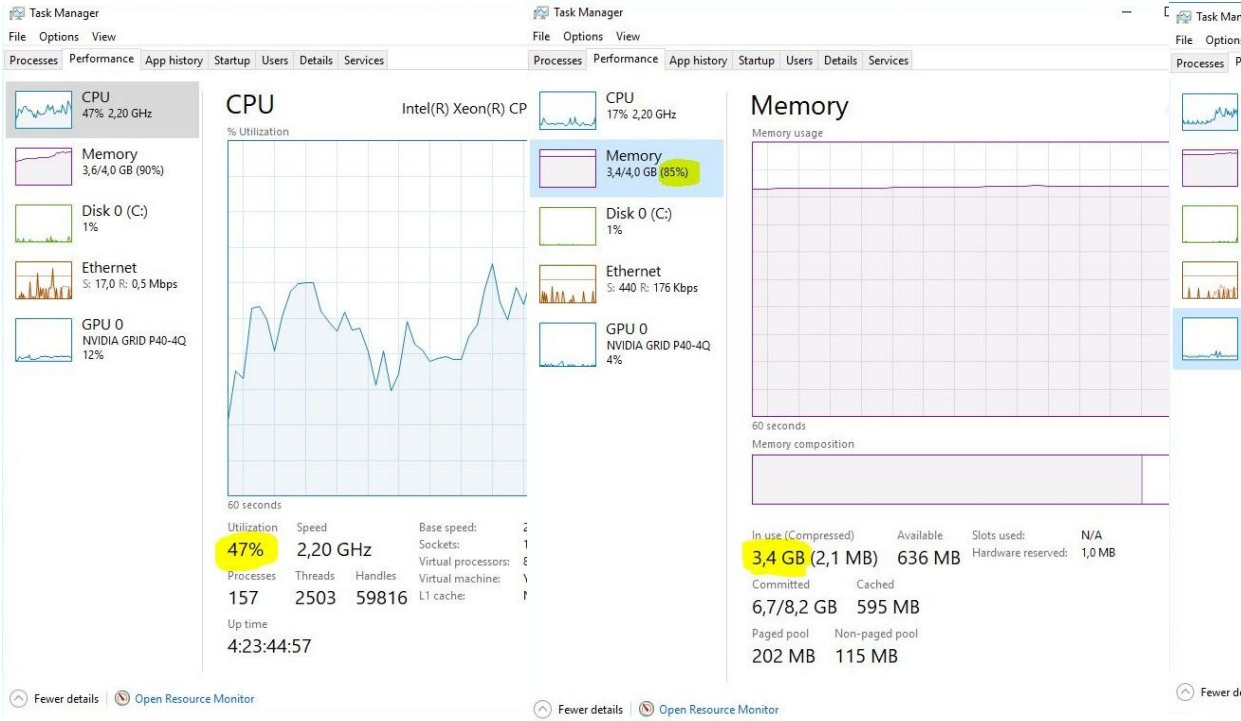
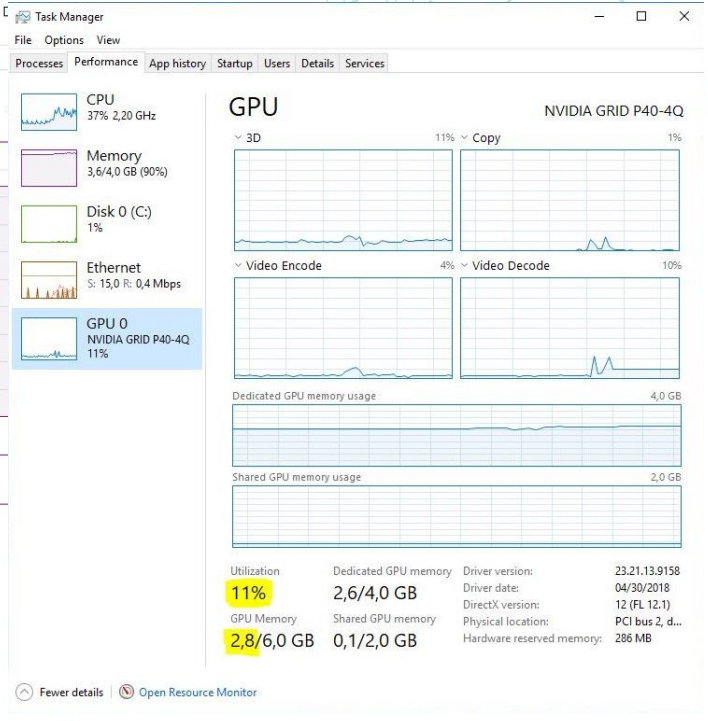
Windows Powershell





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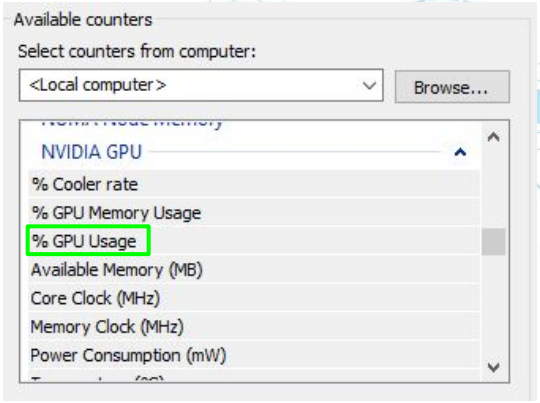
Windows Powershell

For monitoring for Windows Powershell

A part of a custom script I wrote




```powershell
$Array = @()
# the loop
while ($true){

$Server = 'localhost'

    # time
    $date = Get-Date -format T

    # Processor utilization
    $Processor = (Get-WmiObject -ComputerName $Server -Class win32_processor -ErrorAction Stop | Measure-Object -Property LoadPercentage -Average | Select-Object Average).Average

    # Memory utilization
    $ComputerMemory = Get-WmiObject -ComputerName $Server -Class win32_operatingsystem -ErrorAction Stop
    $Memory = ((($ComputerMemory.TotalVisibleMemorySize - $ComputerMemory.FreePhysicalMemory)*100)/ $ComputerMemory.TotalVisibleMemorySize)
    $RoundMemory = [math]::Round($Memory)

    # gpu utilization
    $counter = "\NVIDIA GPU(*)\% GPU Usage"
    $data = get-counter $counter
    $data5 = $data.countersamples.CookedValue

    # gpu memory dedicated use
    $raw_data = (Get-WmiObject -ComputerName $Server -Class Win32_PerfFormattedData_GPUPerformanceCounters_GPUAdapterMemory -ErrorAction Stop | Measure-Object -Property DedicatedUsage -sum | Select-Object sum).sum
    $raw_data2 = $raw_data /1000/1000/1000
    $data3 = [math]::round($raw_data2, 2)
```

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Windows Powershell

Time	CPU%	Memory%	Gpu%	GPU-memory-GB
11:30:23	10	47	4	0.55
11:30:28	21	47	5	0.55
11:30:33	15	47	17	0.97
11:30:38	16	48	18	1.55
11:30:43	91	53	28	1.7
11:30:49	49	53	20	1.7
11:30:54	65	54	21	1.7
11:30:59	40	56	21	2.87
11:31:04	38	57	32	2.87
11:31:09	38	59	36	2.87
11:31:14	43	64	33	2.87
11:31:20	41	69	38	2.87

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Benchmark

Skyrim on ultra, 2650 x 1440 screen resolution

Time period of 15 minutes

Intervals of 2 seconds

Change only 1 thing at the time!

Use the same base line every test

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Test-matrix

I ran the test-matrix on the M10 and on the P40

	CPU	Mem Gb	GPU Gb
test-1	4	4	2
test-2	4	4	4
test-3	8	4	2
test-4	8	4	4

I only used Q-profiles, cause I've been testing with 4Gb of GPU memory

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The fun part, actually playing Skyrim!

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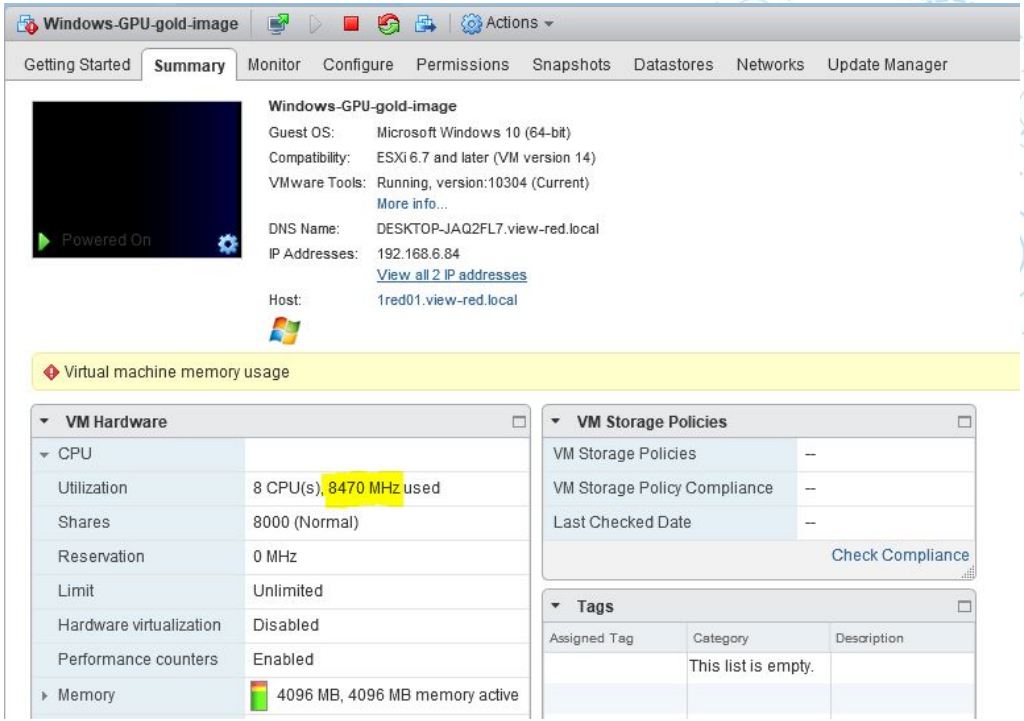
During the testing

To test how the game will respond I put a limit on the CPU usage

- 3000 MHz
- 4500 MHz
- 6000 MHz



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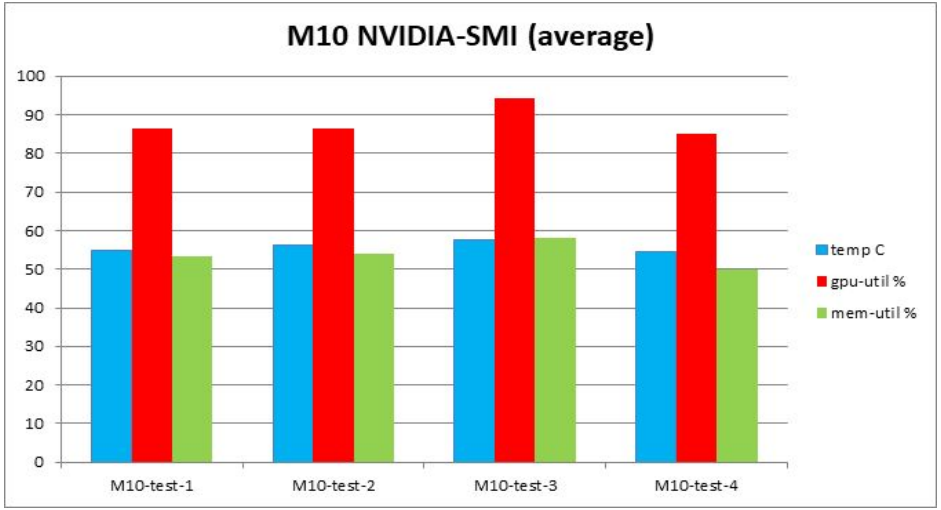
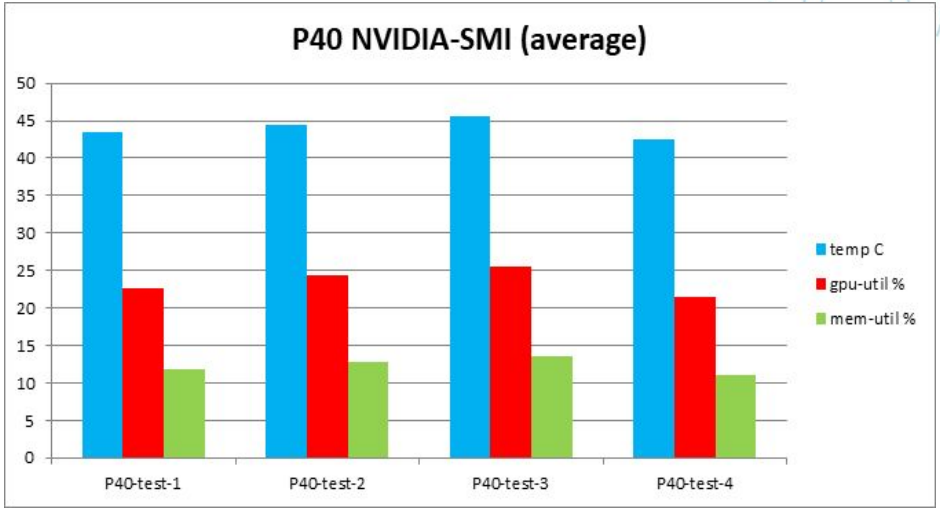
Metrics





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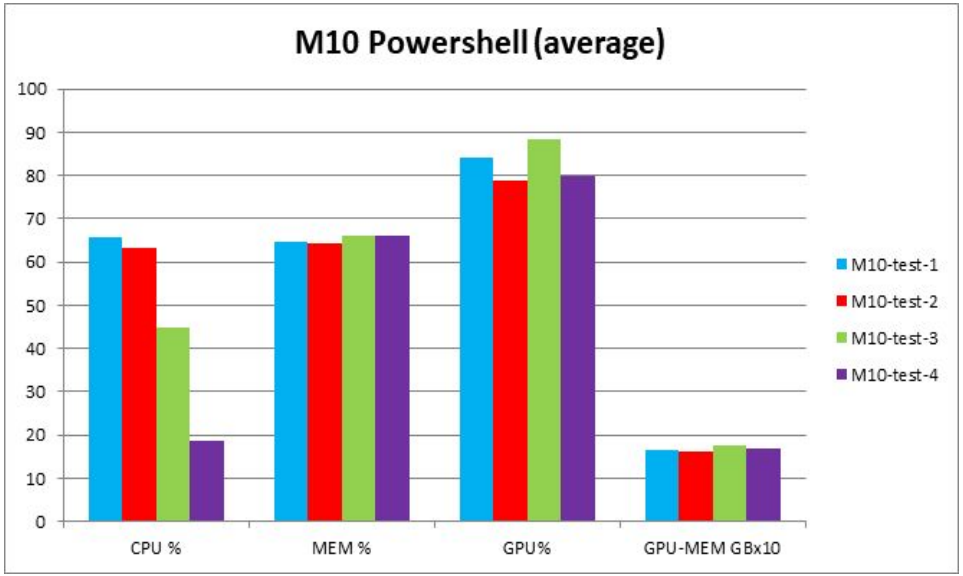
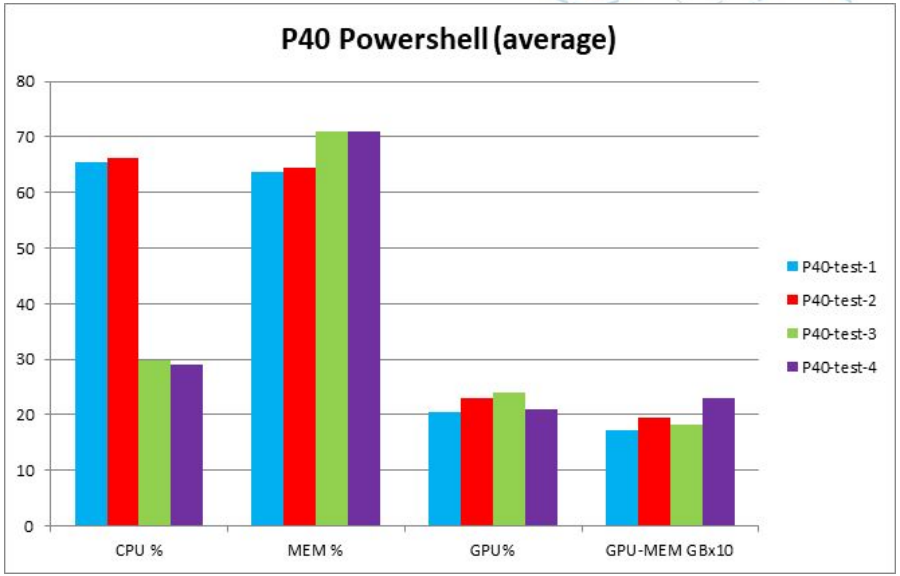
Metrics





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Something for you to think about

Let’s say, it will probably not happen often that all your users are working on the exact same time with the exact same workload on the exact same ESXi host and NVIDIA-card??

Will it ?

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