

NVIDIA Virtual GPU Software for VMware vSphere Release Notes

Release 21.0

NVIDIA Corporation

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Contents

1 Release Notes **1**
1.1 NVIDIA vGPU Software Driver Versions . . . 1
1.2 Compatibility Requirements for the NVIDIA vGPU Manager and Guest VM Driver . . . 1
1.2.1 Compatible NVIDIA vGPU Manager and Guest VM Driver Releases . . . 2
1.2.2 Incompatible NVIDIA vGPU Manager and Guest VM Driver Releases . . . 2
1.3 Updates in Release 21.0 . . . 3
1.3.1 New Features in Release 21.0 . . . 3
1.3.2 Hardware and Software Support Introduced in Release 21.0 . . . 3
1.3.3 Features Deprecated in Release 21.0 . . . 3

2 Validated Platforms **5**
2.1 Supported NVIDIA GPUs and Validated Server Platforms . . . 5
2.1.1 GPUs Based on the NVIDIA Blackwell Architecture . . . 5
2.1.2 GPUs Based on the NVIDIA Ada Lovelace Architecture . . . 7
2.1.3 GPUs Based on the NVIDIA Ampere Architecture . . . 9
2.1.4 GPUs Based on the NVIDIA Turing Architecture . . . 11
2.1.5 Support for a Mixture of Time-Sliced vGPU Types on the Same GPU . . . 11
2.1.6 Switching the Mode of a GPU that Supports Multiple Display Modes . . . 12
2.1.7 Requirements for Using vGPU on GPUs Requiring 64 GB or More of MMIO Space with Large-Memory VMs . . . 13
2.1.8 Requirements for Using GPUs Requiring Large MMIO Space in Pass-Through Mode 14
2.1.9 Requirements for Assigning Multiple GPUs in Pass-Through Mode to a Single VM . . 14
2.1.10 Linux Only: Error Messages for Misconfigured GPUs Requiring Large MMIO Space . 15
2.2 Hypervisor Software Releases . . . 15
2.2.1 Supported VMware vSphere Hypervisor (ESXi) and VCF Releases . . . 15
2.2.2 Supported Management Software and Virtual Desktop Software Releases . . . 17
2.3 Guest OS Support . . . 18
2.3.1 Windows Guest OS Support . . . 18
2.3.1.1 Windows Guest OS Support in Release 21.0 . . . 19
2.3.2 Linux Guest OS Support . . . 19
2.3.2.1 Linux Guest OS Support in Release 21.0 . . . 20
2.4 NVIDIA CUDA Toolkit Version Support . . . 21
2.5 Wayland Display Server Protocol Support . . . 21
2.5.1 Supported GPUs . . . 21
2.5.2 Supported Guest OS Releases . . . 21
2.5.3 Supported Display Resolutions . . . 21
2.5.4 Limitations with Wayland Display Server Protocol Support . . . 22
2.5.5 Known Issues with Wayland Display Server Protocol Support . . . 22
2.6 vGPU Migration Support . . . 22
2.6.1 Limitations with vGPU Migration Support . . . 22
2.6.2 Supported Hypervisor Software Releases . . . 22
2.6.3 Supported Guest OS Releases . . . 23
2.6.4 Known Issues with vGPU Migration Support . . . 23

2.7 Fast Suspend-Resume Support . . . 23
2.7.1 Supported GPUs . . . 23
2.7.2 Supported Hypervisor Software Releases . . . 23
2.7.3 Supported Guest OS Releases . . . 23
2.7.4 Limitations with Fast Suspend-Resume Support . . . 23
2.8 Multiple vGPU Support . . . 24
2.8.1 vGPUs that Support Multiple vGPUs Assigned to a VM . . . 24
2.8.1.1 Multiple vGPU Support on the NVIDIA Blackwell Architecture . . . 24
2.8.1.2 Multiple vGPU Support on the NVIDIA Ada Lovelace Architecture . . . 25
2.8.1.3 Multiple vGPU Support on the NVIDIA Ampere GPU Architecture . . . 25
2.8.1.4 Multiple vGPU Support on the NVIDIA Turing GPU Architecture . . . 25
2.8.2 Maximum Number of vGPUs Supported per VM . . . 25
2.8.3 Hypervisor Releases that Support Multiple vGPUs Assigned to a VM . . . 26
2.9 Peer-to-Peer CUDA Transfers over NVLink Support . . . 26
2.9.1 vGPUs that Support Peer-to-Peer CUDA Transfers . . . 26
2.9.1.1 Peer-to-Peer CUDA Transfer Support on the NVIDIA Ampere GPU Architecture 26
2.9.1.2 Peer-to-Peer CUDA Transfer Support on the NVIDIA Turing GPU Architecture . 27
2.9.1.3 Peer-to-Peer CUDA Transfer Support on the NVIDIA Volta GPU Architecture . . 27
2.9.2 Hypervisor Releases that Support Peer-to-Peer CUDA Transfers . . . 27
2.9.3 Guest OS Releases that Support Peer-to-Peer CUDA Transfers . . . 27
2.9.4 Limitations on Support for Peer-to-Peer CUDA Transfers . . . 27
2.10 Unified Memory Support . . . 27
2.10.1 vGPUs that Support Unified Memory . . . 28
2.10.1.1 Unified Memory Support on the NVIDIA Blackwell GPU Architecture . . . 28
2.10.1.2 Unified Memory Support on the NVIDIA Ada Lovelace GPU Architecture . . . 29
2.10.1.3 Unified Memory Support on the NVIDIA Ampere GPU Architecture . . . 29
2.10.2 Guest OS Releases that Support Unified Memory . . . 29
2.10.3 Limitations on Support for Unified Memory . . . 29
2.11 Microsoft Compute Driver Model (MCDM) Support . . . 30
2.11.1 Supported vGPUs . . . 30
2.11.2 Supported GPUs . . . 30
2.11.3 Supported Guest OS Releases . . . 30
2.12 NVIDIA GPU Operator Support . . . 30
2.13 NVIDIA Deep Learning Super Sampling (DLSS) Support . . . 30
2.14 vSphere Lifecycle Management (vLCM) Support . . . 31

3 Known Product Limitations **33**
3.1 vGPUs of different sizes on the same GPU are not supported . . . 33
3.2 Maximum Allowed Network Adapters on a VM . . . 33
3.3 NVENC does not support resolutions greater than 4096×4096 . . . 34
3.3.1 Description . . . 34
3.3.2 Workaround . . . 34
3.4 NVIDIA vGPU for Compute is not supported on VMware vSphere . . . 34
3.5 Nested Virtualization Is Not Supported by NVIDIA vGPU . . . 35
3.6 Issues occur when the channels allocated to a vGPU are exhausted . . . 35
3.6.1 Description . . . 35
3.6.2 Workaround . . . 35
3.7 Total frame buffer for vGPUs is less than the total frame buffer on the physical GPU . . 35
3.8 Issues may occur with graphics-intensive OpenCL applications on vGPU types with limited frame buffer . . . 37
3.8.1 Description . . . 37
3.8.2 Workaround . . . 37
3.9 In pass through mode, all GPUs connected to each other through NVLink must be assigned to the same VM . . . 37

3.9.1 Description . . . 38
3.9.2 Workaround . . . 38
3.10 VM failures or crashes on servers with 1 TiB or more of system memory . . . 38
3.10.1 Description . . . 38
3.10.2 Resolution . . . 38
3.11 VM running an incompatible NVIDIA vGPU guest driver fails to initialize vGPU when booted . . . 39
3.11.1 Description . . . 39
3.11.2 Resolution . . . 39
3.12 Single vGPU benchmark scores are lower than pass-through GPU . . . 39
3.12.1 Description . . . 39
3.12.2 Resolution . . . 40
3.13 VMs configured with large memory fail to initialize vGPU when booted . . . 41
3.13.1 Description . . . 41
3.13.2 Resolution . . . 42

4 Resolved Issues **43**
4.1 Issues Resolved in Release 21.2 . . . 43
4.2 Issues Resolved in Release 21.1 . . . 43
4.3 Issues Resolved in Release 21.0 . . . 43

5 Known Issues **45**

6 Notices **47**

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 VMware vSphere.

1.1. NVIDIA vGPU Software Driver Versions

Each release in this release family of NVIDIA vGPU software includes a specific version of the NVIDIA Virtual GPU Manager, NVIDIA Windows driver, and NVIDIA Linux driver.

NVIDIA vGPU Software Version	NVIDIA Virtual GPU Manager Version	NVIDIA Windows Driver Version	NVIDIA Linux Driver Version
21.0	620.70.04	621.14	620.70.06

For details of which VMware vSphere releases are supported, see *Hypervisor Software Releases*.

1.2. Compatibility Requirements for the NVIDIA vGPU Manager and Guest VM Driver

The releases of the NVIDIA vGPU Manager and guest VM drivers that you install must be compatible. If you install an incompatible guest VM driver release for the release of the vGPU Manager that you are using, the NVIDIA vGPU fails to load.

See *VM running an incompatible NVIDIA vGPU guest driver fails to initialize vGPU when booted*.

Note

You must use NVIDIA License System with every release in this release family of NVIDIA vGPU software. All releases in this release family of NVIDIA vGPU software are **incompatible** with all releases of the NVIDIA vGPU software license server.

1.2.1. Compatible NVIDIA vGPU Manager and Guest VM Driver Releases

The following combinations of NVIDIA vGPU Manager and guest VM driver releases are compatible with each other.

- NVIDIA vGPU Manager with guest VM drivers from the same release
- NVIDIA vGPU Manager from a later major release branch with guest VM drivers from the previous branch
- NVIDIA vGPU Manager from a later long-term support branch with guest VM drivers from the previous long-term support branch

Note

When NVIDIA vGPU Manager is used with guest VM drivers from the previous branch, the combination supports **only** the features, hardware, and software (including guest OSes) that are supported on both releases.

For example, if vGPU Manager from release 21.0 is used with guest drivers from release 16.4, the combination does **not** support Windows Server 2019 because NVIDIA vGPU software release 21.0 does not support Windows Server 2019.

The following table lists the specific software releases that are compatible with the components in the NVIDIA vGPU software 21 major release branch.

NVIDIA vGPU Software Component	Release	Compatible Software Releases
NVIDIA vGPU Manager	21.0	▶ Guest VM driver release 21.0 ▶ All guest VM driver 20.<x> releases ▶ All guest VM driver 19.<x> releases
Guest VM drivers	21.0	NVIDIA vGPU Manager release 21.0

1.2.2. Incompatible NVIDIA vGPU Manager and Guest VM Driver Releases

The following combinations of NVIDIA vGPU Manager and guest VM driver releases are incompatible with each other.

- NVIDIA vGPU Manager from a later major release branch with guest VM drivers from a production branch two or more major releases before the release of the vGPU Manager
- NVIDIA vGPU Manager from an earlier major release branch with guest VM drivers from a later branch

The following table lists the specific software releases that are incompatible with the components in the NVIDIA vGPU software 21 major release branch.

NVIDIA vGPU Software Component	Release	Incompatible Software Releases
NVIDIA vGPU Manager	21.0	All guest VM driver releases 19.<x> and earlier, **except** 19.<x> releases
Guest VM drivers	21.0	All NVIDIA vGPU Manager releases 20.<x> and earlier

1.3. Updates in Release 21.0

1.3.1. New Features in Release 21.0

- Support for vGPU migration when NVIDIA CUDA Toolkit debuggers or profilers are enabled
- Support for hardware-accelerated GPU scheduling for a vGPU
- Support for the Microsoft Compute Driver Model (MCDM)
- Notification to guest VMs of when a GPU reset is required
- Support for GPU performance monitoring (GPM) metrics through NVWMI
- Miscellaneous bug fixes as explained in *Issues Resolved in Release 21.0*

1.3.2. Hardware and Software Support Introduced in Release 21.0

- Newly supported guest OS releases:
  - Windows 11 26H2
- Newly supported remoting solutions:
  - Omnissa Horizon 8 2606

1.3.3. Features Deprecated in Release 21.0

The following table lists features that are deprecated in this release of NVIDIA vGPU software. Although the features remain available in this release, they might be withdrawn in a future release.

Deprecated Feature	Preferred Alternative	Additional Information
Tesla Compute Cluster (TCC) driver model	Microsoft Compute Driver Model (MCDM)	Enabling the Microsoft Compute Driver Model (MCDM)

Chapter 2. Validated Platforms

This release family of NVIDIA vGPU software provides support for several NVIDIA GPUs on validated server hardware platforms, VMware vSphere hypervisor software versions, and guest operating systems. It also supports the version of NVIDIA CUDA Toolkit that is compatible with R620 drivers.

2.1. Supported NVIDIA GPUs and Validated Server Platforms

This release of NVIDIA vGPU software on VMware vSphere provides support for several NVIDIA GPUs running on validated server hardware platforms.

For a list of validated server platforms, refer to NVIDIA GRID Certified Servers.

The supported products for each type of NVIDIA vGPU software deployment depend on the GPU.

> **Note**
>
> NVIDIA vGPU software does **not** support vSGA.

2.1.1. GPUs Based on the NVIDIA Blackwell Architecture

> **Note**
>
> GPUs based on the NVIDIA Blackwell architecture support SR-IOV.
>
> The manual placement of vGPUs on GPUs in equal-size mode **is not** supported on GPUs based on the NVIDIA Blackwell architecture.

GPU	Mixed vGPU Configuration - VCF or VMware vSphere Releases		Supported NVIDIA vGPU Software Products[Page 7, 1],[Pa			
	Frame Buffer Size (Mixed-Size Mode)	Series	Time-Sliced NVIDIA vGPU on Single-Instance GPU[Page 7, 4]	1:1 MIG-Backed NVIDIA vGPU[Page 7, 5]	Time-Sliced, MIG-Backed NVIDIA vGPU[Page 7, 6]	GPU Pass Through
NVIDIA RTX PRO 6000 Blackwell Server Edition	9.0.1 and, unless explicitly stated otherwise, later maintenance releases 8.0 Update 3g and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA RTX PRO 6000 Blackwell Server Edition liquid cooled	9.0.1 and, unless explicitly stated otherwise, later maintenance releases 8.0 Update 3g and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA RTX PRO 4500 Blackwell Server Edition	9.0.1 and, unless explicitly stated otherwise, later maintenance releases 8.0 Update 3g and, unless	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps

2.1.2. GPUs Based on the NVIDIA Ada Lovelace Architecture

Note

GPUs based on the NVIDIA Ada Lovelace architecture support SR-IOV.

The manual placement of vGPUs on GPUs in equal-size mode **is not** supported on GPUs based on the NVIDIA Ada Lovelace architecture.

[1] The supported products are as follows:

- vWS: NVIDIA RTX Virtual Workstation
- vPC: NVIDIA Virtual PC
- vApps: NVIDIA Virtual Applications

[2] N/A indicates that the deployment is not supported.
[3] vApps is supported only on Windows operating systems.
[4] A single-instance GPU is a GPU that is not partitioned into multiple GPU instances.
[5] A 1:1 MIG-backed NVIDIA vGPU is a MIG-backed vGPU that occupies an entire GPU instance.
[6] Time-sliced, MIG-backed NVIDIA vGPU support requires VCF 9.1 or a later release. Earlier VCF 9.0 builds and all VMware vSphere Hypervisor (ESXi) 8 releases are not supported.

GPU	Mixed vGPU Configuration - VCF or VMware vSphere Releases Frame Buffer Size (Mixed-Size Mode)	Series	Supported NVIDIA vGPU Software Products[Page 7, 1],[Page 7, 2],[F NVIDIA vGPU	 GPU Pass Through
NVIDIA L40S	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA L40	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA L20	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA L20 liquid cooled	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA L4	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA L2	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA RTX 6000 Ada	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA RTX 5880 Ada	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA RTX 5000 Ada	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps

2.1.3. GPUs Based on the NVIDIA Ampere Architecture

Note

GPUs based on the NVIDIA Ampere architecture support SR-IOV.

The manual placement of vGPUs on GPUs in equal-size mode **is not** supported on GPUs based on the NVIDIA Ampere architecture.

GPU	Mixed vGPU Configuration - VCF or VMware vSphere Releases Frame Buffer Size (Mixed-Size Mode)	Series	Supported NVIDIA vGPU Software Products[Page 7, 1][Page 7, 2] NVIDIA vGPU	 GPU Pass Through
NVIDIA A40[7]	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA A16	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA A10	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA A2	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA RTX A6000[7]	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA RTX A5500[7]	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA RTX A5000[7]	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps

[7] This GPU is supported only in displayless mode. In displayless mode, local physical display connectors are disabled.

2.1.4. GPUs Based on the NVIDIA Turing Architecture

Note

SR-IOV and the manual placement of vGPUs on GPUs in equal-size mode are **not** supported on GPUs based on the NVIDIA Turing™ architecture.

GPU	Mixed vGPU Configuration - VCF or VMware vSphere Releases Frame Buffer Size (Mixed-Size Mode)	Series	Supported NVIDIA vGPU Software Products[Page 7, 1],[Page 7, 2],[F NVIDIA vGPU	 GPU Pass Through
Tesla T4	9.0, 8.0 Update 3 and, unless explicitly stated otherwise, later update releases	9.0, 8.0	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps

2.1.5. Support for a Mixture of Time-Sliced vGPU Types on the Same GPU

VMware vSphere Hypervisor (ESXi) support for a mixture of time-sliced vGPU types on the same GPU depends on the VMware vSphere Hypervisor (ESXi) release.

VMware vSphere Hypervisor (ESXi) Release	Mixture of Time-Sliced vGPU Support
9.0 and, unless explicitly stated otherwise, later releases 8 Update 3 and, unless explicitly stated otherwise, later update releases	VMware vSphere Hypervisor (ESXi) supports a mixture of different types of time-sliced vGPUs on the same physical GPU. Any combination of A-series, B-series, and Q-series vGPUs with any amount of frame buffer can reside on the same physical GPU simultaneously. The total amount of frame buffer allocated to the vGPUs on a physical GPU must not exceed the amount of frame buffer that the physical GPU has. For example, the following combinations of vGPUs can reside on the same physical GPU simultaneously: ▶ A40-2B and A40-2Q ▶ A40-2Q and A40-4Q ▶ A40-2B and A40-4Q By default, a GPU or GPU instance supports only vGPUs with the same amount of frame buffer and, therefore, is in equal-size mode. To support vGPUs with different amounts of frame buffer, the GPU or GPU instance must be put into mixed-size mode. In mixed-size mode, the maximum number of some types of vGPU allowed on a GPU or GPU instance is less than in equal-size mode. For more information, refer to Virtual GPU Software User Guide.
8.0 through 8 Update 2	VMware vSphere Hypervisor (ESXi) supports a mixture of time-sliced vGPUs with the same amount of frame buffer from different virtual GPU series on the same physical GPU. A-series, B-series, and Q-series vGPUs with the same amount of frame buffer, for example, A40-2B and A40-2Q, can reside on the same physical GPU simultaneously. However, vGPUs with different amounts of frame buffer are not supported on the same GPU. For example, the following combinations of vGPUs are **not** supported on the same GPU: ▶ A40-2Q and A40-4Q ▶ A40-2B and A40-4Q

2.1.6. Switching the Mode of a GPU that Supports Multiple Display Modes

Some GPUs support display-off and display-enabled modes but must be used in NVIDIA vGPU software deployments in display-off mode.

The GPUs listed in the following table support multiple display modes. As shown in the table, some GPUs are supplied from the factory in display-off mode, but other GPUs are supplied in a display-enabled mode.

GPU	Mode as Supplied from the Factory
NVIDIA A40	Display-off
NVIDIA L40	Display-off
NVIDIA L40S	Display-off
NVIDIA L20	Display-off
NVIDIA L20 liquid cooled	Display-off
NVIDIA RTX 5000 Ada	Display enabled
NVIDIA RTX 6000 Ada	Display enabled
NVIDIA RTX A5000	Display enabled
NVIDIA RTX A5500	Display enabled
NVIDIA RTX A6000	Display enabled
NVIDIA RTX PRO 6000 Blackwell Server Edition	Display-off
NVIDIA RTX PRO 6000 Blackwell Server Edition liquid cooled	Display-off

A GPU that is supplied from the factory in display-off mode, such as the NVIDIA A40 GPU, might be in a display-enabled mode if its mode has previously been changed.

To change the mode of a GPU that supports multiple display modes, use the `displaymodeselector` tool, which you can request from the NVIDIA Display Mode Selector Tool page on the NVIDIA Developer website.

Note

Only the GPUs listed in the table support the `displaymodeselector` tool. Other GPUs that support NVIDIA vGPU software do not support the `displaymodeselector` tool and, unless otherwise stated, do not require display mode switching.

2.1.7. Requirements for Using vGPU on GPUs Requiring 64 GB or More of MMIO Space with Large-Memory VMs

Some GPUs require 64 GB or more of MMIO space. When a vGPU on a GPU that requires 64 GB or more of MMIO space is assigned to a VM with 32 GB or more of memory on ESXi , the VM's MMIO space must be increased to the amount of MMIO space that the GPU requires.

For more information, refer to Broadcom Knowledge Base Article: VMware vSphere VMDirectPath I/O: Requirements for Platforms and Devices.

No extra configuration is needed.

The following table lists the GPUs that require 64 GB or more of MMIO space and the amount of MMIO space that each GPU requires.

GPU	MMIO Space Required
NVIDIA A10	64 GB
NVIDIA A40	128 GB
NVIDIA RTX A5000	64 GB
NVIDIA RTX A5500	64 GB
NVIDIA RTX A6000	128 GB

2.1.8. Requirements for Using GPUs Requiring Large MMIO Space in Pass-Through Mode

- If a GPU that requires more than 32 GB of MMIO space is assigned to a VM, the VM's MMIO space must be increased as explained in Broadcom Knowledge Base Article: VMware vSphere VMDirectPath I/O: Requirements for Platforms and Devices.
- Pass through of GPUs with large BAR memory settings has some restrictions on VMware ESXi:
  - The guest OS must be a 64-bit OS.
  - 64-bit MMIO must be enabled for the VM.
  - If the total BAR1 memory exceeds 256 Mbytes, EFI boot must be enabled for the VM.

    Note

    To determine the total BAR1 memory, run `nvidia-smi -q` on the host.

  - The guest OS must be able to be installed in EFI boot mode.

2.1.9. Requirements for Assigning Multiple GPUs in Pass-Through Mode to a Single VM

If you are assigning multiple GPUs in pass-through mode to a single VM, ensure that you allocate enough MMIO space to the VM for all the GPUs.

1. Calculate the amount of MMIO space that is required for all the GPUs that you want to assign in pass-through mode to the VM.
   1. On the hypervisor host, get the total BAR1 memory usage for each GPU.

```
nvidia-smi -q
==============NVSMI LOG==============

Timestamp                                 : Mon May 18 18:36:45 2026
Driver Version                            : 620.70.04
CUDA Version                              : 13.5
```

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```
Attached GPUs                             : 4
GPU 00000000:01:00.0
...
   BAR1 Memory Usage
        Total                             : 128 GiB
...
```

In this example, the total BAR1 memory usage for each GPU is 128 GiB.

2. Multiply the total BAR1 memory usage for each GPU by the number of GPUs that you are assigning in pass-through mode to the VM.

   For example, if you are assigning four GPUs to a VM, the amount of MMIO space that is required for all the GPUs is 4×128 GiB, which equals 512 GiB.

2. Under the VM settings, choose **VM Options** > **Advanced** and set `pciPassthru.use64bitMMIO="TRUE"`.
3. Allocate the required amount of MMIO space to the VM.

```
pciPassthru.64bitMMIOSizeGB = "<mmio-space-in-gb>"
```

<mmio-space-in-gb>
The required amount of MMIO space in GiB that you calculated previously. For example, if you are assigning four GPUs to a VM that each use a total of 128 GiB of BAR1 memory, the amount of MMIO space that is required for all the GPUs is 512 GiB.

```
pciPassthru.64bitMMIOSizeGB = "512"
```

2.1.10. Linux Only: Error Messages for Misconfigured GPUs Requiring Large MMIO Space

In a Linux VM, if the requirements for using GPUs requiring large MMIO space in pass-through mode are not met, the following error messages are written to the VM's `dmesg` log during installation of the NVIDIA vGPU software graphics driver:

```
NVRM: BAR1 is 0M @ 0x0 (PCI:0000:02:02.0)
[  90.823015] NVRM: The system BIOS may have misconfigured your GPU.
[  90.823019] nvidia: probe of 0000:02:02.0 failed with error -1
[  90.823031] NVRM: The NVIDIA probe routine failed for 1 device(s).
```

2.2. Hypervisor Software Releases

2.2.1. Supported VMware vSphere Hypervisor (ESXi) and VCF Releases

Note

Broadcom has changed how VMware vSphere Hypervisor (ESXi) is distributed. Starting with release 9.0, ESXi is no longer available as a standalone product. Instead, ESXi 9.x is distributed only as part of VMware Cloud Foundation (VCF). In this documentation, references specifically to 9.x hypervisor releases use VCF. References specifically to 8.x releases and generic, release-independent references continue to use VMware vSphere.

This release is supported on the VMware vSphere Hypervisor (ESXi) and VCF releases listed in the table.

Note

Support for NVIDIA vGPU software requires the vSphere Foundation edition of VMware vSphere Hypervisor (ESXi) or a vSphere Enterprise Plus license. For details, see VMware vSphere Product Line Comparison (PDF).

Updates to a base release of VMware vSphere Hypervisor (ESXi) or VCF are compatible with the base release and can also be used with this version of NVIDIA vGPU software unless expressly stated otherwise.

Software	Release Supported	Notes
VMware Cloud Foundation (VCF) 9.1	9.1	This release supports all NVIDIA GPUs with vGPU and in pass-through mode that support NVIDIA vGPU software on VCF.
VMware Cloud Foundation (VCF) 9.0	9.0 and, unless explicitly stated otherwise, later maintenance releases for 9.0, such as 9.0.1	This release supports all NVIDIA GPUs with vGPU and in pass-through mode that support NVIDIA vGPU software on VCF. Support for the following GPUs requires VCF 9.0.1 or a later release: ▶ NVIDIA RTX PRO 4500 Blackwell Server Edition ▶ NVIDIA RTX PRO 6000 Blackwell Server Edition ▶ NVIDIA RTX PRO 6000 Blackwell Server Edition liquid cooled
VMware vSphere Hypervisor (ESXi) 8.0	8.0u3 P06 and later updates to release 8.0 unless explicitly stated otherwise. Earlier VMware vSphere Hypervisor (ESXi) 8.0 builds are **not** supported.	This release supports all NVIDIA GPUs with vGPU and in pass-through mode that support NVIDIA vGPU software on VMware vSphere. Support for the following GPUs requires VMware vSphere Hypervisor (ESXi) 8 Update 3g or a later update to release 8.0: ▶ NVIDIA RTX PRO 4500 Blackwell Server Edition ▶ NVIDIA RTX PRO 6000 Blackwell Server Edition ▶ NVIDIA RTX PRO 6000 Blackwell Server Edition liquid cooled

2.2.2. Supported Management Software and Virtual Desktop Software Releases

This release supports the management software and virtual desktop software releases listed in the table.

Note

Updates to a base release of Omnissa Horizon and VMware vCenter Server are compatible with the base release and can also be used with this version of NVIDIA vGPU software unless expressly stated otherwise.

Software	Releases Supported
Omnissa Horizon	**Note** All versions supported by earlier NVIDIA vGPU software 21 releases are also supported. 8 2606 8 2603 8 2512 8 2506 8 2503 2006 (8.0) through 2412 (8.14)
VMware Horizon	7.0 through 7.13
VMware vCenter Server	9.0 8.0

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.

Note

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.

NVIDIA vGPU software supports **only** 64-bit guest operating systems. No 32-bit guest operating systems are supported.

2.3.1. Windows Guest OS Support

NVIDIA vGPU software supports **only** the 64-bit Windows releases listed as a guest OS on VMware vSphere. The releases of VMware vSphere for which a Windows release is supported depend on whether NVIDIA vGPU or pass-through GPU is used.

Note

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

VMware vMotion with vGPU and suspend-resume with vGPU are supported on supported Windows guest OS releases.

2.3.1.1 Windows Guest OS Support in Release 21.0

- Windows Server 2025
- Windows Server 2022
- Windows 11 26H2 and all Windows 11 releases supported by Microsoft up to and including this release
- Windows 10 2022 Update (22H2) and all Windows 10 releases supported by Microsoft up to and including this release

Note

The hardware-accelerated GPU scheduling feature introduced in Windows 10 May 2020 Update (2004) is **not** supported on GPUs based on the Maxwell architecture. On GPUs based on an architecture later than the Maxwell architecture and earlier than the NVIDIA Blackwell architecture, this feature is supported only in pass-through mode.

On GPUs based on the NVIDIA Blackwell architecture or a later architecture, hardware-accelerated GPU scheduling is supported for a vGPU on Windows 11 24H2 (build 26100) or a later Windows 11 release. The feature is enabled only for the Windows Display Driver Model (WDDM). It is **not** enabled for the Microsoft Compute Driver Model (MCDM) or the Tesla Compute Cluster (TCC) driver model.

2.3.2. Linux Guest OS Support

NVIDIA vGPU software supports **only** the Linux distributions listed as a guest OS on VMware vSphere. The releases of VMware vSphere for which a Linux release is supported depend on whether NVIDIA vGPU or pass-through GPU is used.

Note

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

VMware vMotion with vGPU and suspend-resume with vGPU are supported on supported Linux guest OS releases.

Rocky Linux releases that are compatible with supported Red Hat Enterprise Linux releases are also supported as a guest OS.

2.3.2.1 Linux Guest OS Support in Release 21.0

Guest OS	Wayland Support	X11 Support
Deprecated: CentOS Linux 8 (2105)	××	✓✓
Debian 12	××	✓✓
Red Hat CoreOS 4.11	××	✓✓
Red Hat Enterprise Linux 10.2 Not supported on VCF releases before VCF 9.1	✓✓	××
Red Hat Enterprise Linux 10.1 Not supported on VCF releases before VCF 9.1	✓✓	××
Red Hat Enterprise Linux 10.0 Not supported on VCF releases before VCF 9.1	✓✓	××
Red Hat Enterprise Linux 9.8	×!	✓!
Red Hat Enterprise Linux 9.6	×!	✓!
Red Hat Enterprise Linux 9.4	×!	✓!
Red Hat Enterprise Linux 8.10	×!	✓!
SUSE Linux Enterprise Server 16.0	✓✓	××
SUSE Linux Enterprise Server 15 SP7	××	✓✓
SUSE Linux Enterprise Server 15 SP6	××	✓✓
Ubuntu 24.04 LTS	✓×	✓✓
Ubuntu 22.04 LTS	××	✓✓
Ubuntu 20.04 LTS	××	✓✓

✓✓ Supported by NVIDIA vGPU software and enabled by default in the OS.

✓× Supported by NVIDIA vGPU software but disabled by default in the OS and must be enabled.

✓! Supported by NVIDIA vGPU software but requires the **alternative** display server protocol to be disabled in the OS.

×× Not supported by NVIDIA vGPU software or the OS.

×! Not supported by NVIDIA vGPU software and must be disabled in the OS.

2.4. NVIDIA CUDA Toolkit Version Support

The releases in this release family of NVIDIA vGPU software support NVIDIA CUDA Toolkit 13.5.

To build a CUDA application, the system must have the NVIDIA CUDA Toolkit and the libraries required for linking. For details of the components of NVIDIA CUDA Toolkit, refer to NVIDIA CUDA Toolkit 13.5 Release Notes.

To run a CUDA application, the system must have a CUDA-enabled GPU and an NVIDIA display driver that is compatible with the NVIDIA CUDA Toolkit release that was used to build the application. If the application relies on dynamic linking for libraries, the system must also have the correct version of these libraries.

For more information about NVIDIA CUDA Toolkit, refer to CUDA Toolkit Documentation 13.5.

Note

If you are using NVIDIA vGPU software with CUDA on Linux, avoid conflicting installation methods by installing CUDA from a distribution-independent runfile package. Do not install CUDA from a distribution-specific RPM or Deb package.

To ensure that the NVIDIA vGPU software graphics driver is not overwritten when CUDA is installed, deselect the CUDA driver when selecting the CUDA components to install.

For more information, see NVIDIA CUDA Installation Guide for Linux.

2.5. Wayland Display Server Protocol Support

The Wayland display server protocol is supported with only a subset of supported GPUs, guest OS releases, and display resolutions.

2.5.1. Supported GPUs

All GPUs supported by NVIDIA vGPU software, **except** GPUs based on the NVIDIA Turing™ architecture.

2.5.2. Supported Guest OS Releases

Only Red Hat Enterprise Linux 10 guest OS releases supported by NVIDIA vGPU software.

- Ubuntu 26.04 LTS
- Ubuntu 24.04 LTS

2.5.3. Supported Display Resolutions

- 2560×1600
- 3840×2160
- 4096×2160
- 5120×2880

- 7680×4320

2.5.4. Limitations with Wayland Display Server Protocol Support

The following use cases are not supported:

- VDPAU
- Vulkan video playback
- Console VNC
- Frame-rate limiting (FRL)

2.5.5. Known Issues with Wayland Display Server Protocol Support

Refer to the online version of this document at Known Issues.

2.6. vGPU Migration Support

vGPU Migration, which includes vMotion and suspend-resume, is supported on all supported GPUs, but only on a subset of supported VMware vSphere Hypervisor (ESXi) releases and guest operating systems.

2.6.1. Limitations with vGPU Migration Support

vGPU migration is disabled for a VM for which unified memory is enabled.

Enabling NVIDIA CUDA Toolkit debuggers or profilers for a VM does **not** disable vGPU migration for the VM. Earlier restrictions on migrating a VM for which these tools are enabled no longer apply.

However, a VM cannot be migrated while a NVIDIA CUDA Toolkit debugger or profiler is actively performing an operation that would not survive migration:

- Profiling the system or an application
- Debugging an application
- Running Compute Sanitizer

Migration is permitted after the operation stops.

2.6.2. Supported Hypervisor Software Releases

All supported releases of VMware vSphere

2.6.3. Supported Guest OS Releases

Windows and Linux.

2.6.4. Known Issues with vGPU Migration Support

Use Case	Affected GPUs	Issue
Migration of a VM configured with NVIDIA vGPU software release 21.1 to a host running release 21.0	All GPUs that support vGPU Migration	Migrating a VM configured with NVIDIA vGPU software release 20.1 to a host running release 20.0 fails
Migration between hosts with different ECC memory configuration	All GPUs that support vGPU Migration	Migration of VMs configured with vGPU stops before the migration is complete

2.7. Fast Suspend-Resume Support

NVIDIA vGPU software supports VMware Fast Suspend-Resume with the NVIDIA Virtual GPU Manager. Fast Suspend-Resume enables changes to a VM, such as adding a network adapter, with minimal disruption to the VM. Fast Suspend-Resume is supported on all supported guest operating systems, but on only a subset of supported GPUs and VMware vSphere Hypervisor (ESXi) releases.

2.7.1. Supported GPUs

Fast Suspend-Resume is supported on all supported GPUs, **except** the Tesla M10 GPU.

2.7.2. Supported Hypervisor Software Releases

Since VCF 9.0

2.7.3. Supported Guest OS Releases

Windows and Linux.

2.7.4. Limitations with Fast Suspend-Resume Support

Unified memory is **not** supported. If unified memory is enabled for a vGPU, VMware vSphere Hypervisor (ESXi) operations that involve Fast Suspend-Resume fail, reporting a hot plug operation failure.

2.8. Multiple vGPU Support

To support applications and workloads that are compute or graphics intensive, multiple vGPUs can be added to a single VM. The assignment of more than one vGPU to a VM is supported only on a subset of vGPUs and hypervisor software releases.

2.8.1. vGPUs that Support Multiple vGPUs Assigned to a VM

The supported vGPUs depend on the architecture of the GPU on which the vGPUs reside:

- For GPUs based on the NVIDIA Volta architecture and later GPU architectures, **all** Q-series vGPUs are supported.

  On GPUs that support the Multi-Instance GPU (MIG) feature, both time-sliced and MIG-backed vGPUs are supported. Support for MIG-backed vGPUs requires VCF 9.1 or a later release.

- For GPUs based on the NVIDIA Maxwell™ graphics architecture, only Q-series vGPUs that are allocated all of the physical GPU's frame buffer are supported.

You can assign multiple vGPUs with differing amounts of frame buffer to a single VM, provided the board type and the series of all the vGPUs is the same. For example, you can assign an A40-48Q vGPU and an A40-16Q vGPU to the same VM. However, you cannot assign an A30-8Q vGPU and an A16-8Q vGPU to the same VM.

2.8.1.1 Multiple vGPU Support on the NVIDIA Blackwell Architecture

Board	vGPU
NVIDIA RTX PRO 6000 Blackwell Server Edition	
NVIDIA RTX PRO 6000 Blackwell Server Edition liquid cooled	All Q-series vGPUs. Support for MIG-backed vGPUs requires VCF 9.1 or a later release.
NVIDIA RTX PRO 4500 Blackwell Server Edition	All Q-series vGPUs. Support for MIG-backed vGPUs requires VCF 9.1 or a later release.

2.8.1.2 Multiple vGPU Support on the NVIDIA Ada Lovelace Architecture

Board	vGPU
NVIDIA L40S	All Q-series vGPUs
NVIDIA L40	All Q-series vGPUs
NVIDIA L20	
NVIDIA L20 liquid cooled	All Q-series vGPUs
NVIDIA L4	All Q-series vGPUs
NVIDIA L2	All Q-series vGPUs
NVIDIA RTX 6000 Ada	All Q-series vGPUs
NVIDIA RTX 5880 Ada	All Q-series vGPUs
NVIDIA RTX 5000 Ada	All Q-series vGPUs

2.8.1.3 Multiple vGPU Support on the NVIDIA Ampere GPU Architecture

Board	vGPU
NVIDIA A40	All Q-series vGPUs[8]
NVIDIA A16	All Q-series vGPUs[8]
NVIDIA A10	All Q-series vGPUs[8]
NVIDIA A2	All Q-series vGPUs[8]
NVIDIA RTX A6000	All Q-series vGPUs[8]
NVIDIA RTX A5500	All Q-series vGPUs[8]
NVIDIA RTX A5000	All Q-series vGPUs[8]

2.8.1.4 Multiple vGPU Support on the NVIDIA Turing GPU Architecture

Board	vGPU
Tesla T4	All Q-series vGPUs

2.8.2. Maximum Number of vGPUs Supported per VM

For VMware vSphere, the maximum number of vGPUs per VM supported depends on the hypervisor release:

[8] This type of vGPU cannot be assigned with other types of vGPU to the same VM.

Hypervisor Release	Maximum Number of vGPUs per VM
Since VMware vSphere 8.0 Update 2	16
VMware vSphere 8.0 and 8.0 Update 1	8

2.8.3. Hypervisor Releases that Support Multiple vGPUs Assigned to a VM

All hypervisor releases that support NVIDIA vGPU software are supported.

2.9. Peer-to-Peer CUDA Transfers over NVLink Support

Peer-to-peer CUDA transfers enable device memory between vGPUs on different GPUs that are assigned to the same VM to be accessed from within the CUDA kernels. NVLink is a high-bandwidth interconnect that enables fast communication between such vGPUs. Peer-to-Peer CUDA transfers over NVLink are supported only on a subset of vGPUs, VMware vSphere Hypervisor (ESXi) releases, and guest OS releases.

2.9.1. vGPUs that Support Peer-to-Peer CUDA Transfers

Only Q-series time-sliced vGPUs that are allocated all of the physical GPU's frame buffer on physical GPUs that support NVLink are supported.

2.9.1.1 Peer-to-Peer CUDA Transfer Support on the NVIDIA Ampere GPU Architecture

Board	vGPU
NVIDIA A40	A40-48Q
NVIDIA RTX A6000	A6000-48Q
NVIDIA RTX A5500	A5500-24Q
NVIDIA RTX A5000	A5000-24Q

2.9.1.2 Peer-to-Peer CUDA Transfer Support on the NVIDIA Turing GPU Architecture

Board	vGPU
Quadro RTX 6000	RTX6000-24Q
Quadro RTX 6000 passive	RTX6000P-24Q
Quadro RTX 8000	RTX8000-48Q
Quadro RTX 8000 passive	RTX8000P-48Q

2.9.1.3 Peer-to-Peer CUDA Transfer Support on the NVIDIA Volta GPU Architecture

Board	vGPU
Tesla V100 SXM2 32GB	V100DX-32Q
Tesla V100 SXM2	V100X-16Q

2.9.2. Hypervisor Releases that Support Peer-to-Peer CUDA Transfers

Peer-to-Peer CUDA transfers over NVLink are supported on all hypervisor releases that support the assignment of more than one vGPU to a VM. For details, see *Multiple vGPU Support*.

2.9.3. Guest OS Releases that Support Peer-to-Peer CUDA Transfers

Linux only. Peer-to-Peer CUDA transfers over NVLink are **not** supported on Windows.

2.9.4. Limitations on Support for Peer-to-Peer CUDA Transfers

- NVSwitch is not supported. Only direct connections are supported.
- Only time-sliced vGPUs are supported. MIG-backed vGPUs are **not** supported.
- PCIe is not supported.
- SLI is not supported.

2.10. Unified Memory Support

Unified memory is a single memory address space that is accessible from any CPU or GPU in a system. It creates a pool of managed memory that is shared between the CPU and GPU to provide a simple

way to allocate and access data that can be used by code running on any CPU or GPU in the system. Unified memory is supported only on a subset of vGPUs and guest OS releases.

Note

Unified memory is disabled by default. If used, you must enable unified memory individually for each vGPU that requires it by setting a vGPU plugin parameter. NVIDIA CUDA Toolkit profilers are supported and can be enabled on a VM for which unified memory is enabled.

2.10.1. vGPUs that Support Unified Memory

On GPUs that support the MIG feature and on which this feature is enabled, **only** Q-series MIG-backed vGPUs that occupy an entire GPU instance are supported. All other MIG-backed vGPUs are **not** supported.

On single-instance GPUs, only Q-series vGPUs that are allocated all of the physical GPU's frame buffer on physical GPUs that support unified memory are supported.

2.10.1.1 Unified Memory Support on the NVIDIA Blackwell GPU Architecture

Board	vGPU
NVIDIA RTX PRO 6000 Blackwell Server Edition	
NVIDIA RTX PRO 6000 Blackwell Server Edition liquid cooled	NVIDIA RTX PRO 6000 Blackwell DC-96Q
All Q-series MIG-backed vGPUs that occupy an entire GPU instance	
NVIDIA RTX PRO 4500 Blackwell Server Edition	NVIDIA RTX PRO 4500 Blackwell DC-32Q
All Q-series MIG-backed vGPUs that occupy an entire GPU instance	

2.10.1.2 Unified Memory Support on the NVIDIA Ada Lovelace GPU Architecture

Board	vGPU
NVIDIA L40	L40-48Q
NVIDIA L40S	L40S-48Q
NVIDIA L20	
NVIDIA L20 liquid cooled	L20-48Q
NVIDIA L4	L4-24Q
NVIDIA L2	L2-24Q
NVIDIA RTX 6000 Ada	RTX 6000 Ada-48Q
NVIDIA RTX 5880 Ada	RTX 5880 Ada-48Q
NVIDIA RTX 5000 Ada	RTX 5000 Ada-32Q

2.10.1.3 Unified Memory Support on the NVIDIA Ampere GPU Architecture

Board	vGPU
NVIDIA A40	A40-48Q
NVIDIA A16	A16-16Q
NVIDIA A10	A10-24Q
NVIDIA A2	A2-16Q
NVIDIA RTX A6000	A6000-48Q
NVIDIA RTX A5500	A5500-24Q
NVIDIA RTX A5000	A5000-24Q

2.10.2. Guest OS Releases that Support Unified Memory

Linux only. Unified memory is **not** supported on Windows.

2.10.3. Limitations on Support for Unified Memory

- Only time-sliced Q-series and C-series vGPUs that are allocated all of the physical GPU's frame buffer on physical GPUs that support unified memory are supported. Fractional time-sliced vGPUs are **not** supported.
- When unified memory is enabled for a VM, vGPU migration is disabled for the VM.

2.11. Microsoft Compute Driver Model (MCDM) Support

MCDM is supported only on a subset of vGPUs, GPUs, and guest operating systems.

If you want to use MCDM, you must enable it explicitly as explained in Enabling MCDM.

2.11.1. Supported vGPUs

Only Q-series vGPUs are supported. B-series and A-series vGPUs are **not** supported.

2.11.2. Supported GPUs

MCDM is supported only on GPUs based on the NVIDIA Ampere architecture and later architectures.

2.11.3. Supported Guest OS Releases

- Windows 11 24H2 (build 26100) or a later Windows 11 release
- Windows Server 2025

2.12. NVIDIA GPU Operator Support

NVIDIA GPU Operator simplifies the deployment of NVIDIA vGPU software with software container platforms on immutable operating systems. An immutable operating system does not allow the installation of the NVIDIA vGPU software graphics driver directly on the operating system. NVIDIA GPU Operator is supported only on specific combinations of hypervisor software release, container platform, and guest OS release.

For more information, refer to Using NVIDIA vGPU in the NVIDIA GPU Operator documentation.

2.13. NVIDIA Deep Learning Super Sampling (DLSS) Support

NVIDIA vGPU software supports NVIDIA DLSS on NVIDIA RTX Virtual Workstation.

Supported DLSS versions: 2.0. Version 1.0 is **not** supported.

Supported GPUs:

- NVIDIA L40
- NVIDIA L40S
- NVIDIA L20
- NVIDIA L20 liquid cooled
- NVIDIA L4

- NVIDIA L2
- NVIDIA RTX 6000 Ada
- NVIDIA RTX 5880 Ada
- NVIDIA RTX 5000 Ada
- NVIDIA A40
- NVIDIA A16
- NVIDIA A2
- NVIDIA A10
- NVIDIA RTX A6000
- NVIDIA RTX A5500
- NVIDIA RTX A5000
- NVIDIA RTX PRO 6000 Blackwell Server Edition
- NVIDIA RTX PRO 6000 Blackwell Server Edition liquid cooled
- NVIDIA RTX PRO 4500 Blackwell Server Edition
- Tesla T4

Note

NVIDIA graphics driver components that DLSS requires are installed only if a supported GPU is detected during installation of the driver. Therefore, if the creation of VM templates includes driver installation, the template should be created from a VM that is configured with a supported GPU while the driver is being installed.

Supported applications: only applications that use `nvngx_dlss.dll` version 2.0.18 or newer

2.14. vSphere Lifecycle Management (vLCM) Support

NVIDIA vGPU software supports updating the Virtual GPU Manager for VMware vSphere Hypervisor (ESXi) by using vLCM.

Supported VMware vSphere Hypervisor (ESXi) releases: All releases supported by NVIDIA vGPU software

Supported VMware vCenter Server releases: All releases supported by NVIDIA vGPU software

Note

Updating the Virtual GPU Manager for VMware vSphere Hypervisor (ESXi) by using vLCM might fail with the following error:

```
Host not compatible with the image. The bootbank partition on the host has
↪a capacity of <size>, the image requires <size>. Remove unnecessary
↪components from the image.
```

For information about how to work around this issue, refer to Broadcom Knowledge Base Article: ESXi upgrade or installation failure: Host not compatible with the image. The bootbank partition on the host has a capacity of □size□, the image requires □size□.

Chapter 3. Known Product Limitations

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

3.1. vGPUs of different sizes on the same GPU are not supported

VMware vSphere Hypervisor (ESXi) supports a mixture of time-sliced vGPUs with the same amount of frame buffer from different virtual GPU series on the same physical GPU. A-series, B-series, and Q-series vGPUs with the same amount of frame buffer, for example, A40-2B and A40-2Q, can reside on the same physical GPU simultaneously. However, vGPUs with different amounts of frame buffer are not supported on the same GPU.

VMware vSphere Hypervisor (ESXi) 8 Update 3 and, unless explicitly stated otherwise, later update releases supports a mixture of different types of time-sliced vGPUs on the same physical GPU. Any combination of A-series, B-series, and Q-series vGPUs with any amount of frame buffer can reside on the same physical GPU simultaneously. The total amount of frame buffer allocated to the vGPUs on a physical GPU must not exceed the amount of frame buffer that the physical GPU has.

3.2. Maximum Allowed Network Adapters on a VM

If a VM is configured with too many network adapters, the VM might fail to acquire or return a license. The exact number of network adapters allowed on a VM depends on your system. In testing, it was verified that a VM with **40** network adapters could successfully acquire a license.

If a VM fails to acquire or return a license because the VM is configured with too many network adapters, the following error message is written to the licensing event log file:

```
Failed to update local trusted store - Maximum buffer size exceeded
```

For information about how to recover from such a failure, refer to Virtual GPU Software Client Licensing User Guide.

3.3. NVENC does not support resolutions greater than 4096×4096

3.3.1. Description

The NVIDIA hardware-based H.264 video encoder (NVENC) does not support resolutions greater than 4096×4096. This restriction applies to all NVIDIA GPU architectures and is imposed by the GPU encoder hardware itself, not by NVIDIA vGPU software. The maximum supported resolution for each encoding scheme is listed in the documentation for NVIDIA Video Codec SDK. This limitation affects any remoting tool where H.264 encoding is used with a resolution greater than 4096×4096. Most supported remoting tools fall back to software encoding in such scenarios.

3.3.2. Workaround

Use H.265 encoding. H.265 is more efficient than H.264 encoding and has a maximum resolution of 8192×8192.

> **Note**
>
> Resolutions greater than 4096×4096 are supported only by the H.265 decoder that 64-bit client applications use. The H.265 decoder that 32-bit applications use supports a maximum resolution of 4096×4096.

Because the client-side Workspace App on Windows is a 32-bit application, resolutions greater than 4096×4096 are not supported for Windows clients of Citrix Virtual Apps and Desktops. Therefore, if you are using a Windows client with Citrix Virtual Apps and Desktops, ensure that you are using H.264 hardware encoding with the default Use video codec for compression Citrix graphics policy setting, namely **Actively Changing Regions**. This policy setting encodes only actively changing regions of the screen (for example, a window in which a video is playing). Provided that the number of pixels along any edge of the actively changing region does not exceed 4096, H.264 encoding is offloaded to the NVENC hardware encoder.

3.4. NVIDIA vGPU for Compute is not supported on VMware vSphere

NVIDIA vGPU for Compute is not supported on VMware vSphere. C-series vGPU types are not available.

Instead, NVIDIA vGPU for Compute is supported with NVIDIA AI Enterprise. For more information, see NVIDIA AI Enterprise Documentation.

3.5. Nested Virtualization Is Not Supported by NVIDIA vGPU

In general, NVIDIA vGPU deployments do not support nested virtualization, that is, running a hypervisor in a guest VM. For example, enabling the Hyper-V role in a guest VM running the Windows Server OS is **not** supported because it entails enabling nested virtualization. Similarly, enabling Windows Hypervisor Platform is not supported because it requires the Hyper-V role to be enabled.

3.6. Issues occur when the channels allocated to a vGPU are exhausted

3.6.1. Description

Issues occur when the channels allocated to a vGPU are exhausted and the guest VM to which the vGPU is assigned fails to allocate a channel to the vGPU. A physical GPU has a fixed number of channels and the number of channels allocated to each vGPU is inversely proportional to the maximum number of vGPUs allowed on the physical GPU.

When the channels allocated to a vGPU are exhausted and the guest VM fails to allocate a channel, the following errors are reported on the hypervisor host or in an NVIDIA bug report:

```
Jun 26 08:01:25 srvxen06f vgpu-3[14276]: error: vmiop_log: (0x0): Guest
 ↪attempted to allocate channel above its max channel limit 0xfb
Jun 26 08:01:25 srvxen06f vgpu-3[14276]: error: vmiop_log: (0x0): VGPU
 ↪message 6 failed, result code: 0x1a
Jun 26 08:01:25 srvxen06f vgpu-3[14276]: error: vmiop_log: (0x0):
 ↪0xc1d004a1, 0xff0e0000, 0xff0400fb, 0xc36f,
Jun 26 08:01:25 srvxen06f vgpu-3[14276]: error: vmiop_log: (0x0):         0x1,
 ↪ 0xff1fe314, 0xff1fe038, 0x100b6f000, 0x1000,
Jun 26 08:01:25 srvxen06f vgpu-3[14276]: error: vmiop_log: (0x0):
 ↪0x80000000, 0xff0e0200, 0x0, 0x0, (Not logged),
Jun 26 08:01:25 srvxen06f vgpu-3[14276]: error: vmiop_log: (0x0):         0x1,
 ↪ 0x0
Jun 26 08:01:25 srvxen06f vgpu-3[14276]: error: vmiop_log: (0x0): , 0x0
```

3.6.2. Workaround

Use a vGPU type with more frame buffer, thereby reducing the maximum number of vGPUs allowed on the physical GPU. As a result, the number of channels allocated to each vGPU is increased.

3.7. Total frame buffer for vGPUs is less than the total frame buffer on the physical GPU

Some of the physical GPU's frame buffer is used by the hypervisor on behalf of the VM for allocations that the guest OS would otherwise have made in its own frame buffer. The frame buffer used by the

hypervisor is not available for vGPUs on the physical GPU. In NVIDIA vGPU deployments, frame buffer for the guest OS is reserved in advance, whereas in bare-metal deployments, frame buffer for the guest OS is reserved on the basis of the runtime needs of applications.

If error-correcting code (ECC) memory is enabled on a physical GPU that does not have HBM2 memory, the amount of frame buffer that is usable by vGPUs is further reduced. All types of vGPU are affected, not just vGPUs that support ECC memory.

On all GPUs that support ECC memory and, therefore, dynamic page retirement, additional frame buffer is allocated for dynamic page retirement. The amount that is allocated is inversely proportional to the maximum number of vGPUs per physical GPU. All GPUs that support ECC memory are affected, even GPUs that have HBM2 memory or for which ECC memory is disabled.

The approximate amount of frame buffer that NVIDIA vGPU software reserves can be calculated from the following formula:

`<max-reserved-fb> = <vgpu-profile-size-in-mb>÷16 + 16 + <ecc-adjustments> + <page-retirement-allocation> + <compression-adjustment>`

`<max-reserved-fb>`
The maximum total amount of reserved frame buffer in Mbytes that is not available for vGPUs.

`<vgpu-profile-size-in-mb>`
The amount of frame buffer in Mbytes allocated to a single vGPU. This amount depends on the vGPU type. For example, for the T4-16Q vGPU type, `<vgpu-profile-size-in-mb>` is 16384.

`<ecc-adjustments>`
The amount of frame buffer in Mbytes that is not usable by vGPUs when ECC is enabled on a physical GPU that does not have HBM2 memory.

- If ECC is enabled on a physical GPU that does not have HBM2 memory `<ecc-adjustments>` is `<fb-without-ecc>`/16, which is equivalent to 64 Mbytes for every Gbyte of frame buffer assigned to the vGPU. `<fb-without-ecc>` is total amount of frame buffer with ECC disabled.
- If ECC is disabled or the GPU has HBM2 memory, `<ecc-adjustments>` is 0.

`<page-retirement-allocation>`
The amount of frame buffer in Mbytes that is reserved for dynamic page retirement.

- On GPUs based on the NVIDIA Maxwell GPU architecture, `<page-retirement-allocation>` = 4÷`<max-vgpus-per-gpu>`.
- On GPUs based on NVIDIA GPU architectures **after** the Maxwell architecture, `<page-retirement-allocation>` = 128÷`<max-vgpus-per-gpu>`

`<max-vgpus-per-gpu>`
The maximum number of vGPUs that can be created simultaneously on a physical GPU. This number varies according to the vGPU type. For example, for the T4-16Q vGPU type, `<max-vgpus-per-gpu>` is 1.

`<compression-adjustment>`
The amount of frame buffer in Mbytes that is reserved for the higher compression overhead in vGPU types with 12 Gbytes or more of frame buffer on GPUs based on the Turing architecture.

`<compression-adjustment>` depends on the vGPU type as shown in the following table.

vGPU Type	Compression Adjustment (MB)
T4-16Q T4-16C T4-16A	28

For all other vGPU types, `<compression-adjustment>` is 0.

Note

In VMs running Windows Server 2012 R2, which supports Windows Display Driver Model (WDDM) 1.<x>, an additional 48 Mbytes of frame buffer are reserved and not available for vGPUs.

3.8. Issues may occur with graphics-intensive OpenCL applications on vGPU types with limited frame buffer

3.8.1. Description

Issues may occur when graphics-intensive OpenCL applications are used with vGPU types that have limited frame buffer. These issues occur when the applications demand more frame buffer than is allocated to the vGPU.

For example, these issues may occur with the Adobe Photoshop and LuxMark LuxCoreRender applications:

- When the image resolution and size are changed in Adobe Photoshop, a program error may occur or Photoshop may display a message about a problem with the graphics hardware and a suggestion to disable OpenCL.
- When the LuxMark LuxCoreRender application is run, XID error 31 may occur.

3.8.2. Workaround

For graphics-intensive OpenCL applications, use a vGPU type with more frame buffer.

3.9. In pass through mode, all GPUs connected to each other through NVLink must be assigned to the same VM

3.9.1. Description

In pass through mode, all GPUs connected to each other through NVLink must be assigned to the same VM. If a subset of GPUs connected to each other through NVLink is passed through to a VM, unrecoverable error `XID 74` occurs when the VM is booted. This error corrupts the NVLink state on the physical GPUs and, as a result, the NVLink bridge between the GPUs is unusable.

3.9.2. Workaround

Restore the NVLink state on the physical GPUs by resetting the GPUs or rebooting the hypervisor host.

3.10. VM failures or crashes on servers with 1 TiB or more of system memory

3.10.1. Description

Support for vGPU is limited to servers with less than 1 TiB of system memory. On servers with 1 TiB or more of system memory, VM failures or crashes may occur. For example, when Citrix Virtual Apps and Desktops is used with a Windows 7 guest OS, a blue screen crash may occur. However, support for vDGA is not affected by this limitation.

Depending on the version of NVIDIA vGPU software that you are using, the log file on the VMware vSphere host might also report the following errors:

```
2016-10-27T04:36:21.128Z cpu74:70210)DMA: 1935: Unable to perform element
 ↪mapping: DMA mapping could not be completed
2016-10-27T04:36:21.128Z cpu74:70210)Failed to DMA map address 0x118d296c000
 ↪(0x4000): Can't meet address mask of the device..
2016-10-27T04:36:21.128Z cpu74:70210)NVRM: VM: nv_alloc_contig_pages: failed
 ↪to allocate memory
```

This limitation applies only to systems with supported GPUs based on the Maxwell architecture, namely, Tesla M10.

3.10.2. Resolution

Limit the amount of system memory on the server to 1 TiB minus 16 GiB.

1. Set `memmapMaxRAMMB` to 1032192, which is equal to 1048576 minus 16384.

   For detailed instructions, see Set Advanced Host Attributes in the VMware vSphere documentation.

2. Reboot the server.

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

3.11. VM running an incompatible NVIDIA vGPU guest driver fails to initialize vGPU when booted

3.11.1. Description

A VM running a version of the NVIDIA guest VM driver that is incompatible with the current release of Virtual GPU Manager will fail to initialize vGPU when booted on a VMware vSphere platform running that release of Virtual GPU Manager.

A guest VM driver is incompatible with the current release of Virtual GPU Manager in either of the following situations:

- The guest driver is from a release in a branch two or more major releases before the current release, for example release 9.4.

  In this situation, the VMware vSphere VM's log file reports the following error:

  ```
  vmiop_log: (0x0): Incompatible Guest/Host drivers: Guest VGX version is
  ↪older than the minimum version supported by the Host. Disabling vGPU.
  ```

- The guest driver is from a later release than the Virtual GPU Manager.

  In this situation, the VMware vSphere VM's log file reports the following error:

  ```
  vmiop_log: (0x0): Incompatible Guest/Host drivers: Guest VGX version is
  ↪newer than the maximum version supported by the Host. Disabling vGPU.
  ```

In either situation, 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)
```

3.11.2. Resolution

Install a release of the NVIDIA guest VM driver that is compatible with current release of Virtual GPU Manager.

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

3.12.1. 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.

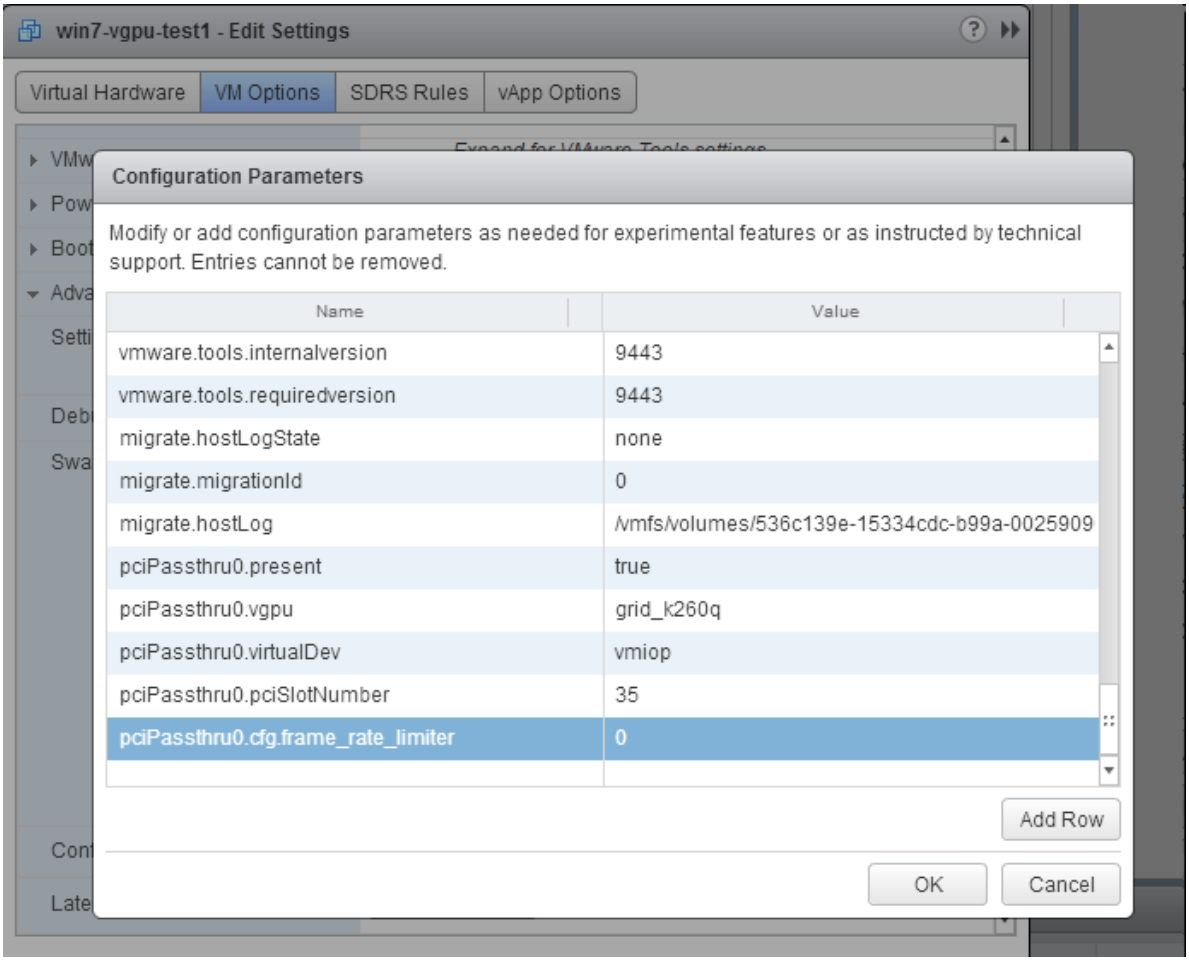
FRL is used to ensure balanced performance across multiple vGPUs that are resident on the same physical GPU. The FRL setting is designed to give good interactive remote graphics experience but may reduce scores in benchmarks that depend on measuring frame rendering rates, as compared to the same benchmarks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

3.12.2. 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 adding the configuration parameter `pciPassthru0.cfg.frame_rate_limiter` in the VM's advanced configuration options.

> **Note**
>
> This setting can only be changed when the VM is powered off.

1. Select **Edit Settings**.
2. In Edit Settings window, select the **VM Options** tab.
3. From the **Advanced** drop-down list, select **Edit Configuration**.
4. In the Configuration Parameters dialog box, click **Add Row**.
5. In the **Name** field, type the parameter name `pciPassthru0.cfg.frame_rate_limiter`, in the **Value** field type 0, and click **OK**.



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 by setting `pciPassthru0.cfg.frame_rate_limiter` to `1` or by removing the parameter from the advanced settings.

3.13. VMs configured with large memory fail to initialize vGPU when booted

3.13.1. Description

When starting multiple VMs configured with large amounts of RAM (typically more than 32GB per VM), a VM may fail to initialize vGPU. In this scenario, the VM boots in VMware SVGA mode and doesn't load the NVIDIA driver. The NVIDIA vGPU software 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)
```

When this error occurs, `VGPU message failed` messages and XID error messages are written to the VMware vSphere VM's log file.

3.13.2. Resolution

vGPU reserves a portion of the VM's framebuffer for use in GPU mapping of VM system memory. The reservation is sufficient to support up to 32GB of system memory, and may be increased to accommodate up to 64GB by adding the configuration parameter `pciPassthru0.cfg.enable_large_sys_mem` in the VM's advanced configuration options

> **Note**
>
> This setting can only be changed when the VM is powered off.

1. Select **Edit Settings**.
2. In Edit Settings window, select the **VM Options** tab.
3. From the **Advanced** drop-down list, select **Edit Configuration**.
4. In the Configuration Parameters dialog box, click **Add Row**.
5. In the **Name** field, type the parameter name `pciPassthru0.cfg.enable_large_sys_mem`, in the **Value** field type 1, and click **OK**.

With this setting in place, less GPU framebuffer is available to applications running in the VM. To accommodate system memory larger than 64GB, the reservation can be further increased by adding `pciPassthru0.cfg.extra_fb_reservation` in the VM's advanced configuration options, and setting its value to the desired reservation size in megabytes. The default value of 64M is sufficient to support 64 GB of RAM. We recommend adding 2 M of reservation for each additional 1 GB of system memory. For example, to support 96 GB of RAM, set `pciPassthru0.cfg.extra_fb_reservation` to 128.

The reservation can be reverted back to its default setting by setting `pciPassthru0.cfg.enable_large_sys_mem` to 0, or by removing the parameter from the advanced settings.

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**.

4.1. Issues Resolved in Release 21.2

No resolved issues are reported in this release for VMware vSphere.

4.2. Issues Resolved in Release 21.1

No resolved issues are reported in this release for VMware vSphere.

4.3. Issues Resolved in Release 21.0

No resolved issues are reported in this release for VMware vSphere.

Chapter 5. Known Issues

Refer to the separate Known Issues document.

Chapter 6. Notices

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