



# VIRTUAL GPU SOFTWARE R390 FOR RED HAT ENTERPRISE LINUX WITH KVM

RN-08687-001 \_v6.0 through 6.4 Revision 02 | May 2020

## Release Notes



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# Chapter 1.

## RELEASE NOTES

These *Release Notes* summarize current status, information on validated platforms, and known issues with NVIDIA vGPU software and associated hardware on Red Hat Enterprise Linux with KVM.

The releases in this release family of NVIDIA vGPU software include the software listed in the following table:

Software	6.0	6.1	6.2	6.3	6.4
NVIDIA Virtual GPU Manager for the Red Hat Enterprise Linux with KVM releases listed in <a href="#">Hypervisor Software Releases</a>	Not supported	390.57	390.72	390.94	390.113
NVIDIA Windows driver	391.03	391.58	391.81	392.05	392.37
NVIDIA Linux driver	390.42	390.57	390.75	390.96	390.115



### Caution

If you install the wrong NVIDIA vGPU software packages for the version of Red Hat Enterprise Linux with KVM you are using, NVIDIA Virtual GPU Manager will fail to load.

The releases of the vGPU Manager and guest VM drivers that you install must be compatible. Different versions of the vGPU Manager and guest VM driver from within the same main release branch can be used together. For example, you can use the vGPU Manager from release 6.1 with guest VM drivers from release 6.0. However, versions of the vGPU Manager and guest VM driver from different main release branches cannot be used together. For example, you cannot use the vGPU Manager from release 6.1 with guest VM drivers from release 5.2.

See [VM running older NVIDIA vGPU drivers fails to initialize vGPU when booted](#).

This requirement does not apply to the NVIDIA vGPU software license server. All releases of NVIDIA vGPU software are compatible with **all** releases of the license server.

## 1.1. Updates in Release 6.0

### New Features in Release 6.0

- ▶ New -2B vGPU type for each supported GPU
- ▶ vGPU support for NVML accounting functions
- ▶ vGPU support for `nvidia-smi` accounting modes
- ▶ Change of default scheduler to best effort scheduler for GPUs based on the NVIDIA<sup>®</sup> Pascal<sup>™</sup> architecture
- ▶ Change of maximum resolution for unlicensed GPUs based on the Pascal architecture to 1280×1024
- ▶ Plain-text logging on Windows of significant licensing events
- ▶ New setting `EnableLogging` for disabling or enabling logging of significant licensing events
- ▶ Miscellaneous bug fixes

### Hardware and Software Support Introduced in Release 6.0

- ▶ Support for GPUs based on the NVIDIA<sup>®</sup> Volta architecture
- ▶ Support for Windows 10 Fall Creators Update (1709) as a guest OS
- ▶ Support for Windows Server 2016 1607 and 1709 as a guest OS

## 1.2. Updates in Release 6.1

### New Features in Release 6.1

- ▶ Change in behavior to enable logging of licensing events on Windows by default
- ▶ Miscellaneous bug fixes

### Hardware and Software Support Introduced in Release 6.1

- ▶ Support for GPU pass through on Red Hat Enterprise Linux with KVM 7.5 and Red Hat Virtualization (RHV) 4.1 and 4.2
- ▶ Support for vGPU on Red Hat Enterprise Linux with KVM 7.5 and RHV 4.2
- ▶ Support for the Tesla V100 SXM2 32GB GPU
- ▶ Support for the Tesla V100 PCIe 32GB GPU

## 1.3. Updates in Release 6.2

### New Features in Release 6.2

- ▶ New -2B4 vGPU type, which supports up to four displays at resolutions up to 2560×1600 for each supported GPU
- ▶ Relaxation of restrictions on unlicensed vGPUs to allow screen resolutions higher than 1280×1024
- ▶ Miscellaneous bug fixes

## 1.4. Updates in Release 6.3

### New Features in Release 6.3

- ▶ Inclusion of the name and version of the licensed product in logged license acquisition events
- ▶ Ability to disable pop-up notifications for license state changes
- ▶ Miscellaneous bug fixes

## 1.5. Updates in Release 6.4

### New Features in Release 6.4

- ▶ Miscellaneous bug fixes
- ▶ Security updates - see [Security Updates](#)

# Chapter 2.

## VALIDATED PLATFORMS

This release family of NVIDIA vGPU software provides support for several NVIDIA GPUs on validated server hardware platforms, Red Hat Enterprise Linux with KVM hypervisor software versions, and guest operating systems. It also supports the version of NVIDIA CUDA Toolkit that is compatible with R390 drivers.

### 2.1. Supported NVIDIA GPUs and Validated Server Platforms

This release of NVIDIA vGPU software provides support for the following NVIDIA GPUs on Red Hat Enterprise Linux with KVM, running on validated server hardware platforms:

- ▶ Tesla M6
- ▶ Tesla M10
- ▶ Tesla M60
- ▶ Tesla P4
- ▶ Tesla P6
- ▶ Tesla P40
- ▶ Tesla P100 PCIe 16 GB
- ▶ Tesla P100 SXM2 16 GB
- ▶ Tesla P100 PCIe 12GB
- ▶ Tesla V100 SXM2
- ▶ Tesla V100 SXM2 32GB
- ▶ Tesla V100 PCIe
- ▶ Tesla V100 PCIe 32GB
- ▶ Tesla V100 FHHL

For a list of validated server platforms, refer to [NVIDIA GRID Certified Servers](#).



Tesla M60 and M6 GPUs support compute mode and graphics mode. NVIDIA vGPU requires GPUs that support both modes to operate in graphics mode.

Recent Tesla M60 GPUs and M6 GPUs are supplied in graphics mode. However, your GPU might be in compute mode if it is an older Tesla M60 GPU or M6 GPU, or if its mode has previously been changed.

To configure the mode of Tesla M60 and M6 GPUs, use the `gpumodeswitch` tool provided with NVIDIA vGPU software releases.

## 2.2. Hypervisor Software Releases

This release supports **only** the hypervisor software release listed in the table.



If a specific release, even an update release, is not listed, it's **not** supported.

Software	Releases Supported	Notes
Red Hat Enterprise Linux with KVM	7.0, 7.1	Only the following NVIDIA GPUs are supported in pass-through mode only: <ul style="list-style-type: none"> <li>▶ Tesla M6</li> <li>▶ Tesla M10</li> <li>▶ Tesla M60</li> </ul>
Red Hat Enterprise Linux with KVM	7.2 through 7.4	All NVIDIA GPUs that support NVIDIA vGPU software are supported in pass-through mode only.
Since 6.1: Red Hat Enterprise Linux with KVM	7.5	All NVIDIA GPUs that support NVIDIA vGPU software are supported with vGPU and in pass-through mode.
Since 6.1: Red Hat Virtualization (RHV)	4.1, 4.2	All NVIDIA GPUs that support NVIDIA vGPU software are supported with vGPU and in pass-through mode.

## 2.3. Guest OS Support

NVIDIA vGPU software supports several Windows releases and Linux distributions as a guest OS. The supported guest operating systems depend on the hypervisor software version.



Use only a guest OS release that is listed as supported by NVIDIA vGPU software with your virtualization software. To be listed as supported, a guest OS release must be supported not only by NVIDIA vGPU software, but also by your virtualization software.

NVIDIA cannot support guest OS releases that your virtualization software does not support.

In pass-through mode, GPUs based on the Pascal architecture or Volta architecture support only 64-bit guest operating systems. No 32-bit guest operating systems are supported in pass-through mode for these GPUs.

## 2.3.1. Windows Guest OS Support



Red Hat Enterprise Linux with KVM and Red Hat Virtualization (RHV) support Windows guest operating systems only under specific Red Hat subscription programs. For details, see:

- ▶ [Certified guest operating systems for Red Hat Enterprise Linux with KVM](#)
- ▶ [Certified Guest Operating Systems in Red Hat OpenStack Platform and Red Hat Enterprise Virtualization](#)

NVIDIA vGPU software supports **only** the Windows releases listed in the table as a guest OS on Red Hat Enterprise Linux with KVM. The releases of Red Hat Enterprise Linux with KVM for which a Windows release is supported depend on whether NVIDIA vGPU or pass-through GPU is used. When configured for NVIDIA vGPU, GPUs based on the Volta architecture support only 64-bit Windows guest operating systems. No 32-bit Windows guest operating systems are supported for these GPUs when configured for NVIDIA vGPU.



If a specific release, even an update release, is not listed, it's **not** supported.

Support for vGPU on Red Hat Enterprise Linux with KVM and RHV was introduced in NVIDIA vGPU software release 6.1. NVIDIA vGPU software release 6.0 supports only GPU pass through.

Guest OS	NVIDIA vGPU - Red Hat Enterprise Linux with KVM Releases	Pass-Through GPU - Red Hat Enterprise Linux with KVM Releases
Windows Server 2016 1607, 1709	<p>Since 6.1: RHEL KVM 7.5</p> <p>Since 6.1: RHV 4.2</p>	<p>RHEL KVM 7.4, 7.3, 7.2, 7.1, 7.0</p> <p>Since 6.1: RHEL KVM 7.5</p> <p>Since 6.1: RHV 4.2, 4.1</p>
Windows Server 2012 R2	<p>Since 6.1: RHEL KVM 7.5</p> <p>Since 6.1: RHV 4.2</p>	<p>RHEL KVM 7.4, 7.3, 7.2, 7.1, 7.0</p> <p>Since 6.1: RHEL KVM 7.5</p> <p>Since 6.1: RHV 4.2, 4.1</p>
Windows Server 2008 R2	<p>Since 6.1: RHEL KVM 7.5</p> <p>Since 6.1: RHV 4.2</p>	<p>RHEL KVM 7.4, 7.3, 7.2, 7.1, 7.0</p>

Guest OS	NVIDIA vGPU - Red Hat Enterprise Linux with KVM Releases	Pass-Through GPU - Red Hat Enterprise Linux with KVM Releases
		Since 6.1: RHEL KVM 7.5 Since 6.1: RHV 4.2, 4.1 Supported only on GPUs based on the Maxwell architecture
Windows 10 RTM (1507), November Update (1511), Anniversary Update (1607), Creators Update (1703), Fall Creators Update (1709) (64-bit)	Since 6.1: RHV 4.2	Since 6.1: RHV 4.2, 4.1
Windows 10 RTM (1507), November Update (1511), Anniversary Update (1607), Creators Update (1703), Fall Creators Update (1709) (32-bit)	Since 6.1: RHV 4.2	Since 6.1: RHV 4.2, 4.1 Supported only on GPUs based on the Maxwell architecture
Windows 8.1 Update (64-bit)	Since 6.1: RHV 4.2	Since 6.1: RHV 4.2, 4.1
Windows 8.1 Update (32-bit)	Since 6.1: RHV 4.2	Since 6.1: RHV 4.2, 4.1 Supported only on GPUs based on the Maxwell architecture
Windows 7 (64-bit)	Since 6.1: RHV 4.2	Since 6.1: RHV 4.2, 4.1 Supported only on GPUs based on the Maxwell architecture
Windows 7 (32-bit)	Since 6.1: RHV 4.2 Supported only on GPUs based on the Maxwell and Pascal architectures	Since 6.1: RHV 4.2, 4.1 Supported only on GPUs based on the Maxwell architecture

## 2.3.2. Linux Guest OS Support

NVIDIA vGPU software supports **only** the 64-bit Linux distributions listed in the table as a guest OS on Red Hat Enterprise Linux with KVM. The releases of Red Hat Enterprise Linux with KVM for which a Linux release is supported depend on whether NVIDIA vGPU or pass-through GPU is used.



If a specific release, even an update release, is not listed, it's **not** supported.

Support for vGPU on Red Hat Enterprise Linux with KVM and RHV was introduced in NVIDIA vGPU software release 6.1. NVIDIA vGPU software release 6.0 supports only GPU pass through.

Guest OS	NVIDIA vGPU - Red Hat Enterprise Linux with KVM Releases	Pass-Through GPU - Red Hat Enterprise Linux with KVM Releases
Red Hat Enterprise Linux 7.0-7.4	<b>Since 6.1:</b> RHEL KVM 7.5 <b>Since 6.1:</b> RHV 4.2	RHEL KVM 7.4, 7.3, 7.2, 7.1, 7.0 <b>Since 6.1:</b> RHEL KVM 7.5 <b>Since 6.1:</b> RHV 4.2, 4.1
<b>Since 6.1:</b> Red Hat Enterprise Linux 7.5	<b>Since 6.1:</b> RHEL KVM 7.5 <b>Since 6.1:</b> RHV 4.2	RHEL KVM 7.4, 7.3, 7.2, 7.1, 7.0 <b>Since 6.1:</b> RHEL KVM 7.5 <b>Since 6.1:</b> RHV 4.2, 4.1
CentOS 7.0-7.4 See Note (1)	<b>Since 6.1:</b> RHEL KVM 7.5 <b>Since 6.1:</b> RHV 4.2	RHEL KVM 7.4, 7.3, 7.2, 7.1, 7.0 <b>Since 6.1:</b> RHEL KVM 7.5 <b>Since 6.1:</b> RHV 4.2, 4.1
<b>Since 6.1:</b> CentOS 7.5 See Note (1)	<b>Since 6.1:</b> RHEL KVM 7.5 <b>Since 6.1:</b> RHV 4.2	RHEL KVM 7.4, 7.3, 7.2, 7.1, 7.0 <b>Since 6.1:</b> RHEL KVM 7.5 <b>Since 6.1:</b> RHV 4.2, 4.1
Red Hat Enterprise Linux 6.6	<b>Since 6.1:</b> RHEL KVM 7.5 <b>Since 6.1:</b> RHV 4.2	<b>Since 6.1:</b> RHEL KVM 7.5 RHEL KVM 7.4, 7.3, 7.2, 7.1, 7.0 <b>Since 6.1:</b> RHV 4.2, 4.1
CentOS 6.6 See Note (1)	<b>Since 6.1:</b> RHEL KVM 7.5 <b>Since 6.1:</b> RHV 4.2	RHEL KVM 7.4, 7.3, 7.2, 7.1, 7.0 <b>Since 6.1:</b> RHEL KVM 7.5 <b>Since 6.1:</b> RHV 4.2, 4.1



1. CentOS is not a certified guest OS for Red Hat Enterprise Linux with KVM or RHV.

## 2.4. NVIDIA CUDA Toolkit Version Support

The releases in this release family of NVIDIA vGPU software support NVIDIA CUDA Toolkit 9.1.

For more information about NVIDIA CUDA Toolkit, see [CUDA Toolkit 9.1 Documentation](#).

# Chapter 3.

## KNOWN PRODUCT LIMITATIONS

Known product limitations for this release of NVIDIA vGPU software are described in the following sections.

### 3.1. vGPU profiles with 512 Mbytes or less of frame buffer support only 1 virtual display head on Windows 10

#### Description

To reduce the possibility of memory exhaustion, vGPU profiles with 512 Mbytes or less of frame buffer support only 1 virtual display head on a Windows 10 guest OS.

The following vGPU profiles have 512 Mbytes or less of frame buffer:

- ▶ Tesla M6-0B, M6-0Q
- ▶ Tesla M10-0B, M10-0Q
- ▶ Tesla M60-0B, M60-0Q

#### Workaround

Use a profile that supports more than 1 virtual display head and has at least 1 Gbyte of frame buffer.

## 3.2. NVENC requires at least 1 Gbyte of frame buffer

### Description

Using the frame buffer for the NVIDIA hardware-based H.264/HEVC video encoder (NVENC) may cause memory exhaustion with vGPU profiles that have 512 Mbytes or less of frame buffer. To reduce the possibility of memory exhaustion, NVENC is disabled on profiles that have 512 Mbytes or less of frame buffer. Application GPU acceleration remains fully supported and available for all profiles, including profiles with 512 Mbytes or less of frame buffer. NVENC support from both Citrix and VMware is a recent feature and, if you are using an older version, you should experience no change in functionality.

The following vGPU profiles have 512 Mbytes or less of frame buffer:

- ▶ Tesla M6-0B, M6-0Q
- ▶ Tesla M10-0B, M10-0Q
- ▶ Tesla M60-0B, M60-0Q

### Workaround

If you require NVENC to be enabled, use a profile that has at least 1 Gbyte of frame buffer.

## 3.3. VM running older NVIDIA vGPU drivers fails to initialize vGPU when booted

### Description

A VM running a version of the NVIDIA guest VM drivers from a previous main release branch, for example release 4.4, will fail to initialize vGPU when booted on a Red Hat Enterprise Linux with KVM platform running the current release of Virtual GPU Manager.

In this scenario, the VM boots in standard VGA mode with reduced resolution and color depth. The NVIDIA virtual GPU is present in **Windows Device Manager** but displays a warning sign, and the following device status:

```
Windows has stopped this device because it has reported problems. (Code 43)
```

Depending on the versions of drivers in use, the Red Hat Enterprise Linux with KVM VM's `/var/log/messages` log file reports one of the following errors:

- ▶ An error message:

```
vmiop_log: error: Unable to fetch Guest NVIDIA driver information
```

- ▶ A version mismatch between guest and host drivers:

```
vmiop_log: error: Guest VGX version(1.1) and Host VGX version(1.2) do not match
```

- ▶ A signature mismatch:

```
vmiop_log: error: VGPU message signature mismatch.
```

## Resolution

Install the current NVIDIA guest VM driver in the VM.

## 3.4. Virtual GPU fails to start if ECC is enabled

### Description

Tesla M60, Tesla M6, and GPUs based on the Pascal GPU architecture, for example Tesla P100 or Tesla P4, support error correcting code (ECC) memory for improved data integrity. Tesla M60 and M6 GPUs in graphics mode are supplied with ECC memory disabled by default, but it may subsequently be enabled using `nvidia-smi`. GPUs based on the Pascal GPU architecture are supplied with ECC memory enabled.

However, NVIDIA vGPU does not support ECC memory. If ECC memory is enabled, NVIDIA vGPU fails to start.

The following error is logged in the Red Hat Enterprise Linux with KVM host's `/var/log/messages` log file:

```
vmiop_log: error: Initialization: VGX not supported with ECC Enabled.
```

### Resolution

Ensure that ECC is disabled on all GPUs.

Before you begin, ensure that NVIDIA Virtual GPU Manager is installed on your hypervisor.

1. Use `nvidia-smi` to list the status of all GPUs, and check for ECC noted as enabled on GPUs.

```
# nvidia-smi -q
=====NVSMI LOG=====
Timestamp                : Tue Dec 19 18:36:45 2017
Driver Version            : 384.99
Attached GPUs             : 1
GPU 0000:02:00.0
```

```
[...]
Ecc Mode
  Current          : Enabled
  Pending         : Enabled
[...]
```

2. Change the ECC status to off on each GPU for which ECC is enabled.

- ▶ If you want to change the ECC status to off for all GPUs on your host machine, run this command:

```
# nvidia-smi -e 0
```

- ▶ If you want to change the ECC status to off for a specific GPU, run this command:

```
# nvidia-smi -i id -e 0
```

*id* is the index of the GPU as reported by `nvidia-smi`.

This example disables ECC for the GPU with index `0000:02:00.0`.

```
# nvidia-smi -i 0000:02:00.0 -e 0
```

3. Reboot the host.

4. Confirm that ECC is now disabled for the GPU.

```
# nvidia-smi -q
=====NVSMI LOG=====
Timestamp                : Tue Dec 19 18:37:53 2017
Driver Version           : 384.99
Attached GPUs            : 1
GPU 0000:02:00.0
[...]
Ecc Mode
  Current                : Disabled
  Pending                : Disabled
[...]
```

If you later need to enable ECC on your GPUs, run one of the following commands:

- ▶ If you want to change the ECC status to on for all GPUs on your host machine, run this command:

```
# nvidia-smi -e 1
```

- ▶ If you want to change the ECC status to on for a specific GPU, run this command:

```
# nvidia-smi -i id -e 1
```

*id* is the index of the GPU as reported by `nvidia-smi`.

This example enables ECC for the GPU with index `0000:02:00.0`.

```
# nvidia-smi -i 0000:02:00.0 -e 1
```

After changing the ECC status to on, reboot the host.

## 3.5. Single vGPU benchmark scores are lower than pass-through GPU

### Description

A single vGPU configured on a physical GPU produces lower benchmark scores than the physical GPU run in pass-through mode.

Aside from performance differences that may be attributed to a vGPU's smaller frame buffer size, vGPU incorporates a performance balancing feature known as Frame Rate Limiter (FRL). On vGPUs that use the best-effort scheduler, FRL is enabled. On vGPUs that use the fixed share or equal share scheduler, FRL is disabled.

FRL is used to ensure balanced performance across multiple vGPUs that are resident on the same physical GPU. The FRL setting is designed to give good interactive remote graphics experience but may reduce scores in benchmarks that depend on measuring frame rendering rates, as compared to the same benchmarks running on a pass-through GPU.

### Resolution

FRL is controlled by an internal vGPU setting. On vGPUs that use the best-effort scheduler, NVIDIA does not validate vGPU with FRL disabled, but for validation of benchmark performance, FRL can be temporarily disabled by setting `frame_rate_limiter=0` in the vGPU configuration file.

```
# echo "frame_rate_limiter=0" > /sys/bus/mdev/devices/vgpu-id/nvidia/vgpu_params
```

For example:

```
# echo "frame_rate_limiter=0" > /sys/bus/mdev/devices/aa618089-8b16-4d01-a136-25a0f3c73123/nvidia/vgpu_params
```

The setting takes effect the next time any VM using the given vGPU type is started.

With this setting in place, the VM's vGPU will run without any frame rate limit.

The FRL can be reverted back to its default setting as follows:

1. Clear all parameter settings in the vGPU configuration file.

```
# echo " " > /sys/bus/mdev/devices/vgpu-id/nvidia/vgpu_params
```



You cannot clear specific parameter settings. If your vGPU configuration file contains other parameter settings that you want to keep, you must reinstate them in the next step.

2. Set `frame_rate_limiter=1` in the vGPU configuration file.

```
# echo "frame_rate_limiter=1" > /sys/bus/mdev/devices/vgpu-id/nvidia/vgpu_params
```

If you need to reinstate other parameter settings, include them in the command to set `frame_rate_limiter=1`. For example:

```
# echo "frame_rate_limiter=1 disable_vnc=1" > /sys/bus/mdev/devices/aa618089-8b16-4d01-a136-25a0f3c73123/nvidia/vgpu_params
```

## 3.6. `nvidia-smi` fails to operate when all GPUs are assigned to GPU pass-through mode

### Description

If all GPUs in the platform are assigned to VMs in pass-through mode, `nvidia-smi` will return an error:

```
[root@vgx-test ~]# nvidia-smi
Failed to initialize NVML: Unknown Error
```

This is because GPUs operating in pass-through mode are not visible to `nvidia-smi` and the NVIDIA kernel driver operating in the Red Hat Enterprise Linux with KVM host.

To confirm that all GPUs are operating in pass-through mode, confirm that the `vfio-pci` kernel driver is handling each device.

```
# lspci -s 05:00.0 -k
05:00.0 VGA compatible controller: NVIDIA Corporation GM204GL [Tesla M60] (rev a1)
Subsystem: NVIDIA Corporation Device 113a
Kernel driver in use: vfio-pci
```

### Resolution

N/A

# Chapter 4.

## RESOLVED ISSUES

Only resolved issues that have been previously noted as known issues or had a noticeable user impact are listed. The summary and description for each resolved issue indicate the effect of the issue on NVIDIA vGPU software **before the issue was resolved**.

### Issues Resolved in Release 6.0

Bug ID	Summary and Description
200376678	<p><b>The license expires prematurely in Linux guest VMs</b></p> <p>In Linux guest VMs, the license expires before the default borrow period has elapsed. In normal operation, the license is renewed periodically at an interval that depends on the license borrow period. As a result, a failure to renew the license may cause the license to expire before the default borrow period has elapsed.</p>
200333574	<p><b>CILP is not working in Windows VMs</b></p> <p>CILP is not working in Windows VMs. If a CUDA application is running in one VM and a graphics application is running in another VM, the following errors occur:</p> <ul style="list-style-type: none"><li>▶ The CUDA application times out.</li><li>▶ A TDR is triggered in the VM that is running graphics application, which may cause flickering or an application crash.</li></ul>

### Issues Resolved in Release 6.1

Bug ID	Summary and Description
2075467	<p><b>The displays flicker each time a license is requested or renewed in Linux guest VMs</b></p>

Bug ID	Summary and Description
	Whenever a license is requested or renewed in Linux guest VMs, the displays are reconfigured and rescanned. Rescanning the displays causes the remoting solution to momentarily drop the connection and, as a result, the displays flicker.
200391532	<p><b>Issues in remote desktop sessions if a license is acquired after a session is started</b></p> <p>A VM might acquire a license for NVIDIA vGPU software after a remote desktop session has connected to the VM. In this situation, some licensed features and capabilities are not available to a properly licensed vGPU or pass-through GPU in the session. For example, the updated maximum resolution supported is not available.</p>

### Issues Resolved in Release 6.2

Bug ID	Summary and Description
2104867	<p><b>Screen resolution reverts to a lower value after a VM is rebooted</b></p> <p>When a VM is booted, the NVIDIA vGPU software graphics driver is initially unlicensed. Screen resolution is limited to a maximum of 1280×1024 until the VM requires a license for NVIDIA vGPU software.</p>
200407382	<p><b>Benign Calling <code>load_byte_array(tra)</code> messages are logged</b></p> <p>In Linux guest VMs, the Calling <code>load_byte_array(tra)</code> messages from the <code>nvidia-gridd</code> daemon are logged in <code>/var/log/syslog</code>.</p>

### Issues Resolved in Release 6.3

Bug ID	Summary and Description
2194234	<p><b>The mouse cursor moves slowly when traversing the Windows 10 Start menu</b></p> <p>When a user traverses the Windows 10 Start menu with the mouse, highlighting of items on the menu is slow and lags behind the motion of the mouse.</p>
200346607	<p><b>Licensing pop-up windows contain the text <code>microsoft.explorer.notification</code></b></p> <p>On Windows 10 Creators Update (1703), licensing pop-up windows contain the text <code>microsoft.explorer.notification</code>.</p>
2187717	<p><b>VMs configured with vGPU fail to power on on servers with 1 TB or more of system memory</b></p>

Bug ID	Summary and Description
	Support for vGPU is limited to servers with less than 1 TB of system memory. On servers with 1 TB or more of system memory, VMs configured with vGPU fail to power on. However, support for GPU pass through is not affected by this limitation.

#### Issues Resolved in Release 6.4

No resolved issues are reported in this release for Red Hat Enterprise Linux with KVM.

# Chapter 5.

## SECURITY UPDATES

### 5.1. Since 6.4: Restricting Access to GPU Performance Counters

The NVIDIA graphics driver contains a vulnerability (CVE-2018-6260) that may allow access to application data processed on the GPU through a side channel exposed by the GPU performance counters. To address this vulnerability, update the driver and restrict access to GPU performance counters to allow access only by administrator users and users who need to use CUDA profiling tools.

The GPU performance counters that are affected by this vulnerability are the hardware performance monitors used by the CUDA profiling tools such as CUPTI, Nsight Graphics, and Nsight Compute. These performance counters are exposed on the hypervisor host and in guest VMs only as follows:

- ▶ On the hypervisor host, they are always exposed. However, the Virtual GPU Manager does not access these performance counters and, therefore, is not affected.
- ▶ In Windows and Linux guest VMs, they are exposed **only** in VMs configured for GPU pass through. They are not exposed in VMs configured for NVIDIA vGPU.

#### 5.1.1. Windows: Restricting Access to GPU Performance Counters for One User by Using NVIDIA Control Panel

Perform this task from the guest VM to which the GPU is passed through.

Ensure that you are running **NVIDIA Control Panel** version 8.1.950.

1. Open **NVIDIA Control Panel**:
  - ▶ Right-click on the Windows desktop and select **NVIDIA Control Panel** from the menu.
  - ▶ Open **Windows Control Panel** and double-click the **NVIDIA Control Panel** icon.

2. In **NVIDIA Control Panel**, select the **Manage GPU Performance Counters** task in the **Developer** section of the navigation pane.
3. Complete the task by following the instructions in the **Manage GPU Performance Counters > Developer** topic in the **NVIDIA Control Panel** help.

## 5.1.2. Windows: Restricting Access to GPU Performance Counters Across an Enterprise by Using a Registry Key

You can use a registry key to restrict access to GPU Performance Counters for all users who log in to a Windows guest VM. By incorporating the registry key information into a script, you can automate the setting of this registry for all Windows guest VMs across your enterprise.

Perform this task from the guest VM to which the GPU is passed through.



**Caution** Only enterprise administrators should perform this task. Changes to the Windows registry must be made with care and system instability can result if registry keys are incorrectly set.

1. Set the `RmProfilingAdminOnly` Windows registry key to 1.

```
[HKLM\SYSTEM\CurrentControlSet\Services\nvlddmkm\Global\NVTweak]
Value: "RmProfilingAdminOnly"
Type: DWORD
Data: 00000001
```

The data value 1 restricts access, and the data value 0 allows access, to application data processed on the GPU through a side channel exposed by the GPU performance counters.

2. Restart the VM.

## 5.1.3. Linux Guest VMs and Hypervisor Host: Restricting Access to GPU Performance Counters

On systems where unprivileged users don't need to use GPU performance counters, restrict access to these counters to system administrators, namely users with the `CAP_SYS_ADMIN` capability set. By default, the GPU performance counters are not restricted to users with the `CAP_SYS_ADMIN` capability.

Perform this task from the guest VM to which the GPU is passed through or from your hypervisor host machine.

In Linux guest VMs, this task requires `sudo` privileges. On your hypervisor host machine, this task must be performed as the root user on the machine.

1. Log in to the guest VM or open a command shell on your hypervisor host machine.
2. Set the kernel module parameter `NVreg_RestrictProfilingToAdminUsers` to 1 by adding this parameter to the `/etc/modprobe.d/nvidia.conf` file.

- ▶ If you are setting only this parameter, add an entry for it to the `/etc/modprobe.d/nvidia.conf` file as follows:

```
options nvidia
NVreg_RegistryDwords="NVreg_RestrictProfilingToAdminUsers=1"
```

- ▶ If you are setting multiple parameters, set them in a single entry as in the following example:

```
options nvidia NVreg_RegistryDwords="RmPVMRL=0x0 "
"NVreg_RestrictProfilingToAdminUsers=1"
```

If the `/etc/modprobe.d/nvidia.conf` file does not already exist, create it.

3. Restart the VM or reboot your hypervisor host machine.

# Chapter 6.

## KNOWN ISSUES

### 6.1. Frame capture while the interactive logon message is displayed returns blank screen

#### Description

Because of a known limitation with NvFBC, a frame capture while the interactive logon message is displayed returns a blank screen.

An NvFBC session can capture screen updates that occur after the session is created. Before the logon message appears, there is no screen update after the message is shown and, therefore, a black screen is returned instead. If the NvFBC session is created after this update has occurred, NvFBC cannot get a frame to capture.

#### Workaround

Press **Enter** or wait for the screen to update for NvFBC to capture the frame.

#### Status

Not a bug

#### Ref. #

2115733

## 6.2. 6.1, 6.2 Only: VMs configured with vGPU fail to power on on servers with 1 TB or more of system memory

### Description

Support for vGPU is limited to servers with less than 1 TB of system memory. On servers with 1 TB or more of system memory, VMs configured with vGPU fail to power on. However, support for GPU pass through is not affected by this limitation.

This limitation applies only to systems with supported GPUs based on the Maxwell architecture: Tesla M6, Tesla M10, and Tesla M60.

### Resolution

1. Limit the amount of system memory on the server to 1 TB minus 16 GB.
2. Reboot the server.

If the problem persists, contact your server vendor for the recommended system memory configuration with NVIDIA GPUs.

### Status

Resolved in NVIDIA vGPU software release 6.3

### Ref. #

2187717

## 6.3. Even when the scheduling policy is equal share, unequal GPU utilization is reported

### Description

When the scheduling policy is equal share, unequal GPU engine utilization can be reported for the vGPUs on the same physical GPU.

For example, GPU engine usage for three P40-8Q vGPUs on a Tesla P40 GPU might be reported as follows:

```
[root@localhost:~] nvidia-smi vgpu
Wed Jun 27 10:33:18 2018
+-----+
| NVIDIA-SMI 390.59                Driver Version: 390.59          |
+-----+-----+
```

GPU	Name		Bus-Id		GPU-Util
vGPU ID	Name		VM ID	VM Name	vGPU-Util
0	Tesla P40		00000000:81:00.0		52%
	2122661	GRID P40-8Q	2122682	centos7.4-xmpl-211...	19%
	2122663	GRID P40-8Q	2122692	centos7.4-xmpl-211...	0%
	2122659	GRID P40-8Q	2122664	centos7.4-xmpl-211...	25%
1	Tesla P40		00000000:85:00.0		58%
	2122662	GRID P40-8Q	2122689	centos7.4-xmpl-211...	0%
	<b>2122658</b>	<b>GRID P40-8Q</b>	<b>2122667</b>	<b>centos7.4-xmpl-211...</b>	<b>59%</b>
	2122660	GRID P40-8Q	2122670	centos7.4-xmpl-211...	0%

The vGPU utilization of the vGPU 2122658 is reported as 59%. However, the expected vGPU utilization should not exceed 33%.

This behavior is a result of the mechanism that is used to measure GPU engine utilization.

## Status

Open

## Ref. #

2175888

## 6.4. When the scheduling policy is fixed share, GPU utilization is reported as higher than expected

### Description

When the scheduling policy is fixed share, GPU engine utilization can be reported as higher than expected for a vGPU.

For example, GPU engine usage for six P40-4Q vGPUs on a Tesla P40 GPU might be reported as follows:

```
[root@localhost:~] nvidia-smi vgpu
Mon Aug 20 10:33:18 2018
```

GPU	Name		Bus-Id		GPU-Util
vGPU ID	Name		VM ID	VM Name	vGPU-Util
0	Tesla P40		00000000:81:00.0		99%
	<b>85109</b>	<b>GRID P40-4Q</b>	<b>85110</b>	<b>win7-xmpl-146048-1</b>	<b>32%</b>
	<b>87195</b>	<b>GRID P40-4Q</b>	<b>87196</b>	<b>win7-xmpl-146048-2</b>	<b>39%</b>
	<b>88095</b>	<b>GRID P40-4Q</b>	<b>88096</b>	<b>win7-xmpl-146048-3</b>	<b>26%</b>
	89170	GRID P40-4Q	89171	win7-xmpl-146048-4	0%
	90475	GRID P40-4Q	90476	win7-xmpl-146048-5	0%

93363	GRID P40-4Q	93364	win7-xmpl-146048-6	0%
1	Tesla P40	00000000:85:00.0		0%

The vGPU utilization of vGPU 85109 is reported as 32%. For vGPU 87195, vGPU utilization is reported as 39%. And for 88095, it is reported as 26%. However, the expected vGPU utilization of any vGPU should not exceed approximately 16.7%.

This behavior is a result of the mechanism that is used to measure GPU engine utilization.

### Status

Open

### Ref. #

2227591

## 6.5. Since 6.1: License is not acquired in Windows VMs

### Description

When a windows VM configured with a licensed vGPU is started, the VM fails to acquire a license.

Error messages in the following format are written to the NVIDIA service logs:

```
[000000020.860152600 sec] - [Logging.lib] ERROR: [nvGridLicensing.FlexUtility]
353@FlexUtility::LogFneError : Error: Failed to add trusted storage. Server
URL : license-server-url -
[1,7E2,2,1[7000003F,0,9B00A7]]
```

```
System machine type does not match expected machine type..
```

### Workaround

This workaround requires administrator privileges.

1. Stop the **NVIDIA Display Container LS** service.
2. Delete the contents of the folder %SystemDrive%:\Program Files\NVIDIA Corporation\Grid Licensing.
3. Start the **NVIDIA Display Container LS** service.

### Status

Closed

**Ref. #**

200407287

## 6.6. Since 6.1: `nvidia-smi` reports that vGPU migration is supported on all hypervisors

**Description**

The command `nvidia-smi vgpu -m` shows that vGPU migration is supported on all hypervisors, even hypervisors or hypervisor versions that do not support vGPU migration.

**Status**

Closed

**Ref. #**

200407230

## 6.7. Screen resolution reverts to a lower value after a VM is rebooted

**Description**

When a VM is booted, the NVIDIA vGPU software graphics driver is initially unlicensed. Screen resolution is limited to a maximum of 1280×1024 until the VM requires a license for NVIDIA vGPU software. Because the higher resolutions are not available, the OS falls back to next available resolution in its mode list (for example, 1366×768) even if the resolution for the VM had previously been set to a higher value (for example, 1920×1080). After the license has been acquired, the OS does not attempt to set the resolution to a higher value.

This behavior is the expected behavior for licensed NVIDIA vGPU software products.

**Workaround**

Manually set the screen resolution to the required higher value after the VM has acquired the NVIDIA vGPU software license.

**Status**

Resolved in NVIDIA vGPU software release 6.2.

**Ref. #**

2104867

## 6.8. Hot plugging and unplugging vCPUs causes a blue-screen crash in Windows VMs

**Description**

Hot plugging or unplugging vCPUs causes a blue-screen crash in Windows VMs that are running NVIDIA vGPU software graphics drivers.

When the blue-screen crash occurs, one of the following error messages may also be seen:

- ▶ `SYSTEM_SERVICE_EXCEPTION (nvlddmkm.sys)`
- ▶ `DRIVER_IRQL_NOT_LESS_OR_EQUAL (nvlddmkm.sys)`

NVIDIA vGPU software graphics drivers do not support hot plugging and unplugging of vCPUs.

**Status**

Closed

**Ref. #**

2101499

## 6.9. 6.1 Only: Benign Calling `load_byte_array(tra)` messages are logged

**Description**

In Linux guest VMs, the following messages from the `nvidia-gridd` daemon are logged in `/var/log/syslog`:

```
May 21 18:36:39 test-HVM-domU nvidia-gridd: Started (657)
May 21 18:36:39 test-HVM-domU nvidia-gridd: Ignore Service Provider Licensing.
May 21 18:36:39 test-HVM-domU nvidia-gridd: Calling load_byte_array(tra)
May 21 18:36:41 test-HVM-domU nvidia-gridd: Acquiring license for GRID vGPU
Edition.
May 21 18:36:41 test-HVM-domU nvidia-gridd: Calling load_byte_array(tra)
May 21 18:36:43 test-HVM-domU nvidia-gridd: License acquired successfully.
Server URL : http://192.0.2.117:7070/request
```

## Workaround

Ignore these messages as they are benign.

## Status

Resolved in NVIDIA vGPU software release 6.2.

## Ref. #

200407382

# 6.10. 6.0 Only: Issues in remote desktop sessions if a license is acquired after a session is started

## Description

A VM might acquire a license for NVIDIA vGPU software after a remote desktop session has connected to the VM. In this situation, some licensed features and capabilities are not available to a properly licensed vGPU or pass-through GPU in the session. For example, the updated maximum resolution supported is not available.

## Workaround

Before attempting this workaround, confirm that the VM has obtained the correct license for NVIDIA vGPU software.

1. After installing the guest VM driver package and configuring required license settings on the VM (or on the master image used for VM deployment), set the IgnoreSP property to 1.

- ▶ On Windows, add the following registry setting:

```
[HKEY_LOCAL_MACHINE\SOFTWARE\NVIDIA Corporation\Global\GridLicensing]
"IgnoreSP"=dword:00000001
```

- ▶ On Linux, add the following setting to the file `/etc/nvidia/gridd.conf`:

```
IgnoreSP=1
```

2. Restart the VM.

## Status

Resolved in NVIDIA vGPU software release 6.1.

## Ref. #

200391532

## 6.11. 6.0-6.2 Only: Licensing pop-up windows contain the text `microsoft.explorer.notification`

### Description

On Windows 10 Creators Update (1703), licensing pop-up windows contain the text `microsoft.explorer.notification`.

### Version

Windows 10 Creators Update (1703)

### Status

Resolved in NVIDIA vGPU software release 6.3

### Ref. #

200346607

## 6.12. Luxmark causes a segmentation fault on an unlicensed Linux client

### Description

If the Luxmark application is run on a Linux guest VM configured with NVIDIA vGPU that is booted without acquiring a license, a segmentation fault occurs and the application core dumps. The fault occurs when the application cannot allocate a CUDA object on NVIDIA vGPUs where CUDA is disabled. On NVIDIA vGPUs that can support CUDA, CUDA is disabled in unlicensed mode.

### Status

Not an NVIDIA bug.

### Ref. #

200330956

## 6.13. Resolution is not updated after a VM acquires a license and is restarted

### Description

In a Red Enterprise Linux 7.3 guest VM, an increase in resolution from 1024×768 to 2560×1600 is not applied after a license is acquired and the `gridd` service is restarted. This issue occurs if the `multimonitor` parameter is added to the `xorg.conf` file.

### Version

Red Enterprise Linux 7.3

### Status

Open

### Ref. #

200275925

## 6.14. NVIDIA vGPU encoder and process utilization counters don't work with Windows Performance Counters

### Description

GPU encoder and process utilization counter groups are listed in Windows Performance Counters, but no instances of the counters are available. The counters are disabled by default and must be enabled.

### Workaround

Enable the counters by running the following sequence of commands from a command shell:

```
wmic /namespace:nv path System call enableProcessUtilizationPerfCounter
```

```
wmic /namespace:nv path System call enableEncoderSessionsPerfCounter
```

If you need to disable the counters, run the following sequence of commands from a command shell:

```
wmic /namespace:nv path System call disableProcessUtilizationPerfCounter
```

```
wmic /namespace:nv path System call disableEncoderSessionsPerfCounter
```

**Status**

Open

**Ref. #**

1971698

## 6.15. A segmentation fault in DBus code causes `nvidia-gridd` to exit on Red Hat Enterprise Linux and CentOS

**Description**

On Red Hat Enterprise Linux 6.8 and 6.9, and CentOS 6.8 and 6.9, a segmentation fault in DBus code causes the `nvidia-gridd` service to exit.

The `nvidia-gridd` service uses DBus for communication with **NVIDIA X Server Settings** to display licensing information through the **Manage License** page. Disabling the GUI for licensing resolves this issue.

To prevent this issue, the GUI for licensing is disabled by default. You might encounter this issue if you have enabled the GUI for licensing and are using Red Hat Enterprise Linux 6.8 or 6.9, or CentOS 6.8 and 6.9.

**Version**

Red Hat Enterprise Linux 6.8 and 6.9

CentOS 6.8 and 6.9

**Status**

Open

**Ref. #**

- ▶ 200358191
- ▶ 200319854
- ▶ 1895945

## 6.16. No Manage License option available in NVIDIA X Server Settings by default

### Description

By default, the **Manage License** option is not available in **NVIDIA X Server Settings**. This option is missing because the GUI for licensing on Linux is disabled by default to work around the issue that is described in [A segmentation fault in Dbus code causes nvidia-gridd to exit on Red Hat Enterprise Linux and CentOS](#).

### Workaround

This workaround requires `sudo` privileges.



Do not use this workaround with Red Hat Enterprise Linux 6.8 and 6.9 or CentOS 6.8 and 6.9. To prevent a segmentation fault in Dbus code from causing the `nvidia-gridd` service from exiting, the GUI for licensing must be disabled with these OS versions.

1. If **NVIDIA X Server Settings** is running, shut it down.
2. If the `/etc/nvidia/gridd.conf` file does not already exist, create it by copying the supplied template file `/etc/nvidia/gridd.conf.template`.
3. As root, edit the `/etc/nvidia/gridd.conf` file to set the `EnableUI` option to `TRUE`.
4. Start the `nvidia-gridd` service.

```
# sudo service nvidia-gridd start
```

When **NVIDIA X Server Settings** is restarted, the **Manage License** option is now available.

### Status

Open

## 6.17. Licenses remain checked out when VMs are forcibly powered off

### Description

NVIDIA vGPU software licenses remain checked out on the license server when non-persistent VMs are forcibly powered off.

The NVIDIA service running in a VM returns checked out licenses when the VM is shut down. In environments where non-persistent licensed VMs are not cleanly shut down, licenses on the license server can become exhausted. For example, this issue can occur in automated test environments where VMs are frequently changing and are not guaranteed to be cleanly shut down. The licenses from such VMs remain checked out against their MAC address for seven days before they time out and become available to other VMs.

### Resolution

If VMs are routinely being powered off without clean shutdown in your environment, you can avoid this issue by shortening the license borrow period. To shorten the license borrow period, set the `LicenseInterval` configuration setting in your VM image. For details, refer to *Virtual GPU Client Licensing User Guide*.

### Status

Closed

### Ref. #

1694975

## 6.18. VM bug checks after the guest VM driver for Windows 10 RS2 is installed

### Description

When the VM is rebooted after the guest VM driver for Windows 10 RS2 is installed, the VM bug checks. When Windows boots, it selects one of the standard supported video modes. If Windows is booted directly with a display that is driven by an NVIDIA driver, for example a vGPU on Citrix XenServer, a blue screen crash occurs.

This issue occurs when the screen resolution is switched from VGA mode to a resolution that is higher than 1920×1200.

### Fix

Download and install [Microsoft Windows Update KB4020102](#) from the Microsoft Update Catalog.

### Workaround

If you have applied the fix, ignore this workaround.

Otherwise, you can work around this issue until you are able to apply the fix by not using resolutions higher than 1920×1200.

1. Choose a GPU profile in Citrix XenCenter that does not allow resolutions higher than 1920×1200.
2. Before rebooting the VM, set the display resolution to 1920×1200 or lower.

### Status

Not an NVIDIA bug

### Ref. #

200310861

## 6.19. GNOME Display Manager (GDM) fails to start on Red Hat Enterprise Linux 7.2 and CentOS 7.0

### Description

GDM fails to start on Red Hat Enterprise Linux 7.2 and CentOS 7.0 with the following error:

```
Oh no! Something has gone wrong!
```

### Workaround

Permanently enable permissive mode for Security Enhanced Linux (SELinux).

1. As root, edit the `/etc/selinux/config` file to set SELINUX to permissive.  

```
SELINUX=permissive
```
2. Reboot the system.

```
~]# reboot
```

For more information, see [Permissive Mode](#) in *Red Hat Enterprise Linux 7 SELinux User's and Administrator's Guide*.

### Status

Not an NVIDIA bug

### Ref. #

200167868

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