CHYRONHEGO

GPU RENDER EDID GUIDE

Avoiding GPU output disconnects, and setting up simulated GPU outputs

EDID20180928

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EXECUTIVE SUMMARY

Often GPU-based render systems are deemed unstable because of the potential for Windows to reset or turn off GPU outputs (monitor or Mosaic) upon an interruption or video cable disconnect.

A simple example is an engineer inadvertently knocking a cable loose in the server room. The results of this are far-reaching: this creates a low-level event within the Windows operating system that resets most output configurations, and then crashes the renderer.

However, technology is available on all NVidia-based render servers that can be used to prevent these types of changes to the system's GPU output configuration, making sure output rendering can continue uninterrupted.

This document offers information about what EDID is, as well as step-by-step instructions on how to use EDID to your advantage.

ABBREVIATIONS AND DEFINITIONS

In this document, the following definitions and abbreviations are used.

GPU - the graphics card installed for rendering or desktop display purposes (e.g. P5000)

GPU output / GPU connection - a connector on the back of the GPU (e.g. DVI, DisplayPort)

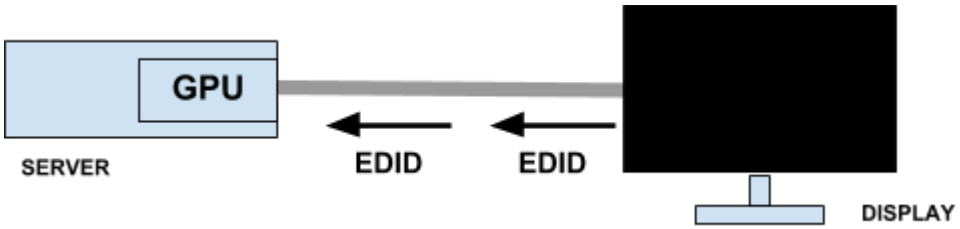
UI - User interface of software

Mosaic - NVidia's technology for grouping together GPU outputs into a single output (e.g. used for Display Matrix setups)

UNDERSTANDING EDID

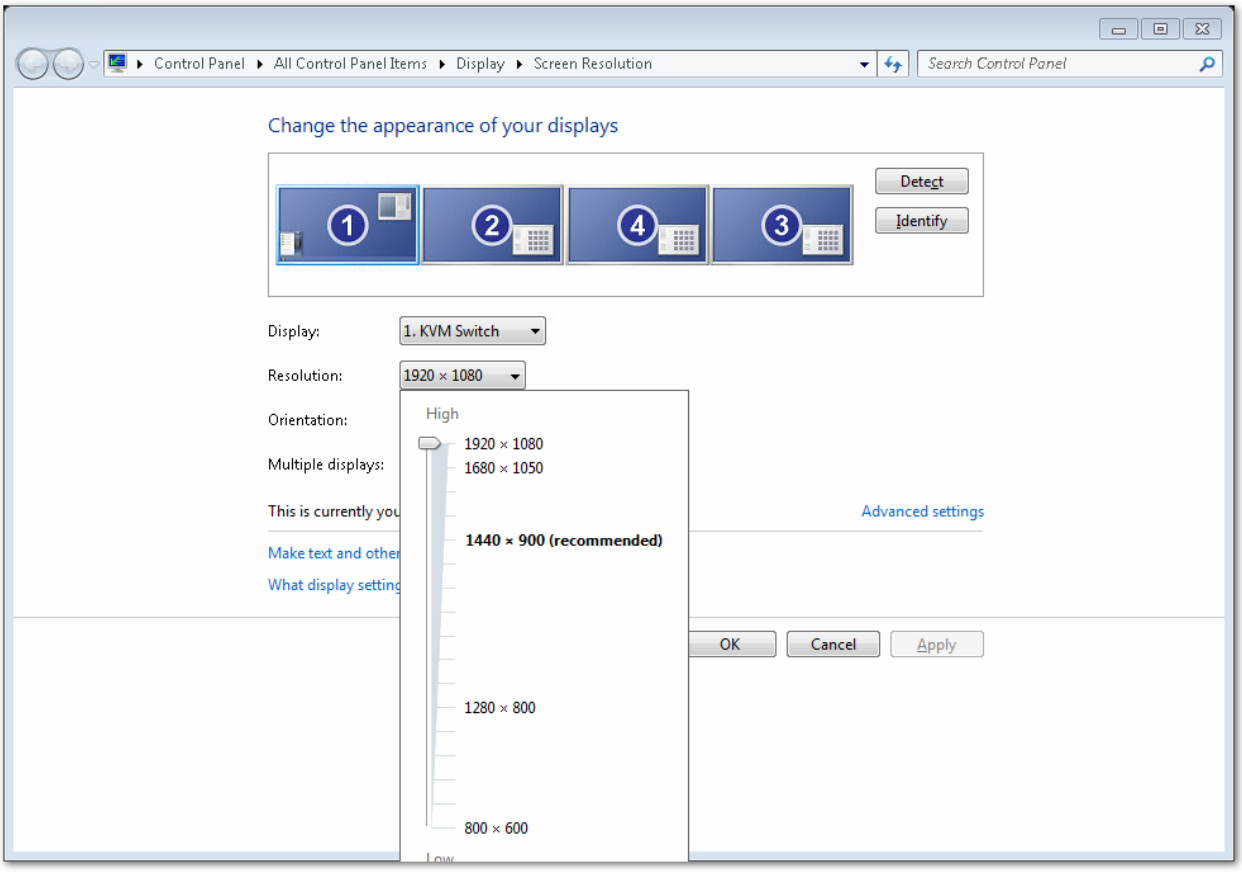
EDID stands for *Extended Display Identification Data* and is a metadata format for display devices to describe their capabilities to a video source (source: Wikipedia). EDID is an identification packet that is continuously streamed by display devices (monitors, etc.) while said devices are turned on, or while in a low power consumption mode (e.g. standby).

Easier said: if a display device or monitor is powered, it is actively sending EDID to graphics cards via the video cable (DVI, DisplayPort, HDMI, etc.)



Basics

As soon as a monitor is connected to a graphics card, the monitor starts streaming to the graphics card all resolutions it supports, the frame rates, the make and model, etc. This information is what shows up in Windows and the NVidia Control Panel as the resolutions you can select from.



Graphics cards (and Windows) require the EDID stream from the monitor to the GPU connection to remain active. Otherwise it is assumed that the monitor was removed from the system and Windows and the graphics card will turn off the output.

Interruption or Disconnect

An interruption or disconnect in the EDID stream going from the monitor to the graphics card can have various causes:

- A power loss on the monitor
- Removal of video cables
- A poor adapter connection

It is the result that is more destructive and unrecoverable for render engines:

- Windows turns off the NVidia Mosaic that was configured

- Outputs are turned off
- Monitors are no longer available

This ultimately results in render engines crashing because an extremely low-level system change took place, and there is no way to catch this cleanly.

TAKING ADVANTAGE OF EDID

While the EDID data stream from display device to graphics card, and the resulting instability, as a concept may raise eyebrows from a render perspective, from a technology perspective there are ways of taking advantage of EDID using tools that are available **on all NVidia-based render servers**.

Capturing EDID

With NVidia cards, we can capture the EDID stream received from display devices and save this to a file **for immediate or later use**. The file is a simple text file that could contain the following if opened in Notepad:

```
00 ff ff ff ff ff ff 00 17 0e 00 00 00 00 00 00 00 13 01 03 80 00 00 78 ee
00 00 00 00 00 00 00 00 00 00 a5 4f 80 81 c0 81 00 81 80 95 00 90 40 b3 00
d1 c0 01 01 02 3a 80 18 71 38 2d 40 58 2c 45 00 00 00 00 00 00 1e 00 00 00
ff 00 31 39 32 30 78 31 30 38 30 20 36 30 20 00 00 00 fd 00 17 4c 0e 5c 11
00 0a 20 20 20 20 20 20 00 00 00 fc 20 45 78 74 72 6f 6e 20 44 20 20 20 20
20 00 3a
```

Because we can save this EDID stream to file, for any device we connect to the graphics card we can save its unique identification method including low-level information such as resolutions and frame rates. A step-by-step guide for this will follow later in this document.

Using EDID

Once captured, there are two potential use cases that are applicable for the resulting EDID files:

- Stabilizing GPU setups (avoiding system changes)
- Simulating any display device/monitor without it being connected, in any configuration

Stabilizing GPU Setups

With EDID information provided by a file and not a cable, we can remove the graphics card's reliability on the continuous EDID stream coming through the video cable. **This is accomplished by saving the EDID information directly onto the graphics card itself.**

This ensures that whether display devices are connected, Windows always sees monitors connected because the information is in a file. This then also ensures that output configurations do not experience low-level changes, and NVidia Mosaic configurations do not get reset, **even after a reboot or shutdown of the system**.

Simulating GPU Outputs

For testing and staging purposes, it can be extremely useful to simulate outputs (or even Mosaic configurations) **ahead of having display devices available**. Loading EDID onto a graphics card from file allows you to do so, even to a point where this information is maintained between reboots.

As soon as Windows starts up it sees the EDID information stored on the graphics card and will show a monitor connected in the display settings, regardless of whether a physical monitor is connected via a video cable.

When to Use

For the Stabilizing GPU Setups use case, the best time to use EDID files is during installation and commissioning of systems when all display devices are available. This ensures that all devices are known and EDID capture is accurate based on makes and models.

No Override

It is important to note that while EDID information may be saved to a graphics card, **this does not imply that it will override EDID information received from a display device through the video cable**.

For instance, if EDID information for a Samsung display is loaded from a file and then subsequently a Dell monitor is connected, in most all cases NVidia will honor the Dell monitor EDID information that it receives via the video cable, and it will disregard the EDID information from file.

Hardware-Based Alternatives

EDID files present a very stable approach for GPU output needs. If scepticism remains that this will be disaster proof, hardware-based alternatives are available in the form of external EDID Minder devices. These low-cost, self-powered devices can be installed between the GPU output and the display device, and provide the same functionality as EDID files.

Example: https://www.extron.com/product/edid101h4k

STEP-BY-STEP INSTRUCTIONS

Getting Started

If you are only interested in setting up simulated displays without monitors present or connected, you can skip to Step 3 of these instructions.

The system used for the screenshots in this document is an HX server with a P5000 card. This system was prepared for a video wall installation that included one GPU output for desktop/UI and three GPU outputs for NVidia Mosaic.

The following display devices/monitors were connected:

- DVI: Avocent KVM Switch (VGA in)
- DisplayPort 1: LG IPS Full HD monitor (HDMI in)
- DisplayPort 2: LG IPS Full HD monitor (HDMI in)
- DisplayPort 3: LG IPS Full HD monitor (HDMI in)

Step 1: Identify Display Devices

In a typical GPU output render environment there may be different types of display devices or monitors connected:

- A monitor for the Desktop/UI
- One or multiple display devices that will consume the GPU render output

All display devices should be identified and the EDID information for each unique make and model should be captured to an EDID file.

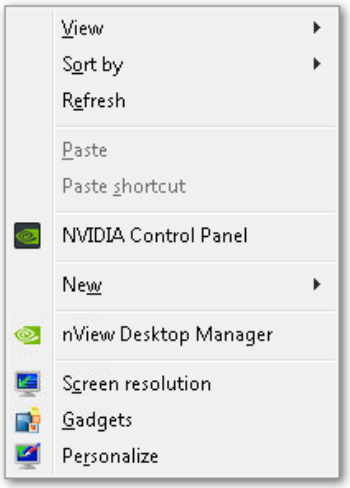
Only one EDID file capture is needed for display devices of the same make and model.

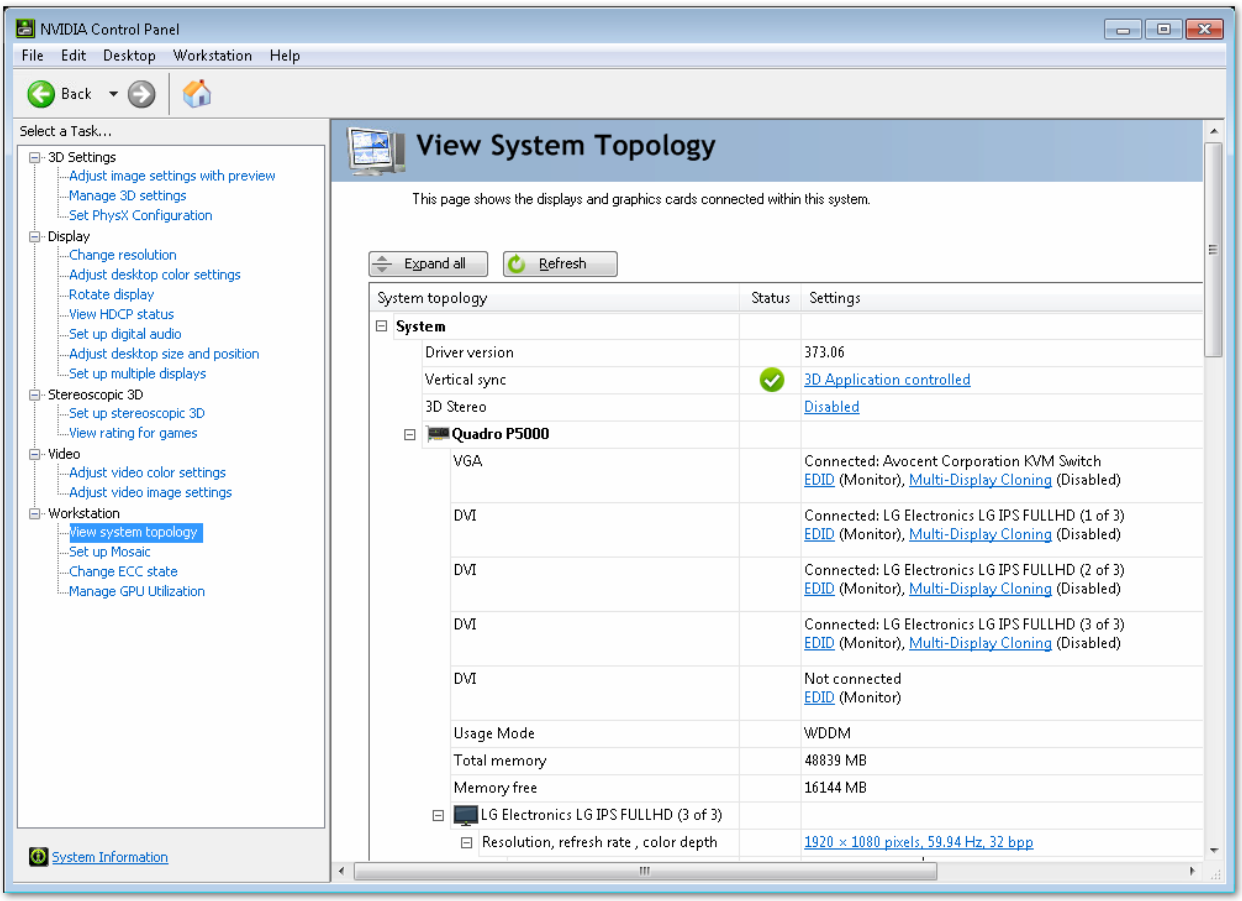
Step 2: Capture to File

To stabilize a GPU output for a display device or monitor, or to be able to simulate and test with a display device that is not physically present, first the device's EDID information needs to be captured to file.

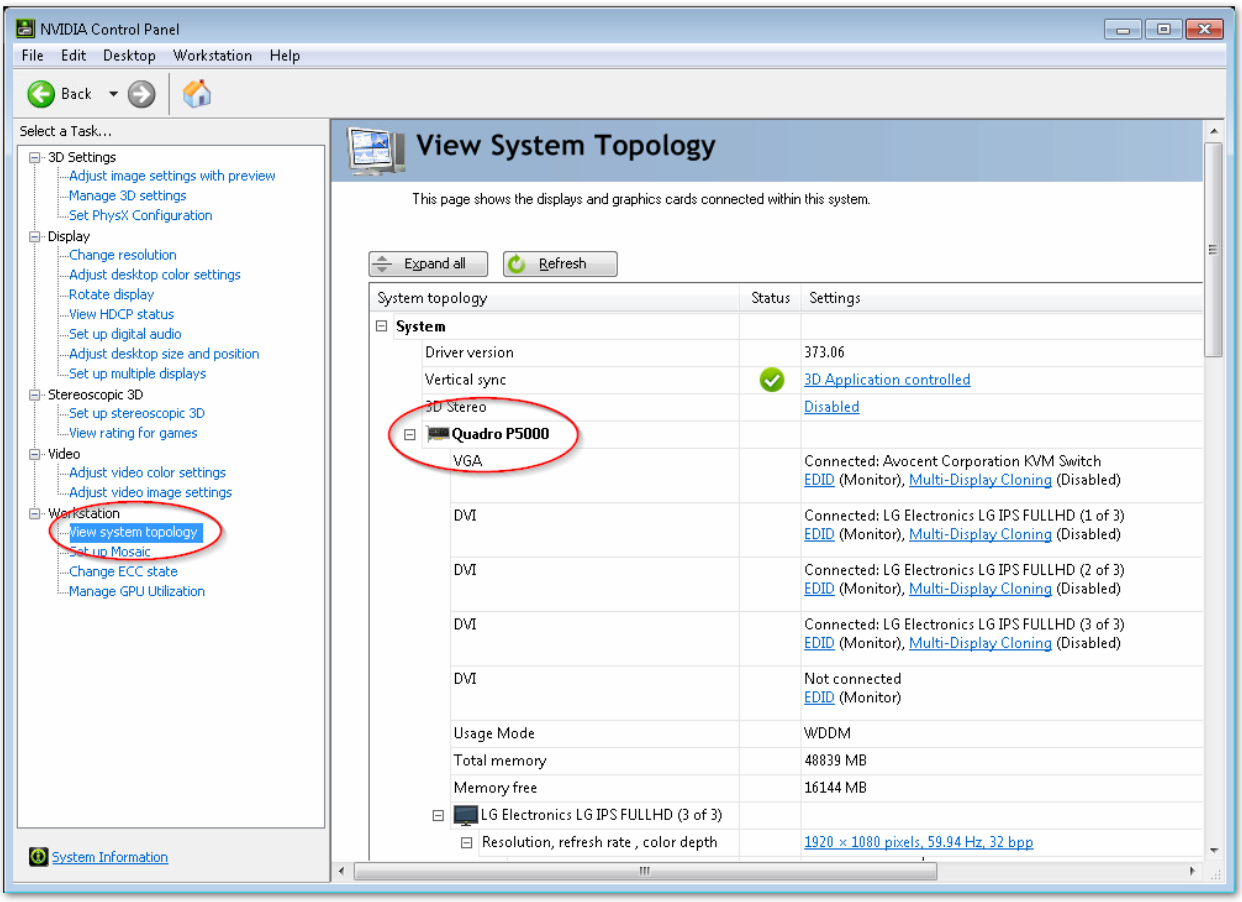
This should be performed **for each unique display device/monitor identified in Step 1**.

Right-click on the desktop and click on *NVidia Control Panel*.

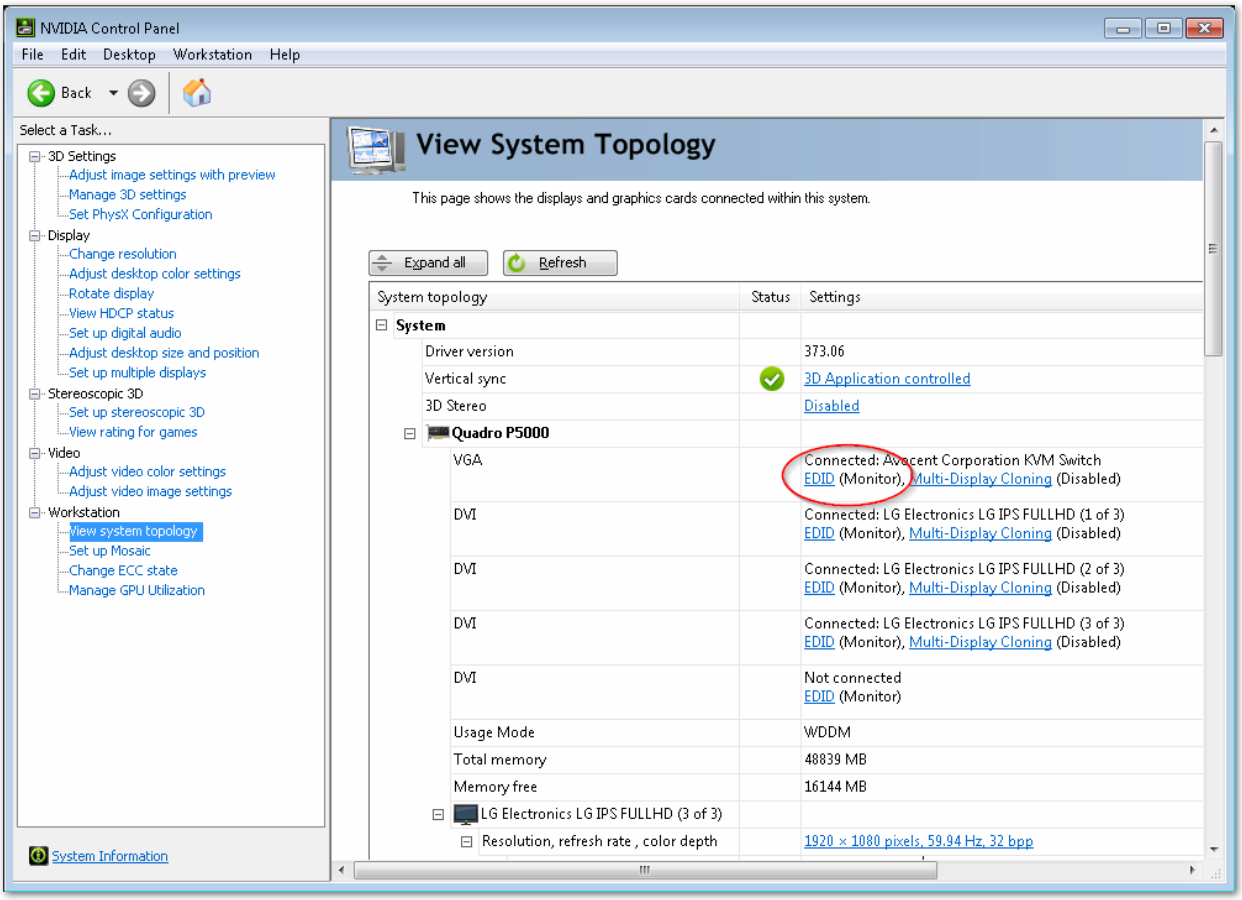

View
Sort by
Refresh
Paste
Paste shortcut
NVIDIA Control Panel
New
nView Desktop Manager
Screen resolution
Gadgets
Personalize


NVIDIA Control Panel
File Edit Desktop Workstation Help
Back
Select a Task...
3D Settings
Adjust image settings with preview
Manage 3D settings
Set PhysX Configuration
Display
Change resolution
Adjust desktop color settings
Rotate display
View HDCP status
Set up digital audio
Adjust desktop size and position
Set up multiple displays
Stereoscopic 3D
Set up stereoscopic 3D
View rating for games
Video
Adjust video color settings
Adjust video image settings
Workstation
View system topology
Set up Mosaic
Change ECC state
Manage GPU Utilization
System Information
View System Topology
This page shows the displays and graphics cards connected within this system.
Expand all
Refresh
System topology
Status
Settings
System
Driver version
373.06
Vertical sync
3D Application controlled
3D Stereo
Disabled
Quadro P5000
VGA
Connected: Avocent Corporation KVM Switch
EDID (Monitor), Multi-Display Cloning (Disabled)
DVI
Connected: LG Electronics LG IPS FULLHD (1 of 3)
EDID (Monitor), Multi-Display Cloning (Disabled)
DVI
Connected: LG Electronics LG IPS FULLHD (2 of 3)
EDID (Monitor), Multi-Display Cloning (Disabled)
DVI
Connected: LG Electronics LG IPS FULLHD (3 of 3)
EDID (Monitor), Multi-Display Cloning (Disabled)
DVI
Not connected
EDID (Monitor)
Usage Mode
WDDM
Total memory
48839 MB
Memory free
16144 MB
LG Electronics LG IPS FULLHD (3 of 3)
Resolution, refresh rate , color depth
1920 × 1080 pixels, 59.94 Hz, 32 bpp

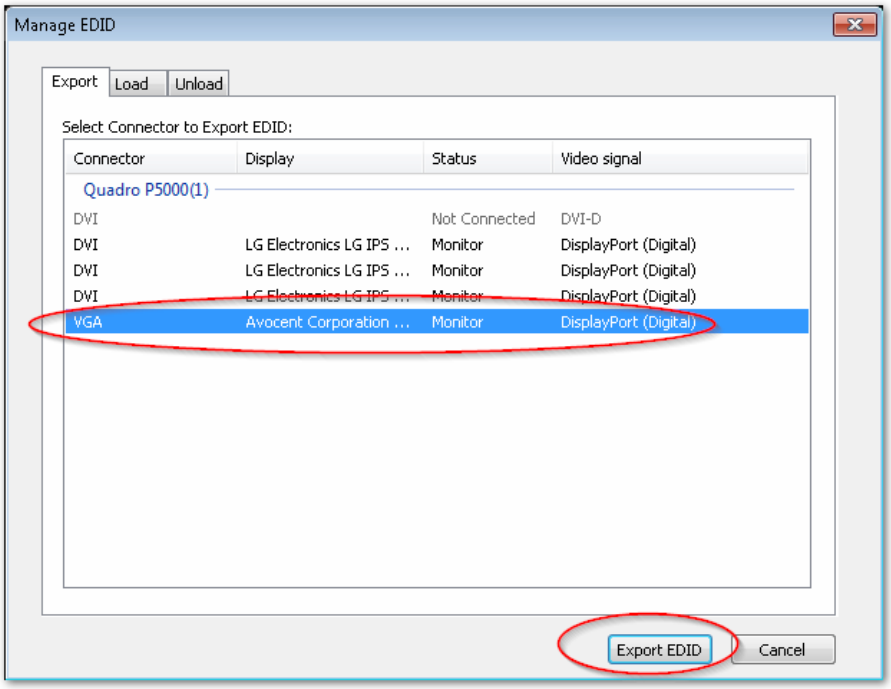
In the tree on the left under Workstation, click on *View system topology* and expand the nodes under the output GPU:



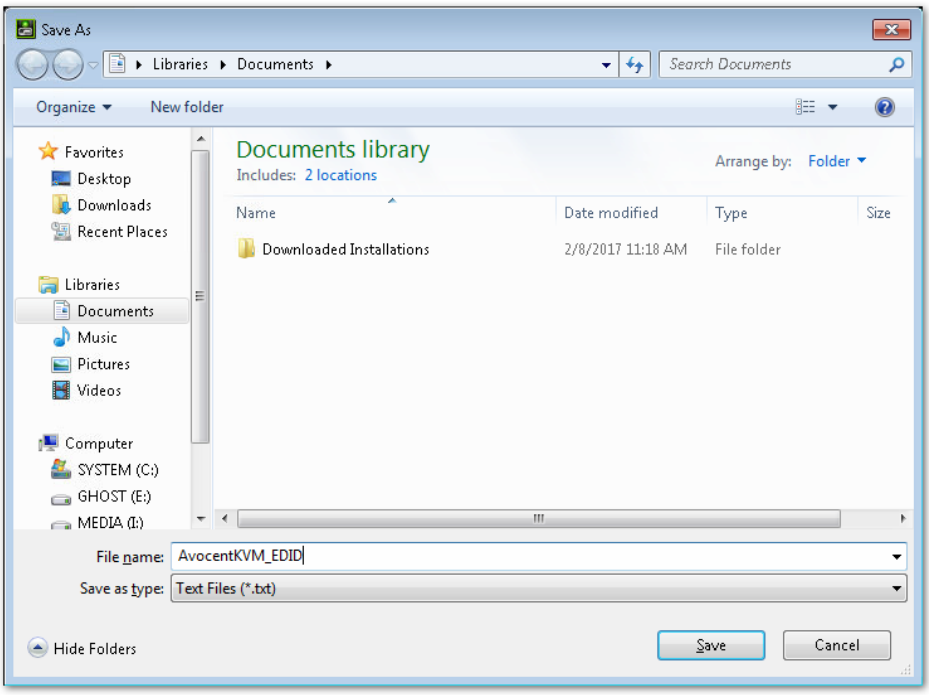
Locate the connected display device or monitor for which you want to capture the EDID. Note that it currently lists *EDID (Monitor)*, which means that the graphics card is currently receiving EDID information from the monitor. Click on the EDID link:



In the Manage EDID screen select the Export tab select the display devices/monitor for which you want to export the EDID information to file, and click on the Export EDID button:



Use a filename that can be used to identify the monitor you are saving the EDID information for. This is useful when loading EDID files. Find a suitable location for the file and hit Save:



The EDID information has now been captured to a file.

Save the file to a local drive and not a network drive or removable drive.

Perform this step for each uniquely identified display device or monitor, regardless of its use.

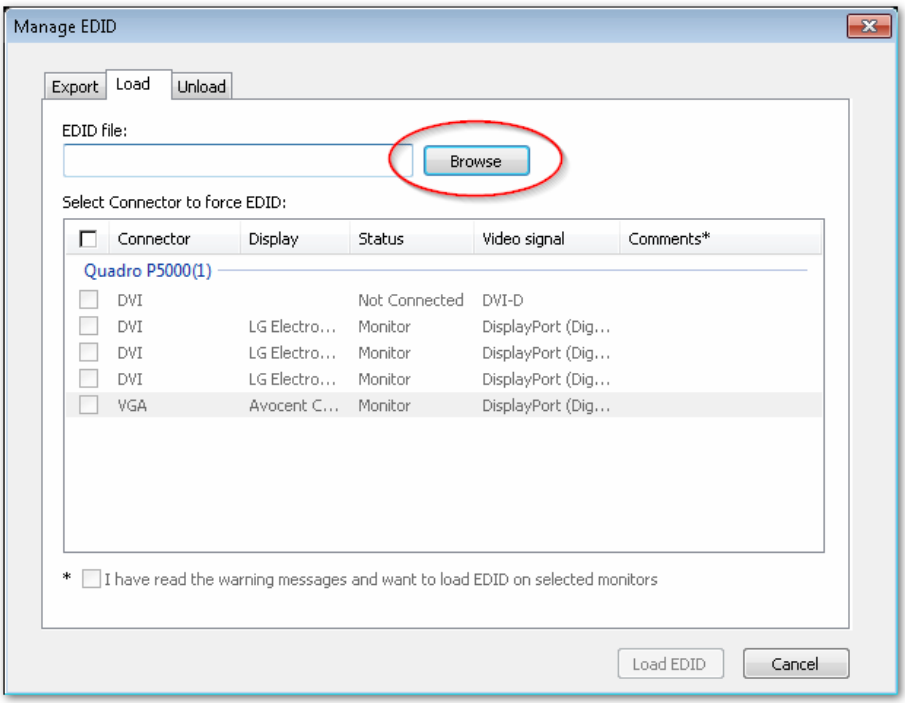
In our case, we saved the EDID information for the Avocent KVM monitor to file first, and then we saved the EDID information for one of the three LG monitors. Since all LG monitors were of the same make and model we only had to save this information once.

Step 3: Load

First, make sure to keep in mind the different files saved based on the monitor identification of Step 1. Desktop/UI monitors and render monitors usually vary, and you must load the proper EDID information for each monitor to ensure that EDID retrieval from file is successful and applicable to the GPU output.

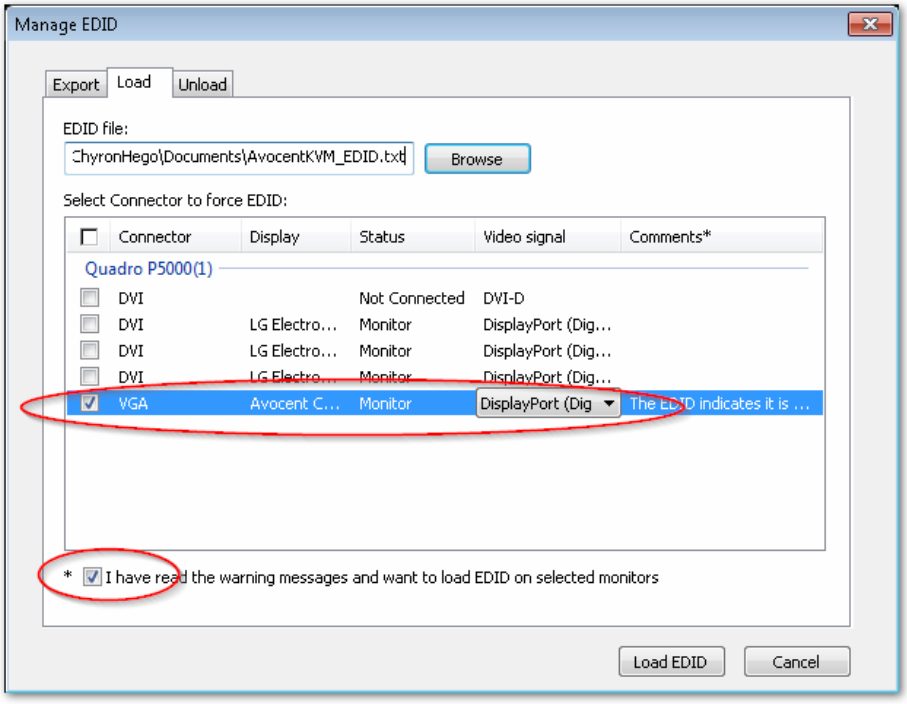
For loading EDID files without having captured first (e.g. when creating simulated GPU outputs for testing/staging), sample EDID files can be made available upon request.

To use the EDID information from a file instead of relying on the EDID stream from the video cable, select the Load tab. Click on the Browse button to navigate to the EDID file to use:

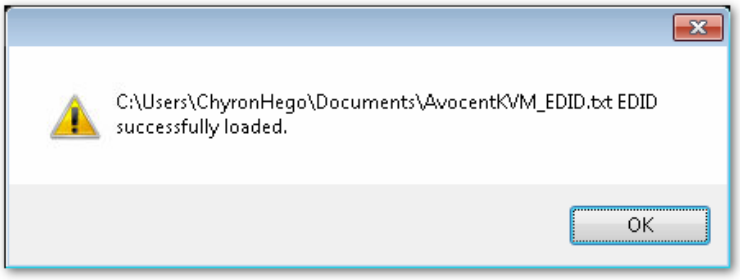


From the list of GPU connectors, check the box in front of the connector to select one or many that should use the EDID information stored in the file. You may optionally select the connection type (e.g. DVI-D, DisplayPort) if you are familiar with this. This is not required but could help replicate exactly the signal path at the time of EDID capture.

Check the disclaimer box at the bottom. Then, click on the Load EDID button.

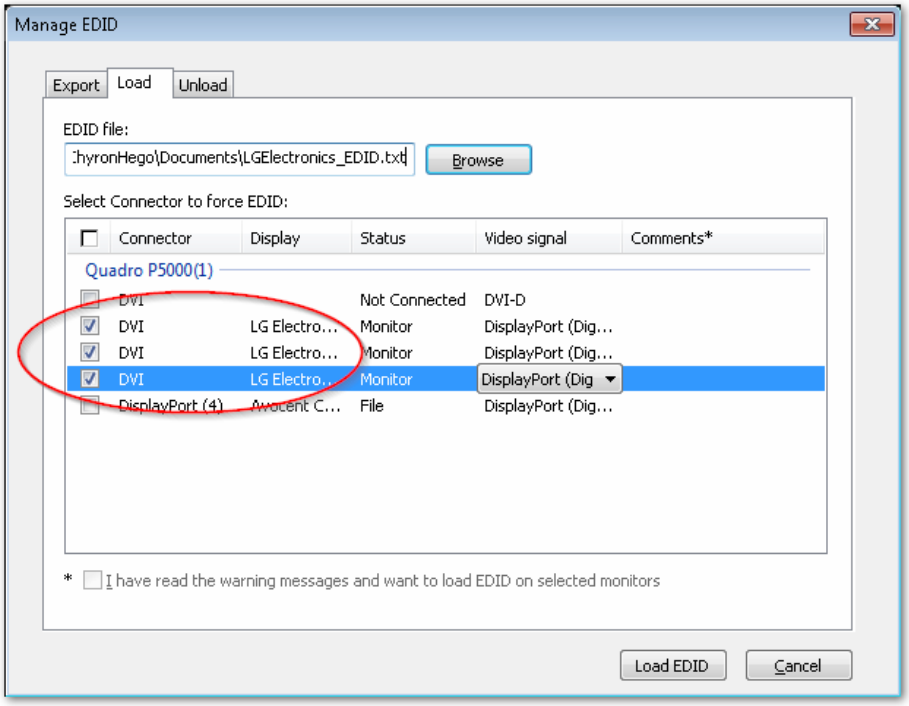


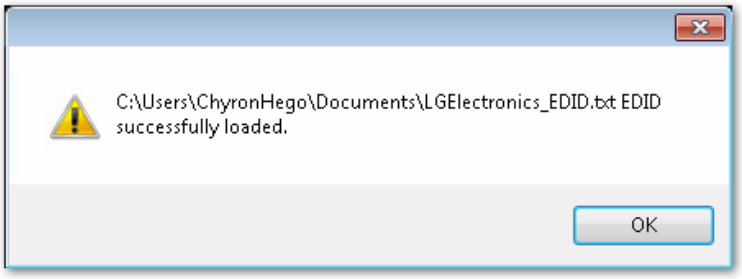
A confirmation message should appear that loading the EDID information succeeded:



The EDID information for this monitor (in our case the Avocent KVM for desktop/UI display) is now stored on the GPU connector(s) of the graphics card.

Repeat this process for each uniquely identified display device in Step 1:





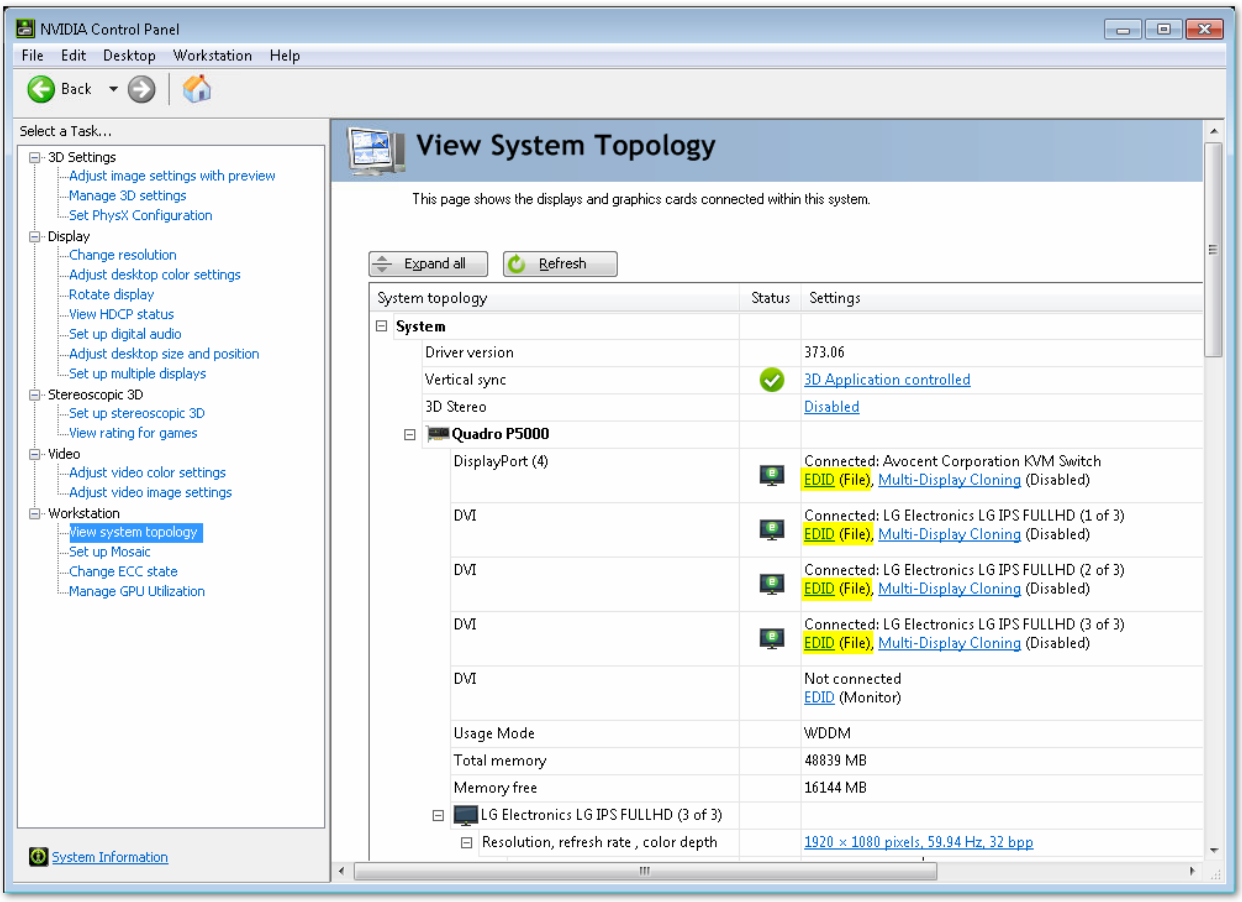
Here we have selected a single file for all three LG monitors that are of the same make and model. In our case these are the monitors that make up the Mosaic for the Display Matrix render output.

All GPU connectors that are to be used for the product now have EDID information loaded from file. You may now click on Cancel to close the Manage EDID screen.

Step 4: Verify

In the System Topology screen of the nVidia Control Panel, verify that for the GPU connectors that were selected to load EDID information from file, the following is now listed: *EDID (File)*.

This previously listed *EDID (Monitor)*, so the fact that it now lists *File* means that the EDID information is successfully processed from the EDID file:

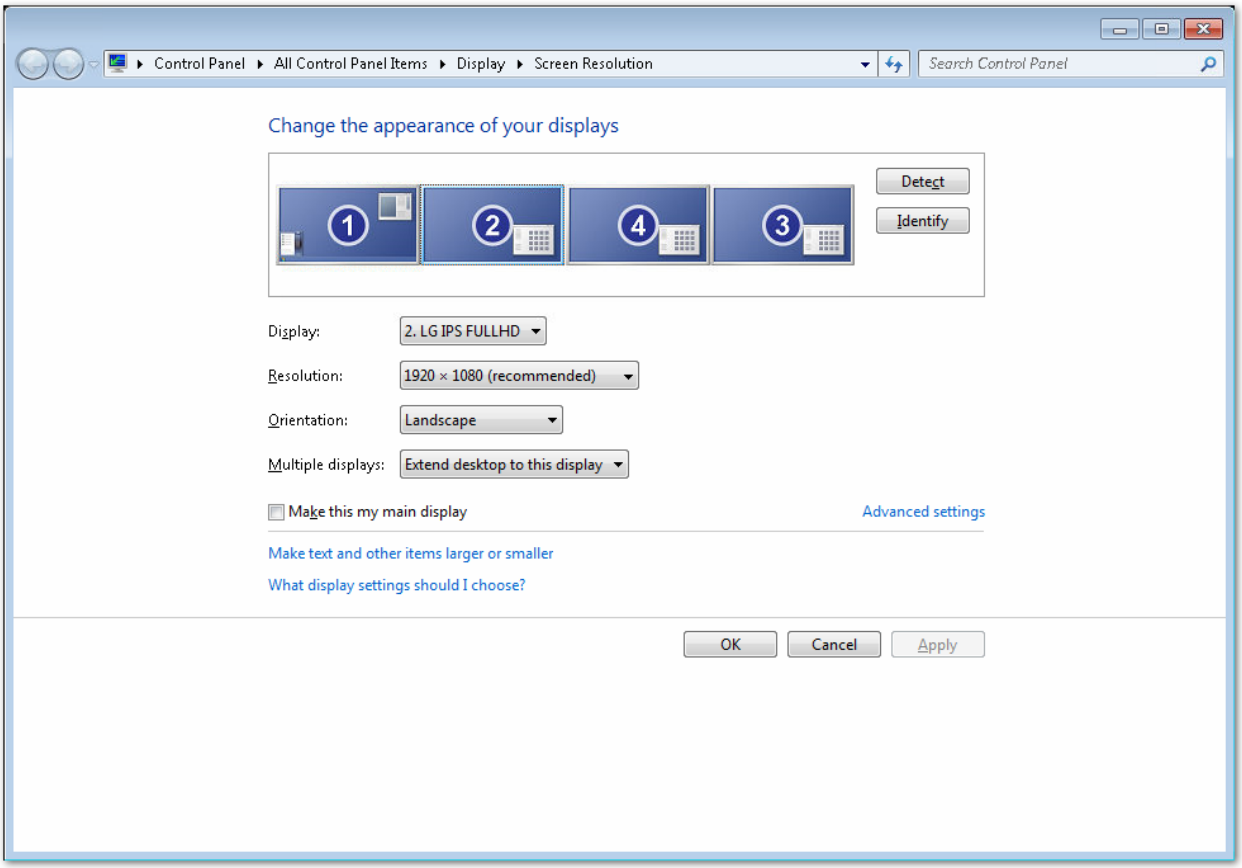


There is also an EDID file icon listed in the status field: 

At this point you can test removing one of the video cables from the system. This should not result in any of these screens disappearing or disabling.

Close the NVidia Control Panel and open the Windows display settings screen. Note the following for the two use cases described previously:

- For systems **with** physical display devices connected to the graphics card, the proper make and model is listed, and all resolutions and frame rates are available
- For systems **without** physical display devices connected or present, now a monitor is listed as available as if it is physically present and connected



Step 5: Setup NVidia Mosaic (optional)

Now that EDID information has been loaded, you can proceed to setting up output resolutions. This may include setting up NVidia Mosaic by grouping together GPU outputs. For step-by-step instructions for configuring NVidia Mosaic, see Appendix A

Step 6: Recapture (optional)

In case a different monitor or display devices is connected to the system (e.g. a monitor is replaced by a monitor of a different make and model), Step 1 through 5 needs to be repeated.

If the monitor connected to the graphics card does not match the EDID information loaded from file, the monitor's EDID information will be used. This then destabilizes the configuration and will again cause low-level changes on cable disconnects.

GPU STABILITY

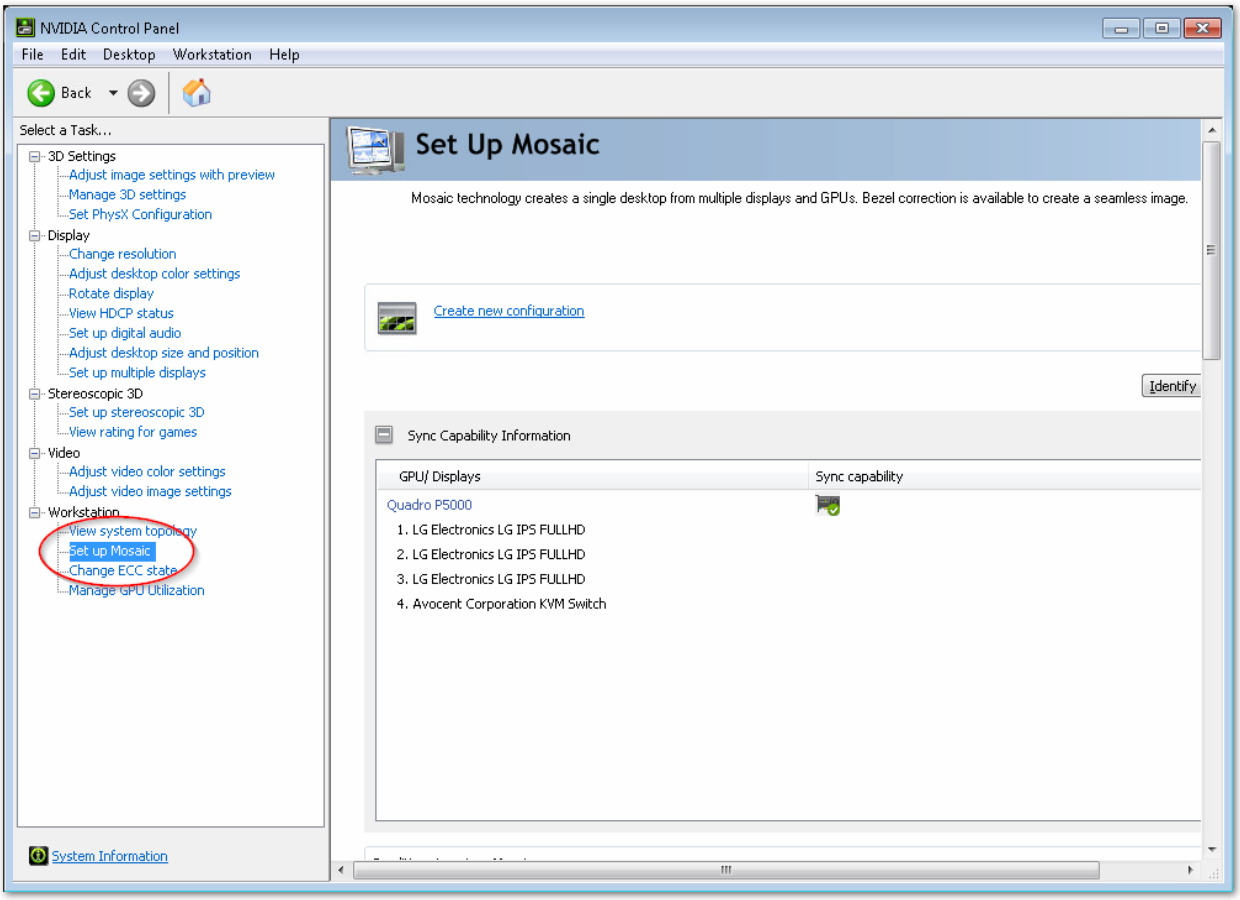
Now that you have loaded EDID files onto GPU outputs and set up output resolutions, your system is stable and protected from low-level changes such as EDID interruptions (cable disconnects, etc.)

If a cable is disconnected from the system, you should not see a change to the outputs. NVidia Mosaic configurations will remain enabled and operational and render engines will continue to render without throwing errors or exceptions.

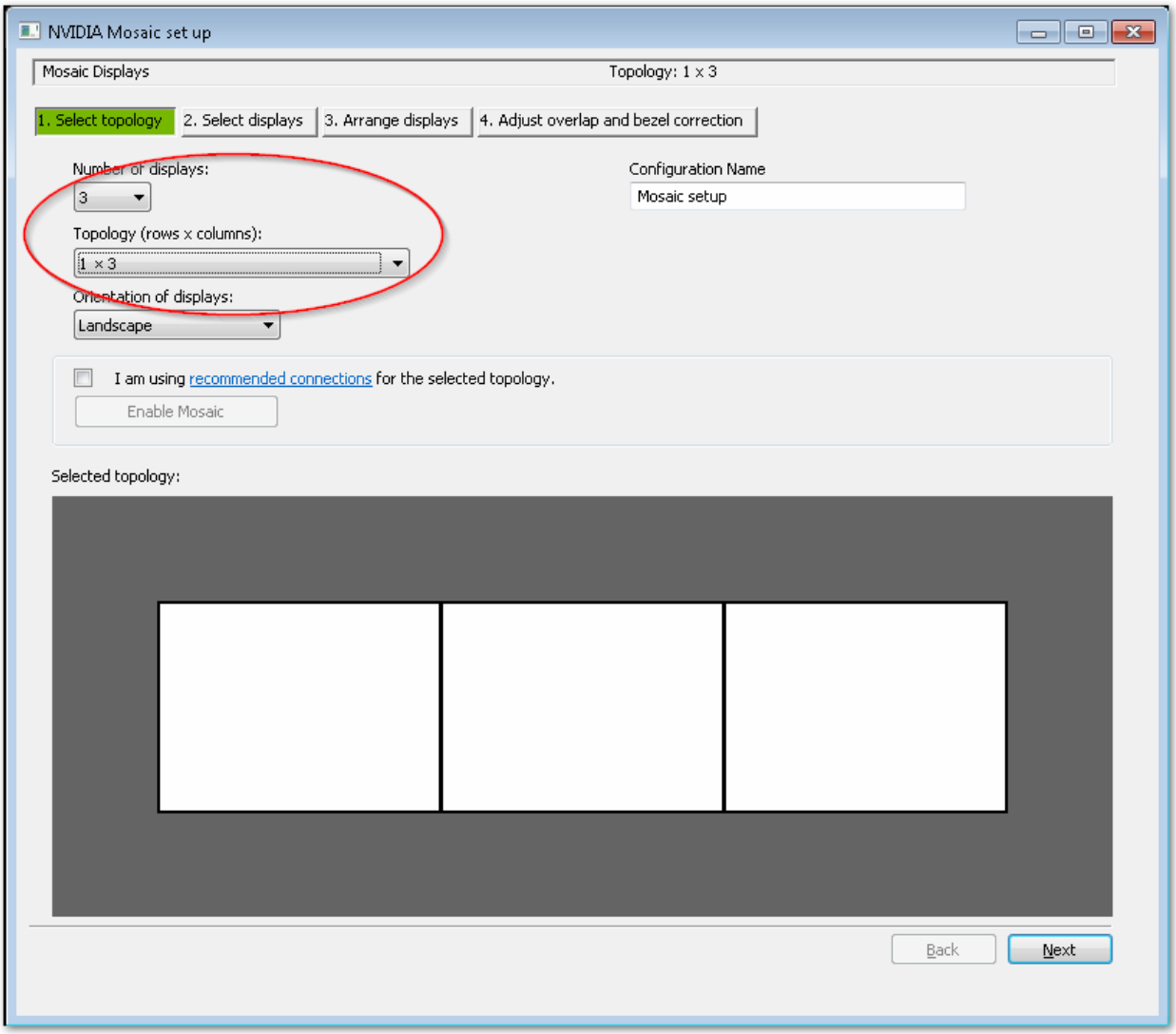
If the monitor connected to the graphics card does not match the EDID information loaded from file, the monitor's EDID information will be used. This then destabilizes the configuration and will again cause low-level changes on cable disconnects.

APPENDIX A - NVIDIA MOSAIC SETUP

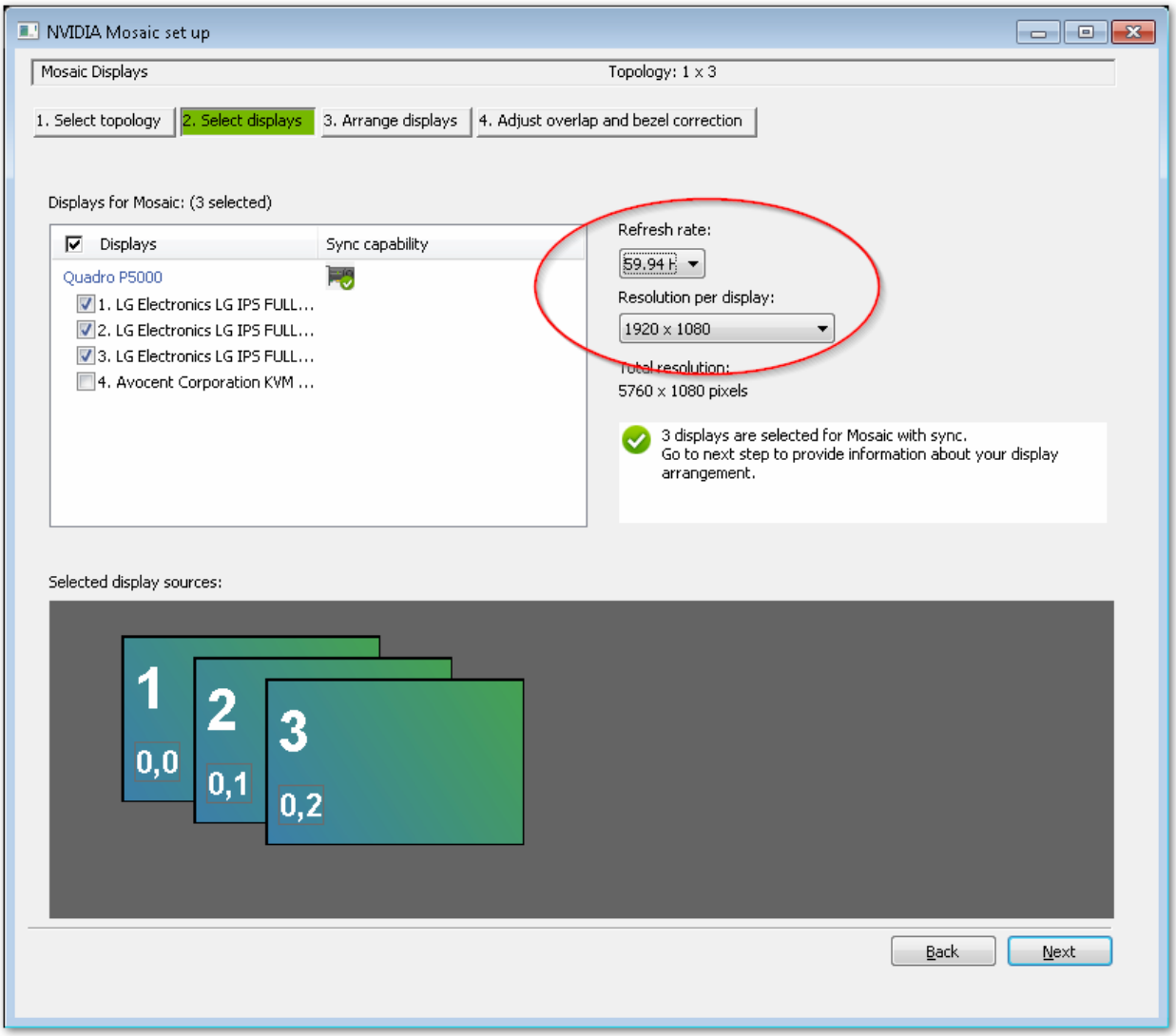
In the NVidia Control Panel, select *Set up Mosaic* in the tree on the left:



Click on the *Create new configuration* link. Select the number of displays and the topology. In our setup, the video wall will be 5,760x1,080 so we select 3 displays and a 1x3 topology:

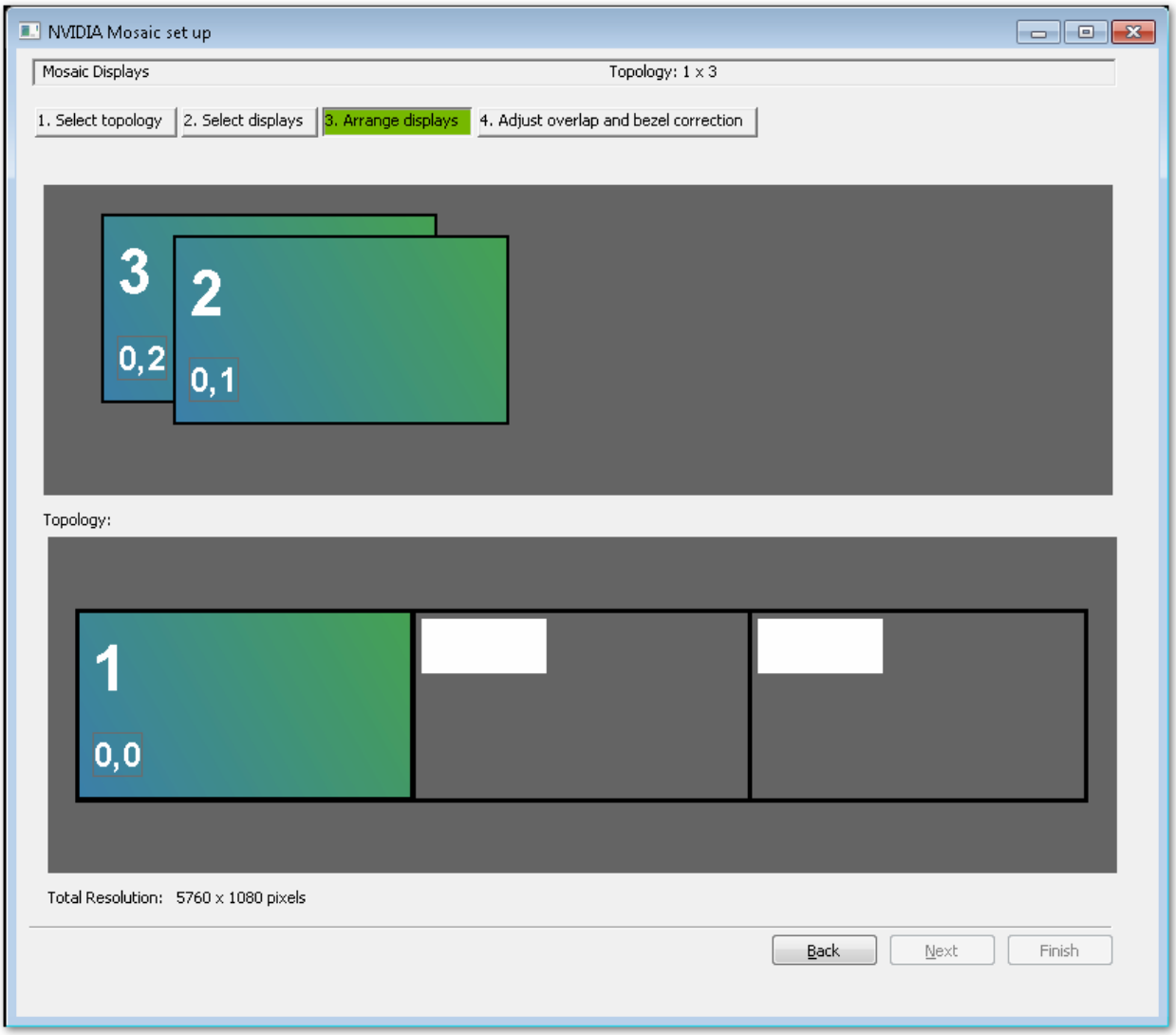


Click on *Next* and select the displays that will be part of the Mosaic. In our case we select the three LG monitors. Select the resolution per display, and the refresh rate.

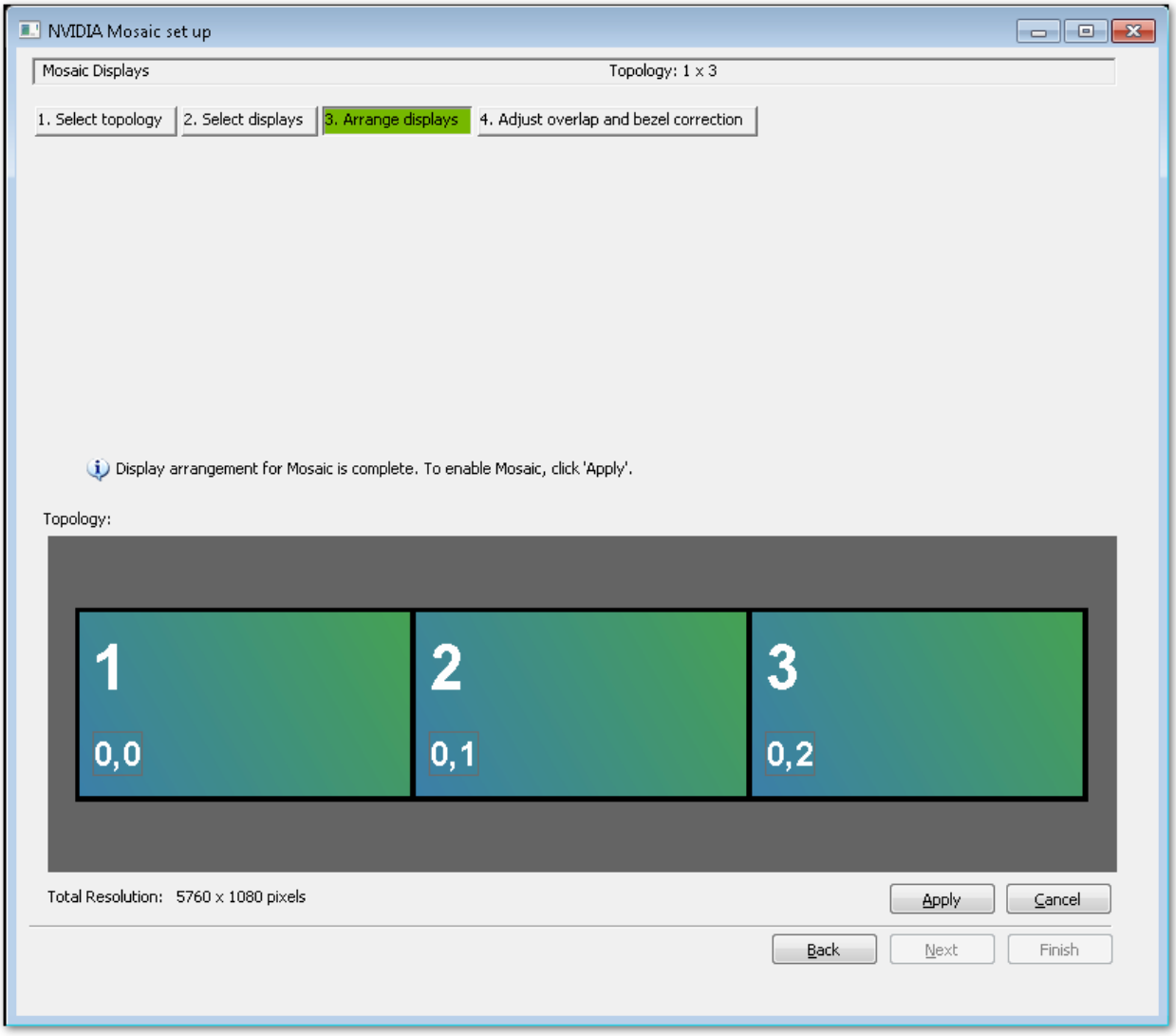


Often when setting the Resolution per display the Refresh rate value will default to 50Hz. Clicking the Back button will also reset the Refresh rate field. Before clicking Next, make sure to double-check the Refresh rate.

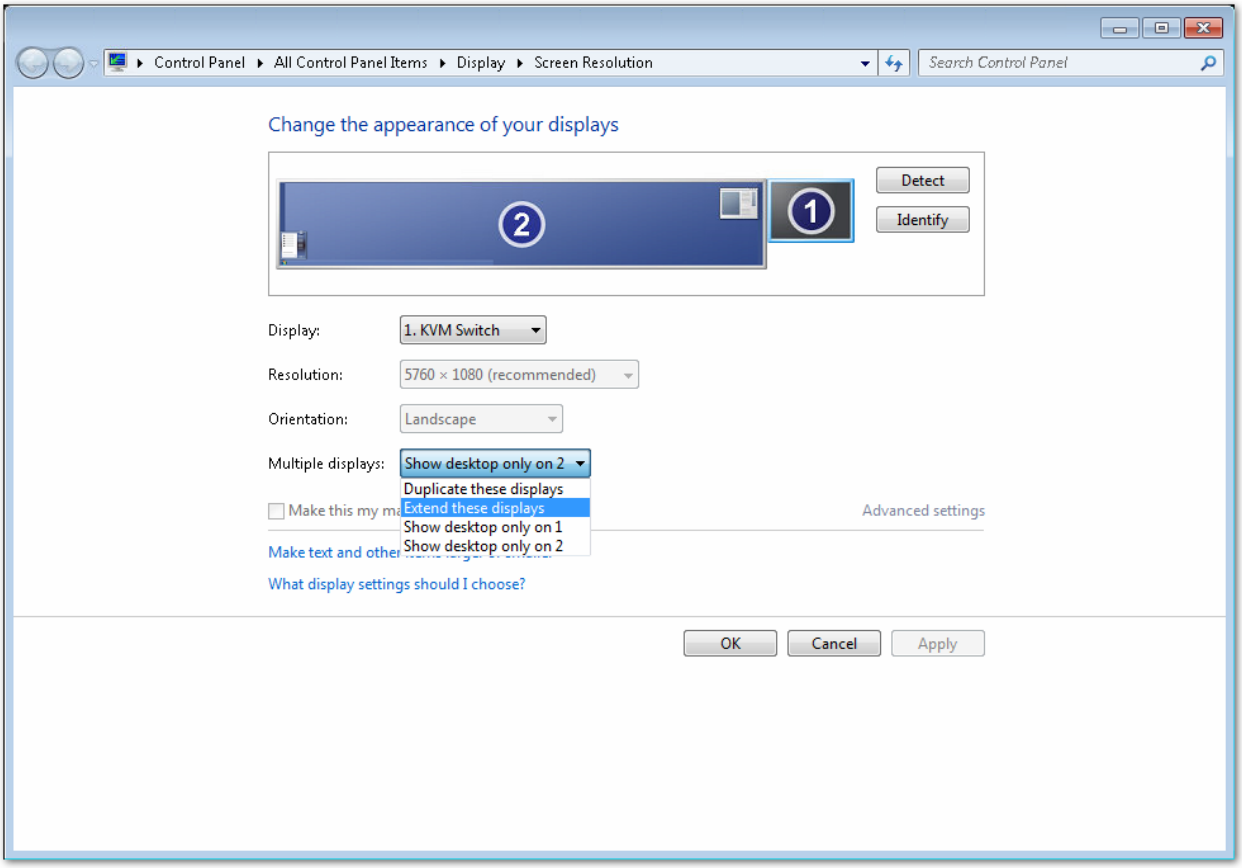
Click *Next* and select and drag the displays into their desired location within the topology. You can use the numbers displayed on the monitors to identify the order:



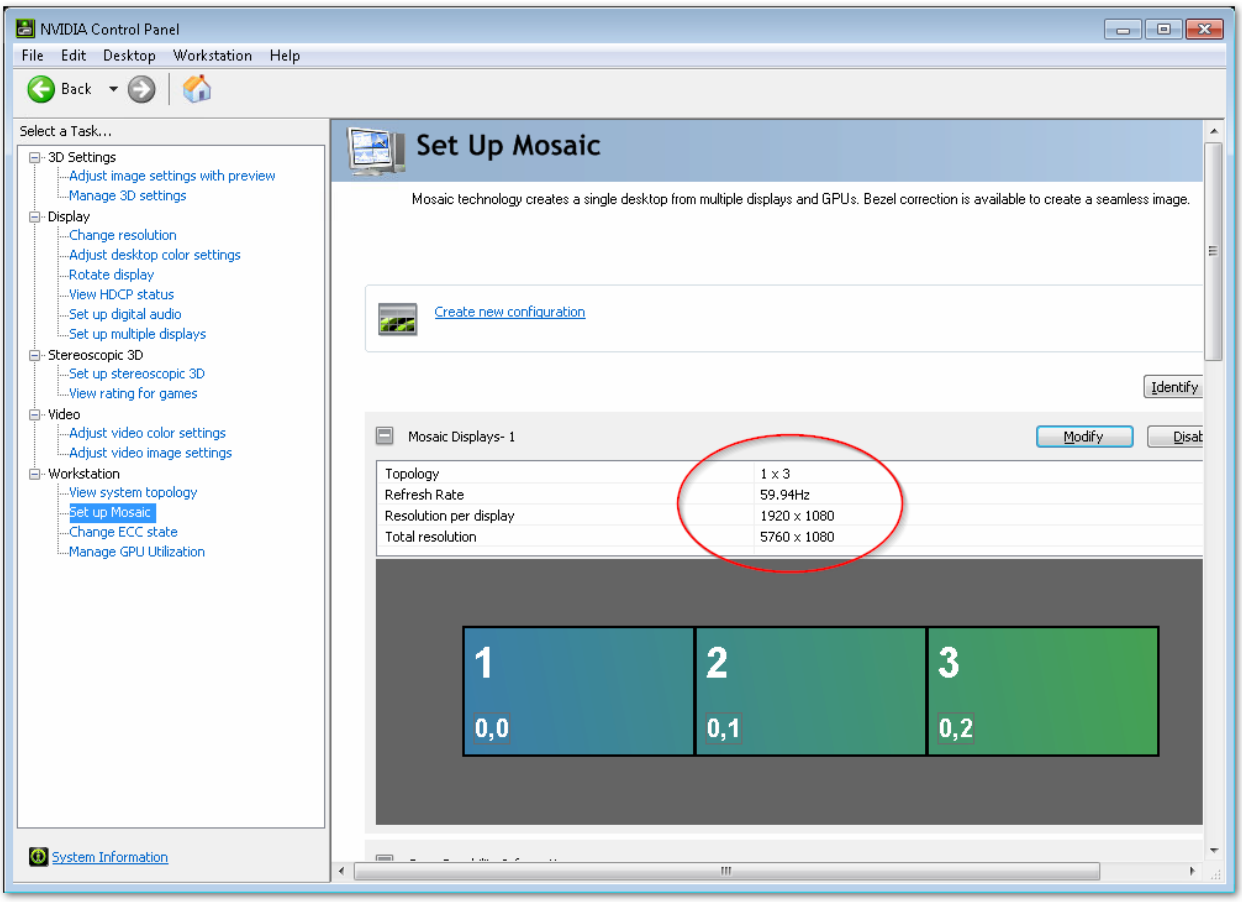
Drag all displays into place and click on the Apply button:



In most cases when the Mosaic is applied the monitor that is **not** part of the Mosaic gets disabled. You can enable this without breaking the Mosaic configuration. To do this, right click on the desktop and select *Screen resolution*. Select the monitor that is grayed out, and select *Extend these displays*:



This should turn on the desktop/UI monitor again while maintaining the Mosaic configuration. You can verify the Mosaic configuration in the NVidia Control Panel:



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