

NVIDIA Virtual GPU Software for Ubuntu Release Notes

Release 21.0

NVIDIA Corporation

Nov 05, 2026

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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 Ubuntu.

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 Ubuntu 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

- `nvidia-xid-logd` support for GPU bind and unbind events

  The service is enabled by default and automatically releases its GPU reference on unbind and resumes monitoring on rebind. You no longer need to stop or disable the service before switching a GPU between vGPU and pass-through modes.

- Windows Subsystem for Linux v2 in Windows guest VMs

  Windows Subsystem for Linux v2 is supported in Windows guest VMs. No other use case that relies on nested virtualization is supported. For details, see *Nested Virtualization Is Not Supported by NVIDIA vGPU*.

- 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
- Console VNC support with the Wayland display server protocol
- 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

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, Ubuntu 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 Ubuntu 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.

2.1.1. GPUs Based on the NVIDIA Blackwell Architecture

Note

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

GPUs based on the NVIDIA Blackwell architecture support manual placement of vGPUs on GPUs in equal-size mode.

GPU	Mixed vGPU Configuration - Ubuntu Releases		Supported NVIDIA vGPU Software Products[1,2,3]			
	Frame Buffer Size (Mixed-Size Mode)	Series	Time-Sliced NVIDIA vGPU on Single-Instance GPU[4]	1:1 MIG-Backed NVIDIA vGPU[5]	Time-Sliced, MIG-Backed NVIDIA vGPU	GPU Pass Through
NVIDIA RTX PRO 6000 Blackwell Server Edition	24.04, 22.04, 20.04	24.04, 22.04, 20.04	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA RTX PRO 6000 Blackwell Server Edition liquid cooled	24.04, 22.04, 20.04	24.04, 22.04, 20.04	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA RTX PRO 4500 Blackwell Server Edition	24.04, 22.04, 20.04	24.04, 22.04, 20.04	▶ 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.

GPUs based on the NVIDIA Ada Lovelace architecture support manual placement of vGPUs on GPUs

[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.

in equal-size mode.

GPU	Mixed vGPU Configuration - Ubuntu Releases		Supported NVIDIA vGPU Software Products[Page 6, 1],[Page 6, 2],[F	
	Frame Buffer Size (Mixed-Size Mode)	Series	NVIDIA vGPU	GPU Pass Through
NVIDIA L40S	24.04, 20.04	22.04, 24.04, 20.04	22.04, ▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA L40	24.04, 20.04	22.04, 24.04, 20.04	22.04, ▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA L20	24.04, 20.04	22.04, 24.04, 20.04	22.04, ▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA L20 liquid cooled	24.04, 20.04	22.04, 24.04, 20.04	22.04, ▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA L4	24.04, 20.04	22.04, 24.04, 20.04	22.04, ▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA L2	24.04, 20.04	22.04, 24.04, 20.04	22.04, ▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA RTX 6000 Ada	24.04, 20.04	22.04, 24.04, 20.04	22.04, ▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA RTX 5880 Ada	24.04, 20.04	22.04, 24.04, 20.04	22.04, ▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA RTX 5000 Ada	24.04, 20.04	22.04, 24.04, 20.04	22.04, ▶ 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 - Ubuntu Releases		Supported NVIDIA vGPU Software Products[Page 6, 1],[Page 6, 2],[F	
	Frame Buffer Size (Mixed-Size Mode)	Series	NVIDIA vGPU	GPU Pass Through
NVIDIA A40[6]	24.04, 20.04	22.04, 24.04, 20.04	22.04, ▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA A16	24.04, 20.04	22.04, 24.04, 20.04	22.04, ▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA A10	24.04, 20.04	22.04, 24.04, 20.04	22.04, ▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA A2	24.04, 20.04	22.04, 24.04, 20.04	22.04, ▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA RTX A6000[6]	24.04, 20.04	22.04, 24.04, 20.04	22.04, ▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA RTX A5500[6]	24.04, 20.04	22.04, 24.04, 20.04	22.04, ▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps
NVIDIA RTX A5000[6]	24.04, 20.04	22.04, 24.04, 20.04	22.04, ▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps

[6] 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 - Ubuntu Releases		Supported NVIDIA vGPU Software Products[Page 6, 1],[Page 6, 2],[F	
	Frame Buffer Size (Mixed-Size Mode)	Series	NVIDIA vGPU	GPU Pass Through
Tesla T4	24.04, 22.04, 20.04	24.04, 22.04, 20.04	▶ vWS ▶ vPC ▶ vApps	▶ vWS ▶ vApps

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

Ubuntu 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.

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.

2.2. Hypervisor Software Releases

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

Note

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

Software	Releases Supported	Notes
Ubuntu	26.04 LTS	All NVIDIA GPUs that NVIDIA vGPU software supports are supported with vGPU and in pass-through mode, **except** on systems that are based on NVIDIA® NVSwitch™ on-chip memory fabric.
Ubuntu	24.04 LTS	All NVIDIA GPUs that NVIDIA vGPU software supports are supported with vGPU and in pass-through mode, **except** on systems that are based on NVIDIA® NVSwitch™ on-chip memory fabric.
Ubuntu	22.04 LTS	All NVIDIA GPUs that NVIDIA vGPU software supports are supported with vGPU and in pass-through mode, **except** on systems that are based on NVIDIA® NVSwitch™ on-chip memory fabric.
Ubuntu	20.04 LTS	All NVIDIA GPUs that NVIDIA vGPU software supports are supported with vGPU and in pass-through mode, **except** on systems that are based on NVIDIA® NVSwitch™ on-chip memory fabric.

2.3. Guest OS Support

NVIDIA vGPU software supports several 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 Ubuntu. The releases of Ubuntu 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.

2.3.1.1 Windows Guest OS Support in Release 21.0

- 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 64-bit Linux distributions listed as a guest OS on Ubuntu. The releases of Ubuntu 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.

2.3.2.1 Linux Guest OS Support in Release 21.0

Guest OS	Wayland Support	X11 Support
Ubuntu 26.04 LTS Not supported on Ubuntu hypervisor releases earlier than Ubuntu 26.04 LTS	✓×	✓✓
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

- 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
- Frame-rate limiting (FRL)

Console VNC is **not** supported on MIG-backed, time-sliced vGPUs. It is supported only on the following types of vGPUs:

- Time-sliced vGPUs on a single-instance GPU
- 1:1 MIG-backed vGPUs

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 is supported on all supported GPUs, but only on a subset of supported Ubuntu releases and guest operating systems.

2.6.1. Limitations with vGPU Migration Support

Migration between hosts that are running different versions of the NVIDIA Virtual GPU Manager driver is not supported, even within the same NVIDIA Virtual GPU Manager driver branch.

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

Since Ubuntu 24.04

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. 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.

2.7.1. 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.
- For GPUs based on the NVIDIA Pascal™ graphics architecture, only Q-series vGPUs that are allocated all of the physical GPU's frame buffer are supported.
- 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.

2.7.1.1 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
NVIDIA RTX PRO 4500 Blackwell Server Edition	All Q-series vGPUs

2.7.1.2 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

2.7.1.3 Multiple vGPU Support on the NVIDIA Ampere GPU Architecture

Board	vGPU
NVIDIA A40	All Q-series vGPUs[7]
NVIDIA A16	All Q-series vGPUs[7]
NVIDIA A10	All Q-series vGPUs[7]
NVIDIA A2	All Q-series vGPUs[7]
NVIDIA RTX A6000	All Q-series vGPUs[7]
NVIDIA RTX A5500	All Q-series vGPUs[7]
NVIDIA RTX A5000	All Q-series vGPUs[7]

2.7.1.4 Multiple vGPU Support on the NVIDIA Turing GPU Architecture

Board	vGPU
Tesla T4	All Q-series vGPUs

2.7.2. Maximum Number of vGPUs Supported per VM

NVIDIA vGPU software supports up to a maximum of 16 vGPUs per VM.

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

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

All hypervisor releases that support NVIDIA vGPU software are supported.

2.8. 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, Ubuntu releases, and guest OS releases.

2.8.1. 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.

2.8.1.1 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

2.8.1.2 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

2.8.1.3 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

2.8.2. 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*.

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

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

2.8.4. 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.

2.9. 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.

2.9.1. 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.

2.9.1.1 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	

2.9.1.2 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

2.9.1.3 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

2.9.2. Guest OS Releases that Support Unified Memory

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

2.9.3. 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.

2.10. 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.

2.10.1. Supported vGPUs

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

2.10.2. Supported GPUs

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

2.10.3. Supported Guest OS Releases

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

2.11. 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

Chapter 3. Known Product Limitations

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

3.1. 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.

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

3.2.1. 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.

3.2.2. 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.

3.3. NVIDIA vGPU for Compute is not supported on Ubuntu

NVIDIA vGPU for Compute is not supported on Ubuntu. 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.

3.4. 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.

However, the following features, which rely on nested virtualization, are supported in Windows guest VMs:

- Windows Subsystem for Linux v2

No other use case that relies on nested virtualization is supported.

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

3.5.1. 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
```

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```
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
```

3.5.2. 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.

3.6. Virtual GPU hot plugging is not supported

NVIDIA vGPU software does not support the addition of virtual function I/O (VFIO) mediated device (`mdev`) devices after the VM has been started by QEMU. All `mdev` devices must be added before the VM is started.

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

3.10.1. 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 an Ubuntu 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 Ubuntu VM's `/var/log/messages` 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 Ubuntu VM's `/var/log/messages` 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)
```

3.10.2. Resolution

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

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

3.11.1. 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.

3.11.2. 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 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
   ```

   Note

   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
   ```

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

3.12.1. 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 Ubuntu 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
```

3.12.2. 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**.

4.1. Issues Resolved in Release 21.2

No resolved issues are reported in this release for Ubuntu.

4.2. Issues Resolved in Release 21.1

No resolved issues are reported in this release for Ubuntu.

4.3. Issues Resolved in Release 21.0

No resolved issues are reported in this release for Ubuntu.

Chapter 5. Known Issues

Refer to the separate Known Issues document.

Chapter 6. Notices

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