

Introduction

In most circumstances, Remote Boost is used to connect to a remote system that has peripherals like a mouse, keyboard, and display. Sometimes, a system may be stored on a rack without any of these things. A system without a display connected to it is called a “headless” system. Remote Boost can function on these as well, but the machine needs a little configuration before it can function properly. In this paper, I will walk through the necessary steps to configure a headless Linux sender system.

There are some packages required on the sender before we begin:

- A desktop environment
 - Minimally, the machine needs an X server and a login screen. This is provided by packages like gdm.
- The proprietary Linux Nvidia driver. This provides several tools and features required to successfully set up a headless system.

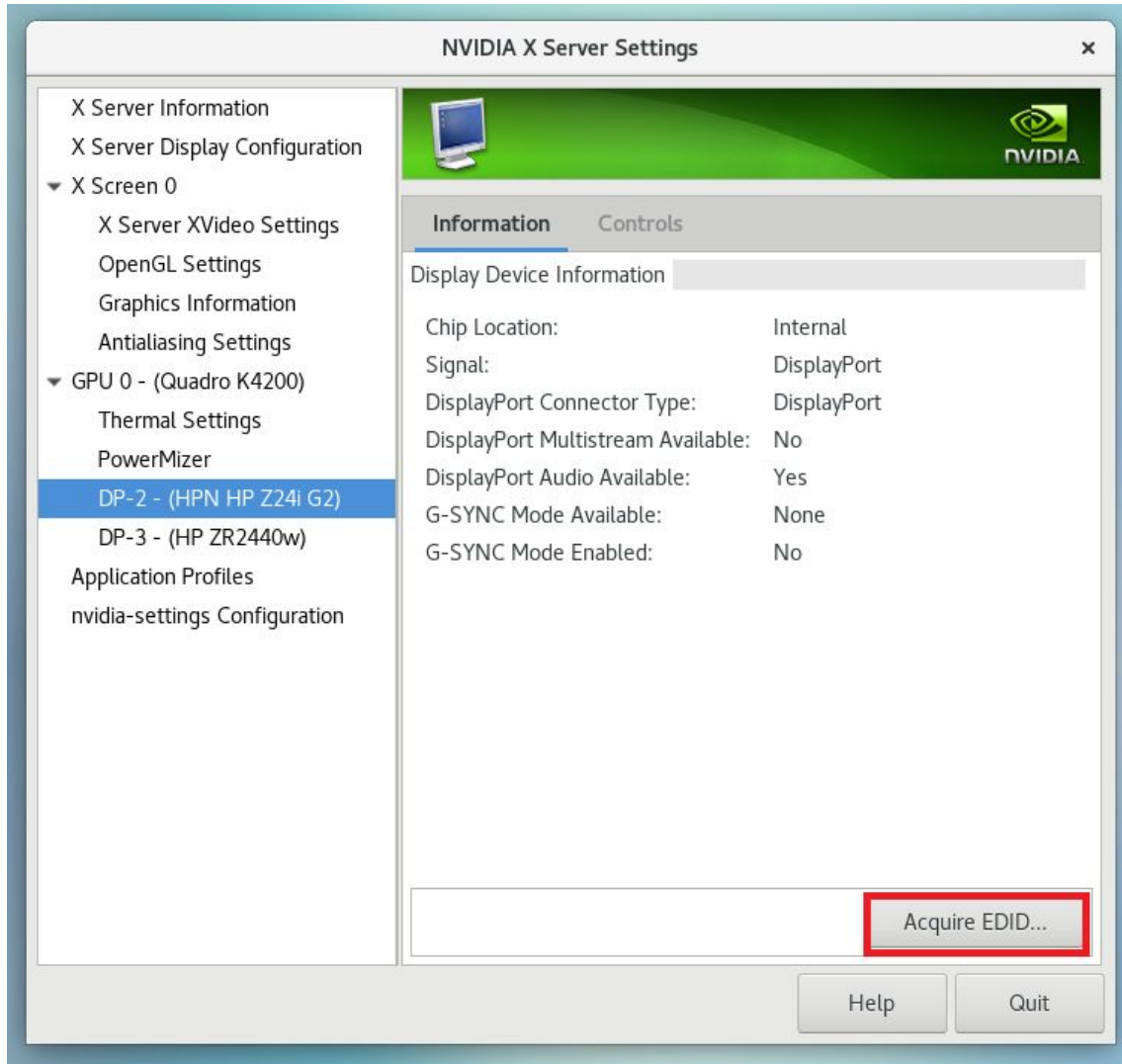
Getting an EDID

EDID files describe the resolutions and capabilities of a monitor. In order to set up a headless system on Linux, you need one of these files so that the system can pretend like it’s actually connected. There are many tools that can generate one of these EDID files.

All of these methods must be performed on a machine with physical monitors attached. You will be copying the attributes of those physical monitors to use on the headless machines later.

Using Nvidia X Server Settings

1. From the application menu, open “Nvidia X Server Settings”
2. On the left-hand side, click on one of the connected monitors. It should appear under a menu titled GPU-0
3. On the bottom right, click on the “Acquire EDID” button.
4. Choose a location to save your EDID file. Choose a name that corresponds with the monitor it came from.



Using xrandr

1. Open a terminal and a text editor
2. Run the command:
`xrandr --props`

- The connected monitor should have an "EDID" property with several rows of data. Copy that data into the text editor.

```
kiswatz@main:~  
1024x768    75.03    60.00  
800x600    75.00    60.32  
720x576    50.00  
720x480    59.94  
640x480    75.00    59.93    59.94  
DP-3 connected primary 1920x1080+0+0 (normal left inverted right x axis y axis) 520mm x 320mm  
MUTTER_PRESENTATION_OUTPUT: 0  
CTM: 0 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0  
      0 1  
CscMatrix: 65536 0 0 0 0 65536 0 0 0 0 65536 0  
EDID:  
00ffffffffffff0022f0542901010101  
04180104a5342078234ca5a7554da226  
105054210800d1c081c0814081809500  
a940b3000101283c80a070b023403020  
360006442100001a000000fd00183c18  
5011000a202020202020000000fc0048  
50205a5232343430770a2020000000ff  
00434e34343034315344340a202001e4  
020319c14c901f051404130302070612  
012309070783010000023a801871382d  
40582c450006442100001e023a80d072  
382d40102c458006442100001e011d00  
7251d01e206e28550006442100001e01  
1d00bc52d01e20b82855400644210000  
1e8c0ad08a20e02d10103e9600064421  
00001800000000000000000000007b  
  
BorderDimensions: 4  
  supported: 4  
Border: 0 0 0 0  
  range: (0, 65535)  
SignalFormat: DisplayPort  
  supported: DisplayPort  
ConnectorType: DisplayPort  
ConnectorNumber: 3  
  _ConnectorLocation: 3  
non-desktop: 0  
  supported: 0, 1  
1920x1200    59.95 +  
1920x1080    60.00*  59.94  50.00  
1680x1050    59.95  
1600x1200    60.00  
1440x900     59.89  
1280x1024    60.02  
1280x960     60.00  
1280x720     60.00  59.94  50.00  
1024x768     60.00  
800x600      60.32  
720x576      50.00  
720x480      59.94  
640x480      59.94  59.93  
[kiswatz@main ~]$
```

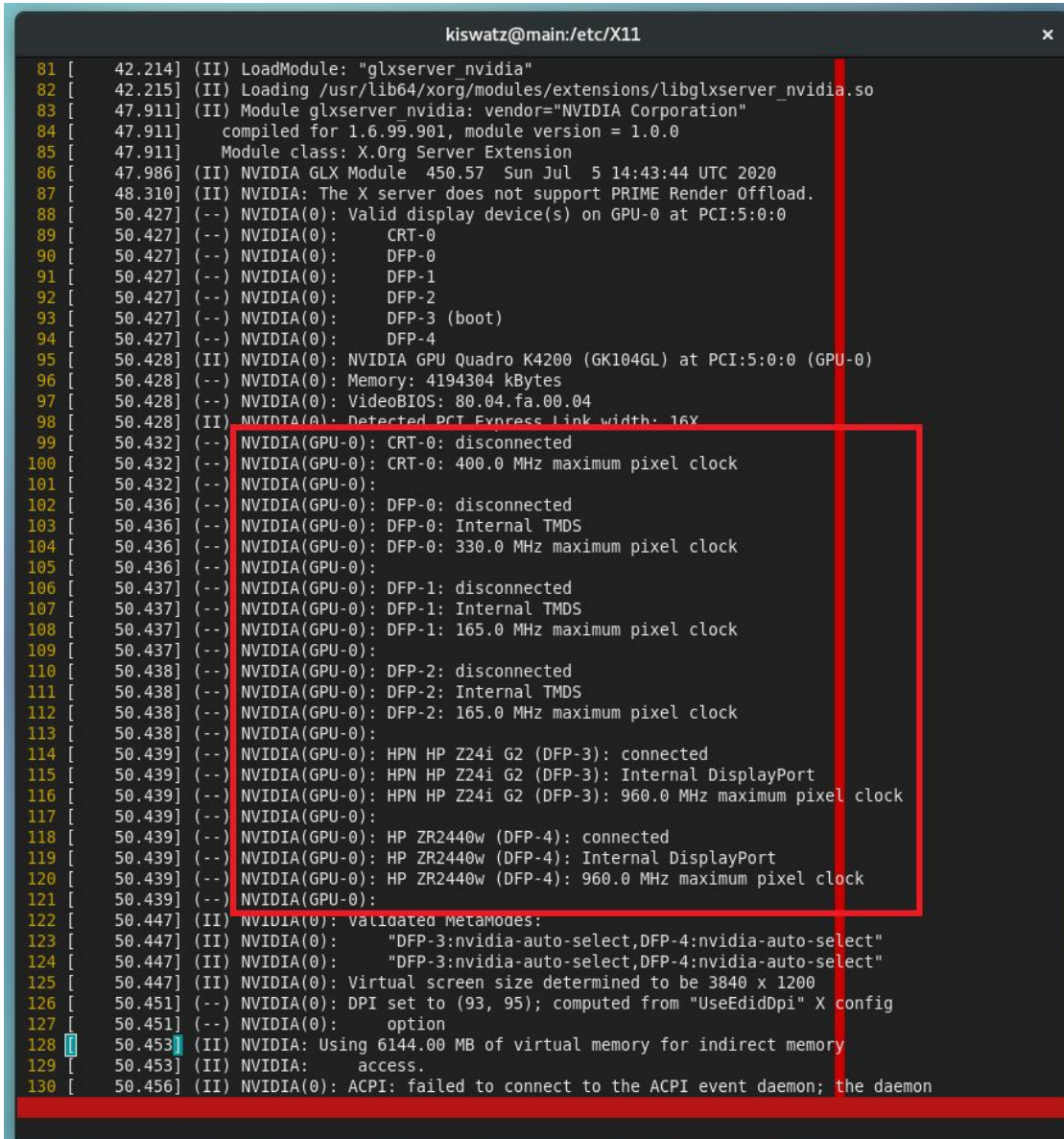
- Removing all the leading spaces.
- Save that file with a name that corresponds to the name of the monitor it came from.

After obtaining your EDID files, move them to this location: **/etc/X11/EDIDS**
It may be necessary to create this folder.

Choosing The Correct Ports

Now that we have an EDID file, we have to choose a location for it. Each system will have multiple supported ports where we can plug in our EDID file, but some of them may not have a high enough clock speed to handle the virtual monitor. To find the best port, do the following:

1. On your headless machine, open up the file “/var/log/Xorg.0.log”
2. Scroll until you see several lines that look like this:
 - a. (-- NVIDIA(GPU-0) <other data here>



```
kiswatz@main:/etc/X11
81 [ 42.214] (II) LoadModule: "glxserver_nvidia"
82 [ 42.215] (II) Loading /usr/lib64/xorg/modules/extensions/libglxserver_nvidia.so
83 [ 47.911] (II) Module glxserver_nvidia: vendor="NVIDIA Corporation"
84 [ 47.911]   compiled for 1.6.99.901, module version = 1.0.0
85 [ 47.911]   Module class: X.Org Server Extension
86 [ 47.986] (II) NVIDIA GLX Module 450.57 Sun Jul 5 14:43:44 UTC 2020
87 [ 48.310] (II) NVIDIA: The X server does not support PRIME Render Offload.
88 [ 50.427] (-- NVIDIA(0): Valid display device(s) on GPU-0 at PCI:5:0:0
89 [ 50.427] (-- NVIDIA(0):   CRT-0
90 [ 50.427] (-- NVIDIA(0):   DFP-0
91 [ 50.427] (-- NVIDIA(0):   DFP-1
92 [ 50.427] (-- NVIDIA(0):   DFP-2
93 [ 50.427] (-- NVIDIA(0):   DFP-3 (boot)
94 [ 50.427] (-- NVIDIA(0):   DFP-4
95 [ 50.428] (II) NVIDIA(0): NVIDIA GPU Quadro K4200 (GK104GL) at PCI:5:0:0 (GPU-0)
96 [ 50.428] (-- NVIDIA(0): Memory: 4194304 kBytes
97 [ 50.428] (-- NVIDIA(0): VideoBIOS: 80.04.f0.00.04
98 [ 50.428] (II) NVIDIA(0): Detected PCI Express Link width: 16X
99 [ 50.432] (-- NVIDIA(GPU-0): CRT-0: disconnected
100 [ 50.432] (-- NVIDIA(GPU-0): CRT-0: 400.0 MHz maximum pixel clock
101 [ 50.432] (-- NVIDIA(GPU-0):
102 [ 50.436] (-- NVIDIA(GPU-0): DFP-0: disconnected
103 [ 50.436] (-- NVIDIA(GPU-0): DFP-0: Internal TMDS
104 [ 50.436] (-- NVIDIA(GPU-0): DFP-0: 330.0 MHz maximum pixel clock
105 [ 50.436] (-- NVIDIA(GPU-0):
106 [ 50.437] (-- NVIDIA(GPU-0): DFP-1: disconnected
107 [ 50.437] (-- NVIDIA(GPU-0): DFP-1: Internal TMDS
108 [ 50.437] (-- NVIDIA(GPU-0): DFP-1: 165.0 MHz maximum pixel clock
109 [ 50.437] (-- NVIDIA(GPU-0):
110 [ 50.438] (-- NVIDIA(GPU-0): DFP-2: disconnected
111 [ 50.438] (-- NVIDIA(GPU-0): DFP-2: Internal TMDS
112 [ 50.438] (-- NVIDIA(GPU-0): DFP-2: 165.0 MHz maximum pixel clock
113 [ 50.438] (-- NVIDIA(GPU-0):
114 [ 50.439] (-- NVIDIA(GPU-0): HPN HP Z24i G2 (DFP-3): connected
115 [ 50.439] (-- NVIDIA(GPU-0): HPN HP Z24i G2 (DFP-3): Internal DisplayPort
116 [ 50.439] (-- NVIDIA(GPU-0): HPN HP Z24i G2 (DFP-3): 960.0 MHz maximum pixel clock
117 [ 50.439] (-- NVIDIA(GPU-0):
118 [ 50.439] (-- NVIDIA(GPU-0): HP ZR2440w (DFP-4): connected
119 [ 50.439] (-- NVIDIA(GPU-0): HP ZR2440w (DFP-4): Internal DisplayPort
120 [ 50.439] (-- NVIDIA(GPU-0): HP ZR2440w (DFP-4): 960.0 MHz maximum pixel clock
121 [ 50.439] (-- NVIDIA(GPU-0):
122 [ 50.447] (II) NVIDIA(0): Validated MetaModes:
123 [ 50.447] (II) NVIDIA(0):   "DFP-3:nvidia-auto-select,DFP-4:nvidia-auto-select"
124 [ 50.447] (II) NVIDIA(0):   "DFP-3:nvidia-auto-select,DFP-4:nvidia-auto-select"
125 [ 50.447] (II) NVIDIA(0): Virtual screen size determined to be 3840 x 1200
126 [ 50.451] (-- NVIDIA(0): DPI set to (93, 95); computed from "UseEdidDpi" X config
127 [ 50.451] (-- NVIDIA(0):   option
128 [ 50.453] (II) NVIDIA: Using 6144.00 MB of virtual memory for indirect memory
129 [ 50.453] (II) NVIDIA:   access.
130 [ 50.456] (II) NVIDIA(0): ACPI: failed to connect to the ACPI event daemon; the daemon
```

3. These lines describe the ports you have. Each has a name, a small descriptor, and a maximum clock speed. If the port is connected, it may have the name of the monitor as well, in which case the port name will be in parentheses next to it.

4. You should always choose disconnected ports with the highest maximum clock speed. In the above example, that would be the port CRT-0.
 - a. A headless system would not show any ports as connected.
 - b. This example was generated on an older system. More modern systems will likely only have DFP ports.
5. Write down the port names for use in the next step.

NOTE: Some ports on modern systems are “paired”, meaning only one of the two paired ports can be used to plug in our EDID file. While there’s no strict rule for determining paired ports, it’s generally safe to use all odd or all even ports.

Modifying xorg.conf

Now that we have a EDID file and we know where we want to put it, we have to tell the X server to do that when it starts up. We do this by modifying the xorg.conf file. This will require root privileges.

All this work can be done with command **nvidia-xconfig** from the command line. Your command will look something like this:

```
nvidia-xconfig -c /dev/null \  
-o test.conf \  
--custom-edid="DFP:/etc/X11/EDIDS/mymonitor.txt" \  
--connected-monitor="DFP-0"
```

This is a pretty long command, so let’s break it down.

- The “-c /dev/null” option forces the command to generate an xorg.conf file from scratch. If you have other modifications in your xorg.conf file, you should not include this option.
- The “-o test.conf” option prevents the command from overwriting your current xorg.conf file. This way you can review your changes before you apply it to your system.
- The “--custom-edid” option plugs our EDID files into all the ports that begin with DFP. You should replace “mymonitor.txt” with the name of the EDID file you created in part 1.
 - If you want to apply an edid file to a specific port rather than a set of ports, replace DFP with DFP-0, DFP-1, etc. like this:

```
--custom-edid="DFP-2:/etc/X11/EDIDS/mymonitor.txt"
```

- If you want to use different EDIDS with different ports, separate them with a semicolon, like this:

```
--custom-edid="DFP-0:/etc/X11/EDIDS/monitor1.txt; DFP-2:/etc/X11/EDIDS/monitor2.txt"
```

- The “--connected-monitor” option specifies that these ports are active and can be configured. You must specify individual ports here, not sets of ports like “DFP”
 - If you want to activate multiple ports, separate them by commas, like this:

```
--connected-monitor="DFP-0, DFP-2"
```

After you're satisfied with your configuration, apply it to your system by running the command:

```
mv test.conf /etc/X11/xorg.conf
```

And restart your system.

Common Errors

When modifying your `xorg.conf` file, it's easy to get your system into a state where the system fails to initialize properly. Trying to connect to this system with Remote Boost may result in the sender crashing or just displaying a black screen. It's also possible you can connect, and the resolutions associated with your EDID won't load properly. If any of these happen, check for these common mistakes:

- Check the spelling of all options to `nvidia-xconfig`. Note that the option `--connected-monitor` is **NOT** `--connected-monitors` if you're listing multiple.
- In the `--custom-edid` option, make sure there's a colon between the port and the path to the EDID file. There shouldn't be a space after the colon.
- If you're listing multiple EDID files in the `--custom-edid` option, make sure they're separated by a semicolon and a space.
- In the `--connected-monitor` option, multiple monitors must be separated by a comma and a space.
- Always use the ports listed in the `Xorg.0.log` file rather than those reported by tools like `xrandr`. The log file will show ports like `"DFP-0"`, whereas `xrandr` may list the ports as `"DP-0"`.