Virtual GPU Software

Quick Start Guide

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About this Guide

Virtual GPU Software Quick Start Guide provides minimal instructions for installing and configuring NVIDIA® virtual GPU software on the Citrix Hypervisor or VMware vSphere hypervisor and for installing and configuring a single-instance NVIDIA virtual GPU License Server on Windows. If you need complete instructions, are using other platforms, or require high availability for the license server, refer to *Virtual GPU Software User Guide* and *Virtual GPU License Server User Guide*.

Chapter 1. Getting Your NVIDIA vGPU Software

After your order for NVIDIA vGPU software is processed, you will receive an order confirmation message from NVIDIA. This message contains information that you need for getting your NVIDIA vGPU software from the NVIDIA Licensing Portal. To log in to the NVIDIA Licensing Portal, you must have an NVIDIA Enterprise Account.

1.1. Before You Begin

Before following the procedures in this guide, ensure that the following prerequisites are met:

- You have a server platform that is capable of hosting your chosen hypervisor and NVIDIA GPUs that support NVIDIA vGPU software. For a list of validated server platforms, refer to NVIDIA GRID Certified Servers.
- One or more NVIDIA GPUs that support NVIDIA vGPU software is installed in your server platform.
- A supported virtualization software stack is installed according to the instructions in the software vendor's documentation.
- A virtual machine (VM) running a supported Windows guest operating system (OS) is configured in your chosen hypervisor.

For information about supported hardware and software, and any known issues for this release of NVIDIA vGPU software, refer to the *Release Notes* for your chosen hypervisor:

- *Virtual GPU Software for Citrix Hypervisor Release Notes*
- *Virtual GPU Software for VMware vSphere Release Notes*

1.2. Your Order Confirmation Message

After your order for NVIDIA vGPU software is processed, you will receive an order confirmation message to which your NVIDIA Entitlement Certificate is attached.

Thank you for your software and/or services order!

Please find enclosed your Entitlement Certificate for the Software and/or Services products you ordered.

Please refer to the attached Entitlement Certificate to register for your software and services.

The following is your order information:

PO Number	NVIDIA Sales Order	NVIDIA Delivery Number

Questions?
NVIDIA Enterprise Support contact information can be found here https://www.NVIDIA.com/en-us/support/enterprise/

Your NVIDIA Entitlement Certificate contains your product activation keys.

NVIDIA Corporation
2788 San Tomas Expressway
SANTA CLARA CA 95051
USA

NVIDIA® Entitlement Certificate
This certificate serves as evidence that NVIDIA has entitled you for the following product(s).

End Customer ( )

NVIDIA Delivery	
Entitlement Date	11 APR 2019
PO Number	
NVIDIA Sales Order	

No	Entitlement Description	Quantity	Sales Type	Term	Start Date	End Date
1	Quadro vDWS Bundle - Subscription, CCU					
	Quadro vDWS Subscription, CCU	48 EA	Initial	1 Year	11 APR 2019	10 APR 2020
	GRID vApps Subscription, CCU	48 EA	Initial	1 Year	11 APR 2019	10 APR 2020
	PAK ID					

Please follow the instructions provided in the following section to register your entitlements.

Thank you for your order!

Your NVIDIA Entitlement Certificate also provides instructions for using the certificate.

NOTICE

HOW TO USE THIS CERTIFICATE

Registration Instructions

Please refer to the NVIDIA Virtual GPU Software Quick Start Guide for information on how to get started, including instructions on how to register for your entitlement.

Sales Type: Initial

1. Already have vGPU entitlements? Please Login
2. New to vGPU entitlements? Please register and follow instructions on the registration page.

Questions?
NVIDIA Enterprise Support contact information can be found here

Rights and restrictions on the use, transfer and copying of the Software are set forth in NVIDIA's End User License Agreement.

1.3. NVIDIA Enterprise Account Requirements

To get your NVIDIA vGPU software, you must have a suitable NVIDIA Enterprise Account for accessing your licenses.

Note: For a Support, Upgrade, and Maintenance Subscription (SUMS) renewal, you should already have a suitable NVIDIA Enterprise Account and this requirement should already be met. However, if you have an account that was created for an evaluation license and you want to access licenses that you purchased, you must repeat the registration process.

- If you do not have an account, follow the **Register** link in the instructions for using the certificate to create your account. For details, refer to Creating your NVIDIA Enterprise Account.
- If you have an account that was created for an evaluation license and you want to access licenses that you purchased, follow the **Register** link in the instructions for using the certificate to create an account for your **purchased** licenses. You can choose to create a separate account for your purchased licenses or link your existing account for an evaluation license to the account for your purchased licenses.
  - To create a separate account for your purchased licenses, follow the instructions in Creating your NVIDIA Enterprise Account, specifying a different e-mail address than the address with which you created your existing account.
  - To link your existing account for an evaluation license to the account for your purchased licenses, follow the instructions in Linking an Evaluation Account to an

NVIDIA Enterprise Account for Purchased Licenses, specifying the e-mail address with which you created your existing account.

- If you already have a suitable NVIDIA Enterprise Account for accessing your licenses, follow the **Login** link in the instructions for using the certificate to log in to the NVIDIA Enterprise Application Hub, go to the NVIDIA Licensing Portal, and download your NVIDIA vGPU software. For details, refer to Downloading your NVIDIA vGPU Software.

1.4. Creating your NVIDIA Enterprise Account

If you do not have an NVIDIA Enterprise Account, you must create an account to be able to log in to the NVIDIA Licensing Portal.

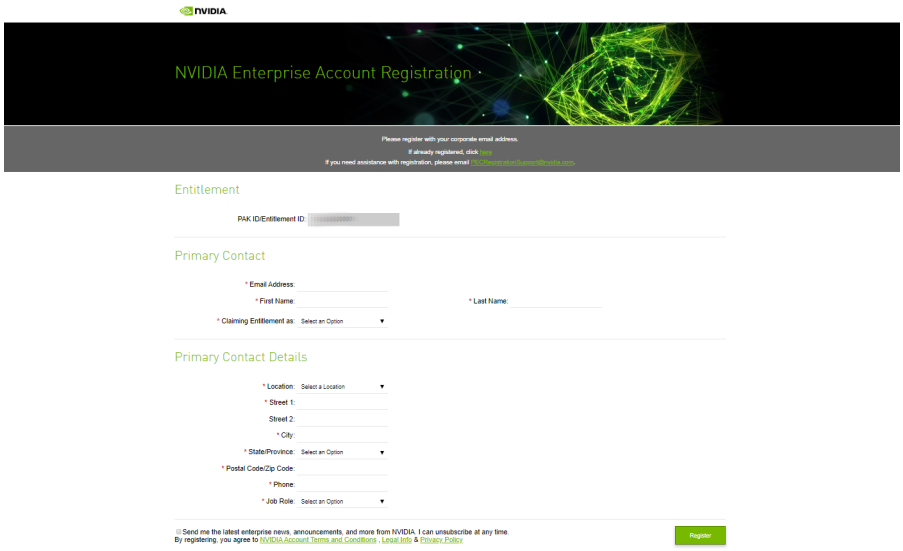
If you already have an account, skip this task and go to Downloading your NVIDIA vGPU Software.

However, if you have an account that was created for an evaluation license and you want to access licenses that you purchased, you must repeat the registration process when you receive your purchased licenses. You can choose to create a separate account for your purchased licenses or link your existing account for an evaluation license to the account for your purchased licenses.

- To create a separate account for your purchased licenses, perform this task, specifying a different e-mail address than the address with which you created your existing account.
- To link your existing account for an evaluation license to the account for your purchased licenses, follow the instructions in Linking an Evaluation Account to an NVIDIA Enterprise Account for Purchased Licenses, specifying the e-mail address with which you created your existing account.

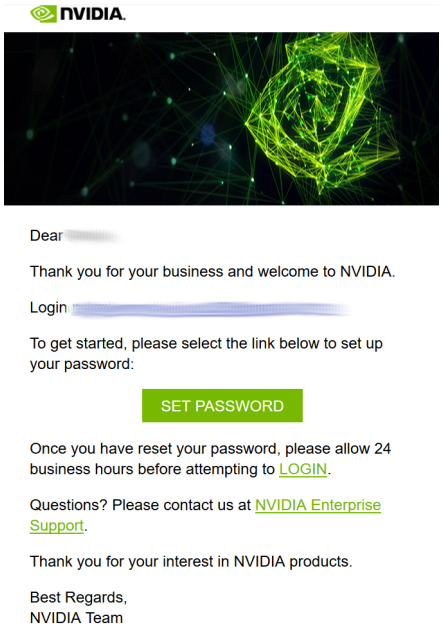
Before you begin, ensure that you have your order confirmation message.

1. In the instructions for using your NVIDIA Entitlement Certificate, follow the **Register** link.
2. Fill out the form on the **NVIDIA Enterprise Account Registration** page and click **Register**.



A message confirming that an account has been created appears, and an e-mail instructing you to set your NVIDIA password is sent to the e-mail address you provided.

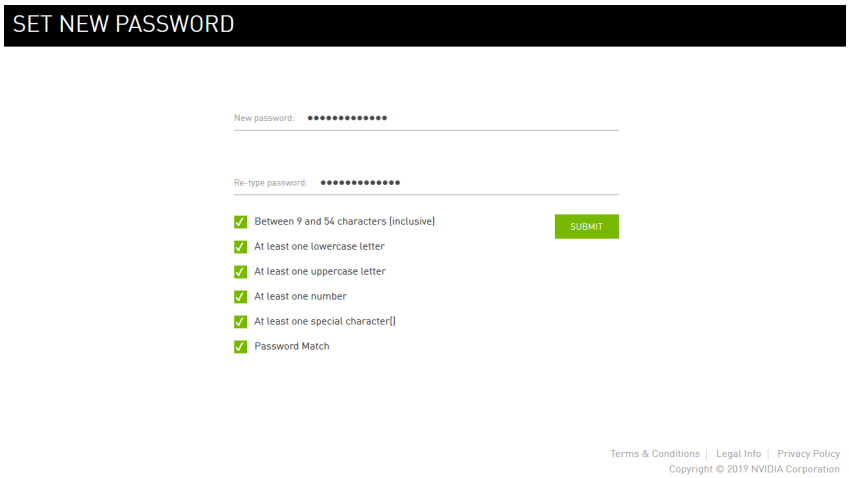
3. Open the e-mail instructing you to set your password and click **SET PASSWORD**.



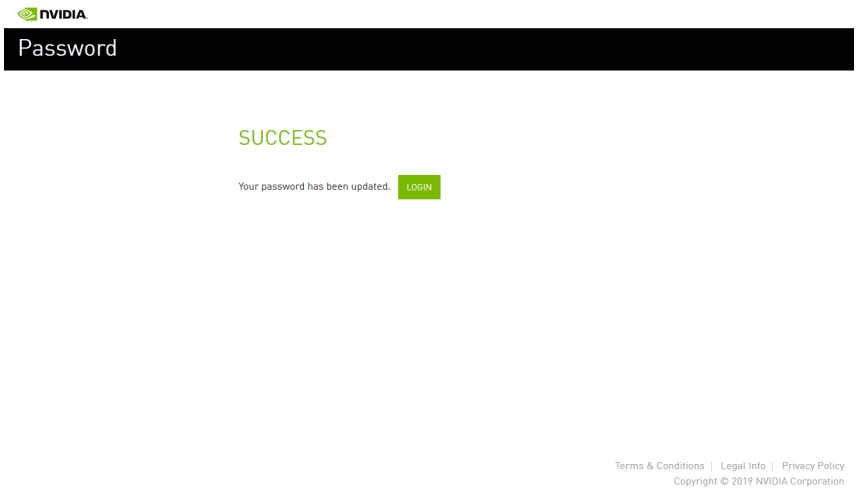
Note: After you have set your password during the initial registration process, you will be able to log in to your account within 15 minutes. However, it may take up to 24 business hours for your entitlement to appear in your account.

For your account security, the **SET PASSWORD** link in this e-mail is set to expire in 24 hours.

4. Enter and re-enter your new password, and click **SUBMIT**.



A message confirming that your password has been set successfully appears.



You are then automatically directed to log in to the NVIDIA Licensing Portal with your new password.

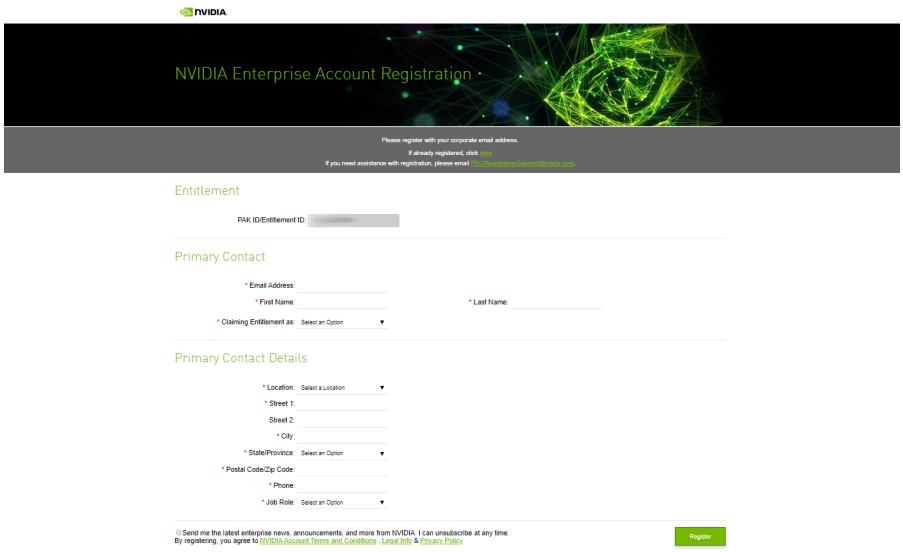
1.5. Linking an Evaluation Account to an NVIDIA Enterprise Account for Purchased Licenses

If you have an account that was created for an evaluation license, you must repeat the registration process when you receive your purchased licenses. To link your existing account

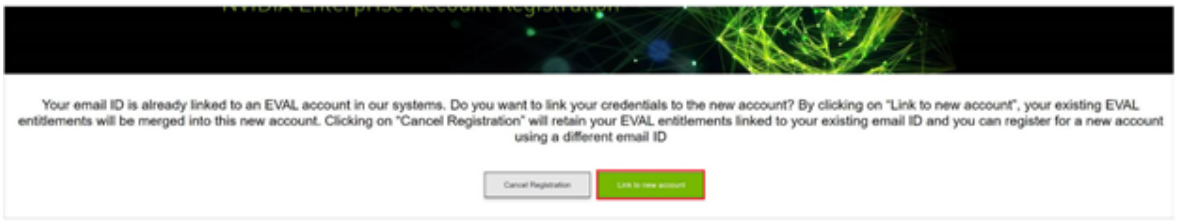
for an evaluation license to the account for your purchased licenses, register for an NVIDIA Enterprise Account with the e-mail address with which you created your existing account.

If you want to create a separate account for your purchased licenses, follow the instructions in Creating your NVIDIA Enterprise Account, specifying a different e-mail address than the address with which you created your existing account.

1. In the instructions for using the NVIDIA Entitlement Certificate **for your purchased licenses**, follow the **Register** link.
2. Fill out the form on the **NVIDIA Enterprise Account Registration** page, specifying the e-mail address with which you created your existing account, and click **Register**.



3. When a message stating that your e-mail address is already linked to an evaluation account is displayed, click **LINK TO NEW ACCOUNT**.

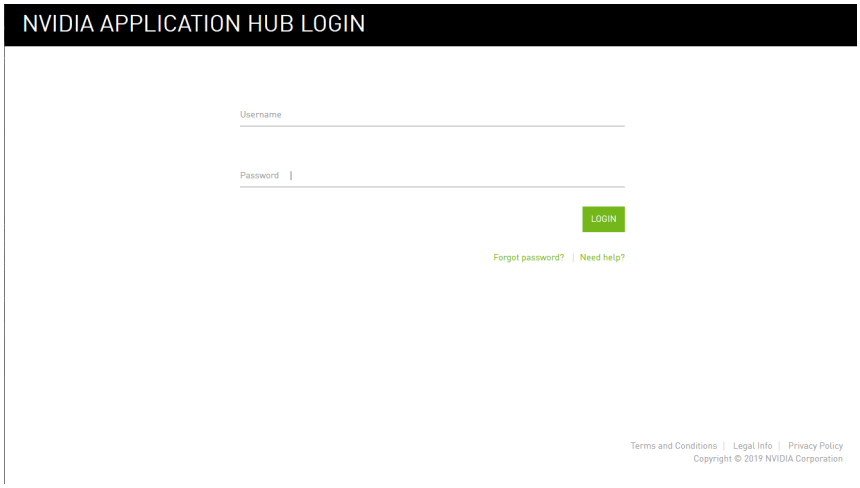


Log in to the NVIDIA Licensing Portal with the credentials for your existing account.

1.6. Downloading your NVIDIA vGPU Software

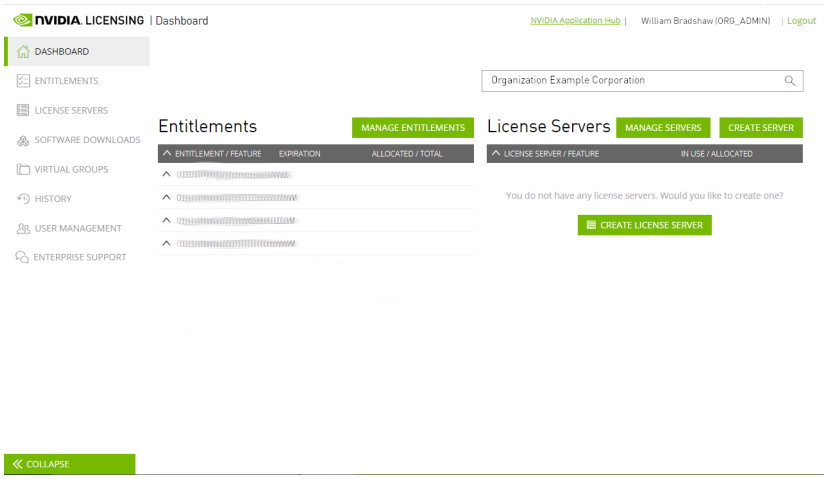
Before you begin, ensure that you have your order confirmation message and have created an NVIDIA Enterprise Account.

1. Visit the NVIDIA Enterprise Application Hub by following the **Login** link in the instructions for using your NVIDIA Entitlement Certificate or when prompted after setting the password for your NVIDIA Enterprise Account.
2. When prompted, provide your e-mail address and password, and click **LOGIN**.



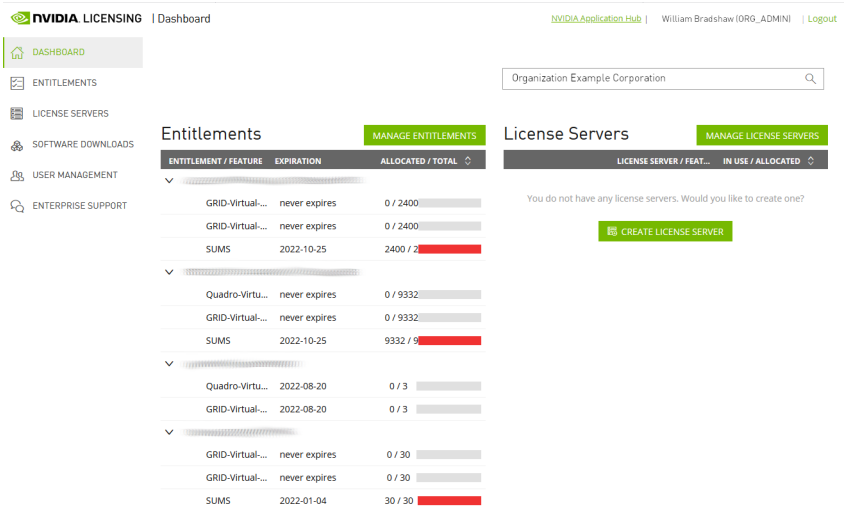
3. On the **NVIDIA APPLICATION HUB** page that opens, click **NVIDIA LICENSING PORTAL**.

   The NVIDIA Licensing Portal dashboard page opens.



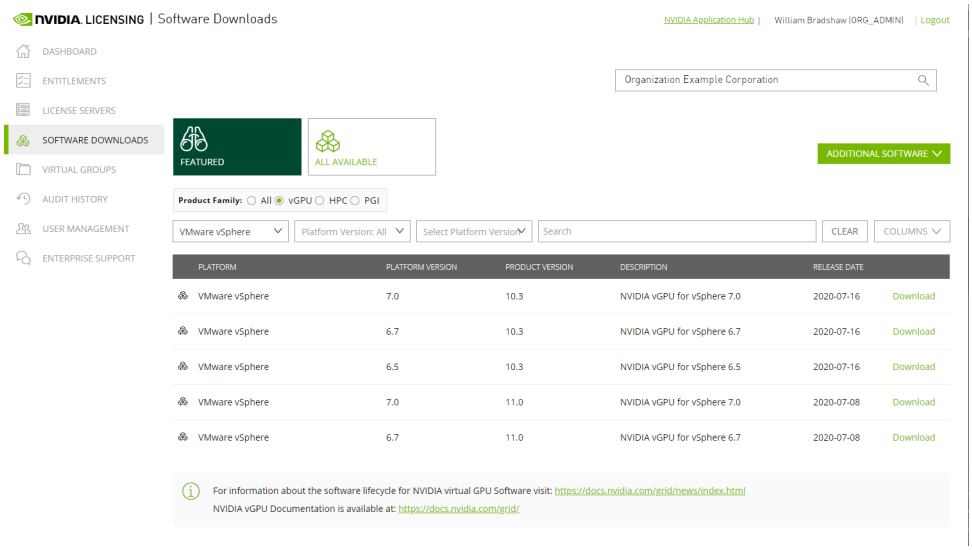
Note: Your entitlement might not appear on the NVIDIA Licensing Portal dashboard page until 24 business hours after you set your password during the initial registration process.

4. In the NVIDIA Licensing Portal dashboard page opens, click the down arrow next to each entitlement listed to view details of the NVIDIA vGPU software that you purchased.



5. In the left navigation pane of the NVIDIA Licensing Portal dashboard, click **SOFTWARE DOWNLOADS**.
6. On the **Product Download** page that opens, set the **Product Family** option to **vGPU** and follow the **Download** link for the brand and version of your chosen hypervisor for the release of NVIDIA vGPU software that you are using, for example, NVIDIA vGPU for vSphere 6.7 for NVIDIA vGPU software release 13.0.

Note: To be able to download any additional software that you need for your NVIDIA vGPU software deployment, for example, the license server software, you **must** set the **Product Family** option to **vGPU**. Otherwise, the **ADDITIONAL SOFTWARE** button does not appear on the **Product Download** page and the pop-up window for downloading additional software is not opened.



If the brand and version of your chosen hypervisor for the release of NVIDIA vGPU software that you are using aren't displayed, click **ALL AVAILABLE** to display a list of all NVIDIA vGPU software available for download. Use the drop-down lists or the search box to filter the software listed.

7. When prompted to accept the license for the software that you are downloading, click **AGREE & DOWNLOAD**.
8. When the browser asks what it should do with the file, select the option to save the file.

   After the download starts, a pop-up window opens for you to download any additional software that you might need for your NVIDIA vGPU software deployment.

9. In the pop-up window, follow the links to download any additional software that you need for your NVIDIA vGPU software deployment.
   a). Follow the link to the NVIDIA vGPU software license server software for your license server host machine's operating system, for example, **License Manager for Windows**.
   b). If you are using an NVIDIA Tesla™ M60 or M6 GPU and think you might need to change its mode, follow the **Mode Change Utility** link.

   For details about when you need to change the mode, see Switching the Mode of a Tesla M60 or M6 GPU.

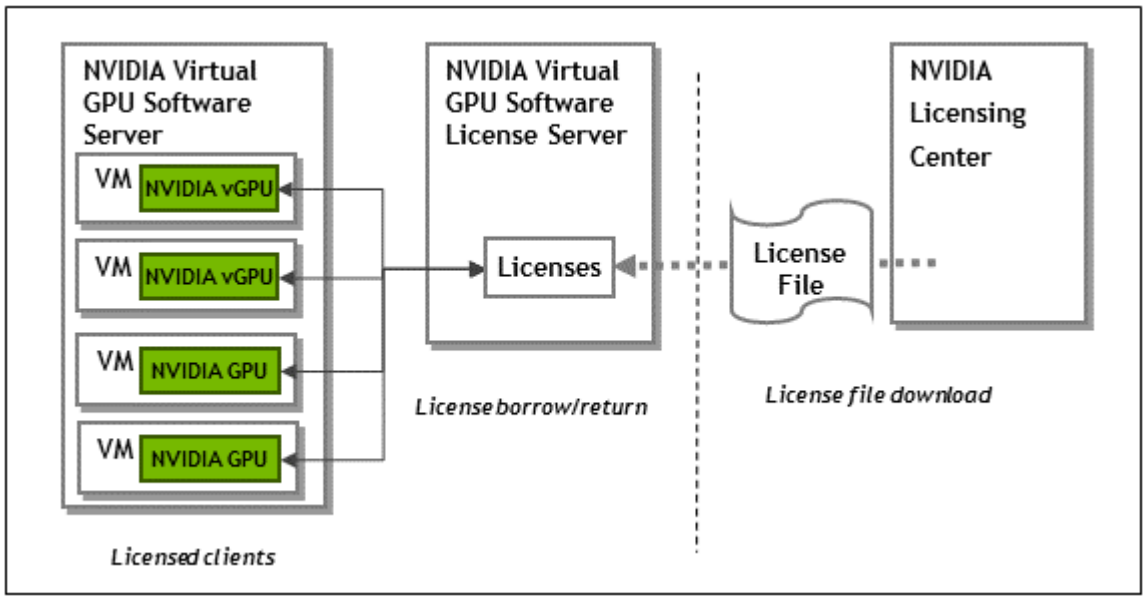
Chapter 2. Installing Your NVIDIA vGPU Software License Server and License Files

The NVIDIA vGPU software License Server is used to serve a pool of floating licenses to NVIDIA vGPU software licensed products. The license server is designed to be installed at a location that is accessible from a customer's network, and be configured with licenses obtained from the NVIDIA Licensing Portal.

Note: These instructions cover only the installation and configuration of a single-instance license server. If you require high availability for the license server, refer to *Virtual GPU License Server User Guide* for instructions for how to configure a primary and secondary license server. If you do not register a secondary server when the primary server is registered, you **cannot** register the secondary server later.

2.1. Overview of NVIDIA vGPU software Licensing

NVIDIA vGPU software is a licensed product. Licensed vGPU functionalities are activated during guest OS boot by the acquisition of a software license served over the network from an NVIDIA vGPU software license server. The license is returned to the license server when the guest OS shuts down.



The licenses served by the NVIDIA vGPU software license server are obtained from the NVIDIA Licensing Portal as downloadable license files and installed into the license server through its management interface.

2.2. Platform Configuration Requirements

- The platform must have a fixed (unchanging) IP address. The IP address may be assigned dynamically by DHCP or statically configured but must be constant.
- The platform must have at least one unchanging Ethernet MAC address to be used as a unique identifier when registering the server and generating licenses in the NVIDIA Licensing Portal.
- The platform's date and time must be set accurately. NTP is recommended.

2.3. Installing the Java Runtime Environment

If a suitable Java runtime environment (JRE) version is not already installed on your system, install a supported JRE before running the NVIDIA license server installer.

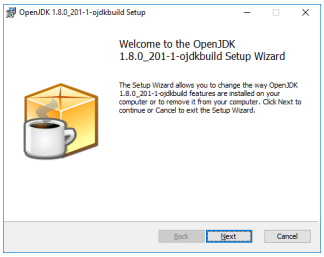
Install a JRE for the same the processor architecture as the license server that you will install: If you will install a 32-bit license server, install a 32-bit JRE; if you will install a 64-bit license server, install a 64-bit JRE.

1. Download a supported Oracle Java SE JRE or OpenJDK JRE.

> **CAUTION:** To ensure that you download a 64-bit JRE, do **not** download the JRE from `www.java.com`. Either a 32-bit JRE is downloaded or the bitness of the downloaded version is determined from your browser, which might be 32-bit even on a 64-bit operating system.

   - Download Oracle Java SE JRE from the java.com: Java + You page.
   - Download OpenJDK JRE from the Community builds using source code from OpenJDK project on GitHub.
2. Install the JRE that you downloaded.
   - Oracle Java SE JRE installation:

   - OpenJDK JRE installation:



3. Set the `JAVA_HOME` system variable to the full path to the `jre` folder of your JRE installation.
   For example:
   - For 64-bit Oracle Java SE JRE: `C:\Program Files\Java\jre1.8.0_191`
   - For 32-bit Oracle Java SE JRE: `C:\Program Files (x86)\Java\jre1.8.0_191`
   - For 64-bit OpenJDK JRE: `C:\Program Files\ojdkbuild\java-1.8.0-openjdk-1.8.0.201-1\jre`
   - For 32-bit OpenJDK JRE: `C:\Program Files (x86)\ojdkbuild\java-1.8.0-openjdk-1.8.0.201-1\jre`

   Ensure that the path does **not** include any trailing characters, such as a slash or a space.

   The license server installer warns users if the path in the `JAVA_HOME` system environment variable appears to be incorrect.

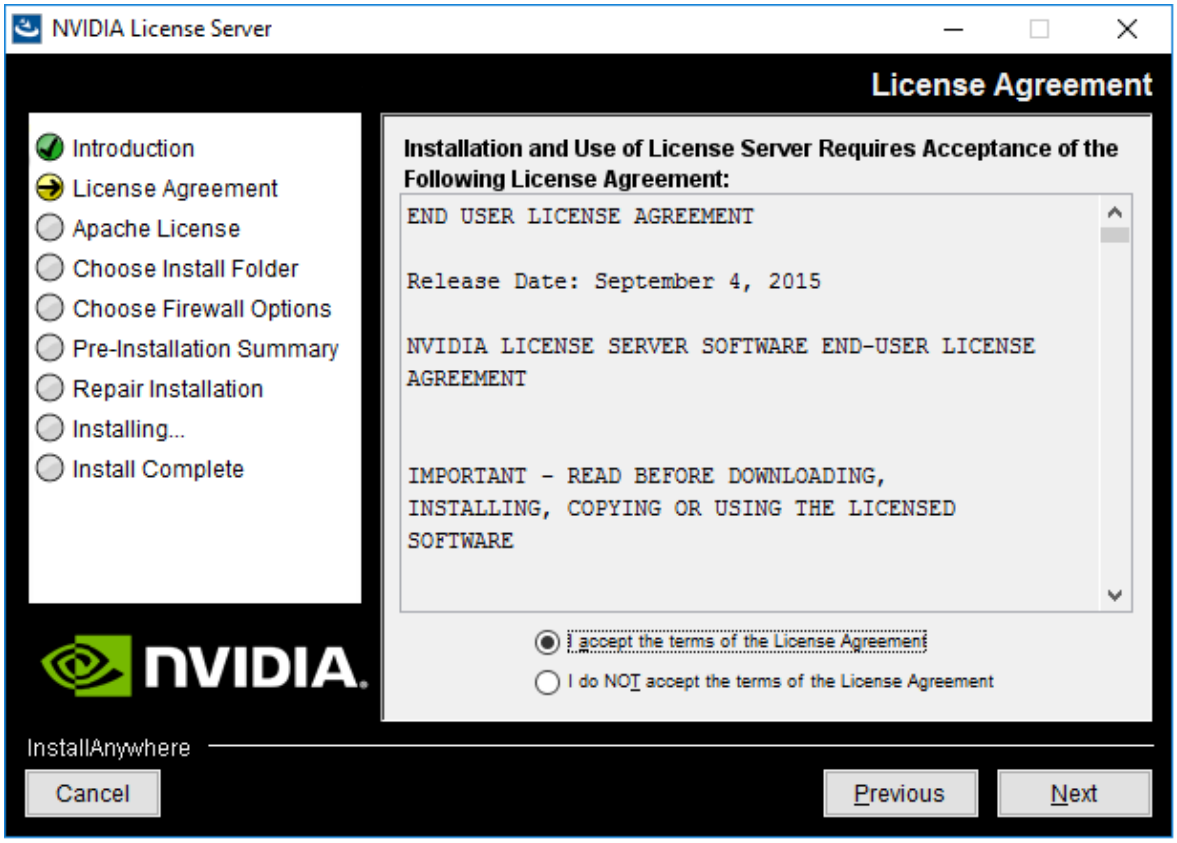
   If you are upgrading to a new version of the JRE, update the value of the `JAVA_HOME` system variable to the full path to the `jre` folder of your **new** JRE version.
4. Ensure that the `Path` system variable contains the path to the `java.exe` executable file.
   The installer may have already added this path for you.
   For example:
   - For 64-bit Oracle Java SE JRE: `C:\Program Files\Java\jre1.8.0_191\bin`
   - For 32-bit Oracle Java SE JRE: `C:\Program Files (x86)\Java\jre1.8.0_191\bin`
   - For 64-bit OpenJDK JRE: `C:\Program Files\ojdkbuild\java-1.8.0-openjdk-1.8.0.201-1\bin`
   - For 32-bit OpenJDK JRE: `C:\Program Files (x86)\ojdkbuild\java-1.8.0-openjdk-1.8.0.201-1\bin`

Note: If a 32-bit JRE and 64-bit JRE are installed, ensure that the path to the 64-bit JRE appears before the path to the 32-bit JRE in the `Path` system variable.

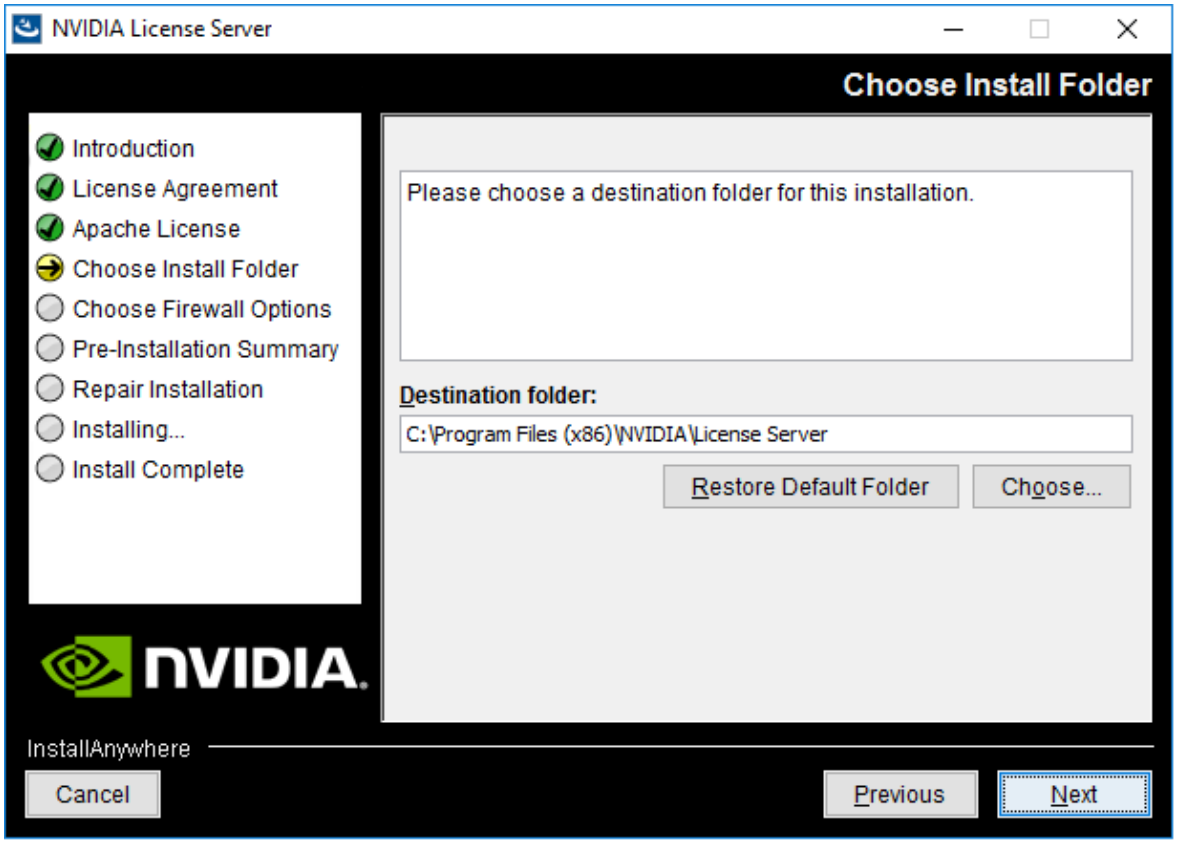
2.4. Installing the License Server Software

1. Unzip the license server installer and run `setup.exe`.

2. Accept the EULA for the license server software and the Apache Tomcat software used to support the license server's management interface.



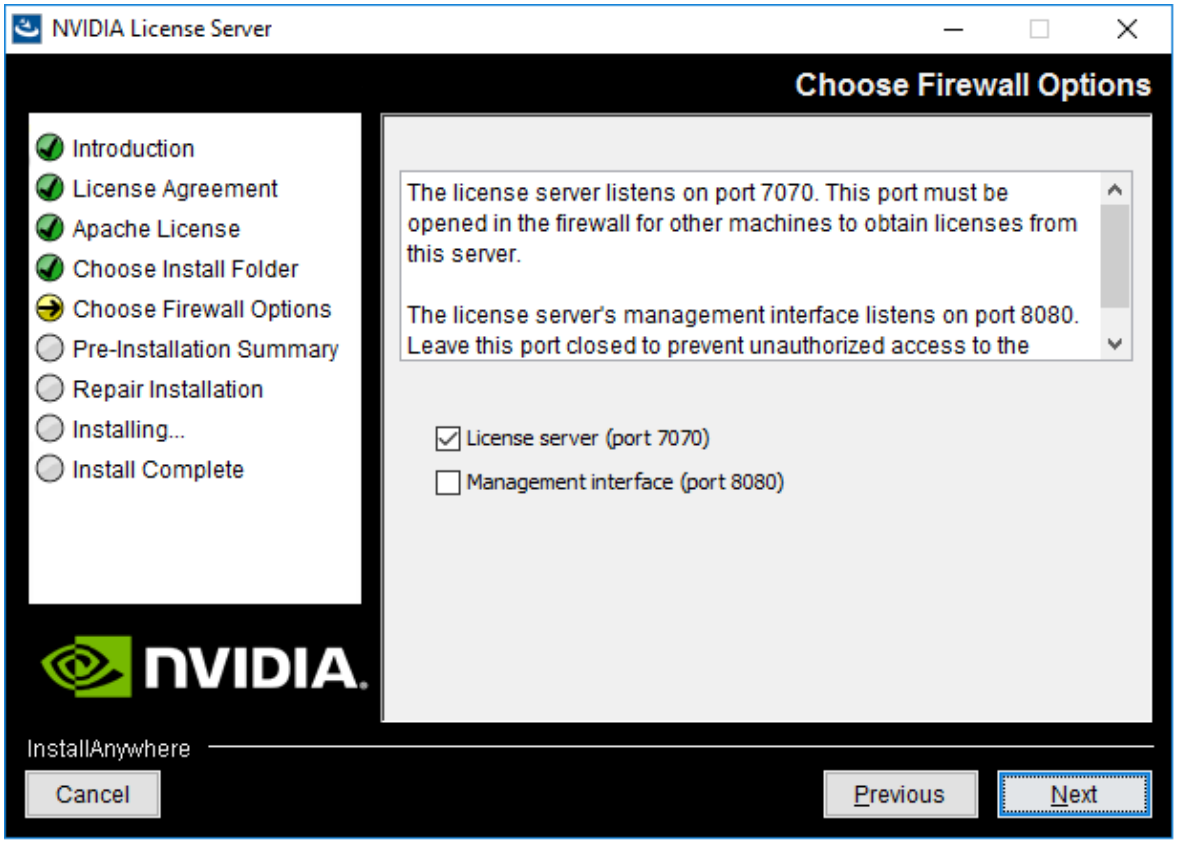
3. Choose the destination folder where you want the license server software to be installed.



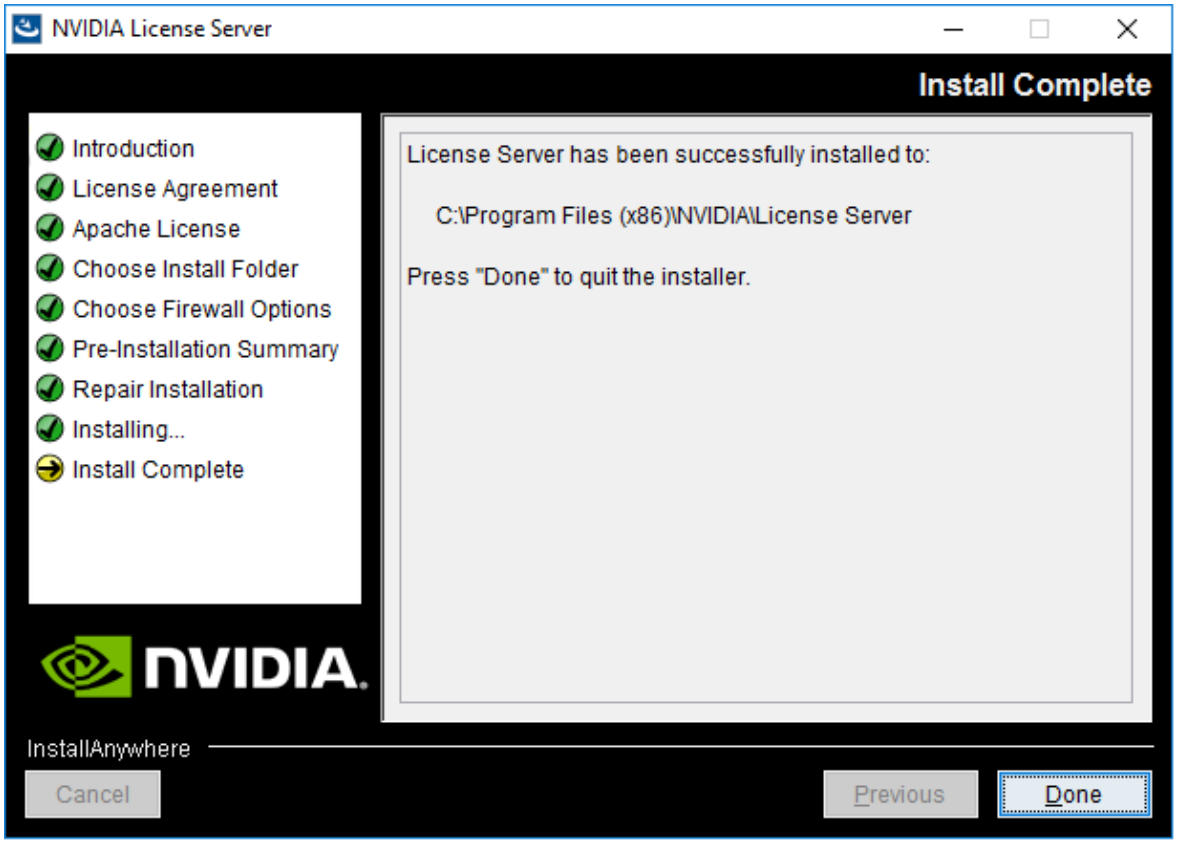
4. In the **Choose Firewall Options** dialog box, select the ports to be opened in the firewall.

   To enable remote clients to access licenses from the server and prevent remote access to the management interface, use the default setting, which sets ports as follows:

   - Port 7070 is open to enable remote clients to access licenses from the server.
   - Port 8080 is closed to ensure that the management interface is available only through a web browser running locally on the license server host.



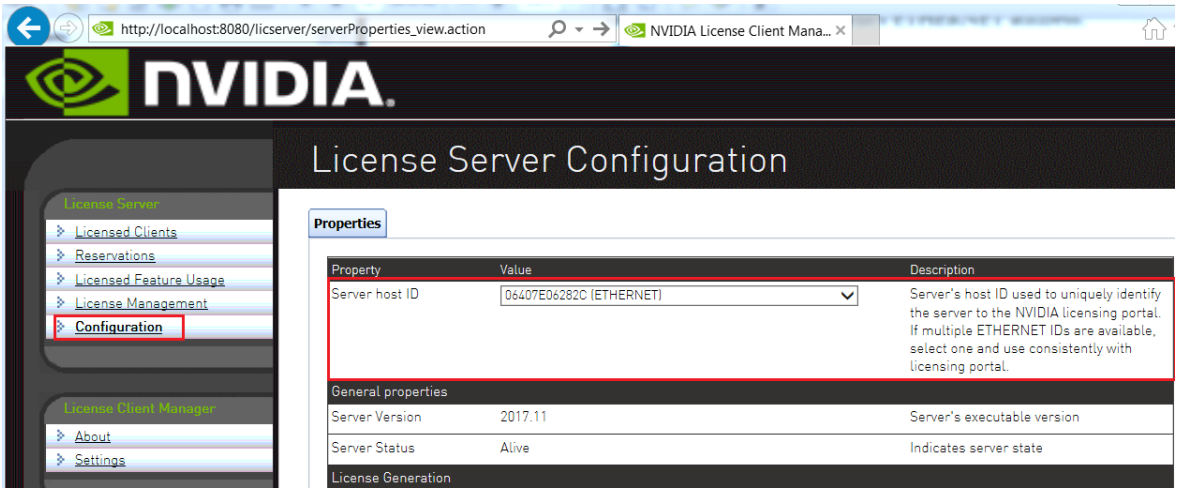
5. After installation has completed successfully, click **Done** to exit the installer.



2.5. Obtaining the License Server's MAC Address

The license server's Ethernet MAC address uniquely identifies your server to the NVIDIA Licensing Portal. You will need this address to register your license server with the NVIDIA Licensing Portal to generate license files.

1. Open a web browser on the license server host and connect to the URL `http://localhost:8080/licserver`.
2. In the license server management interface, select **Configuration**.
3. On the **License Server Configuration** page that opens, in the **Server host ID** drop-down list, select the platform's ETHERNET address.



2.6. Managing your License Servers and Getting your License Files

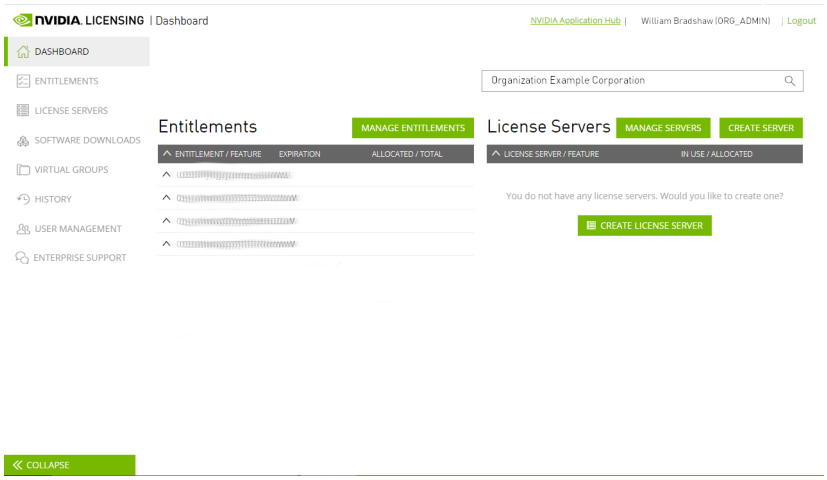
To be able to download NVIDIA vGPU software licenses, you must create at least one license server on the NVIDIA Licensing Portal and allocate licenses to the server. After creating a license server and allocating licenses to it, you can download your license file.

2.6.1. Creating a License Server on the NVIDIA Licensing Portal

To be able to download NVIDIA vGPU software licenses, you must create at least one license server on the NVIDIA Licensing Portal. Creating a license server on the NVIDIA Licensing Portal registers your license server host with the NVIDIA Licensing Portal through the MAC address of the host.

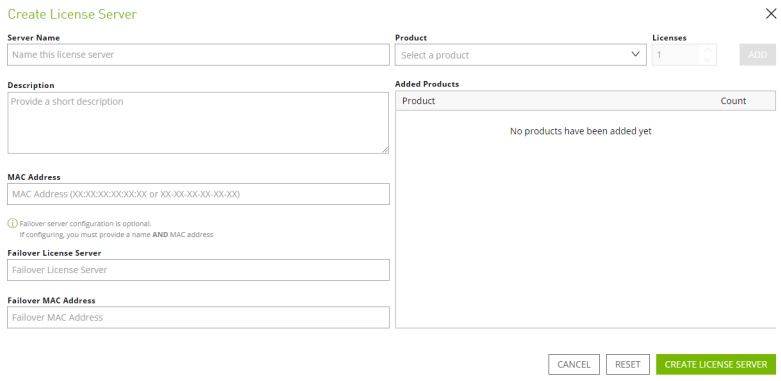
1. In the NVIDIA Licensing Portal, navigate to the organization or virtual group for which you want to create the license server.
   a). If you are not already logged in, log in to the NVIDIA Enterprise Application Hub and click **NVIDIA LICENSING PORTAL** to go to the NVIDIA Licensing Portal.
   b). **Optional:** If your assigned roles give you access to multiple virtual groups, select the virtual group for which you are creating the license server from the list of virtual groups at the top right of the page.

   If no license servers have been created for your organization or virtual group, the NVIDIA Licensing Portal dashboard displays a message asking if you want to create a license server.



2. On the NVIDIA Licensing Portal dashboard, click **CREATE LICENSE SERVER**.

   The **Create License Server** pop-up window opens.



3. Provide the details of your license server.
   a). In the **Server Name** field, enter the host name of the license server.
   b). In the **Description** field, enter a text description of the license server.

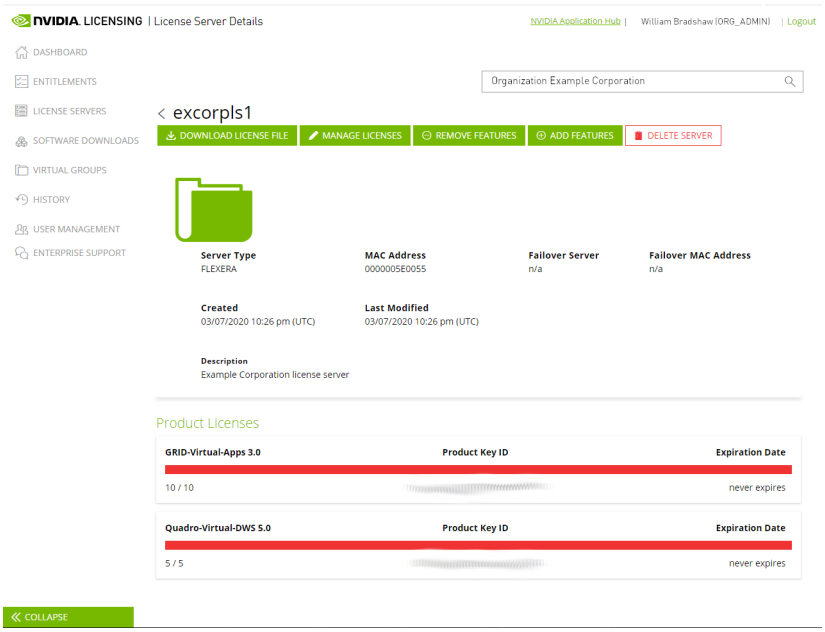
   This description is required and will be displayed on the details page for the license server that you are creating.
   c). In the **MAC Address** field, enter the MAC address of your license server.
4. Add the licenses for the products that you want to allocate to this license server.

   For each product, add the licenses as follows:
   a). From the **Product** drop-down list, select the product for which you want to add licenses.
   b). In the **Licenses** field, enter the number of licenses for the product that you want to add.
   c). Click **ADD**.
5. Leave the **Failover License Server** and **Failover MAC Address** fields unset.
6. Click **CREATE LICENSE SERVER**.

2.6.2. Downloading a License File

Each license server that you create has a license file associated with it. The license file contains all the licenses that you allocated to the license server. After downloading the license file, you can install it on the license server host associated with the license server on the NVIDIA Licensing Portal.

1. In the NVIDIA Licensing Portal, navigate to the organization or virtual group for which you want to download the license file.
   a). If you are not already logged in, log in to the NVIDIA Enterprise Application Hub and click **NVIDIA LICENSING PORTAL** to go to the NVIDIA Licensing Portal.
   b). **Optional:** If your assigned roles give you access to multiple virtual groups, select the virtual group for which you are downloading the license file from the list of virtual groups at the top right of the page.
2. In the list of license servers on the NVIDIA Licensing Portal dashboard, select the license server whose associated license file you want to download.
3. In the **License Server Details** page that opens, review the licenses allocated to the license server.



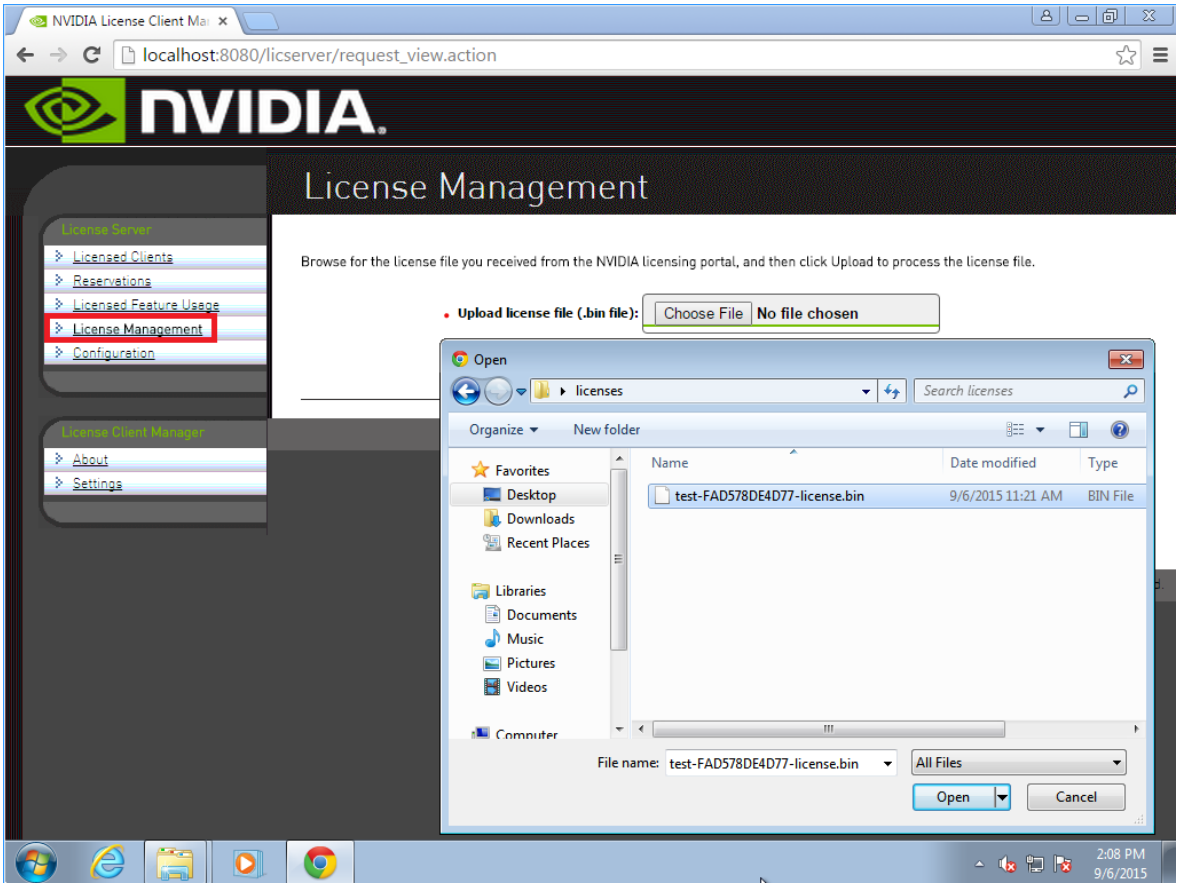
4. Click **DOWNLOAD LICENSE FILE** and save the `.bin` license file to your license server for installation.

2.7. Installing a License

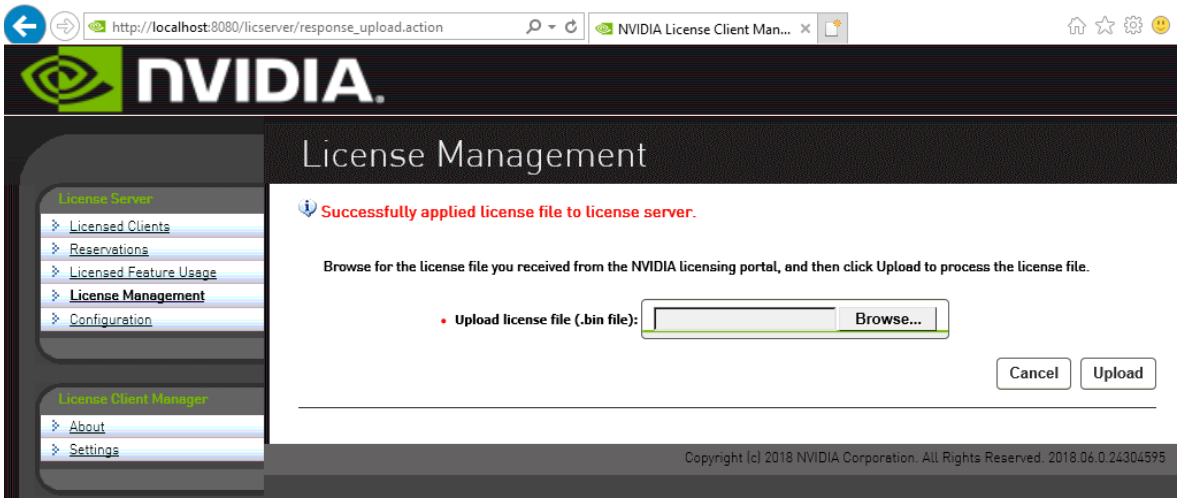
NVIDIA vGPU software licenses are distributed as `.bin` files for download from the NVIDIA Licensing Portal.

Before installing a license, ensure that you have downloaded the license file from the NVIDIA Licensing Portal.

1. In the license server management interface, select **License Management**.
2. On the **License Management** page that opens, click **Choose File**.



3. In the file browser that opens, select the `.bin` file and click **Open**.
4. Back on the **License Management** page, click **Upload** to install the license file on the license server.
   The license server should confirm the successful installation of the license file.


http://localhost:8080/licserver/response_upload.action
NVIDIA License Client Man...
NVIDIA
License Management
License Server
Licensed Clients
Reservations
Licensed Feature Usage
License Management
Configuration
License Client Manager
About
Settings
Successfully applied license file to license server.
Browse for the license file you received from the NVIDIA licensing portal, and then click Upload to process the license file.
Upload license file (.bin file):
Browse...
Cancel
Upload
Copyright (c) 2018 NVIDIA Corporation. All Rights Reserved. 2018.06.0.24304595

Chapter 3. Installing and Configuring NVIDIA vGPU Manager and the Guest Driver

Before installing and configuring NVIDIA vGPU Manager and the Guest Driver, ensure that a VM running a supported Windows guest OS is configured in your chosen hypervisor.

The factory settings of some supported GPU boards are incompatible with NVIDIA vGPU software. Before configuring NVIDIA vGPU software on these GPU boards, you must configure the boards to change these settings.

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

Some GPUs support displayless and display-enabled modes but must be used in NVIDIA vGPU software deployments in displayless 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 displayless mode, but other GPUs are supplied in a display-enabled mode.

GPU	Mode as Supplied from the Factory
NVIDIA A40	Displayless
NVIDIA RTX A5000	Display enabled
NVIDIA RTX A6000	Display enabled

A GPU that is supplied from the factory in displayless 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 following GPUs support the `displaymodeselector` tool:

- NVIDIA A40
- NVIDIA RTX A5000
- NVIDIA RTX A6000

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

3.2. Switching the Mode of a Tesla M60 or M6 GPU

Tesla M60 and M6 GPUs support compute mode and graphics mode. NVIDIA vGPU requires GPUs that support both modes to operate in graphics mode.

Recent Tesla M60 GPUs and M6 GPUs are supplied in graphics mode. However, your GPU might be in compute mode if it is an older Tesla M60 GPU or M6 GPU or if its mode has previously been changed.

To configure the mode of Tesla M60 and M6 GPUs, use the `gpumodeswitch` tool provided with NVIDIA vGPU software releases. If you are unsure which mode your GPU is in, use the `gpumodeswitch` tool to find out the mode.

Note:

Only Tesla M60 and M6 GPUs support the `gpumodeswitch` tool. Other GPUs that support NVIDIA vGPU do not support the `gpumodeswitch` tool and, unless otherwise stated, do not require mode switching.

Even in compute mode, Tesla M60 and M6 GPUs do **not** support NVIDIA Virtual Compute Server vGPU types. Furthermore, vCS is not supported on any GPU on Citrix Hypervisor.

For more information, refer to *gpumodeswitch User Guide*.

3.3. Installing the NVIDIA Virtual GPU Manager

Before guests enabled for NVIDIA vGPU can be configured, the NVIDIA Virtual GPU Manager must be installed in your chosen hypervisor. The process for installing the NVIDIA Virtual GPU Manager depends on the hypervisor that you are using.

If you need more detailed instructions, refer to the appropriate NVIDIA vGPU installation guide.

3.3.1. Installing the NVIDIA Virtual GPU Manager on VMware vSphere

For all supported VMware vSphere releases, the NVIDIA Virtual GPU Manager package is distributed as a software component in a ZIP archive. For supported releases **before** VMware

vSphere 7.0, the NVIDIA Virtual GPU Manager package is also distributed as a vSphere Installation Bundle (VIB) file.

1. Copy the NVIDIA Virtual GPU Manager package file to the ESXi host.
2. Put the ESXi host into maintenance mode.

   ```
   $ esxcli system maintenanceMode set --enable true
   ```
3. Run the `esxcli` command to install the NVIDIA Virtual GPU Manager from the package file.

   - For a software component, run the following command:

     ```
     $ esxcli software vib install -d /vmfs/volumes/datastore/software-component.zip
     ```

     datastore
     The name of the VMFS datastore to which you copied the software component.

     software-component
     The name of the file that contains the software component.

   - For a VIB file, run the following command:

     ```
     $ esxcli software vib install -v directory/NVIDIA**.vib
     ```

     directory
     The absolute path to the directory to which you copied the VIB file. You must specify the absolute path even if the VIB file is in the current working directory.
4. Exit maintenance mode.

   ```
   $ esxcli system maintenanceMode set --enable false
   ```
5. Reboot the ESXi host.

   ```
   $ reboot
   ```
6. Verify that the NVIDIA kernel driver can successfully communicate with the physical GPUs in your system by running the `nvidia-smi` command without any options.

   ```
   $ nvidia-smi
   ```

   If successful, the `nvidia-smi` command lists all the GPUs in your system.

3.3.2. Installing the NVIDIA Virtual GPU Manager on Citrix Hypervisor

The NVIDIA Virtual GPU Manager for Citrix Hypervisor is distributed as an RPM Package Manager (RPM) file. It runs in the Citrix Hypervisor Control Domain (dom0) shell.

1. Copy the NVIDIA Virtual GPU Manager RPM file to the Citrix Hypervisor dom0 shell.
2. Run the `rpm` command to install the package.

   ```
   [root@xenserver ~]# rpm -iv NVIDIA-**.rpm
   ```
3. Reboot the Citrix Hypervisor platform.

   ```
   [root@xenserver ~]# shutdown -r now
   ```
4. After the Citrix Hypervisor host has rebooted, verify the installation of the NVIDIA Virtual GPU Manager package for Citrix Hypervisor by checking for the NVIDIA kernel driver in the list of kernel-loaded modules.

   ```
   [root@xenserver ~]# lsmod |grep nvidia
   nvidia 8152994 0
   i2c_core 20294 2 nvidia,i2c_
   ```

3.4. Disabling and Enabling ECC Memory

Some GPUs that support NVIDIA vGPU software support error correcting code (ECC) memory with NVIDIA vGPU. ECC memory improves data integrity by detecting and handling double-bit errors. However, not all GPUs, vGPU types, and hypervisor software versions support ECC memory with NVIDIA vGPU.

On GPUs that support ECC memory with NVIDIA vGPU, ECC memory is supported with C-series and Q-series vGPUs, but not with A-series and B-series vGPUs. Although A-series and B-series vGPUs start on physical GPUs on which ECC memory is enabled, enabling ECC with vGPUs that do not support it might incur some costs.

On physical GPUs that do not have HBM2 memory, the amount of frame buffer that is usable by vGPUs is reduced. All types of vGPU are affected, not just vGPUs that support ECC memory.

The effects of enabling ECC memory on a physical GPU are as follows:

- ECC memory is exposed as a feature on all supported vGPUs on the physical GPU.
- In VMs that support ECC memory, ECC memory is enabled, with the option to disable ECC in the VM.
- ECC memory can be enabled or disabled for individual VMs. Enabling or disabling ECC memory in a VM does not affect the amount of frame buffer that is usable by vGPUs.

GPUs based on the Pascal GPU architecture and later GPU architectures support ECC memory with NVIDIA vGPU. These GPUs are supplied with ECC memory enabled.

Tesla M60 and M6 GPUs support ECC memory when used without GPU virtualization, but NVIDIA vGPU does not support ECC memory with these GPUs. In graphics mode, these GPUs are supplied with ECC memory disabled by default.

Some hypervisor software versions do not support ECC memory with NVIDIA vGPU.

If you are using a hypervisor software version or GPU that does not support ECC memory with NVIDIA vGPU and ECC memory is enabled, NVIDIA vGPU fails to start. In this situation, you must ensure that ECC memory is disabled on all GPUs if you are using NVIDIA vGPU.

3.4.1. Disabling ECC Memory

If ECC memory is unsuitable for your workloads but is enabled on your GPUs, disable it. You must also ensure that ECC memory is disabled on all GPUs if you are using NVIDIA vGPU with a hypervisor software version or a GPU that does not support ECC memory with NVIDIA vGPU. If your hypervisor software version or GPU does not support ECC memory and ECC memory is enabled, NVIDIA vGPU fails to start.

Where to perform this task depends on whether you are changing ECC memory settings for a physical GPU or a vGPU.

- For a physical GPU, perform this task from the hypervisor host.

- For a vGPU, perform this task from the VM to which the vGPU is assigned.

> **Note:** ECC memory must be enabled on the physical GPU on which the vGPUs reside.

Before you begin, ensure that NVIDIA Virtual GPU Manager is installed on your hypervisor. If you are changing ECC memory settings for a vGPU, also ensure that the NVIDIA vGPU software graphics driver is installed in the VM to which the vGPU is assigned.

1. Use `nvidia-smi` to list the status of all physical GPUs or vGPUs, and check for ECC noted as enabled.

```
# nvidia-smi -q

==============NVSMI LOG==============

Timestamp                           : Mon Jul 26 18:36:45 2021
Driver Version                      : 470.63

Attached GPUs                       : 1
GPU 0000:02:00.0

[...]

    Ecc Mode
        Current                     : Enabled
        Pending                     : Enabled

[...]
```

2. Change the ECC status to off for each GPU for which ECC is enabled.
   - If you want to change the ECC status to off for all GPUs on your host machine or vGPUs assigned to the VM, run this command:

     ```
     # nvidia-smi -e 0
     ```
   - If you want to change the ECC status to off for a specific GPU or vGPU, run this command:

     ```
     # nvidia-smi -i id -e 0
     ```

     id is the index of the GPU or vGPU as reported by `nvidia-smi`.

     This example disables ECC for the GPU with index `0000:02:00.0`.

     ```
     # nvidia-smi -i 0000:02:00.0 -e 0
     ```
3. Reboot the host or restart the VM.
4. Confirm that ECC is now disabled for the GPU or vGPU.

```
# nvidia–smi –q

==============NVSMI LOG==============

Timestamp                           : Mon Jul 26 18:37:53 2021
Driver Version                      : 470.63

Attached GPUs                       : 1
GPU 0000:02:00.0
[...]

    Ecc Mode
        Current                     : Disabled
        Pending                     : Disabled

[...]
```

3.4.2. Enabling ECC Memory

If ECC memory is suitable for your workloads and is supported by your hypervisor software and GPUs, but is disabled on your GPUs or vGPUs, enable it.

Where to perform this task depends on whether you are changing ECC memory settings for a physical GPU or a vGPU.

- For a physical GPU, perform this task from the hypervisor host.
- For a vGPU, perform this task from the VM to which the vGPU is assigned.

Note: ECC memory must be enabled on the physical GPU on which the vGPUs reside.

Before you begin, ensure that NVIDIA Virtual GPU Manager is installed on your hypervisor. If you are changing ECC memory settings for a vGPU, also ensure that the NVIDIA vGPU software graphics driver is installed in the VM to which the vGPU is assigned.

1. Use `nvidia-smi` to list the status of all physical GPUs or vGPUs, and check for ECC noted as disabled.

```
# nvidia-smi -q

==============NVSMI LOG==============

Timestamp                           : Mon Jul 26 18:36:45 2021
Driver Version                      : 470.63

Attached GPUs                       : 1
GPU 0000:02:00.0

[...]

    Ecc Mode
        Current                     : Disabled
        Pending                     : Disabled

[...]
```

2. Change the ECC status to on for each GPU or vGPU for which ECC is enabled.
   - If you want to change the ECC status to on for all GPUs on your host machine or vGPUs assigned to the VM, run this command:

     ```
     # nvidia-smi -e 1
     ```
   - If you want to change the ECC status to on for a specific GPU or vGPU, run this command:

     ```
     # nvidia-smi -i id -e 1
     ```

     id is the index of the GPU or vGPU as reported by `nvidia-smi`.

     This example enables ECC for the GPU with index `0000:02:00.0`.

     ```
     # nvidia-smi -i 0000:02:00.0 -e 1
     ```
3. Reboot the host or restart the VM.
4. Confirm that ECC is now enabled for the GPU or vGPU.

```
# nvidia–smi –q

==============NVSMI LOG==============
```

```
Timestamp                                 : Mon Jul 26 18:37:53 2021
Driver Version                            : 470.63

Attached GPUs                             : 1
GPU 0000:02:00.0
[...]

    Ecc Mode
        Current                           : Enabled
        Pending                           : Enabled

[...]
```

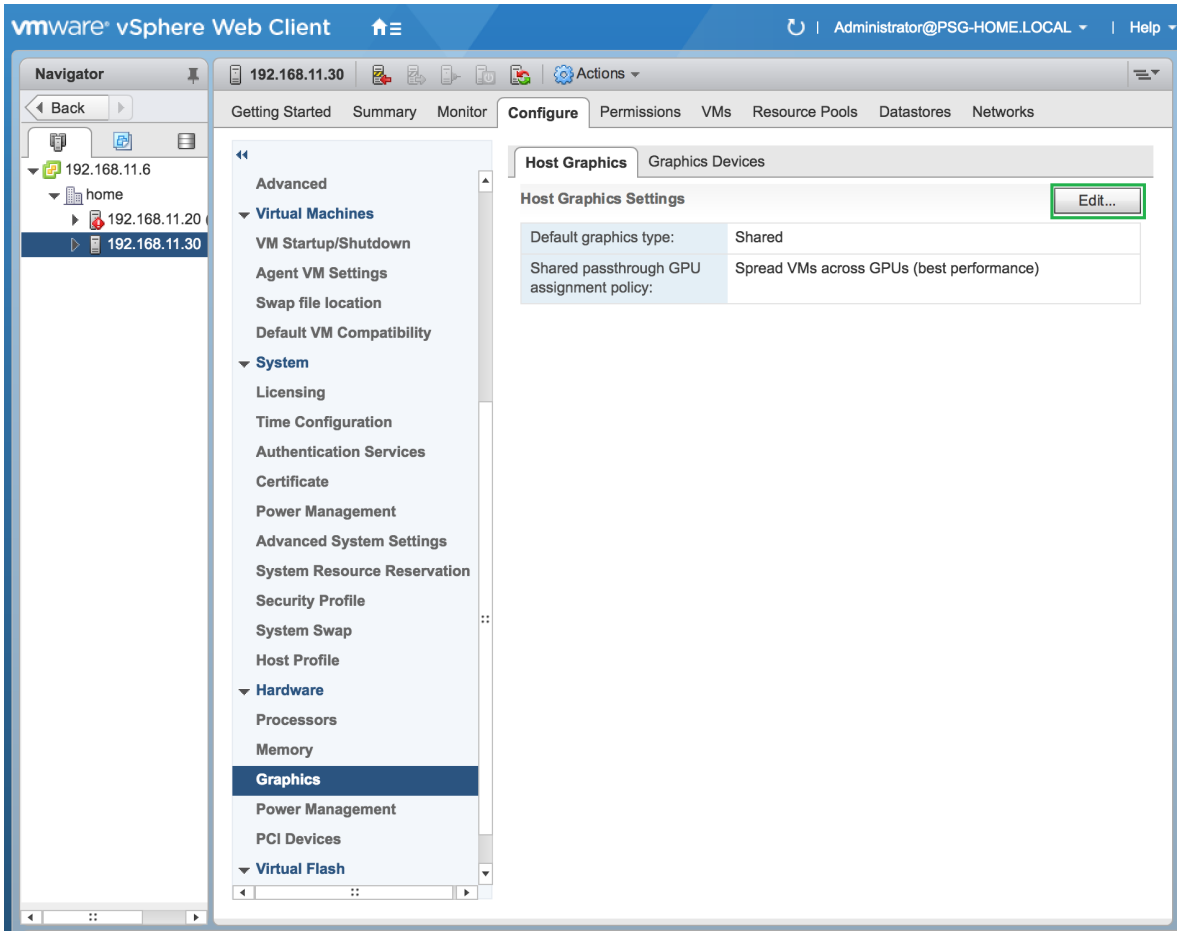
3.5. Attaching an NVIDIA vGPU Profile to a VM

To attach an NVIDIA vGPU profile to a virtual machine (VM), you must configure the VM hardware. The process for attaching an NVIDIA vGPU profile to a VM depends on the hypervisor that you are using.

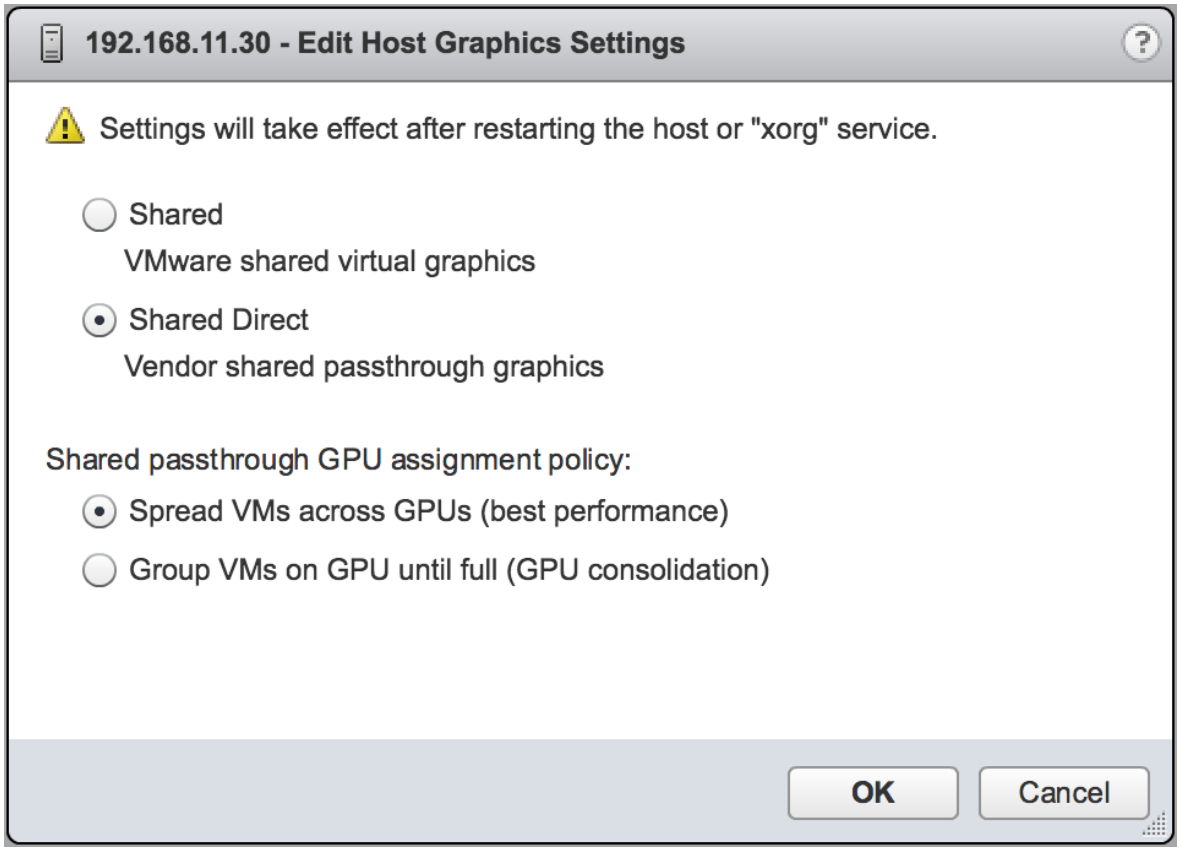
3.5.1. Changing the Default Graphics Type in VMware vSphere 6.5 and Later

Before changing the default graphics type, ensure that the ESXi host is running and that all VMs on the host are powered off.

1. Log in to vCenter Server by using the vSphere Web Client.
2. In the navigation tree, select your ESXi host and click the **Configure** tab.
3. From the menu, choose **Graphics** and then click the **Host Graphics** tab.
4. On the **Host Graphics** tab, click **Edit**.



5. In the **Edit Host Graphics Settings** dialog box that opens, select **Shared Direct** and click **OK**.

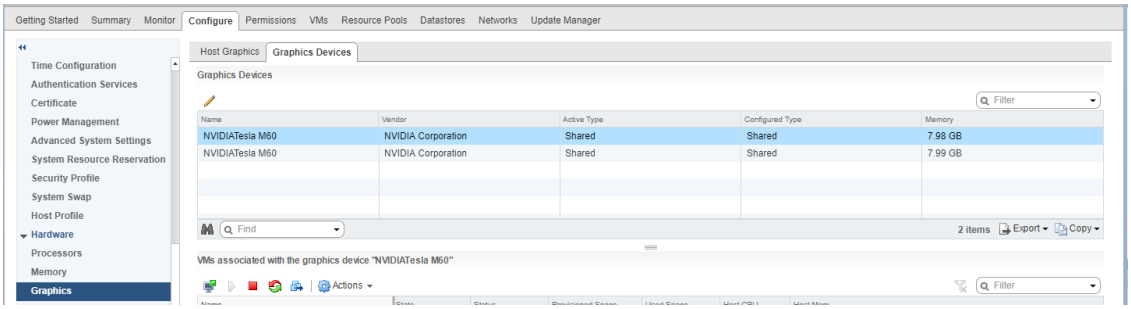


After you click OK, the default graphics type changes to Shared Direct.

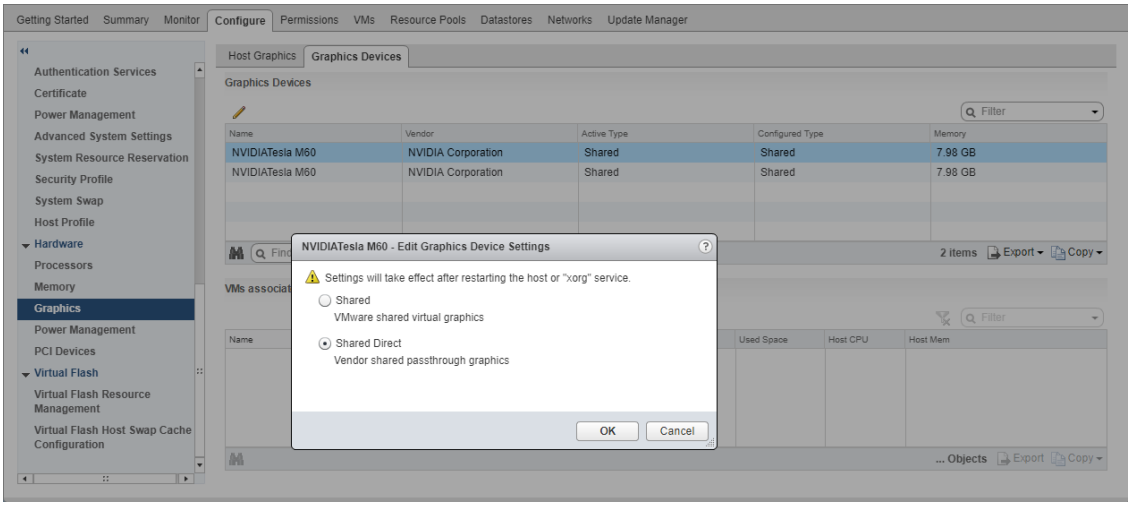
6. Click the **Graphics Devices** tab to verify the configured type of each physical GPU on which you want to configure vGPU.

   The configured type of each physical GPU must be Shared Direct. For any physical GPU for which the configured type is Shared, change the configured type as follows:

   a). On the **Graphics Devices** tab, select the physical GPU and click the **Edit icon**.



   b). In the **Edit Graphics Device Settings** dialog box that opens, select **Shared Direct** and click **OK**.



7. Restart the ESXi host **or** stop and restart the Xorg service if necessary and `nv-hostengine` on the ESXi host.

   To stop and restart the Xorg service and `nv-hostengine`, perform these steps:

   a). **VMware vSphere releases before 7.0 Update 1 only:** Stop the Xorg service.

   As of VMware vSphere 7.0 Update 1, the Xorg service is no longer required for graphics devices in NVIDIA vGPU mode.

   b). Stop `nv-hostengine`.

   ```
   [root@esxi:~] nv-hostengine -t
   ```

   c). Wait for 1 second to allow `nv-hostengine` to stop.

   d). Start `nv-hostengine`.

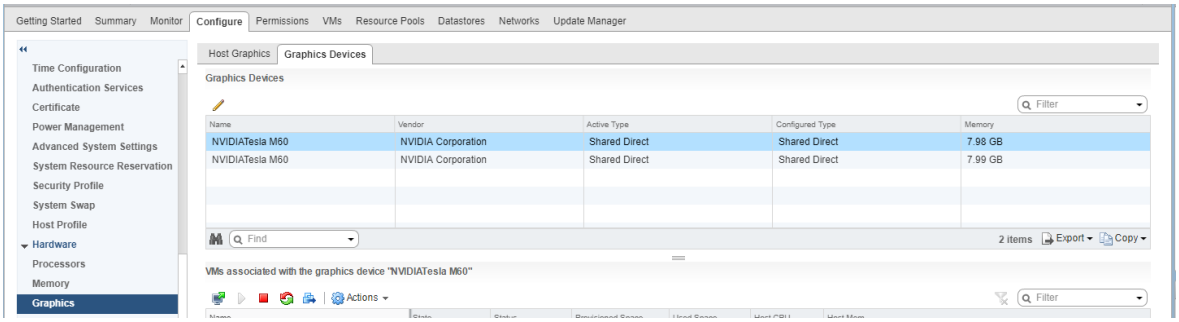
   ```
   [root@esxi:~] nv-hostengine -d
   ```

   e). **VMware vSphere releases before 7.0 Update 1 only:** Start the Xorg service.

   As of VMware vSphere 7.0 Update 1, the Xorg service is no longer required for graphics devices in NVIDIA vGPU mode.

   ```
   [root@esxi:~] /etc/init.d/xorg start
   ```

8. In the **Graphics Devices** tab of the VMware vCenter Web UI, confirm that the active type and the configured type of each physical GPU are Shared Direct.

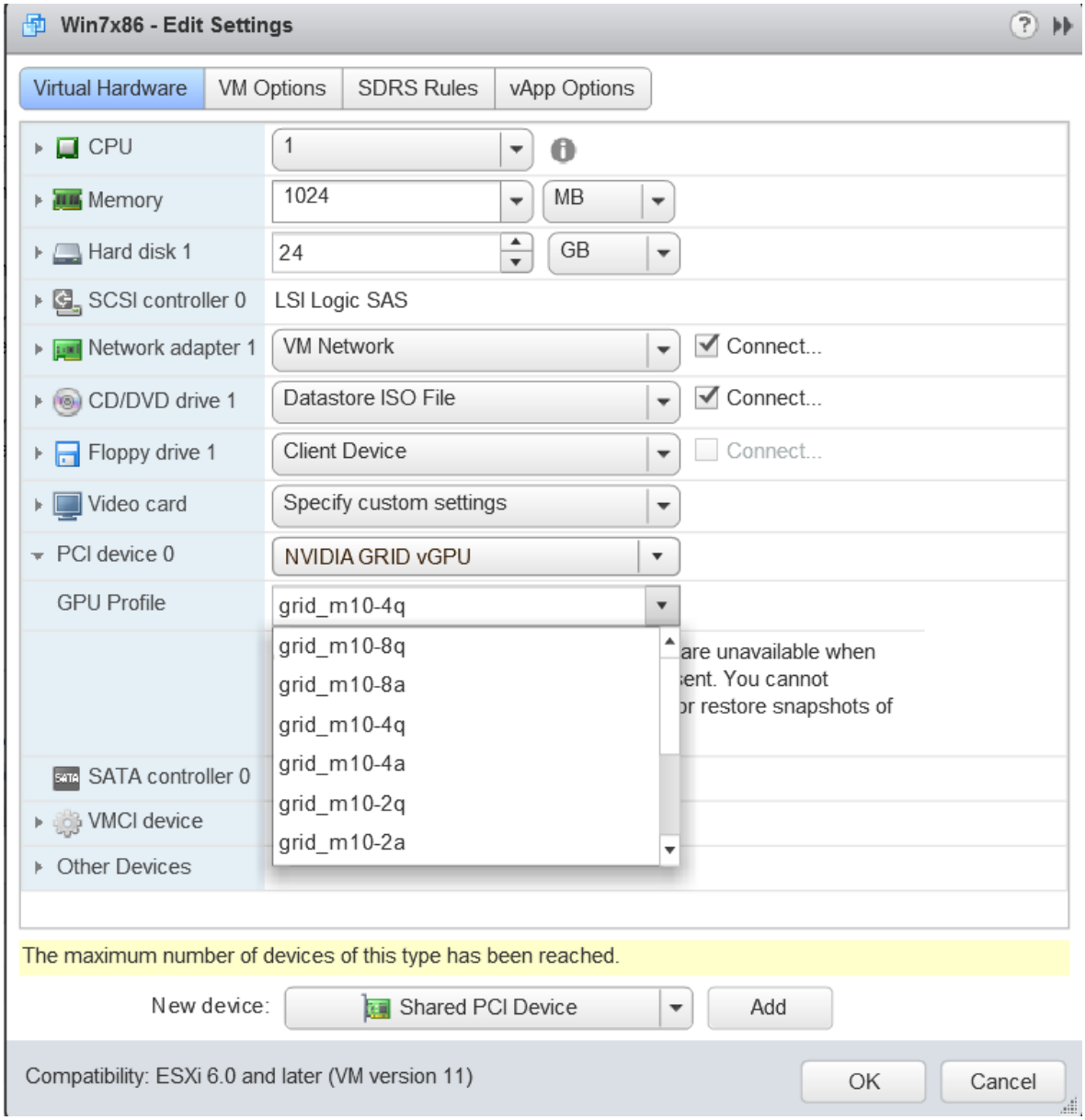


3.5.2. Configuring a vSphere VM with NVIDIA vGPU

CAUTION: Output from the VM console in the VMware vSphere Web Client is not available for VMs that are running vGPU. Make sure that you have installed an alternate means of accessing the VM (such as VMware Horizon or a VNC server) before you configure vGPU.

VM console in vSphere Web Client will become active again once the vGPU parameters are removed from the VM's configuration.

1. Open the vCenter Web UI.
2. In the vCenter Web UI, right-click the VM and choose **Edit Settings**.
3. Click the **Virtual Hardware** tab.
4. In the **New device** list, select **Shared PCI Device** and click **Add**.
   The **PCI device** field should be auto-populated with **`NVIDIA GRID vGPU`**.



5. From the **GPU Profile** drop-down menu, choose the type of vGPU you want to configure and click **OK**.

> **Note:** VMware vSphere does **not** support vCS. Therefore, C-series vGPU types are not available for selection from the **GPU Profile** drop-down menu.

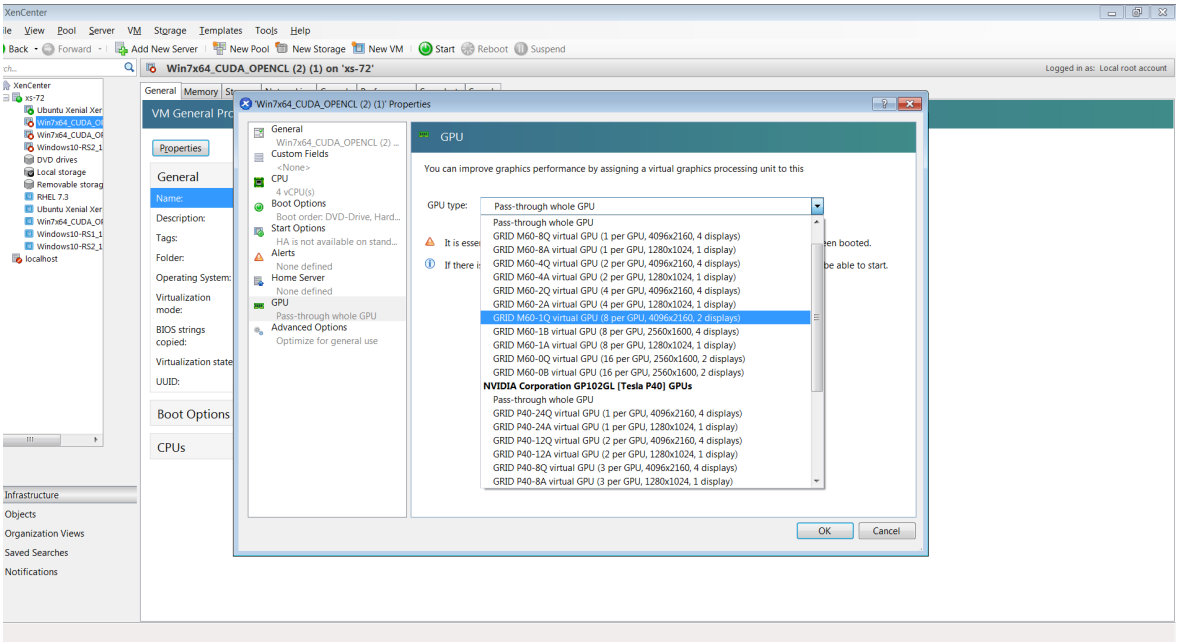
6. Ensure that VMs running vGPU have all their memory reserved:
   a). Select **Edit virtual machine settings** from the vCenter Web UI.
   b). Expand the **Memory** section and click **Reserve all guest memory (All locked)**.

After you have configured a vSphere VM with a vGPU, start the VM. VM console in vSphere Web Client is not supported in this vGPU release. Therefore, use VMware Horizon or VNC to access the VM's desktop.

3.5.3. Configuring a Citrix Hypervisor VM with Virtual GPU

1. Ensure the VM is powered off.
2. Right-click the VM in XenCenter, select **Properties** to open the VM's properties, and select the **GPU** property.

   The available GPU types are listed in the GPU type drop-down list:



After you have configured a Citrix Hypervisor VM with a vGPU, start the VM, either from XenCenter or by using `xe vm-start` in a dom0 shell. You can view the VM's console in XenCenter.

3.6. Installing the NVIDIA vGPU Software Graphics Driver

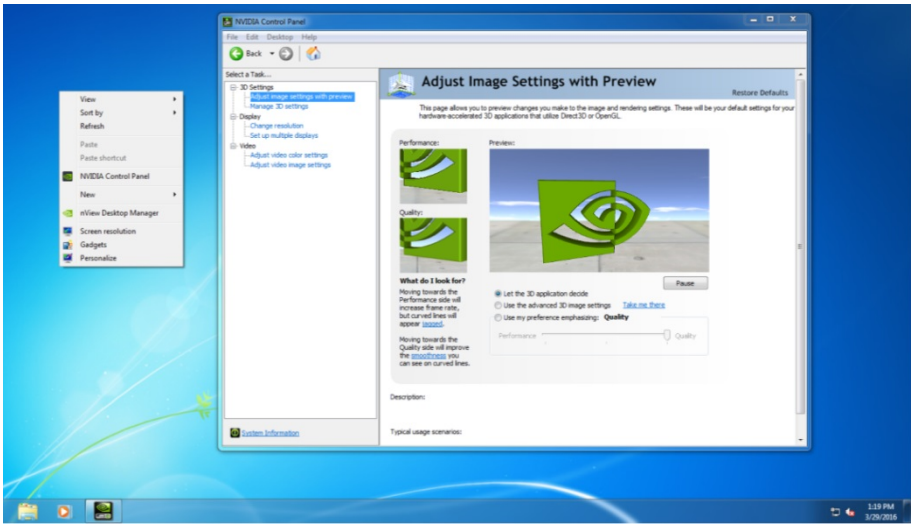
After you create a Windows VM on the hypervisor and boot the VM, the VM should boot to a standard Windows desktop in VGA mode at 800×600 resolution. You can use the Windows screen resolution control panel to increase the resolution to other standard resolutions, but to fully enable GPU operation, the NVIDIA vGPU software graphics driver must be installed.

1. Copy the NVIDIA Windows driver package to the guest VM where you are installing the driver.
2. Execute the package to unpack and run the driver installer.

3. Click through the license agreement.
4. Select **Express Installation** and click **NEXT**.
   After the driver installation is complete, the installer may prompt you to restart the platform.
5. If prompted to restart the platform, do one of the following:
   - Select **Restart Now** to reboot the VM.
   - Exit the installer and reboot the VM when you are ready.

   After the VM restarts, it boots to a Windows desktop.
6. Verify that the NVIDIA driver is running.
   a). Right-click on the desktop.
   b). From the menu that opens, choose **NVIDIA Control Panel**.
   c). In the **NVIDIA Control Panel**, from the **Help** menu, choose **System Information**.

   NVIDIA Control Panel reports the vGPU that is being used, its capabilities, and the NVIDIA driver version that is loaded.



3.7. Licensing an NVIDIA vGPU

Perform this task from the guest VM to which the vGPU is assigned.

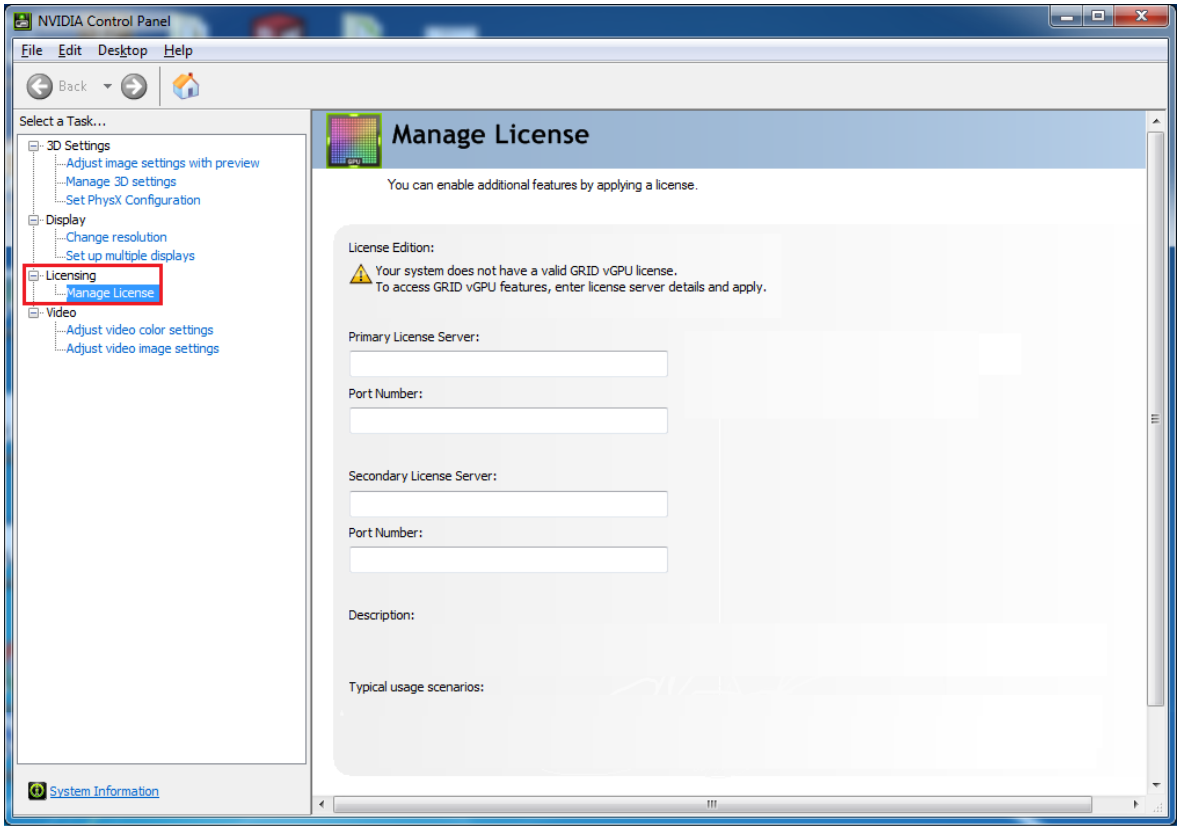
The **NVIDIA Control Panel** tool that you use to perform this task detects that a vGPU is assigned to the VM and, therefore, provides no options for selecting the license type. After you license the vGPU, NVIDIA vGPU software automatically selects the correct type of license based on the vGPU type.

Note: These instructions cover only licensing for a single-instance license server. If you configured a primary and secondary license server, refer to *Virtual GPU Client Licensing User Guide* for instructions for how to specify the address and port number of the primary and secondary license servers.

1. Open **NVIDIA Control Panel**:
   - Right-click on the Windows desktop and select **NVIDIA Control Panel** from the menu.
   - Open **Windows Control Panel** and double-click the **NVIDIA Control Panel** icon.
2. In **NVIDIA Control Panel**, select the **Manage License** task in the **Licensing** section of the navigation pane.

   Note: If the **Licensing** section and **Manage License** task are not displayed in **NVIDIA Control Panel**, the system has been configured to hide licensing controls in **NVIDIA Control Panel**. For information about registry settings, refer to *Virtual GPU Client Licensing User Guide*.

   The **Manage License** task pane shows that NVIDIA vGPU is currently unlicensed.



3. In the **Primary License Server** field, enter the address of yourNVIDIA vGPU software License Server.

   The address can be a fully-qualified domain name such as `gridlicense1.example.com`, or an IP address such as `10.31.20.45`.
4. Leave the **Port Number** field under the **Primary License Server** field unset.
   The port defaults to `7070`, which is the default port number used by NVIDIA vGPU software License Server.
5. Leave the **Secondary License Server** field and the **Port Number** field under it unset.
6. Click **Apply** to assign the settings.
   The system requests the appropriate license for the current vGPU from the configured license server.

The vGPU within the VM should now operate at full capability without any performance degradation over time for as long as the vGPU is licensed.

You have now completed the process of installing NVIDIA vGPU software and setting up a single VM to use NVIDIA vGPU.

If the system fails to obtain a license, see *Virtual GPU Client Licensing User Guide* for guidance on troubleshooting.

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