



# **NVIDIA Data Center GPU Driver version 460.32.03 (Linux) / 461.09 (Windows)**

Release Notes

# Table of Contents

|   |          |
|---|----------|
| <b>Chapter 1. Version Highlights</b> .....            | <b>1</b> |
| 1.1. Software Versions.....                           | 1        |
| 1.2. New Features.....                                | 2        |
| 1.3. Fixed Issues.....                                | 2        |
| 1.4. Known Issues.....                                | 2        |
| <b>Chapter 2. Virtualization</b> .....                | <b>4</b> |
| <b>Chapter 3. Hardware and Software Support</b> ..... | <b>6</b> |

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# Chapter 1. Version Highlights

This section provides highlights of the NVIDIA Data Center GPU R460 Driver (version 460.32.03 Linux and 461.09 Windows).

For changes related to the 460 release of the NVIDIA display driver, review the file "NVIDIA\_Changelog" available in the .run installer packages.

- ▶ Windows driver release date: 01/07/2021
- ▶ Linux driver release date: 01/19/2020

## 1.1. Software Versions

For this release, the software versions are listed below.

- ▶ CUDA Toolkit 11: 11.2.0  
Note that starting with CUDA 11, individual components of the toolkit are versioned independently. For a full list of the individual versioned components (e.g. nvcc, CUDA libraries etc.), see the [CUDA Toolkit Release Notes](#)
- ▶ NVIDIA Data Center GPU Driver: 460.32.03 (Linux) / 461.09 (Windows)
- ▶ Fabric Manager: 460.32.03 (Use `nv-fabricmanager -v`)
- ▶ GPU VBIOS:
  - ▶ 92.00.19.00.01 (NVIDIA A100 SKU200 with heatsink for HGX A100 8-way and 4-way)
  - ▶ 92.00.19.00.02 (NVIDIA A100 SKU202 w/o heatsink for HGX A100 4-way)
- ▶ NVSwitch VBIOS: 92.10.14.00.01
- ▶ NVFlash: 5.641

Due to a revision lock between the VBIOS and driver, VBIOS versions  $\geq$  92.00.18.00.00 must use corresponding drivers  $\geq$  450.36.01. Older VBIOS versions will work with newer drivers.

For more information on getting started with the NVIDIA Fabric Manager on NVSwitch-based systems (for example, HGX A100), refer to the [Fabric Manager User Guide](#).

## 1.2. New Features

### General

- ▶ Added support for CUDA 11.2. For more information on CUDA 11.2, refer to the [CUDA Toolkit 11.2 Release Notes](#)
- ▶ Added support for NVIDIA A40.
- ▶ Added support for NVIDIA RTX A6000.

## 1.3. Fixed Issues

- ▶ Various security issues were addressed. For additional details on the med-high severity issues, review the [NVIDIA Security Bulletin 5142](#).

## 1.4. Known Issues

### General

- ▶ By default, Fabric Manager runs as a systemd service. If using `DAEMONIZE=0` in the Fabric Manager configuration file, then the following steps may be required.
  1. Disable FM service from auto starting. (`systemctl disable nvidia-fabricmanager`)
  2. Once the system is booted, manually start FM process. (`/usr/bin/nv-fabricmanager -c /usr/share/nvidia/nvswitch/fabricmanager.cfg`). Note, since the process is not a daemon, the SSH/Shell prompt will not be returned (use another SSH shell for other activities or run FM as a background task).
- ▶ There is a known issue with cross-socket GPU to GPU memory consistency that is currently under investigation
- ▶ On NVSwitch systems with Windows Server 2019 in shared NVSwitch virtualization mode, the host may hang or crash when a GPU is disabled in the guest VM. This issue is under investigation.

### GPU Performance Counters

The use of developer tools from NVIDIA that access various performance counters requires administrator privileges. See this [note](#) for more details. For example, reading NVLink utilization metrics from `nvidia-smi` (`nvidia-smi nvlink -g 0`) would require administrator privileges.

## NoScanout Mode

NoScanout mode is no longer supported on NVIDIA Data Center GPU products. If NoScanout mode was previously used, then the following line in the “screen” section of /etc/X11/xorg.conf should be removed to ensure that X server starts on data center products:

```
Option      "UseDisplayDevice" "None"
```

NVIDIA Data Center GPU products now support one display of up to 4K resolution.

## Unified Memory Support

Some Unified Memory APIs (for example, CPU page faults) are not supported on Windows in this version of the driver. Review the CUDA Programming Guide on the system requirements for Unified Memory

CUDA and unified memory is not supported when used with Linux power management states S3/S4.

## IMPU FRU for Volta GPUs

The driver does not support the IPMI FRU multi-record information structure for NVLink. See the Design Guide for Tesla P100 and Tesla V100-SXM2 for more information.

## Experimental OpenCL Features

Select features in OpenCL 2.0 are available in the driver for evaluation purposes only.

The following are the features as well as a description of known issues with these features in the driver:

### Device side enqueue

- ▶ The current implementation is limited to 64-bit platforms only.
- ▶ OpenCL 2.0 allows kernels to be enqueued with `global_work_size` larger than the compute capability of the NVIDIA GPU. The current implementation supports only combinations of `global_work_size` and `local_work_size` that are within the compute capability of the NVIDIA GPU. The maximum supported CUDA grid and block size of NVIDIA GPUs is available at <http://docs.nvidia.com/cuda/cuda-c-programming-guide/index.html#computecapabilities>. For a given grid dimension, the `global_work_size` can be determined by CUDA grid size x CUDA block size.
- ▶ For executing kernels (whether from the host or the device), OpenCL 2.0 supports non-uniform ND-ranges where `global_work_size` does not need to be divisible by the `local_work_size`. This capability is not yet supported in the NVIDIA driver, and therefore not supported for device side kernel enqueues.

### Shared virtual memory

- ▶ The current implementation of shared virtual memory is limited to 64-bit platforms only.

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# Chapter 2. Virtualization

To make use of GPU passthrough with virtual machines running Windows and Linux, the hardware platform must support the following features:

- ▶ A CPU with hardware-assisted instruction set virtualization: Intel VT-x or AMD-V.
- ▶ Platform support for I/O DMA remapping.
- ▶ On Intel platforms the DMA remapper technology is called Intel VT-d.
- ▶ On AMD platforms it is called AMD IOMMU.

Support for these features varies by processor family, product, and system, and should be verified at the manufacturer's website.

## Supported Hypervisors

The following hypervisors are supported:

| Hypervisor                  | Notes                                    |
|-----------------------------|--|
| Citrix XenServer            | Version 6.0 and later                    |
| VMware vSphere (ESX / ESXi) | Version 5.1 and later.                   |
| Red Hat KVM                 | Red Hat Enterprise Linux 7 with KVM      |
| Microsoft Hyper-V           | Windows Server 2016 Hyper-V Generation 2 |

Tesla products now support one display of up to 4K resolution.

## Supported Graphics Cards

The following GPUs are supported for device passthrough:

| GPU Family                     | Boards Supported     |
|--------------------------------|----------------------|
| NVIDIA Ampere GPU Architecture | NVIDIA A100, A40     |
| Turing                         | NVIDIA T4            |
| Volta                          | NVIDIA V100          |
| Pascal                         | Tesla: P100, P40, P4 |

| GPU Family | Boards Supported        |
|------------|-------------------------|
| Maxwell    | Tesla: M60, M40, M6, M4 |
| Kepler     | Tesla: K520, K80        |

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# Chapter 3. Hardware and Software Support

Support for these features varies by processor family, product, and system, and should be verified at the manufacturer's website.

## Supported Operating Systems for NVIDIA Data Center GPUs

The Release 460 driver is supported on the following operating systems:

- ▶ Windows x86\_64 operating systems:
  - ▶ Microsoft Windows® Server 2019
  - ▶ Microsoft Windows® Server 2016
  - ▶ Microsoft Windows® 10
- ▶ The table below summarizes the supported Linux 64-bit distributions. For a complete list of distributions, kernel versions supported, see the [CUDA Linux System Requirements](#) documentation.

| Distribution  | x86_64 | POWER | Arm64 Server   |
|---|--------|-------|----------------|
| OpenSUSE Leap 15.x<br>(where y <= 2)                    | Yes    | No    | No             |
| Red Hat Enterprise Linux / CentOS 8.y<br>(where y <= 3) | Yes    | Yes   | Yes            |
| Red Hat Enterprise Linux / CentOS 7.y<br>(where y <= 9) | Yes    | No    | No             |
| SUSE Linux Enterprise Server 15.x (where y <= 2)        | Yes    | No    | Yes (see note) |
| Ubuntu 20.04 LTS  | Yes    | No    | No             |
| Ubuntu 18.04.z LTS<br>(where z <= 5)                    | Yes    | Yes   | Yes            |



| Distribution                         | x86_64 | POWER | Arm64 Server |
|--------------------------------------|--------|-------|--------------|
| Ubuntu 16.04.z LTS<br>(where z <= 7) | Yes    | No    | No           |

Note that SUSE Linux Enterprise Server (SLES) 15.1 is provided as a preview for Arm64 server since there are known issues when running some CUDA applications related to dependencies on `glibc 2.27`.

## Supported Operating Systems and CPU Configurations for HGX A100

The Release 460 driver is validated with HGX A100 on the following operating systems and CPU configurations:

- ▶ Linux 64-bit distributions:
  - ▶ Red Hat Enterprise Linux 8.3 (in 4/8/16-GPU configurations)
  - ▶ Red Hat Enterprise Linux 7.9 (in 4/8/16-GPU configurations)
  - ▶ CentOS Linux 8.3 (in 4/8/16-GPU configurations)
  - ▶ CentOS Linux 7.9 (in 4/8/16-GPU configurations)
  - ▶ Ubuntu 18.04.5 LTS (in 4/8/16-GPU configurations)
  - ▶ SUSE SLES 15.2 (in 4/8/16-GPU configurations)
- ▶ CPU Configurations:
  - ▶ AMD Rome in PCIe Gen4 mode
  - ▶ Intel Skylake/Cascade Lake (4-socket) in PCIe Gen3 mode

## Supported Virtualization Configurations

The Release 460 driver is validated with HGX A100 on the following configurations:

- ▶ Passthrough (full visibility of GPUs and NVSwitches to guest VMs):
  - ▶ 8-GPU configurations with Ubuntu 18.04.4 LTS
- ▶ Shared NVSwitch (guest VMs only have visibility of GPUs and full NVLink bandwidth between GPUs in the same guest VM):
  - ▶ 16-GPU configurations with Ubuntu 18.04.4 LTS

## API Support

This release supports the following APIs:

- ▶ NVIDIA® CUDA® 11.2 for NVIDIA® Kepler™, Maxwell™, Pascal™, Volta™, Turing™ and NVIDIA Ampere architecture GPUs
- ▶ OpenGL® 4.6
- ▶ Vulkan® 1.2

- ▶ DirectX 11
- ▶ DirectX 12 (Windows 10)
- ▶ Open Computing Language (OpenCL™ software) 1.2

Note that for using graphics APIs on Windows (i.e. OpenGL, Vulkan, DirectX 11 and DirectX 12) or any WDDM 2.0+ based functionality on Tesla GPUs, vGPU is required. See the [vGPU documentation](#) for more information.

## Supported NVIDIA Data Center GPUs

The NVIDIA Data Center GPU driver package is designed for systems that have one or more Tesla products installed. This release of the driver supports CUDA C/C++ applications and libraries that rely on the CUDA C Runtime and/or CUDA Driver API.

| NVIDIA Server Platforms |                   |
|-------------------------|-------------------|
| Product                 | Architecture      |
| NVIDIA HGX A100         | A100 and NVSwitch |
| NVIDIA HGX-2            | V100 and NVSwitch |

| RTX-Series Products |                  |
|---------------------|------------------|
| Product             | GPU Architecture |
| NVIDIA RTX A6000    | NVIDIA Ampere    |
| Quadro RTX 8000     | Turing           |
| Quadro RTX 6000     | Turing           |

| A-Series Products |                  |
|-------------------|------------------|
| Product           | GPU Architecture |
| NVIDIA A100       | NVIDIA Ampere    |
| NVIDIA A40        | NVIDIA Ampere    |

| T-Series Products |                  |
|-------------------|------------------|
| Product           | GPU Architecture |
| NVIDIA T4         | Turing           |

| V-Series Products |                  |
|-------------------|------------------|
| Product           | GPU Architecture |
| NVIDIA V100       | Volta            |

| Tesla P-Series Products |                  |
|-------------------------|------------------|
| Product                 | GPU Architecture |
| NVIDIA Tesla P100       | Pascal           |
| NVIDIA Tesla P40        | Pascal           |
| NVIDIA Tesla P4         | Pascal           |

| Tesla K-Series Products |                  |
|-------------------------|------------------|
| Product                 | GPU Architecture |
| NVIDIA Tesla K520       | Kepler           |
| NVIDIA Tesla K80        | Kepler           |

| Tesla M-Class Products |                  |
|------------------------|------------------|
| Product                | GPU Architecture |
| NVIDIA Tesla M60       | Maxwell          |
| NVIDIA Tesla M40 24 GB | Maxwell          |
| NVIDIA Tesla M40       | Maxwell          |
| NVIDIA Tesla M6        | Maxwell          |
| NVIDIA Tesla M4        | Maxwell          |

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