NVIDIA Data Center GPU Driver version 515.65.01 (Linux) / 516.94 (Windows)

Release Notes

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Chapter 1. Version Highlights

This section provides highlights of the NVIDIA Data Center GPU R515 Driver (version 515.65.01 Linux and 516.94 Windows).

For changes related to the 515 release of the NVIDIA display driver, review the file "NVIDIA_Changelog" available in the .run installer packages.

- Linux driver release date: 08/02/2022
- Windows driver release date: 08/02/2022

1.1. Software Versions

For this release, the software versions are as follows:

- CUDA Toolkit 11: 11.7

  Note that starting with CUDA 11, individual components of the toolkit are versioned independently. For a full list of the individual versioned components (for example, nvcc, CUDA libraries, and so on), see the CUDA Toolkit Release Notes.
- NVIDIA Data Center GPU Driver: 515.65.01 (Linux) / 516.94 (Windows)
- Fabric Manager: 515.65.01 (Use `nv-fabricmanager -v`)
- GPU VBIOS:
  - 92.00.19.00.01 (NVIDIA A100 SKU200 with heatsink for NVIDIA HGX A100 8-way and 4-way)
  - 92.00.19.00.02 (NVIDIA A100 SKU202 w/o heatsink for NVIDIA 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 >= 92.00.18.00.00 must use corresponding drivers >= 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, NVIDIA HGX A100), refer to the Fabric Manager User Guide.

1.2. Fixed Issues

- During ongoing testing, NVIDIA identified that due to an algorithm error in a very small number of hardest-to-round cases (less than 0.000007% of tested combinations), the results of 64-bit floating-point division in default round-to-nearest-even mode can differ from the IEEE754 standard by 1 least-significant bit in default round-to-nearest-even mode.

  Floating-point computations have many sources of error accumulation and most algorithms will not have encountered this discrepancy. NVIDIA recommends that all developers requiring strict IEEE754 compliance update to CUDA Toolkit 11.7 Update 1 or newer.

  The affected algorithm is present in both offline compilation as well as just-in-time (JIT) compilation. As JIT compilation is handled by the driver, NVIDIA recommends updating to driver version 515.65.01 when IEEE754 compliance is required and when using JIT.

  This is a software algorithm fix and is not tied to specific hardware.
- Pascal GPU page faults could hit a NULL pointer dereference in the UVM driver if there was not enough system memory available to handle the faults.
- DEVID of POSTLTSSM was reused for a different table. This caused RM to parse the new table incorrectly. This was resolved by removing code which parses PostLTSSM since RISC-V devinit on PMU is currently disabled.

1.3. Known Issues

General

- When switching between the Open and the legacy kernel modules on Ubuntu, use the following commands:

  In order to switch from **open -> legacy**:

  ```
  sudo apt-get remove --purge nvidia-kernel-open-515
  sudo apt-get install cuda-drivers-515
  ```

  In order to switch from **legacy -> open**:

  ```
  sudo apt-get remove --purge nvidia-kernel-source-515
  sudo apt-get install nvidia-kernel-open-515
  sudo apt-get install cuda-drivers-515
  ```
- If you encounter an error on RHEL7 when installing with `cuda-drivers-fabricmanager` packages, use the following alternate instructions. For example:

  If you are upgrading from a different branch, for example to driver 515.65.01:

  ```
  new_version=515.65.01
  sudo yum swap nvidia-driver-latest-dkms nvidia-driver-latest-dkms-${new_version}
  sudo yum install nvidia-fabric-manager-${new_version}
  ```

- When installing a driver on SLES15 or openSUSE15 that previously had an R515 driver installed, users need to run the following command afterwards to finalize the installation:

  ```
  sudo zypper install --force nvidia-gfxG05-kmp-default
  ```

  Without doing this, users may see the kernel objects as missing.
- `nvidia-release-upgrade` may report that not all updates have been installed and exit.

  When running the `nvidia-release-upgrade` command on DGX systems running DGX OS 4.99.x, it may exit and tell users: "Please install all available updates for your release before upgrading" even though all upgrades have been installed.

  Users who see this can run the following command:

  ```
  sudo apt install -y nvidia-fabricmanager-450/bionic-updates --
  allow-downgrades
  ```

  After running this, proceed with the regular upgrade steps:

  ```
  sudo apt update
  sudo apt full-upgrade -y
  sudo apt install -y nvidia-release-upgrade
  sudo nvidia-release-upgrade
  ```
- 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).
- 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.

OpenCL 3.0 Known Issues

Device side enqueue

- Device-Side-Enqueue related queries may return 0 values, although corresponding built-ins can be safely used by kernel. This is in accordance with conformance requirements described at https://www.khronos.org/registry/OpenCL/specs/3.0-unified/html/OpenCL_API.html#opencl-3.0-backwardscompatibility
- Shared virtual memory - the current implementation of shared virtual memory is limited to 64-bit platforms only.

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

Data Center 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, A30, A16, A10
NVIDIA Turing	NVIDIA T4
NVIDIA Volta	NVIDIA V100
NVIDIA Pascal	Tesla: P100, P40, P4

GPU Family	Boards Supported
NVIDIA Maxwell	Tesla: M60, M40, M6, M4

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 515 driver is supported on the following operating systems:

- Windows x86_64 operating systems:
  - Microsoft Windows® Server 2022
  - Microsoft Windows® Server 2019
  - Microsoft Windows® Server 2016
  - Microsoft Windows® 11 21H2
  - Microsoft Windows® 10
- The following table 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
Debian 11.x (where x <= 4)	Yes	No	No
OpenSUSE Leap 15.x (where y <= 4)	Yes	No	No
Fedora 35	Yes	No	No
Red Hat Enterprise Linux 9.0	Yes	No	Yes
Red Hat Enterprise Linux 8.y (where y <= 6)	Yes	Yes	Yes
Rocky Linux 8.y (where y <= 6)	Yes	No	No

Distribution	x86_64	POWER	Arm64 Server
Red Hat Enterprise Linux / CentOS 7.y (where y <= 9)	Yes	No	No
SUSE Linux Enterprise Server 15.y (where y <= 4)	Yes	No	Yes (see note)
Ubuntu 22.04 LTS	Yes	No	Yes
Ubuntu 20.04.z LTS (where z <= 4)	Yes	No	Yes
Ubuntu 18.04.z LTS (where z <= 6)	Yes	No	No

Note: This release was not tested with Rocky Linux 9.0

Note: SUSE Linux Enterprise Server (SLES) 15.3 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 NVIDIA HGX A100

The Release 515 driver is validated with NVIDIA HGX A100 on the following operating systems and CPU configurations:

- Linux 64-bit distributions:
  - Debian 11.4
  - Red Hat Enterprise Linux 8.6 (in 4/8/16-GPU configurations)
  - Red Hat Enterprise Linux 7.9 (in 4/8/16-GPU configurations)
  - Rocky Linux 8.6 (in 4/8/16-GPU configurations)
  - Red Hat Enterprise Linux 9.0 (in 4/8/16-GPU configurations)
  - CentOS Linux 7.9 (in 4/8/16-GPU configurations)
  - Ubuntu 18.04.6 LTS (in 4/8/16-GPU configurations)
  - SUSE SLES 15.3 (in 4/8/16-GPU configurations)
- Windows 64-bit distributions:
  - Windows Server 2019 (in 1/2/4/8-GPU configurations; 16-GPU configurations are currently not supported)

    Windows is supported only in shared NVSwitch virtualization configurations.
- CPU Configurations:

- AMD Rome in PCIe Gen4 mode
- Intel Skylake/Cascade Lake (4-socket) in PCIe Gen3 mode

Supported Virtualization Configurations

The Release 515 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 18.04.6 LTS
- Shared NVSwitch (guest VMs only have visibility of GPUs and full NVLink bandwidth between GPUs in the same guest VM):
  - 1/2/4/8/16-GPU configurations with Ubuntu 18.04.5 LTS

API Support

This release supports the following APIs:

- NVIDIA® CUDA® 11.7 for NVIDIA® Maxwell™, Pascal™, Volta™, Turing™, and NVIDIA Ampere architecture GPUs
- OpenGL® 4.6
- Vulkan® 1.3
- DirectX 11
- DirectX 12 (Windows 10)
- Open Computing Language (OpenCL™ software) 3.0

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 Data Center 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 Data Center GPU 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.

Attention: Release 470 was the last driver branch to support Data Center GPUs based on the Kepler architecture. This includes discontinued support for the following compute capabilities:

- sm_30 (Kepler)
- sm_32 (Kepler)
- sm_35 (Kepler)
- sm_37 (Kepler)

For more information on GPU products and compute capability, see https://developer.nvidia.com/cuda-gpus.

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

RTX-Series / T-Series Products	
Product	**GPU Architecture**
NVIDIA RTX A6000	NVIDIA Ampere
NVIDIA RTX A5000	NVIDIA Ampere
NVIDIA RTX A4000	NVIDIA Ampere
Quadro RTX 8000	Turing
Quadro RTX 6000	Turing
NVIDIA T1000	Turing
NVIDIA T600	Turing
NVIDIA T400	Turing

Data Center A-Series Products	
Product	**GPU Architecture**
NVIDIA A100X	NVIDIA Ampere
NVIDIA A100 NVIDIA A100 80 GB PCIe	NVIDIA Ampere
NVIDIA A40	NVIDIA Ampere
NVIDIA A30. A30X	NVIDIA Ampere
NVIDIA A16	NVIDIA Ampere
NVIDIA A10, A10M	NVIDIA Ampere

Data Center T-Series Products	
Product	**GPU Architecture**
NVIDIA T4	Turing

Data Center V-Series Products	
Product	**GPU Architecture**
NVIDIA V100	Volta

Data Center P-Series Products	
Product	**GPU Architecture**
NVIDIA Tesla P100	Pascal
NVIDIA Tesla P40	Pascal
NVIDIA Tesla P4	Pascal

Data Center 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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