NVIDIA RTX Enterprise Driver Release 570, Version 573.73

Release Notes

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Chapter 1. Introduction to Release Notes

This edition of ***Release Notes*** describes the Release 570 family of NVIDIA® RTX ®, Quadro®, Data Center, and NVIDIA® RTX® Notebook Drivers for Microsoft® Windows® 10 and Windows 11. NVIDIA provides these notes to describe performance improvements and bug fixes in each documented version of the driver.

1.1 Structure of the Document

This document is organized in the following sections:

- Release **570** Driver Changes gives a summary of changes, and fixed and open issues in this version.
- The Release **570** Driver describes the NVIDIA products and languages supported by this driver, the system requirements, and how to install the driver.

1.2 Changes in this Edition

This edition of the Release Notes for Windows 10 and Windows 11 includes information about NVIDIA graphics driver version 573.73, and lists changes made to the driver since version 573.65.

These changes are discussed beginning with the chapter Release 570 Driver Changes.

Chapter 2. Release 570 Driver Changes

This chapter describes open issues for version 573.73, and resolved issues and driver enhancements for versions of the Release 570 driver up to version 573.73.

The chapter contains these sections:

- Version 573.73 Highlights
- Changes in Version 573.73

2.1 Version 573.73 Highlights

This section provides highlights of version 573.73 of the NVIDIA Release 570 Driver for Windows 10 and Windows 11.

- Existing Support
- What's New in Version 573.73
- What's New in Release 570
- Discontinued and Unsupported Features
- Limitations in This Release

2.1.1 Existing Support

This release supports the following APIs:

1. OpenCL™ software 3.0
2. OpenGL® 4.6
3. Vulkan® 1.4
4. DirectX 11
5. DirectX 12
6. NVIDIA® CUDA® 12.8

This driver installs NVIDIA RTX Desktop Manager version 205.28.

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2.1.2 What's New in Version 573.73

2.1.2.1 New Feature Highlights

- Enhanced Encode and Decode — with Blackwell hardware, users can now encode and decode at broadcast quality.
- Support for High Frequency/Bandwidth Displays — with Blackwell hardware, users can now support ultra-high frequency and high bandwidth displays.
- New supported SKUs:
  - NVIDIA RTX PRO 5000 Blackwell Generation Laptop GPU
  - NVIDIA RTX PRO 4000 Blackwell Generation Laptop GPU
  - NVIDIA RTX PRO 3000 Blackwell Generation Laptop GPU
  - NVIDIA RTX PRO 2000 Blackwell Generation Laptop GPU
  - NVIDIA RTX PRO 1000 Blackwell Generation Laptop GPU
  - NVIDIA RTX PRO 500 Blackwell Generation Laptop GPU
- Refer to Changes in Version 573.73 and What's New in Release 570 for the list of new features introduced since Release 565.
- Adds the latest performance improvements, bug fixes, and driver enhancements.

2.1.3 What's New in Release 570

The section summarizes the following driver changes in Release 570 (since Release 565).

2.1.3.1 NVIDIA RTX Production Branch Driver

Release 570 is the latest Production Branch release of the NVIDIA RTX Enterprise Driver. Production Branch drivers are recommended for enterprise deployment, certification with professional applications, and users seeking the latest support for NVIDIA Studio features.

For the most stable and fully supported enterprise driver, please use the Production Branch graphics driver downloadable from the NVIDIA driver download page.

2.1.3.2 New Features

- **HDR** — expanded HDR support by adding HDR10 and HDR10+ capabilities with HEVC and AV1 codecs.
- **VRR Linux** — Variable Rate Refresh can now be enabled on as few as one display in Linux, even while using multiple displays.
- **Optix Enhancements** — enable implementation of AI features to accelerate and enhance advanced rendering capabilities.
- **Vulkan 1.4 Support** — allows NVIDIA GPU users to receive all the features and reliability of Vulkan 1.4 while accelerating their workflow using the GPU.
- **Enhanced Encode and Decode** — with Blackwell hardware, users can now encode and decode at broadcast quality.

- **Support for High Frequency/Bandwidth Displays** — with Blackwell hardware, users can now support ultra-high frequency and high bandwidth displays.

2.1.3.3 NVIDIA OpenCL Vulkan Interop

The NVIDIA OpenCL driver has added support for the following new extension specifications released by Khronos. The specifications are for OpenCL external semaphore and external memory.

1. https://www.khronos.org/registry/OpenCL/specs/3.0-unified/html/OpenCL_Ext.html#cl_khr_semaphore
2. https://www.khronos.org/registry/OpenCL/specs/3.0-unified/html/OpenCL_Ext.html#cl_khr_external_semaphore
3. https://www.khronos.org/registry/OpenCL/specs/3.0-unified/html/OpenCL_Ext.html#cl_khr_external_memory

2.1.3.4 OpenCL External semaphore and memory extensions

The set of new External Memory and Semaphore Sharing extensions provides a generic framework that enables OpenCL to import external memory and semaphore handles exported by external APIs—using a methodology that will be familiar to Vulkan developers—and then use those semaphores to synchronize with the external runtime, coordinating the use of shared memory.

The following key features are supported as part of these extensions:

1. Importing memory into buffers using FD, Win32 KMT and NT handles.
2. Importing memory into images using FD, Win32 KMT and NT handles.
3. Importing binary semaphores using FD, Win32 KMT and NT handles.
4. Synchronizing using Wait and Signal on imported semaphores.
5. Using buffers and images imported in OpenCL kernels and other APIs such as other regular cl_mem.

2.1.3.5 Limitations of the Current Implementation

1. Support for importing external memory and semaphores using FD handles on Linux and Win32 NT and KMT handles on Windows. No other handle types are currently available.
2. Support for binary semaphores only.
3. No support for exporting semaphore or memory from OpenCL.
4. `clEnqueueAcquireExternalMemObjectsKHR` and `clEnqueueReleaseExternalMemObjectsKHR` APIs are currently not required as execution hand-off can be managed through semaphore wait and signal. But these may be required in the future for correct functionality.

2.1.3.6 NVIDIA OpenCL Compiler Upgrade

The NVIDIA OpenCL driver used an older OpenCL Just-In-Time (JIT) compiler based on the legacy 3.4 versions of the Clang front-end and NVVM optimizer. NVIDIA has been working on upgrading its OpenCL JIT compiler to use a newer version 7.0 of the Clang front-end and NVVM optimizer component.

NVIDIA introduced this new OpenCL compiler as an opt-in feature in 510 driver release (511.09 on Windows and 510.54 on linux), with the default OpenCL compiler remaining the same. With 520.xx (exact version TBD), NVIDIA OpenCL will use the new Clang + NVVM 7.0 based compiler as the default compiler, replacing the old compiler.

As part of this driver install, a new compiler library should be visible in the system folder as `libnvidia-nvvm.so/nvvm*.dll` instead of the old `libnvidia-compiler.so*/nvcompiler*.dll`. The driver will pick up the newer compiler library by default.

2.1.3.7 NVVM 7.0 New Compiler Features

The new NVVM 7.0 based compiler takes advantage of years of development in the Clang+LLVM framework. In addition to several minor bug fixes and diagnostic improvements, this compiler introduces the following noteworthy features:

- 16-bit floating point (half) type

  16-bit floating point types or “half” type is available as a native data type in the new compiler. This type is enabled by the `cl_khr_fp16` feature guard pragma.

  Example:

```
#pragma OPENCL EXTENSION cl_khr_fp16 : enable

half scalar_arith(half n, half k) {
   half w = n + k;
   half x = n - k;
   half y = w * x;
   half z = y / x;
   return -z;
}
 kernel void foo( global int* x) {
   half a = 3.5H, b = 4.5H;
   if (scalar_arith(a, b) == -8.0)
       *x = 1;
   return;
}
```

- 128-bit integer type

  128-bit integer types or “(un)signed long long” is available as a native data type in the new compiler. This type is enabled by default and does not require any macros to be defined.

  Example:

```
typedef unsigned long long ULL;
typedef long long LL;
```

```
LL scalar arith (ULL n, ULL k)  {
   LL w = n + k;
   LL x = n - k;
   LL y = w * x;
   LL z = y / x;
   return -z;
}

__kernel void foo( global int* x)
   ULL a = 0x123456789ABCDEF0ULL;
   ULL b = 0xFEDCBA9876543210ULL;
   if (scalar_arith(a, b) < 0)
      *x = 1;
   return;
}
```

- Upgraded math libraries

  The built-in standard math functions (e.g. sin(), cos()) have been upgraded to be on par with CUDA C++. This ensures that your application benefits from high-performance math routines optimized for the latest GPU architectures.

2.1.3.8 Clang Release Notes

The public LLVM release notes for Clang 3.4 – Clang 7.0 mentioned below summarize the behavioral changes between old and new compiler bases.

- Clang 4: https://releases.llvm.org/4.0.0/tools/clang/docs/ReleaseNotes.html
- Clang 5: https://releases.llvm.org/5.0.0/tools/clang/docs/ReleaseNotes.html
- Clang 6: https://releases.llvm.org/6.0.0/tools/clang/docs/ReleaseNotes.html
- Clang 7: https://releases.llvm.org/7.0.0/tools/clang/docs/ReleaseNotes.html

2.1.3.9 Known Issues with NVVM 7.0-based Compiler

The new Clang/NVVM 7.0 based compiler has stricter error checking compared to the previous compiler. The following use-cases which were allowed with the older compiler may now throw an error.

1. Updating `const` variables after they have been assigned.
2. Using address spaces other than `global` for kernel pointer parameters.
3. Using `variadic` arguments in functions and blocks.

2.1.4 Discontinued and Unsupported Features

2.1.4.1 End of Support for Select Windows 10 Operating Systems

Driver Release Branch 550 was the last NVIDIA professional Windows driver to support Version 21H2, and earlier versions of the Windows 10 operating system.

2.1.5 Limitations in This Release

The following features are not currently supported or have limited support in this driver release:

2.1.5.1 External Graphics

- External GPU Surprise Removal

  Not all applications have been designed to address surprise removal of the external GPU; disconnection of the external GPU while applications are running is not advised.
- Mixed GeForce/Quadro Products

  Mixed GeForce/Quadro products are supported (Geforce GPU + Quadro eGPU, or Quadro GPU + Geforce eGPU), but require installation of the GeForce driver package. The Quadro package does not install GeForce drivers.

2.2 Changes in Version 573.73

The following sections list the important changes, and the most common issues resolved in this driver version.

2.2.1 Fixed Issues

- [Blackwell][Notebooks] display issues when connecting three external displays through a docking station.
- Ongoing bug fixes and enhancements.

2.2.2 Open Issues in Version 573.73

- No open issues to highlight.

Chapter 3. The Release 570 Driver

This chapter covers the following main topics:

- Driver Security
- Advanced Driver Information
- Known Product Limitations
- Hardware and Software Support

3.1 Driver Security

Follow these safe computing practices:

- Only download or execute content and programs from trusted third parties.
- Run your system and programs with thes least privilege necessary. Users should run without administrator rights whenever possible.
- When running as administrator, do not elevate UAC privileges for activities or programs that don't need them.

This section describes additional actions to take to mitigate specific known security issues.

3.1.1 Restricting/Enabling Access to GPU Performance Counters

NVIDIA RTX Enterprise drivers automatically disable access to GPU performance counters to non-admin users. For more information, please reference CVE-2018-6260 in NVIDIA Security Bulletin 4772.

3.1.1.1 Enabling Access to GPU Performance Counters Using the NVIDIA Control Panel

Access to GPU performance counters can be enabled for non-admin users who need to use NVIDIA developer tools. Enabling access to GPU performance counters can be accomplished through the NVIDIA Control Panel -> **Developer** -> **Manage GPU Performance Counters** page. Refer to the **Developer** -> **Manage GPU Performance Counters** section of the NVIDIA Control Panel Help for instructions.

Note: Access to GPU performance counters should be kept disabled for non-admin users who do not need to use NVIDIA developer tools.

3.1.1.2 Restricting/Enabling Access to GPU Performance Counters Across an Enterprise Using Scripts

Enterprise administrators can use scripts to programmatically apply the settings. The scripts should incorporate the registry key information provided below to automate the deployment.

Caution: These instructions should be performed only be enterprise administrators. Changes to the registry must be made with care. System instability can result if performed incorrectly.

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

The data value 1 restricts access to admin users, whereas data value 0 allows access to all users.

A system reboot is required for the changes to take effect.

3.2 Advanced Driver Information

This section clarifies instructions for successfully accomplishing the following tasks:

- Turning Off V-Sync to Boost Performance
- NVIDIA Application Configuration Engine (ACE)
- Using the WDDM Driver Model with Tesla GPU GOMs
- SLI Multi-OS – GPU Assignment in System Virtualization

3.2.1 Turning Off V-Sync to Boost Performance

To get the best benchmark and application performance measurements, turn V-Sync off as follows:

1. Open the NVIDIA Control Panel and make sure that *Advanced Settings* is selected from the control panel tool bar.
2. From the *Select a Task* pane, under 3D Settings, click **Manage 3D Settings**, then click the **Global Settings** tab.
3. From the Global presets pull-down menu, select **Base profile**.
4. From the Settings list box, select Vertical sync and change its value to **Force off**, then click Apply.

5. From the Global presets pull-down menu, select 3D App - Default Global Settings (the driver's default profile) or use the application profile that matches the application you are testing, then click Apply.

> **Caution:** Be sure to close the NVIDIA Control Panel completely. Leaving it open will affect benchmark and application performance.

3.2.2 NVIDIA Application Configuration Engine (ACE)

This driver includes the NVIDIA Application Configuration Engine (ACE), which automatically detects the workstation application and configures the appropriate profile settings in the NVIDIA Control Panel.

3.2.3 Using the WDDM Driver Model with Tesla GPU GOMs

3.2.3.1 Tesla GPU Operation Modes

The ability to specify the GPU operation mode using NV-SMI/NVML, previously offered by legacy Tesla GPU Accelerators, is still available (refer to: https://developer.nvidia.com/nvidia-management-library-nvml).

By setting the GPU operation mode, developers can selectively turn off certain features in the GPU to get the best performance per watt for certain workloads.

The following are the supported GOMs:

- **Compute-Only**: For running compute tasks only.

  By default, the data center GPUs ship in this mode.
- **Low-Double Precision**: For graphics applications that don't require high bandwidth double precision.

  This is recommended for workloads that are not sensitive to double precision but at the same time need graphics capabilities.
- **All On**: This is recommended only when the workload needs full double precision as well as graphics capabilities.

3.2.3.2 WDDM and TCC Driver Models

Along with the GPU operation mode, the developer needs to select the compatible driver model for GPU accelerators for servers.

- Tesla Compute Cluster (TCC): Optimized for running compute workloads.
- Windows Device Driver Model (WDDM): Designed for graphics applications and not recommended for compute workloads.

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3.2.3.3 Compatibility Between GOM and Driver Models

Table 1 shows which GPU operation modes are compatible with which driver models.

Table 1. GOM and Driver Model Compatibility

GOM	TCC Driver Model	WDDM Driver Model	Use Case Support
All On	YES	YES	All use cases are supported.
Compute-Only	YES	NO	The following are unsupported: X11 and those that require X11 (GLInterop, OCL conformance and VIPER) 32-bit Windows OS
Low Double Precision	YES	YES	All use cases supported.

The compute-only GOM is supported only on the TCC driver model, while the WDDM driver model supports only GOM modes that enable graphics.

The compute-only GOM and WDDM are incompatible and should not be used simultaneously.

The Tesla K20 Active Accelerators for workstations ship in "compute-only" mode and cannot be modified. Therefore, use only the TCC driver model with these products.

3.2.3.4 Using the WDDM Driver Model

To use the WDDM driver model GPU Accelerators for servers, first switch the GOM mode from compute-only to All On, then switch from TCC to WDDM.

Do not attempt to specify the driver model by editing the registry. Doing so can result in compute- only GOM and WDDM being configured simultaneously, which might require a clean installation of the driver to fix.

Always use NVIDIA-provided tools to specify a processing mode or to switch between driver models.

Such tools include nvidia-smi or the NVIDIA Control Panel->Manage GPU Utilization page. These tools provide warnings in case of a conflict.

3.2.4 Multi-OS – GPU Assignment in System Virtualization

On systems with two or more graphics cards installed, this driver supports a hypervisor's ability to directly assign GPUs to guest virtual machines (VMs). This direct assignment allows each guest VM to run on their own operating system with their own GPU and driver. The assignment allows full GPU performance and functionality in the guest VM.

3.2.4.1 Hardware Platform Requirements

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.

3.2.4.2 Supported Hypervisors

Please reference the Virtual GPU Software Supported Products page for the latest supported configurations.

3.2.4.3 Supported Graphics Cards

The following GPUs are supported for device passthrough:

GPU Family	Boards Supported
NVIDIA Ada Lovelace	NVIDIA Data Center: L40, L20, L2 NVIDIA RTX: 6000 Ada Generation, 5880 Ada Generation, 5000 Ada Generation, 4500 Ada Generation, 4000 Ada Generation, 4000 SFF Ada Generation, 2000 Ada Generation
NVIDIA Ampere	NVIDIA Data Center: AX800, A100, A40, A30, A16, A10, A2 NVIDIA RTX: A6000, A5500, A5000, A4500, A4000H, A4000, A2000 12GB, A2000, A1000, A400
Turing	Quadro: RTX 8000, RTX 6000, RTX 5000, RTX 4000 NVIDIA Data Center: T4
Volta	Quadro: GV100 NVIDIA Data Center: V100
Pascal	Quadro: P2000, P4000, P5000, P6000, GP100 Tesla: P100, P40, P4
Maxwell	Quadro: K2200, M2000, M4000, M5000, M6000, M6000 24GB Tesla: M60, M10, M6

3.3 Known Product Limitations

This section describes problems that will not be fixed. Usually, the source of the problem is beyond the control of NVIDIA. Following is the list of problems and where they are discussed in this document:

- Issues Installing the NVIDIA Control Panel from the Windows Store

3.3.1 Issues Installing the NVIDIA Control Panel from the Windows Store

You may encounter issues when attempting to install the NVIDIA Control Panel from the Windows Store under Windows 10, such as:

- The download process from the Windows Store freezes at the “Starting download …” stage.
- The NVIDIA Control Panel fails to download after initiating the download from the notification popup that appears upon installing the driver.

For assistance with installing the NVIDIA Control Panel from the Microsoft Windows Store, see the NVIDIA Knowledge Base Article, NVIDIA Control Panel Windows Store App.

For information about the DCH vs Standard drivers for Windows 10, see the NVIDIA Knowledge Base Article, NVIDIA DCH/Standard Display Drivers for Windows 10 FAQ.

3.3.2 Some APIs Do Not Report Total Available Graphics Memory Correctly

3.3.2.1 Background–TAG Memory

In the Windows Display Driver Model (WDDM), Total Available Graphics (TAG) memory is reported as the sum of the following:

- Dedicated Video Memory (video memory dedicated for graphics use),
- Dedicated System Memory (system memory dedicated for graphics use), and
- Shared System Memory (system memory shared between the graphics subsystem and the CPU).

The values for each of these components are computed according to WDDM guidelines when the NVIDIA Display Driver is loaded.

3.3.2.2 Issue

NVIDIA has found that some TAG-reporting APIs represent video memory using 32-bits instead of 64-bits, and consequently do not properly report available graphics memory when the TAG would otherwise exceed 4 gigabytes (GB). This results in under reporting of available memory and potentially undesirable behavior of applications that rely on these APIs to report available memory.

The reported memory can be severely reduced. For example, 6 GB might be reported as 454 MB, and 8 GB might be reported as 1259 MB.

3.3.2.3 NVIDIA Action for Some GeForce-based Systems

For GeForce GPUs with 2.75 GB or less of video memory, the NVIDIA display driver constrains TAG.

memory to just below 4 GB[1]. In this scenario, the Shared System Memory component of TAG is limited first, before limiting Dedicated Video Memory.

This is a policy decision within the driver, and results in reliable reporting of sub-4 GB TAG memory.

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1. The WDDM guidelines dictate minimum and maximum values for the components, but the display driver may further constrain the values that are reported (within the allowed minimum and maximum)

3.3.2.4 When TAG Reporting Would Not Be Limited

For GeForce-based GPUs with more than 2.75 GB of video memory, as well as all RTX and Tesla GPUs, the NVIDIA display driver does not constrain TAG memory reporting.

The disadvantage of constraining TAG on systems with larger amounts of video and system memory is that memory which otherwise would be available for graphics use is no longer available. Since shared system memory is limited first, driver components and algorithms utilizing shared system memory may suffer performance degradation when TAG is constrained.

Since these and similar scenarios are prevalent in many Workstation applications, the NVIDIA driver avoids constraining TAG on all Quadro and Tesla-based systems. Likewise, the driver does not constrain TAG for GeForce-based systems with more than 2.75 GB of video memory.

3.3.3 Using HDMI/DisplayPort Audio with Displays that have a High Native Resolution

To use HDMI/DisplayPort audio with some displays that have a native resolution higher than 1920x1080, you must set the display to a lower HD resolution.

Some HDMI TVs have a native resolution that exceeds the maximum supported HD mode. For example, TVs with a native resolution of 1920x1200 exceed the maximum supported HD mode of 1920x1080.

Applying this native mode results in display overscan which cannot be resized using the NVIDIA Control Panel since the mode is not an HD mode.

To avoid this situation and provide a better user experience, the driver treats certain TVs as a DVI monitor when applying the native mode. Because the driver does not treat the TV as an HDMI in this case, the HDMI audio is not used.

3.3.4 Using HDMI/DisplayPort Audio in Dualview or Clone Mode Configurations

3.3.4.1 Two Audio-enabled Ports

In a multi-display configuration where both HDMI/DisplayPort audio ports are enabled, only the primary display will provide the audio.

3.3.4.2 One Audio-enabled Port

In a multi-display configuration where only one audio port is enabled, such as when one display is a DVI display, then the HDMI/DisplayPort display can provide the audio whether is it the primary or secondary display.

3.3.5 GPU Runs at a High-Performance Level in Multi-display Modes

This is a hardware limitation and not a software bug. Even when no 3D programs are running, the driver will operate the GPU at a high-performance level to efficiently drive multiple displays. In the case of SLI or multi-GPU PCs, the second GPU will always operate with full clock speeds; again, to efficiently drive multiple displays. Today, all hardware from all GPU vendors has this limitation.

3.3.6 Applying Workstation Application Profiles

- Background

  The workstation application profiles are software settings used by the NVIDIA Display Drivers to provide optimum performance when using a selected application. The profile also works around known application issues and bugs.

  If there is an available setting for an application, it should be used, otherwise incorrect behavior or reduced performance is likely to occur.

- Issues

  Configuration changes require that you restart the application.

  Once an application is running, it does not receive notification of configuration changes. Therefore, if you change the configuration while the application is running, you must exit and restart the application for the configuration changes to take effect.

Chapter 4. Hardware and Software Support

This chapter covers the following main topics:

- Supported Operating Systems
- Supported NVIDIA Workstation GPUs
- Supported NVIDIA Notebook GPUs
- Supported Languages

4.1 Supported Operating Systems

The Release 570 driver, version 573.73, has been tested with

- Microsoft Windows® 11
- Microsoft Windows® 10, 64-bit (versions 22H2 and later)

4.2 Supported NVIDIA Workstation GPUs

The following tables list the NVIDIA products supported by the Release 570 driver, version 573.73.

4.2.1 NVIDIA Quadro & RTX Product

Table 2. Supported NVIDIA Quadro Products

Product	GPU Architecture
NVIDIA RTX PRO 6000 Blackwell Workstation Edition	NVIDIA Blackwell
NVIDIA RTX PRO 6000 Blackwell Max-Q Workstation Edition	
NVIDIA RTX PRO 5000 Blackwell	
NVIDIA RTX PRO 4500 Blackwell	
NVIDIA RTX PRO 4000 Blackwell	

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Product	GPU Architecture
NVIDIA RTX 6000 Ada Generation	NVIDIA Ada Lovelace
NVIDIA RTX 5880 Ada Generation	
NVIDIA RTX 5000 Ada Generation	
NVIDIA RTX 4500 Ada Generation	
NVIDIA RTX 4000 Ada Generation	
NVIDIA RTX 4000 SFF Ada Generation	
NVIDIA RTX 2000 Ada Generation	
NVIDIA RTX 2000E Ada Generation	
NVIDIA RTX A6000	NVIDIA Ampere
NVIDIA RTX A5500	
NVIDIA RTX A5000	
NVIDIA RTX A4500	
NVIDIA RTX A4000H	
NVIDIA RTX A4000	
NVIDIA RTX A2000 12GB	
NVIDIA RTX A2000	
NVIDIA RTX A1000	
NVIDIA RTX A400	
NVIDIA Quadro RTX 8000	Turing
NVIDIA Quadro RTX 6000	
NVIDIA Quadro RTX 5000	
NVIDIA Quadro RTX 4000	
NVIDIA Quadro RTX 3000	
NVIDIA T1000 8GB	
NVIDIA T1000	
NVIDIA T600	
NVIDIA T400 4GB	
NVIDIA T400	
NVIDIA T400E	
NVIDIA Quadro GV100	Volta
NVIDIA Quadro GP100	Pascal
NVIDIA Quadro P6000	
NVIDIA Quadro P5000	
NVIDIA Quadro P4000	

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Product	GPU Architecture
NVIDIA Quadro P2200	
NVIDIA Quadro P2000	
NVIDIA Quadro P1000	
NVIDIA Quadro P600	
NVIDIA Quadro P400	
NVIDIA Quadro M6000 24GB	Maxwell
NVIDIA Quadro M6000	
NVIDIA Quadro M5000	
NVIDIA Quadro M4000	
NVIDIA Quadro M2000	
NVIDIA Quadro K2200	
NVIDIA Quadro K1200	
NVIDIA Quadro K620	

4.2.2 NVIDIA Quadro Sync II

Table 3. Supported NVIDIA Quadro Sync II Products

Product	GPU Architecture
NVIDIA RTX 6000 Ada Generation	NVIDIA Ada Lovelace
NVIDIA RTX 4000 SFF Ada Generation	
NVIDIA RTX A6000	NVIDIA Ampere
NVIDIA RTX A5500	
NVIDIA RTX A5000	
NVIDIA RTX A4500	
NVIDIA RTX A4000H	
NVIDIA RTX A4000	
NVIDIA Quadro RTX 8000	Turing
NVIDIA Quadro RTX 6000	
NVIDIA Quadro RTX 5000	
NVIDIA Quadro RTX 4000	
NVIDIA Quadro GV100	Volta
NVIDIA Quadro GP100	Pascal
NVIDIA Quadro P6000	
NVIDIA Quadro P5000	

Product	GPU Architecture
NVIDIA Quadro P4000	

4.2.3 NVIDIA Quadro Sync Products

Table 4. Supported NVIDIA Quadro Sync Products

Product	GPU Architecture
NVIDIA Quadro M6000 24GB	Maxwell
NVIDIA Quadro M6000	
NVIDIA Quadro M5000	
NVIDIA Quadro M4000	

4.2.4 NVIDIA Quadro Blade/Embedded Graphics Board

Table 5. Supported NVIDIA Quadro Blade/Embedded Graphics Board Series

Product	GPU Architecture
NVIDIA Quadro RTX 5000	Turing
NVIDIA Quadro RTX 3000	
NVIDIA Quadro T1000	
NVIDIA Quadro P5000	Pascal
NVIDIA Quadro P3000	
NVIDIA Quadro P2000	
NVIDIA Quadro P1000	
NVIDIA Quadro M5000 SE	Maxwell
NVIDIA Quadro M3000 SE	

4.2.5 NVIDIA Data Center Products

The driver package is designed for systems that have one or more NVIDIA Data Center products installed.

- Only one GHIC can be connected to the server in a system.
- This release of the Tesla driver supports CUDA C/C++ applications and libraries that rely on the CUDA C Runtime and/or CUDA Driver API.

Table 6. Supported NVIDIA Data Center Products

Product	GPU Architecture
NVIDIA L-Series Products	
NVIDIA L40	NVIDIA Ada Lovelace
NVIDIA L40S	
NVIDIA L20	
NVIDIA L4	
NVIDIA L2	
NVIDIA H-Series Products	
NVIDIA H200 NVL	NVIDIA Hopper
NVIDIA H100 NVL	
NVIDIA H100	
NVIDIA A-Series Products	
NVIDIA AX800	NVIDIA Ampere
NVIDIA A100	
NVIDIA A40	
NVIDIA A30	
NVIDIA A16	
NVIDIA A10	
NVIDIA A2	
NVIDIA T-Series Products	
NVIDIA T4	Turing
NVIDIA V-Series Products	
NVIDIA V100	Volta
Tesla P-Series Products	
NVIDIA Tesla P100	Pascal
NVIDIA Tesla P40	
NVIDIA Tesla P4	
Tesla M-Series Products	
NVIDIA Tesla M60	Maxwell
NVIDIA Tesla M6	

4.2.6 Supported NVIDIA Notebook GPUs

The notebook driver is part of the NVIDIA Verde Notebook Driver Program, and can be installed on supported NVIDIA notebook GPUs. However, please note that your notebook original equipment manufacturer (OEM) provides certified drivers for your specific notebook on their website. NVIDIA recommends that you check with your notebook OEM about recommended software updates for your notebook. OEMs may not provide technical support for issues that arise from the use of this driver.

:

The following tables list the NVIDIA notebook products supported by the Release 570 driver, version 573.73:

Table 7. NVIDIA Quadro Notebook GPU Support

Notebook Products	GPU Architecture
NVIDIA RTX PRO 5000 Blackwell Generation Laptop GPU NVIDIA RTX PRO 4000 Blackwell Generation Laptop GPU NVIDIA RTX PRO 3000 Blackwell Generation Laptop GPU NVIDIA RTX PRO 2000 Blackwell Generation Laptop GPU NVIDIA RTX PRO 1000 Blackwell Generation Laptop GPU NVIDIA RTX PRO 500 Blackwell Generation Laptop GPU	NVIDIA Blackwell
NVIDIA RTX 5000 Ada Generation Laptop GPU NVIDIA RTX 4000 Ada Generation Laptop GPU NVIDIA RTX 3500 Ada Generation Laptop GPU NVIDIA RTX 3000 Ada Generation Laptop GPU	NVIDIA Ada Lovelace
NVIDIA RTX A5500 Laptop GPU NVIDIA RTX A5000 Laptop GPU NVIDIA RTX A4500 Laptop GPU NVIDIA RTX A4000 Laptop GPU NVIDIA RTX A3000 12GB Laptop GPU NVIDIA RTX A3000 Laptop GPU NVIDIA RTX A2000 8GB Laptop GPU NVIDIA RTX A2000 Laptop GPU NVIDIA RTX A1000 6GB Laptop GPU NVIDIA RTX A1000 Laptop GPU NVIDIA RTX A500 Laptop GPU	NVIDIA Ampere
NVIDIA T1200 Laptop GPU NVIDIA T600 Laptop GPU NVIDIA RTX T550 Laptop GPU	Turing
Quadro RTX 6000 Quadro RTX 5000 Quadro RTX 4000 Quadro RTX 3000	
Quadro T2000 Quadro T1000	
Quadro 5200 Quadro 5000 Quadro 4200 Quadro 4000 Quadro 3200 Quadro P3000	Pascal
Quadro 620 Quadro 520 Quadro 600 Quadro P500	
Quadro M5500 Quadro 5000M Quadro 4000M Quadro 3000M Quadro 2000M	Maxwell

Notebook Products	GPU Architecture
Quadro 1000M Quadro 600M Quadro M500M	
Quadro K2200M Quadro K620M	

4.3 Supported Languages

The Release 570 Graphics Drivers supports the following languages in the main driver Control Panel:

English (USA)	German	Portuguese (Euro/Iberian)
English (UK)	Greek	Russian
Arabic	Hebrew	Slovak
Chinese (Simplified)	Hungarian	Slovenian
Chinese (Traditional)	Italian	Spanish
Czech	Japanese	Spanish (Latin America)
Danish	Korean	Swedish
Dutch	Norwegian	Thai
Finnish	Polish	Turkish
French	Portuguese (Brazil)	

4.4 Driver Installation

4.4.1 Minimum Hard Disk Space

The hard disk space requirement is approximately 1.5x the size of the installation download to accommodate extracted and temporary files.

4.4.2 Installation Instructions

1. Follow the instructions on the NVIDIA.com website driver download page to locate the appropriate driver to download, based on your hardware and operating system.
2. Click the **driver download** link.
3. Open the NVIDIA driver installation .EXE file to run the NVIDIA Package Launcher to extract the driver files.
4. Follow the instructions in the NVIDIA InstallShield Wizard to complete the installation.

:

Note: If you are over-installing the driver (installing over a previous driver without first removing the previous driver), then you must reboot your computer to complete the installation.

Chapter 5. NVIDIA Tesla Compute Cluster Mode

This chapter describes the Tesla Compute Cluster (TCC) mode.

- About Tesla Compute Cluster Mode
- Operating on Systems with non-TCC NVIDIA GPUs
- Setting TCC Mode

5.1 About Tesla Compute Cluster Mode

5.1.1 TCC Overview

Tesla Compute Cluster (TCC) mode is designed for compute cluster nodes that have one or more Tesla or supported NVIDIA RTX / Quadro products installed.

Note: Microsoft Compute Driver Model (MCDM) provides similar advantages and is available as an alternative to TCC for products that can support TCC and are running the latest version of Windows (Windows 11 23H2 and above). For users that want TCC and require CUDA features that are only available in WDDM mode (WSL2, cuMemMap API, Async Memory Pool, ...) MCDM is the suggested path. (Note: some RDMA use cases are not yet available in MCDM)

5.1.1.1 Benefits

- TCC drivers make it possible to use NVIDIA GPUs in nodes with non-NVIDIA integrated graphics.
- NVIDIA GPUs will be available to applications running as a Windows service (i.e. in Session 0) on systems running the Tesla driver in TCC mode.

5.1.1.2 TCC Does not Support Graphics Acceleration

- TCC mode does not provide CUDA–DirectX/OpenGL interoperability.

  It is a “non-display” driver, and NVIDIA GPUs using this driver will not support DirectX or OpenGL hardware acceleration.

:

5.1.2 Running CUDA Applications

- This release of the Tesla/Quadro driver supports CUDA C/C++ applications and libraries that rely on the CUDA C Runtime and/or CUDA Driver API.
- NVIDIA GPUs running the Tesla/Quadro driver in TCC mode will be available for CUDA applications running via services or Remote Desktop.
- In this release, all GPUs will be in compute exclusive mode. As a result, only one CUDA context may exist on a particular device at a time.
- SDK applications that use graphics will not run properly under TCC mode. The following are examples of CUDA SDK applications that are not supported:

bicubicTexture	boxFilter	cudaDecodeD3D9	smokeParticles
cudaDecodeGL	fluidsD3D9	fluidsGL	SobelFilter
imageDenoising	Mandelbrot	marchingCubes	volumeRender
nbody	oceanFFT	particles	
postProcessGL	recursiveGaussian	simpleD3D10	
simpleD3D10Texture	simpleD3D11Texture	simpleD3D9	
simpleD3D9Texture	simpleGL	simpleTexture3D	

5.2 Operating on Systems with non-TCC NVIDIA GPUs

- NVIDIA GPUs running under TCC mode may coexist with other display devices.
- The Tesla/Quadro driver is installed over any NVIDIA display driver in the system – the NVIDIA Tesla driver then becomes the only driver for all NVIDIA GPUs in the system.

  If the Tesla/Quadro driver is uninstalled later, the previous driver is not restored.
- NVIDIA GPUs that do not support TCC mode will appear as “VGA adapters” in the Windows Device Manager and can be used to drive displays.

  Non-supported NVIDIA GPUs can still function as CUDA devices, but the GPU’s graphics functionality is not available to applications.

5.3 Setting TCC Mode

To change the TCC mode, use the NVIDIA **smi** utility as follows:

```
nvidia-smi -g (GPU ID) -dm (0 for WDDM, 1 for TCC, 2 for MCDM)
```

The default TCC mode for NVIDIA RTX / Quadro workstation GPUs is TCC Off.

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