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1.0 About this Release

The NVIDIA® Tegra® Linux Driver Package supports development of platforms running on:

- NVIDIA® Jetson™ TX1 Developer Kit (P2371-2180)

Platform and Release Information

<table>
<thead>
<tr>
<th>Description</th>
<th>Supported Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host machine version required for flashing software onto Jetson TX1.</td>
<td>Ubuntu 14.04 amd64 distribution</td>
</tr>
<tr>
<td>Ubuntu 16.04 is NOT recommended on the host machine.</td>
<td></td>
</tr>
<tr>
<td>Sample root file system (rootfs) Ubuntu operating system to run on Jetson TX1.</td>
<td>Ubuntu 16.04 arm64 distribution</td>
</tr>
<tr>
<td>Supported Linux kernel version.</td>
<td>3.10.96</td>
</tr>
<tr>
<td>Supported ARM architecture.</td>
<td>aarch64</td>
</tr>
<tr>
<td>The board name used in flashing and for paths in the software.</td>
<td>jetson-tx1</td>
</tr>
<tr>
<td>The board and revision number.</td>
<td>Jetson TX1: p2371-2180</td>
</tr>
<tr>
<td>The release tag name.</td>
<td>tegra-l4t-24.2.2</td>
</tr>
<tr>
<td>Consult the kernel source to identify the tag name at:</td>
<td></td>
</tr>
<tr>
<td><a href="http://nv-tegra.nvidia.com/gitweb/?p=linux-3.10.git">http://nv-tegra.nvidia.com/gitweb/?p=linux-3.10.git</a></td>
<td></td>
</tr>
<tr>
<td>Supported EGL or OpenGL version.</td>
<td>362.24.18.0</td>
</tr>
</tbody>
</table>
1.1 Login Credentials

The default login credentials are:

- Username: ubuntu
- Password: ubuntu

The release also includes the following credentials:

- Username: nvidia
- Password: nvidia

1.2 Sources for Included Linux Distribution Packages

Visit the Jetson Embedded Platform website for source code provided subject to the terms of open source licenses that require source code availability, such as the GNU General Public License.

1.3 Top Fixed Issues

These fixed issues apply to Jetson TX1 devices. For a complete list of kernel fixes that go into this release, please consult the NVIDIA git repository available at:

https://nv-tegra.nvidia.com/gitweb/?p=linux-3.10.git

1.3.1 Bluetooth

Bluetooth related issues resolved in this release are as follows.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1810994</td>
<td>Bluetooth audio is disabled in this release to ensure that the bluetooth software stack is conformant in the provided configuration. If you enable additional bluetooth audio profiles, product conformance may be impacted. For compliance information, consult the Jetson TX1 OEM Wireless Compliance Guide Application Note DA_08149-001.</td>
</tr>
</tbody>
</table>
1.3.2 Bootloader

Bootloader related issues resolved in this release are as follows.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>200165179</td>
<td>The device occasionally becomes non-responsive during reboot (u-boot) stress loop testing.</td>
</tr>
<tr>
<td>1809446</td>
<td>ARM Trusted Firmware replaces the NVIDIA secure monitor.</td>
</tr>
<tr>
<td>1818826</td>
<td>The EKS partition is now written during the flashing process. This partition is a placeholder reserved for future use.</td>
</tr>
<tr>
<td>1818826</td>
<td>U-Boot is enhanced to copy the DT property/status from the bootloader-supplied DTB into the DTB and passed to the Linux kernel.</td>
</tr>
</tbody>
</table>

1.3.3 Browser

Browser related issues resolved in this release are as follows.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1796833</td>
<td>The Firefox browser is not supported in this release.</td>
</tr>
</tbody>
</table>

1.3.4 Camera

Camera related issues resolved in this release are as follows.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>200191194</td>
<td>Error messages are displayed when running (successfully) the camera_recording sample application.</td>
</tr>
<tr>
<td>200143368</td>
<td>Corruption is displayed in camera preview for USB 3.0 camera.</td>
</tr>
<tr>
<td>200206942</td>
<td>The libargus implementation does not support USB cameras in this release.</td>
</tr>
</tbody>
</table>

1.3.5 Display

Display related issues resolved in this release are as follows.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>200175128</td>
<td>Resolution goes to 1440 x 576 at 52.1 Hz with warnings from tegra_dc upon idle timeout resume.</td>
</tr>
</tbody>
</table>
1.3.6 Graphics

Graphics related issues resolved in this release are as follows.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>200186978</td>
<td>When X server is terminated (e.g., service lightdm stop), non X11 application display is unsuccessful.</td>
</tr>
<tr>
<td>200168814</td>
<td>Display is blank after switching to virtual terminal from desktop with Alt+Ctrl+F1-F6.</td>
</tr>
</tbody>
</table>

1.3.7 Kernel

Kernel related issues resolved in this release are as follows.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>200159844</td>
<td>Register dump/data CRC error occurs on mmc3/mmcblk1p1 during LP switching.</td>
</tr>
<tr>
<td>200159844</td>
<td>Register dumps and data CRC errors are displayed on mmc2/mmcblk1p1 during LP switching.</td>
</tr>
</tbody>
</table>

1.3.8 Multimedia API Improvements

The multimedia API SDK related improvements provided in this release are as follows.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>200246098</td>
<td>New samples are provided to display with libdrm.</td>
</tr>
<tr>
<td>200247807</td>
<td>By default, error log is enabled to prevent silent failures.</td>
</tr>
<tr>
<td>200249574</td>
<td>Improved performance from ~20 FPS to 30 FPS for using the camera_recording samples on the 4K H264 video in the Multimedia API SDK.</td>
</tr>
<tr>
<td>1857247</td>
<td>Support is added for Surface Composition function in the libv4l2 APIs.</td>
</tr>
<tr>
<td>1710615</td>
<td>Samples are added to render V4L2 stream. The user can capture V4L2 video stream (YUV422), from HDMI-to-CSI bridge, and then render the stream to display on the screen.</td>
</tr>
<tr>
<td>1928668</td>
<td>The v4l2cuda sample is added to demonstrate zero copy between V4L2 capture and CUDA processing.</td>
</tr>
</tbody>
</table>

1.3.9 Tools

Tools related issues resolved in this release are as follows.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>200227653</td>
<td>NVIDIA Visual Profiler is unable to login via ssh to the target from a Windows host system.</td>
</tr>
<tr>
<td>200279703</td>
<td>The flash.sh script is enhanced to allow the -k option to operate on partitions that are renamed during the flashing process.</td>
</tr>
<tr>
<td>200232589</td>
<td>Graphics Debugger is unsuccessful when loading a remote binary if the file name of the binary includes spaces.</td>
</tr>
</tbody>
</table>
1.0 Known Issues

This section provides details about issues that were discovered during development but not resolved prior to this release of the Tegra Linux Driver Package.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1834549</td>
<td>NVIDIA argus-daemon systemd service startup on first boot is unsuccessful.</td>
</tr>
<tr>
<td>200356025</td>
<td>USB2.0/USB3.0 Camera: Streaky corruption with v4l2cuda capture using application allocated buffers and zero copy CUDA memory (-u -z).&lt;br&gt;For a known working example of the samples, consult the Multimedia APIs for Release 28.1.</td>
</tr>
</tbody>
</table>
2.0 Implementation Notes

2.1 NVIDIA argus-daemon Startup on First Boot is Unsuccessful

The NVIDIA argus-daemon fails to start on the first boot of the system.

To workaround

1. After running `apply_binaries.sh`, but before flashing the target, in the following file:
   
   ```bash
   Linux_for_Tegra/rootfs/etc/systemd/system/argus-daemon.service
   ```
   
   change the line:
   ```
   After=network-online.target
   ```
   
   to:
   ```
   After=network-online.target nvfb.service
   ```

2. Boot the device normally.
   
   This issue only occurs on the very first boot of the target.

2.2 Software-based Power Consumption Modeling

Jetson TX1, Revision 300 or greater, enables use of INA monitors for the module and Developer Kit carrier board. Note that developer kits may have an earlier revision of the module, in which case only INA monitors related to the carrier board are available.

To monitor power consumption in software

1. Verify the version of L4T is 24.2 or higher with the following command:
head -l /etc/nv tegra_release

If the version of L4T is not at least 24.2, please download the latest JetPack installer from the Embedded Developer Zone website and update your Jetson TX1.

2. Verify that the Jetson TX1 module is revision 300 or higher from the module SKU with the following command:

```bash
sudo i2cdump -y -r 0x14-0x26 2 0x50 b
```

The feature to enable use of INA monitors is added in revision 300 and later of Jetson TX1. For example, SKU 699-82180-1000-300 has the feature.

3. Read the information from the INA3221 monitors via sysfs nodes. The naming convention for sysfs nodes is given in the following table, where <N> is a channel number 0-2.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>rail_name_&lt;N&gt;</td>
<td>Exports the rail name.</td>
</tr>
<tr>
<td>in_current&lt;N&gt;_input</td>
<td>Exports rail current in mA.</td>
</tr>
<tr>
<td>in_voltage&lt;N&gt;_input</td>
<td>Exports rail voltage in mV.</td>
</tr>
<tr>
<td>In_power&lt;N&gt;_input</td>
<td>Exports rail power in mW.</td>
</tr>
</tbody>
</table>

**Note:** The INA driver may also present other nodes. Do not modify any INA sysfs node value. Modifying these values could result in damage to your device.

The Jetson TX1 module has a 3-channel INA3221 monitor at I2C address 0x40. The sysfs nodes to read for rail names, voltage, current, and power are in the following directory:

```
/sys/devices/platform/7000c400.i2c/i2c-1/1-0040/iio_device/
```

The rail names for I2C address 0x40 are described in the following table:

<table>
<thead>
<tr>
<th>Rail Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel 0: VDD_IN</td>
<td>Main module power input.</td>
</tr>
<tr>
<td>Channel 1: VDD_GPU</td>
<td>GPU power rail.</td>
</tr>
<tr>
<td>Channel 2: VDD_CPU</td>
<td>CPU power rail.</td>
</tr>
</tbody>
</table>

The Jetson TX1 Developer Kit carrier board has 3-channel INA3221 monitors at I2C addresses 0x42 and 0x43. The sysfs nodes to read rail name, voltage, current & power can be found at:

```
/sys/devices/platform/7000c400.i2c/i2c-1/1-0042/iio_device/
/sys/devices/platform/7000c400.i2c/i2c-1/1-0043/iio_device/
```
These are the rail names for I2C address 0x42:

<table>
<thead>
<tr>
<th>Rail Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel 0: VDD_MUX</td>
<td>Main carrier board power input.</td>
</tr>
<tr>
<td>Channel 1: VDD_5V_IO_SYS</td>
<td>Main carrier board 5 V supply.</td>
</tr>
<tr>
<td>Channel 2: VDD_3V3_SYS</td>
<td>Main carrier board 3.3 V supply.</td>
</tr>
</tbody>
</table>

These are the rail names for I2C address 0x43:

<table>
<thead>
<tr>
<th>Rail Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel 0: VDD_3V3_IO (Name on schematic is VDD_3V3_SLP)</td>
<td>Carrier board 3.3 V sleep supply.</td>
</tr>
<tr>
<td>Channel 1: VDD_1V8_IO (Name on schematic is VDD_1V8)</td>
<td>Main carrier board 1.8 V supply.</td>
</tr>
<tr>
<td>Channel 2: VDD_M2_IN (Name on schematic is VDD_3V3_SYS_M2)</td>
<td>3.3 V supply for M.2 Key E connector.</td>
</tr>
</tbody>
</table>

Examples

- To read INA3221 at 0x40, the channel-0 rail name (i.e., VDD_IN), use the following command:

  ```
  cat /sys/devices/platform/7000c400.i2c/i2c-1/1-0040/iio_device/rail_name_0
  ```

- To read VDD_IN voltage, current, and power, use the following commands:

  ```
  cat /sys/devices/platform/7000c400.i2c/i2c-1/1-0040/iio_device/in_current0_input
  cat /sys/devices/platform/7000c400.i2c/i2c-1/1-0040/iio_device/in_voltage0_input
  cat /sys/devices/platform/7000c400.i2c/i2c-1/1-0040/iio_device/in_power0_input
  ```

Use of this feature also has the following considerations:

- The feature enabling use of INAs was not part of the original Jetson TX1 specification. Therefore, earlier modules are not subject to RMA or automatic exchange because they lack this feature. If you need to measure module INAs, purchase the latest module.
- All production modules (i.e., bare modules purchased separately from a Developer Kit) are revision 400 or newer, and support use of INAs.
- In terms of accuracy, common practice is to assume a 10% guard band when working with INAs.
- For Ubuntu, the `i2cdump` program is part of the `i2c-tools` package. You can install it with commands similar to the following:

  ```
  sudo add-apt-repository universe
  sudo apt-get update
  sudo apt-get install i2c-tools
  ```
2.3 HDMI Audio Devices in the Audio Settings Application

The HDMI audio output device is not getting listed for some televisions and monitors including the following:

- Samsung TV 1080p LA40M81BM/XTL
- LG Flatron W2363D
- Samsung UA21ES5000RLXL
- LG 25UM65-p

The issue is inconsistent and sometimes occurs on subsequent reboots.

To workaround

- If the HDMI audio output device is not listed in audio settings, restart the pulseaudio daemon by killing the running instance as a normal user with the following command:

  ```bash
  pulseaudio --kill
  ```

  or register the systemd pulseaudio service to start the pulseaudio daemon at every login:

  ```bash
  systemctl --user enable pulseaudio.service
  ```

  **Note:** Do not run pulseaudio as a root user.

2.4 New Users Must be Added to Video Group

When adding users to the system you must add them to the **video** group for the Linux desktop to appear correctly and function correctly.

2.5 Symlinks May be Overwritten by Installation of Third Party Libraries

Installing third party libraries on the target device may overwrite the accelerated library provided by Linux for Tegra.

For example, installing Mesa EGL may create a `/usr/lib/<arch>/libEGL.so` symlink, overwriting the symlink to the implementation library that should be used instead, `/usr/lib/<arch>/tegra-egl/libEGL.so`.

Linux for Tegra installs a boot-time initialization script `/etc/init/nv.conf`, that corrects typical occurrences, such as with OpenGL, EGL, and X11 GLX libraries. This script runs at boot and corrects typical occurrences.
To workaround

- Reboot after installation of packages that install conflicting library symlinks.

### 2.6 GStreamer-0.10 Not Included

Gstreamer version 0.10 is not included in this release. Use of GStreamer version 1.0 is required for development.

### 2.7 Maximizing Tegra X1 Performance

Use the `jetson_clocks.sh` script to maximize performance by disabling DVFS, CPU Idle, and CPU Quit. JetPack installer or the flashing script places the script in the home directory on the target at:

```
$HOME/jetson_clocks.sh
```

On the host system, the script is delivered in the TAR file at:

```
Linux_for_Tegra/nv_tegra/nv_tools.tbz2
```

For more information on power and performance management, see:

- [http://elinux.org/Jetson/Performance](http://elinux.org/Jetson/Performance)

**Sample Script Usage**

1. Show the current (initial) settings with the following command:

   ```
   sudo ./jetson_clocks.sh --show
   ```

2. Store the current settings with the following command:

   ```
   sudo ./jetson_clocks.sh --store
   ```

3. Maximize Jetson TX1 performance with the following command:

   ```
   sudo ./jetson_clocks.sh
   ```

4. Show the current settings with the following command:

   ```
   sudo ./jetson_clocks.sh --show
   ```

5. Restore the previous settings with the following command:

   ```
   sudo ./jetson_clocks.sh --restore
   ```

6. Show the current settings with the following command:

   ```
   sudo ./jetson_clocks.sh --show
   ```
2.8 32-bit hardfp Support Removed

Beginning with L4T R24.2.1 release, all releases onward support aarch64. The R24.1 release was the last release that the hardfp BSP for 32-bit user space support was also provided.

2.9 Media Controller Support Included in V4L2 for CSI Camera

Support for the soc_camera driver is disabled in the R24.2.1 release and onward releases.
3.0 About Earlier Releases

Nov 2016, 24.2.1

What’s New

- libargus is now multi-process by default, verified two 5MP Ov5693 sensors at 30fps.
- New metadata and controls to support application layer AE and AWB as well as working sample applications.
- Input image is correctly scaled to compensate for black-level correction if lens shading is disabled.
- Implemented fixes for camera stability and performance.

See “Software Features” in the Tegra Linux Driver Package Developer Guide for more information about the features of this release.

For a complete list of kernel changes in this release see the following website:

http://nv-tegra.nvidia.com/gitweb/?p=linux-3.10.git;a=shortlog;h=refs/heads/14t/14t-r24.2

Top Issues Fixed Since Last Release

The following issues are resolved in this release.

- [1794670] HDMI audio output device is not listed in system settings application
- [200232592] Graphics Debugger is unable to debug CUDA graphics samples
- [1806888] VisionWorks samples cannot be successfully built with the 16.04 compiler
- [200214749] Camera preview functions correctly but errors display in logs
- [200194792] Connected Bluetooth headset audio sink shows mode as “mono”
- [200089362] EDID read is unsuccessful using read-edid package
- [200199690] CUDA sample compilation on device is unsuccessful
Release Notes

- [1762118] Multimedia playback and camera preview corruption may occur when using the Gstreamer eglimagesink component on 64-bit X11
- [200152749] Unhandled level 3 translation fault occurs during Bluetooth data transfer
- [200134773] System intermittently becomes non-responsive during reboot stress testing with reboot or init 6
- [200244330] Unstable exposure/flickering with userAutoExposure with IMX-185 sensor
- [200244295] Un-freed EGL handle while quitting gstvideoencode sample application
- [200239249] Preview is black and white, unresponsive, and finally becomes non-responsive with some libargus-based sample applications
- [200228912] Preview is black and white after several images are captured
- [200226718] Corruption in preview image occurs in libargus-based camera application
- [20024210] Running argus_syncsensor and argus_multisensor is unsuccessful
- [200214733] The argus_conformance test is unsuccessful, results in segmentation fault
- [1822082] The argus_conformance test is unsuccessful when performing multiple iterations
- [1821526] Stuttering and dropped frames occur when recording video with libargus-based camera application
- [1792264] SCF unit tests and libargus multi-camera tests are unsuccessful
- [1736102] Camera becomes non-responsive during stress testing
- [200247203] Linearity test is unsuccessful
- [200246779] Syncpoint errors occur when quitting nvtuner with live preview enabled
- [200228319] Live preview is tinted green with nvtuner 3.2.0e
- [200242413] "Invalid xywh" displays when using 02_video_dec_cuda to verify the result of backend or 04_video_dec_gie.
- [200239465] Some BBOXs detect nothing while using B02 sample to verify result.txt from backend or B04 sample
- [200239200] The make utility does not build the B04 sample
- [200233839] The video_dec_gie sample is unsuccessful with larger batch sizes
- [20027668] Arbitrary batch sizes for GIE-based samples are not supported
- [1806268] Unable to compile 11_camera_object_identification is because Thread.o is missing
- [200240455] IMX172 camera sensor conformance test is unsuccessful

12 Sep 2016, 24.2

What’s New

- Multimedia API
- CUDA 8.0
- Ubuntu 16.04-derived sample rootfs
Chromium browser
- Previously deprecated features removed:
  - hardfp support
  - CSI driver
  - Gstreamer 0.10

**Top Issues Fixed Since Last Release**

The following issues are resolved in this release.

- [1747157] Support disabling suspend-to-ram and cpu-idle kernel configurations
- [200203807] Installing libegl1-mesa or updating the corresponding package overwrites libEGL.so.1
- [1794309] Nvcamera daemon is unsuccessful on multiple image capture runs
- [200196911] Intermittently unable to boot the kernel due to PCIe errors
- [1691314] LP switching is unsuccessful when SATA is connected to the Jetson TX1 target (firmware version 50.11).
- [1736102] Camera preview becomes non-responsive during stress testing of video/image recording
- [200122163] Disabled (DSI-0) Primary HDMI display causes the following error to display in logs: “vgaarb: this pci device is not a vga device”
- [200151236] The Camera app (NvGstPlayer-1.0) invokes an out of memory killer because of memory leak when playing multiple images in a loop
- [200174822] Corrupted pixels occur after the image shows up on the preview for a few minutes

**11 Jun 2016, 24.1**

**What’s New**

- Support for 64-bit user space and runtime libraries
- Vulkan support
- V4L2 media-controller driver support for camera sensors (bypassing ISP)

**Top Issues Fixed Since Last Release**

The following issues are resolved in this release.

- [1723265] Hard resetting the TX1 board while it is above 44°C will cause boot failure due to default system shut down value is set to 44°C. The system will boot up once cooled down to below 44°C. This issue does not occur upon warm reset.
- [1723265] Hard resetting the TX1 board while it is above 44°C will cause boot failure due to default system shut down value is set to 44°C.
- [200170514] OSidle power consumption is around 185mW higher when eth0 is disabled.
[1708129] GStreamer unable to set FPS rate to rate supported by sensor.
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