DOCUMENT CHANGE HISTORY

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Authors</th>
<th>Description of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>v1.0</td>
<td>01 May 2015</td>
<td>NVIDIA</td>
<td>Initial release.</td>
</tr>
<tr>
<td>v1.1</td>
<td>30 Jun 2015</td>
<td>mzensus</td>
<td>Added rotation and scaling commands, other new content.</td>
</tr>
<tr>
<td>v1.2</td>
<td>03 Nov 2015</td>
<td>emilyh</td>
<td>Changes for 23.1</td>
</tr>
<tr>
<td>v1.3</td>
<td>19 Nov 2015</td>
<td>mzensus</td>
<td>Added note for display export.</td>
</tr>
<tr>
<td>v1.4</td>
<td>17 Dec 2015</td>
<td>hlang</td>
<td>Updated gst-nvivafilter sample pipelines.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Updated steps to build gstreamer manually.</td>
</tr>
<tr>
<td>v1.5</td>
<td>08 Jan 2016</td>
<td>kstone</td>
<td>Added nvvidconv interpolation method.</td>
</tr>
<tr>
<td>v1.5</td>
<td>29 Jan 2016</td>
<td>hlang</td>
<td>Additional syntax changes for 23.2 release</td>
</tr>
<tr>
<td>v2.0</td>
<td>11 May 2016</td>
<td>mzensus</td>
<td>Minor change to nvgstcapture options.</td>
</tr>
<tr>
<td>v3.0</td>
<td>11 Aug 2016</td>
<td>mzensus</td>
<td>Versioned for 24.2 release. Gstreamer-0.10 content removed. Also Adds Video Cropping example, interpolation methods for video scaling, EGLStream producer example, and an EGL Image transform example.</td>
</tr>
<tr>
<td>v3.1</td>
<td>06 Oct 2016</td>
<td>mzensus</td>
<td>Minor updates to video encoder features.</td>
</tr>
<tr>
<td>v3.1.1</td>
<td>21 Nov 2016</td>
<td>mzensus</td>
<td>Changed title of document.</td>
</tr>
<tr>
<td>v3.2</td>
<td>12 Jan 2017</td>
<td>mzensus</td>
<td>Adds H.264/H.265 encoder documentation. Also corrects the Gstreamer-1.0 installation procedure.</td>
</tr>
<tr>
<td>3.2</td>
<td>03 Mar 2017</td>
<td>hlang</td>
<td>Update date/moniker for L4T 27.1 release. No other updates.</td>
</tr>
<tr>
<td>3.3</td>
<td>13 Jul 2017</td>
<td>mzensus</td>
<td>Minor edit to command syntax, and update of date/moniker for L4T 28.1 release.</td>
</tr>
<tr>
<td>3.4</td>
<td>01 Dec 2017</td>
<td>mzensus</td>
<td>Includes support for Jetson TX1, previously documented elsewhere. Also includes Overlay Sink information, and formatting enhancements.</td>
</tr>
<tr>
<td>Version</td>
<td>Date</td>
<td>Author</td>
<td>Changes</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
<td>--------</td>
<td>---------</td>
</tr>
<tr>
<td>3.5</td>
<td>23 Feb 2018</td>
<td>kstone</td>
<td>Added support for the nvarguscamasrc plugin. Corrected erroneous path. Reformatted commands for line breaks.</td>
</tr>
<tr>
<td>3.5</td>
<td>28 Feb 2018</td>
<td>hlang</td>
<td>Update the GStreamer installation and setup table to add nvcompositor.</td>
</tr>
<tr>
<td>3.6</td>
<td>20 April 2018</td>
<td>kstone</td>
<td>Added prerequisites for Video Composition.</td>
</tr>
<tr>
<td>3.7</td>
<td>23 July 2018</td>
<td>jsachs</td>
<td>Add steps to be performed when testing Wayland based GST Plugin, playing video, or running Wayland based apps on Wayland display server.</td>
</tr>
<tr>
<td>3.8</td>
<td>29 August 2018</td>
<td>jsachs</td>
<td>Updates for L4T release 31 &amp; GStreamer version 1.14.</td>
</tr>
</tbody>
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This document is a user guide for the Gstreamer version 1.0 based accelerated solution included in NVIDIA® Tegra® Linux Driver Package for NVIDIA® Jetson™ Xavier devices.

Note
References to Gstreamer version 1.0 apply to Gstreamer version 1.14.

GSTREAMER-1.0 INSTALLATION AND SETUP

This section describes how to install and configure Gstreamer.

To install Gstreamer-1.0

- Install Gstreamer-1.0 on the platform with the following commands:

```bash
sudo add-apt-repository universe
sudo add-apt-repository multiverse
sudo apt-get update
sudo apt-get install gstreamer1.0-tools gstreamer1.0-alsa \
gstreamer1.0-plugins-base gstreamer1.0-plugins-good \
gstreamer1.0-plugins-bad gstreamer1.0-plugins-ugly \
gstreamer1.0-libav
sudo apt-get install libgstreamer1.0-dev \
libgstreamer-plugins-base1.0-dev \
libgstreamer-plugins-good1.0-dev \
libgstreamer-plugins-bad1.0-dev
```

To check the Gstreamer-1.0 version

- Check the Gstreamer-1.0 version with the following command:

```bash
gst-inspect-1.0 --version
```
Gstreamer-1.0 Plugin Reference

Gstreamer version 1.0 includes the following gst-omx video decoders:

<table>
<thead>
<tr>
<th>Video Decoder</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>omxh265dec</td>
<td>OpenMAX IL H.265 Video Decoder</td>
</tr>
<tr>
<td>omxh264dec</td>
<td>OpenMAX IL H.264 Video Decoder</td>
</tr>
<tr>
<td>omxmpeg4videodec</td>
<td>OpenMAX IL MPEG4 Video Decoder</td>
</tr>
<tr>
<td>omxvp8dec</td>
<td>OpenMAX IL VP8 Video Decoder</td>
</tr>
<tr>
<td>omxvp9dec</td>
<td>OpenMAX IL VP9 video decoder</td>
</tr>
</tbody>
</table>

Gstreamer version 1.0 includes the following gst-omx video encoders:

<table>
<thead>
<tr>
<th>Video Encoders</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>omxh264enc</td>
<td>OpenMAX IL H.264/AVC video encoder</td>
</tr>
<tr>
<td>omxh265enc</td>
<td>OpenMAX IL H.265/AVC video encoder</td>
</tr>
<tr>
<td>omxvp9enc</td>
<td>OpenMAX IL VP9 video encoder (Supported with Jetson TX2 and Jetson Xavier. Not supported with Jetson TX1.)</td>
</tr>
</tbody>
</table>

Gstreamer version 1.0 includes the following gst-omx video sink:

<table>
<thead>
<tr>
<th>Video Sink</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>nvoverlaysink</td>
<td>OpenMAX IL videosink element</td>
</tr>
</tbody>
</table>

Gstreamer version 1.0 includes the following EGL image video sink:

<table>
<thead>
<tr>
<th>Video Sink</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>nveglglessink</td>
<td>EGL/GLES videosink element, both the X11 and Wayland backends</td>
</tr>
</tbody>
</table>

Gstreamer version 1.0 includes the following DRM video sink:

<table>
<thead>
<tr>
<th>Video Sink</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>nvdrmvideosink</td>
<td>DRM videosink element</td>
</tr>
</tbody>
</table>

Gstreamer version 1.0 includes the following proprietary NVIDIA plugins:

<table>
<thead>
<tr>
<th>NVIDIA Proprietary Plugin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>nvarguscamerasrc</td>
<td>Camera plugin for ARGUS API</td>
</tr>
</tbody>
</table>
### NVIDIA Proprietary Plugin

<table>
<thead>
<tr>
<th>Plugin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>nvvidconv</td>
<td>Video format conversion &amp; scaling</td>
</tr>
<tr>
<td>nvcompositor</td>
<td>Video compositor</td>
</tr>
<tr>
<td>nveglstreams</td>
<td>Acts as Gstreamer Source Component, accepts EGLStream from EGLStream producer</td>
</tr>
<tr>
<td>nvvideosink</td>
<td>Video Sink Component. Accepts YUV-I420 format and produces EGLStream (RGBA)</td>
</tr>
<tr>
<td>nvegltransform</td>
<td>Video transform element for NVMM to EGLimage (supported with nveglglessink only)</td>
</tr>
</tbody>
</table>

Gstreamer version 1.0 includes the following libjpeg based JPEG image video encode/decode plugins:

<table>
<thead>
<tr>
<th>JPEG</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>nvjpegenc</td>
<td>JPEG encoder element</td>
</tr>
<tr>
<td>nvjpegdec</td>
<td>JPEG decoder element</td>
</tr>
</tbody>
</table>

**Note**

Execute this command on the target before starting the video decode pipeline using gst-launch or nvgstplayer.

export DISPLAY=:0

Start the X server with xinit &, if it is not already running.

### DECODE EXAMPLES

The examples in this section show how you can perform audio and video decode with Gstreamer.

**Note**

Gstreamer version 0.10 support is deprecated in Linux for Tegra (L4T) Release 24.2. Use of Gstreamer version 1.0 is recommended for development.
Audio Decode Examples Using gst-launch-1.0

The following examples show how you can perform audio decode using Gstreamer-1.0.

AAC Decode (OSS software decode)

```
gst-launch-1.0 filesrc location=<filename.mp4> ! \ 
  qtdemux name=demux demux.audio_0 ! \ 
  queue ! avdec_aac ! audioconvert ! alsasink -e
```

AMR-WB Decode (OSS software decode)

```
gst-launch-1.0 filesrc location=<filename.mp4> ! \ 
  qtdemux name=demux demux.audio_0 ! queue ! avdec_amrwb ! \ 
  audioconvert ! alsasink -e
```

AMR-NB Decode (OSS software decode)

```
gst-launch-1.0 filesrc location=<filename.mp4> ! \ 
  qtdemux name=demux demux.audio_0 ! queue ! avdec_amrnb ! \ 
  audioconvert ! alsasink -e
```

MP3 Decode (OSS software decode)

```
gst-launch-1.0 filesrc location=<filename.mp3> ! mpegaudioparse ! \ 
  avdec_mp3 ! audioconvert ! alsasink -e
```

Note

To route audio over HDMI, set the alsasink property device as follows:

```
hw:Tegra,3
```

Video Decode Examples Using gst-launch-1.0

The following examples show how you can perform video decode on Gstreamer-1.0.

H.264 Decode (NVIDIA accelerated decode)

```
gst-launch-1.0 filesrc location=<filename.mp4> ! \ 
  qtdemux name=demux demux.video_0 ! queue ! h264parse ! omxh264dec ! \ 
  nveglglessink -e
```

H.265 Decode (NVIDIA accelerated decode)
gst-launch-1.0 filesrc location=<filename.mp4> ! \
  gtdemux name=demux demux.video_0 ! queue ! h265parse ! omxh265dec ! \
  nvoverlaysink -e

10-bit H265 decode

gst-launch-1.0 filesrc location=<filename_10bit.mkv> ! \
  matroskademux ! h265parse ! omxh265dec ! nvvidconv ! \
  'video/x-raw(memory:NVMM), format=(string)NV12' ! \
  nvoverlaysink -e

12-bit H265 decode

gst-launch-1.0 filesrc location=<filename_12bit.mkv> ! \
  matroskademux ! h265parse ! omxh265dec ! nvvidconv ! \
  'video/x-raw(memory:NVMM), format=(string)NV12' ! \
  nvoverlaysink -e

VP8 Decode (NVIDIA accelerated decode)

gst-launch-1.0 filesrc location=<filename.mp4> ! \
  gtdemux name=demux demux.video_0 ! queue ! omxvp8dec ! \
  nvoverlaysink -e

Note
If the primary display is NOT used to render video, use the display-
id property of nvoverlaysink.
For example, refer to the pipeline below.

gst-launch-1.0 filesrc location=<filename.mp4> ! \
  gtdemux name=demux demux.video_0 ! queue ! omxvp8dec ! \
  nvoverlaysink display-id=1 -e

VP9 Decode (NVIDIA accelerated decode)

gst-launch-1.0 filesrc location=<filename.mp4> ! \
  matroskademux name=demux demux.video_0 ! queue ! omxvp9dec ! \
  nvoverlaysink display-id=1 -e

MPEG-4 Decode (NVIDIA accelerated decode)


**Image Decode**

```bash
gst-launch-1.0 filesrc location=<filename.jpg> ! nvjpegdec ! imagefreeze ! xvimagesink -e
```

**ENCODE EXAMPLES**

The examples in this section show how you can perform audio and video encode with Gstreamer.

**Audio Encode Examples Using gst-launch-1.0**

The following examples show how you can perform audio encode on Gstreamer-1.0.

**AAC Encode (OSS software encode)**

```bash
gst-launch-1.0 audiotestsrc ! 'audio/x-raw, format=(string)S16LE, layout=(string)interleaved, rate=(int)44100, channels=(int)2' ! voaacenc ! qtmux ! filesink location=test.mp4 -e
```

**AMR-WB Encode (OSS software encode)**

```bash
gst-launch-1.0 audiotestsrc ! 'audio/x-raw, format=(string)S16LE, layout=(string)interleaved, rate=(int)16000, channels=(int)1' ! voamrwbenc ! qtmux ! filesink location=test.mp4 -e
```

**Video Encode Examples Using gst-launch-1.0**

The following examples show how you can perform video encode with Gstreamer-1.0.

**H.264 Encode (NVIDIA accelerated encode)**

```bash
gst-launch-1.0 videotestsrc ! 'video/x-raw, format=(string)I420, width=(int)640, height=(int)480' ! omxh264enc ! 'video/x-h264, stream-format=(string)byte-stream' ! h264parse ! qtmux ! filesink location=test.mp4 -e
```
H.265 Encode (NVIDIA accelerated encode)

```bash
gst-launch-1.0 videotestsrc ! \
  'video/x-raw, format=(string)I420, width=(int)640, \ 
  height=(int)480' ! omxh265enc ! filesink location=test.h265 -e
```

10-bit H265 encode

```bash
gst-launch-1.0 nvarguscamerasrc ! \
  'video/x-raw(memory:NVMM), width=(int)1920, height=(int)1080, \ 
  format=(string)NV12, framerate=(fraction)30/1' ! \
  nvvidconv ! 'video/x-raw(memory:NVMM), format=(string)I420_10LE' ! \
  omxh265enc ! matroskamux ! filesink location=test_10bit.mkv -e
```

VP9 Encode (NVIDIA accelerated, supported with Jetson TX2 and Jetson Xavier)

```bash
gst-launch-1.0 videotestsrc ! \
  'video/x-raw, format=(string)I420, width=(int)640, \ 
  height=(int)480' ! omxvp9enc ! matroskamux ! \
  filesink location=test.mkv -e
```

MPEG-4 Encode (OSS software encode)

```bash
gst-launch-1.0 videotestsrc ! \
  'video/x-raw, format=(string)I420, width=(int)640, \ 
  height=(int)480' ! avenc_mpeg4 ! qtmux ! \
  filesink location=test.mp4 -e
```

H.263 Encode (OSS software encode)

```bash
gst-launch-1.0 videotestsrc ! \
  'video/x-raw, format=(string)I420, width=(int)704, \ 
  height=(int)576' ! avenc_h263 ! qtmux ! filesink location=test.mp4 -e
```

Image Encode

```bash
gst-launch-1.0 videotestsrc num-buffers=1 ! \
  'video/x-raw, width=(int)640, height=(int)480, \ 
  format=(string)I420' ! nvjpegenc ! filesink location=test.jpg -e
```
Supported H.264/H.265 Encoder Features with Gstreamer-1.0

This section describes example gst-launch-1.0 usage for features supported by the NVIDIA accelerated H.264/H.265 encoder.

**Note**
Display detailed information on omxh264enc or omxh265enc encoder properties with the `gst-inspect-1.0 [omxh264enc | omxh265enc]` command.

### Set I-frame interval

```bash
gst-launch-1.0 videotestsrc num-buffers=200 ! \
'video/x-raw, width=(int)1280, height=(int)720, \ 
format=(string)I420' ! omxh264enc iframeinterval=100 ! qtmux ! \
filesink location=test.mp4 -e
```

### Set temporal-tradeoff (the rate the encoder should drop frames)

```bash
gst-launch-1.0 videotestsrc num-buffers=200 ! \
'video/x-raw, width=(int)1280, height=(int)720, \ 
format=(string)I420' ! omxh264enc temporal-tradeoff=1 ! qtmux ! \
filesink location=test.mp4 -e
```

Configuring temporal tradeoff causes the encoder to intentionally, periodically, drop input frames. The following modes are supported:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Disable</td>
</tr>
<tr>
<td>1</td>
<td>Drop 1 in 5 frames</td>
</tr>
<tr>
<td>2</td>
<td>Drop 1 in 3 frames</td>
</tr>
<tr>
<td>3</td>
<td>Drop 1 in 2 frames</td>
</tr>
<tr>
<td>4</td>
<td>Drop 2 in 3 frames</td>
</tr>
</tbody>
</table>

### Set rate control mode

```bash
gst-launch-1.0 videotestsrc num-buffers=200 ! \
'video/x-raw, width=(int)1280, height=(int)720, \ 
format=(string)I420' ! omxh264enc control-rate=1 ! qtmux ! \
filesink location=test.mp4 -e
```

The following modes are supported:
<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Disable</td>
</tr>
<tr>
<td>1</td>
<td>Variable bit rate</td>
</tr>
<tr>
<td>2</td>
<td>Constant bit rate</td>
</tr>
<tr>
<td>3</td>
<td>Variable bit rate with frame skip. The encoder skips frames as necessary to meet the target bit rate.</td>
</tr>
<tr>
<td>4</td>
<td>Constant bit rate with frame skip</td>
</tr>
</tbody>
</table>

**Set peak bitrate**

```plaintext
gst-launch-1.0 videotestsrc num-buffers=200 is-live=true !
    'video/x-raw,width=1280,height=720,format=I420' !
    omxh264enc bitrate=6000000 peak-bitrate=6500000 ! qtmux !
    filesink location=test.mp4 -e
```

It takes effect only in variable bit rate (control-rate=1) mode. By default, the value is configured as (1.2*bitrate).

**Set quantization range for I, P and B frame**

The format for the range is the following:

```
"<I_range>:<P_range>:<B_range>"
```

Where <I_range>, <P_range> and <B_range> are each expressed as hyphenated values, as shown in the following example:

```plaintext
gst-launch-1.0 videotestsrc num-buffers=200 !
    'video/x-raw, width=(int)1280, height=(int)720, 
    format=(string)I420' !
    omxh264enc qp-range="10,30:10,35:10,35" ! qtmux !
    filesink location=test.mp4 -e
```

The range of B frames does not take effect if the number of B frames is 0.

**Set hardware preset level**

```plaintext
gst-launch-1.0 videotestsrc num-buffers=200 !
    'video/x-raw, width=(int)1280, height=(int)720, 
    format=(string)I420' ! omxh264enc preset-level=0 ! qtmux !
    filesink location=test.mp4 -e
```

The following modes are supported:
<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>UltraFastPreset</td>
</tr>
</tbody>
</table>
| 1    | FastPreset  
Only Integer Pixel (integer-pel) block motion is estimated. For I/P macroblock mode decision, only Intra 16 x 16 cost is compared with Inter modes costs. Supports Intra 16 x 16 and Intra 4 x 4 modes. |
| 2    | MediumPreset  
Supports up to Half Pixel (half-pel) block motion estimation. For an I/P macroblock mode decision, only Intra 16 x 16 cost is compared with Inter modes costs. Supports Intra 16 x 16 and Intra 4 x 4 modes. |
| 3    | SlowPreset  
Supports up to Quarter Pixel (Qpel) block motion estimation. For an I/P macroblock mode decision, Intra 4 x 4 as well as Intra 16 x 16 cost is compared with Inter modes costs. Supports Intra 16 x 16 and Intra 4 x 4 modes. |

**Set profile**

```sql
gst-launch-1.0 videotestsrc num-buffers=200 ! \\
  'video/x-raw, width=(int)1280, height=(int)720, \\
  format=(string)I420' ! omxh264enc profile=8 ! qtmux ! \\
  filesink location=test.mp4 -e
```

From `omxh264enc`, the following profiles are supported:

<table>
<thead>
<tr>
<th>Profile</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Baseline profile</td>
</tr>
<tr>
<td>2</td>
<td>Main profile</td>
</tr>
<tr>
<td>8</td>
<td>High profile</td>
</tr>
</tbody>
</table>

**Set level**

```sql
gst-launch-1.0 videotestsrc num-buffers=200 is-live=true ! \\
  'video/x-raw, format=(string)I420, width=(int)256, height=(int)256, \\
  framerate=(fraction)30/1' ! omxh264enc bitrate=40000 ! \\
  'video/x-h264, level=(string)2.2' ! qtmux ! \\
  filesink location= test.mp4 -e
```
From omxh264enc, the following levels are supported: 1, 1b, 1.2, 1.3, 2, 2.1, 2.2, 3, 3.1, 3.2, 4, 4.1, 4.2, 5, 5.1, and 5.2.

From omxh265enc, the following levels are supported: main1, main2, main2.1, main3, main3.1, main4, main4.1, main5, high1, high2, high2.1, high3, high3.1, high4, high4.1, and high5.

Set number of B frames between two reference frames

```
gst-launch-1.0 videotestsrc num-buffers=200 ! 
    'video/x-raw, width=(int)1280, height=(int)720, 
    format=(string)I420' ! omxh264enc num-B-Frames=2 ! qtmux ! 
    filesink location=test.mp4 -e
```

**Note** B-frame-encoding is not supported with omxh265enc.

Insert SPS and PPS at IDR

```
gst-launch-1.0 videotestsrc num-buffers=200 ! 
    'video/x-raw, width=(int)1280, height=(int)720, 
    format=(string)I420' ! omxh264enc insert-sps-pps=1 ! qtmux ! 
    filesink location=test.mp4 -e
```

If enabled, a sequence parameter set (SPS) and a picture parameter set (PPS) are inserted before each IDR frame in the H.264/H.265 stream.

Enable two-pass CBR

```
gst-launch-1.0 videotestsrc num-buffers=200 ! 
    'video/x-raw, width=(int)1280, height=(int)720, 
    format=(string)I420' ! omxh264enc EnableTwopassCBR=1 control-rate=2 ! qtmux ! filesink location=test.mp4 -e
```

Two-pass CBR must be enabled along with constant bit rate (control-rate=2).

Set virtual buffer size

```
gst-launch-1.0 videotestsrc num-buffers=200 ! 
    'video/x-raw, width=(int)1280, height=(int)720, 
    format=(string)I420' ! omxh264enc vbv-size=10 ! qtmux ! 
    filesink location=test.mp4 -e
```

If the buffer size of decoder or network bandwidth is limited, configuring virtual buffer size can cause video stream generation to correspond to the limitations according to the following formula:
virtual buffer size = vbv-size \* (bitrate/fps)

Enable stringent bitrate

gst-launch-1.0 nvarguscamerasrc num-buffers=200 ! \  
'video/x-raw(memory:NVMM),width=1920,height=1080,  
format=(string)NV12' ! \  
omxh264enc control-rate=2 vbv-size=1 EnableTwoPassCBR=true \  
EnableStringentBitrate=true ! qtmux ! filesink location=test.mp4 -e

Stringent Bitrate must be enabled along with constant bit rate (control-rate=2), two-pass CBR being enabled, and virtual buffer size being set.

Slice-header-spacing with spacing in terms of MB

gst-launch-1.0 videotestsrc num-buffers=200 ! \  
'video/x-raw, width=(int)1280, height=(int)720, \  
format=(string)I420' ! \  
omxh264enc slice-header-spacing=200 bit-packetization=0 ! \  
qtmux ! filesink location=test.mp4 -e

The parameter $\text{bit-packetization}=0$ configures the network abstraction layer (NAL) packet as macroblock (MB)-based, and $\text{slice-header-spacing}=200$ configures each NAL packet as 200 MB at maximum.

Slice header spacing with spacing in terms of number of bits

gst-launch-1.0 videotestsrc num-buffers=200 ! \  
'video/x-raw, width=(int)1280, height=(int)720, \  
format=(string)I420' ! \  
omxh264enc slice-header-spacing=1024 bit-packetization=1 ! \  
qtmux ! filesink location=test1.mp4 -e

The parameter $\text{bit-packetization}=1$ configures the network abstraction layer (NAL) packet as size-based, and $\text{slice-header-spacing}=1024$ configures each NAL packet as 1024 bytes at maximum.

**CAMERA CAPTURE WITH GSTREAMER-1.0**

For $\text{nvgstcapture-1.0}$ usage information enter the following command:

```
nvgstcapture-1.0 --help
```
Note
nvgstcapture-1.0 application default only supports ARGUS API using nvarguscamerasrc plugin. Legacy nvcamerasrc plugin support is deprecated.

For more information, see Nvgstcapture-1.0 Option Reference in this guide.

Capture using nvarguscamerasrc and preview display with overlaysink:

```
gst-launch-1.0 nvarguscamerasrc ! 'video/x-raw(memory:NVMM), width=1920, height=1080, format=(string)NV12, framerate=(fraction)30/1' ! nvoverlaysink -e
```

The nvgstcapture-1.0 application uses the v4l2src plugin to capture still images and video.

The following table shows USB camera support.

<table>
<thead>
<tr>
<th>USB Camera Support</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>YUV</td>
<td>Preview display</td>
</tr>
<tr>
<td></td>
<td>Image capture (VGA, 640 x 480)</td>
</tr>
<tr>
<td></td>
<td>Video capture (480p, 720p, H.264/H.265/VP9 encode)</td>
</tr>
</tbody>
</table>

raw-yuv Capture (I420 format) and preview display with xvimagesink

```
gst-launch-1.0 v4l2src device="/dev/video0" ! "video/x-raw, width=640, height=480, format=(string)I420" ! xvimagesink -e
```

**VIDEO PLAYBACK WITH GSTREAMER-1.0**

For nvgstplayer-1.0 usage information enter the following command:

```
nvgstplayer-1.0 --help
```

Video can be output to HD displays using the HDMI connector on the platform. The Gstreamer-1.0 application supports currently the following video sinks:

**Overlay Sink (Video playback on overlay in full-screen mode)**

```
gst-launch-1.0 filesrc location=<filename.mp4> ! qtdemux name=demux ! h264parse ! omxh264dec ! nvoverlaysink -e
```
Overlay Sink (Video playback using overlay parameters)

The following steps are required to use the “overlay” property on Jetson-TX2.

1. **Set win_mask with the following commands:**
   
   ```
   # sudo -s
   # cd /sys/class/graphics/fb0
   # echo 4 > blank      // Blanks monitor for changing display setting.
   # echo 0x0 > device/win_mask      // Clears current window setting.
   # echo 0x3f > device/win_mask      // Assigns all 6 overlay windows in display controller to display 0 (fb0).
   # echo 0 > blank      // Unblank display.
   ```

2. **Stop X11 using following command:**
   
   ```
   $ sudo systemctl stop gdm
   $ sudo loginctl terminate-seat seat0
   ```

   For more introduction about the overlay windows in the display controller, please refer to the TX2 Technical Reference Manual (TRM).

   To use all 6 overlays X11 must be disabled, since it occupies one window. Disabling X11 also helps avoid memory bandwidth contention when using a non X11 overlay.

   ```
   gst-launch-1.0 filesrc location=<filename_1080p.mp4> ! qtdemux ! h264parse ! omxh264dec ! nvoverlaysink overlay-x=100 overlay-y=100 overlay-w=640 overlay-h=480 overlay=1 overlay-depth=0 &
   gst-launch-1.0 filesrc location=<filename_1080p.mp4> ! qtdemux ! h264parse ! omxh264dec ! nvoverlaysink overlay-x=250 overlay-y=250 overlay-w=640 overlay-h=480 overlay=2 overlay-depth=1 -e
   ```

   ```
   gst-launch-1.0 filesrc location=<filename_1080p.mp4> ! qtdemux ! h264parse ! omxh264dec ! nvoverlaysink overlay-x=100 overlay-y=100 overlay-w=640 overlay-h=480 overlay-depth=2 &
   gst-launch-1.0 filesrc location=<filename_1080p.mp4> ! qtdemux ! h264parse ! omxh264dec ! nvoverlaysink overlay-x=250 overlay-y=250 overlay-w=640 overlay-h=480 overlay=2 overlay-depth=1 -e
   ```
nveglglessink (Windowed video playback, NVIDIA EGL/GLES videosink using default X11 backend)

Use the following command to start the Gstreamer pipeline using nveglglessink with the default X11 backend:

```
gst-launch-1.0 filesrc location=<filename.mp4> ! \
  qtdemux name=demux ! h264parse ! omxh264dec ! nveglglessink -e
```

This nvgstplayer-1.0 application supports specific window position and dimensions for windowed playback:

```
nvgstplayer-1.0 -i <filename> --window-x=300 --window-y=300 \ 
  --window-width=500 --window-height=500
```

nveglglessink (Windowed video playback, NVIDIA EGL/GLES videosink using Wayland backend)

You can also use nveglglsink with the Wayland backend, instead of the default X11 backend.

Ubuntu 16.04 does not support the Wayland display server. That is, there is no UI support to switch to Wayland from Xorg. You must start the Wayland server (Weston) using the target’s shell before performing any Weston based operation.

*To start Weston:*

The following steps are required before you first run the Gstreamer pipeline with the Wayland backend. They are not required on subsequent runs.

1. Stop the display manager:

```
sudo systemctl stop gdm
sudo loginctl terminate-seat seat0
```

2. Unset the DISPLAY environment variable:

```
unset DISPLAY
```

3. Create a temporary xdg directory:

```
mkdir /tmp/xdg
chmod 700 /tmp/xdg
```

4. Start the Weston compositor:
To run the GStreamer pipeline with the Wayland backend:

Use the following command to start the Gstreamer pipeline using nveglglesink with the Wayland backend:

```
sudo XDG_RUNTIME_DIR=/tmp/xdg gst-launch-1.0 filesrc \
  location=<filename.mp4> ! qtdemux name=demux ! h264parse ! \
  omxh264dec ! nveglglessink winsys=wayland
```

DRM Video Sink (Video playback using DRM)

This sink element uses DRM to render video on connected displays.

Prerequisite:

1. Stop the display manager:

   ```
sudo systemctl stop gdm
sudo loginctl terminate-seat seat0
   ```

The following command starts the Gstreamer pipeline using nvdrmvideosink:

```
gst-launch-1.0 filesrc location=<filename.mp4> ! \n  qtdemux name=demux ! h264parse ! omxh264dec ! nvdrmvideosink -e
```

Properties

nvdrmvideosink supports the following properties:

<table>
<thead>
<tr>
<th>Property name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>conn_id</td>
<td>Set connector ID for display.</td>
</tr>
<tr>
<td>plane_id</td>
<td>Set plane ID.</td>
</tr>
<tr>
<td>set_mode</td>
<td>Set default mode (resolution) for playback.</td>
</tr>
</tbody>
</table>

The following command illustrates the use of these properties:

```
gst-launch-1.0 filesrc location=<filename.mp4> ! \n  qtdemux name=demux ! h264parse ! omxh264dec ! nvdrmvideosink \n  conn_id=0 plane_id=1 set_mode=0 -e
```
VIDEO FORMAT CONVERSION WITH GSTREAMER-1.0

The NVIDIA proprietary nvvidconv Gstreamer-1.0 plug-in allows conversion between OSS (raw) video formats and NVIDIA video formats. The nvvidconv plug-in currently supports the format conversions described in this section.

raw-yuv Input Formats

Currently nvvidconv supports the I420, UYVY, YUY2, YVYU, NV12, BGRx, and RGBA raw-yuv input formats.

```
    gst-launch-1.0 videotestsrc ! 'video/x-raw, format=(string)UYVY, width=(int)1280, height=(int)720' ! nvvidconv ! 'video/x-raw(memory:NVMM), format=(string)I420' ! omxh264enc ! 'video/x-h264, stream-format=(string)byte-stream' ! h264parse ! qtmux ! filesink location=test.mp4 -e
```

raw-yuv Output Formats

Currently nvvidconv supports the I420, UYVY, YUY2, YVYU, NV12, BGRx, and RGBA raw-yuv output formats.

```
    gst-launch-1.0 filesrc location=640x480_30p.mp4 ! qtdemux ! queue ! h264parse ! omxh264dec ! nvvidconv ! 'video/x-raw, format=(string)UYVY' ! xvimagesink -e
```

VIDEO SCALING WITH GSTREAMER-1.0

The NVIDIA proprietary nvvidconv Gstreamer-1.0 plug-in also allows you to perform video scaling. The nvvidconv plug-in currently supports scaling with the format conversions described in this section.

raw-yuv Input Formats

Currently nvvidconv supports the I420, UYVY, YUY2, YVYU, NV12, BGRx, and RGBA raw-yuv input formats for scaling.

```
    gst-launch-1.0 videotestsrc ! 'video/x-raw, format=(string)I420, width=(int)1280, height=(int)720' ! nvvidconv ! 'video/x-raw(memory:NVMM), width=(int)640, height=(int)480, format=(string)I420' ! omxh264enc ! 'video/x-h264, stream-format=(string)byte-stream' ! h264parse ! qtmux ! filesink location=test.mp4 -e
```
raw-yuv Output Formats

Currently `nvvidconv` supports the I420, UYVY, YUY2, YVYU, NV12, BGRx, and RGBA raw-yuv output formats for scaling.

```bash
gst-launch-1.0 filesrc location=1280x720_30p.mp4 ! qtdemux ! queue ! h264parse ! omxh264dec ! nvvidconv ! 'video/x-raw, format=(string)I420, width=640, height=480' ! xvimagesink -e
```

NVIDIA Input and Output Formats

Currently `nvvidconv` supports the NVIDIA input and output formats for scaling described in the following table:

<table>
<thead>
<tr>
<th>Input Format</th>
<th>Output Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>NV12</td>
<td>NV12</td>
</tr>
<tr>
<td>I420, I420_10LE, I420_12LE</td>
<td>I420, I420_10LE</td>
</tr>
<tr>
<td></td>
<td>RGBA</td>
</tr>
</tbody>
</table>

To scale between NVIDIA formats

- Scale between NVIDIA Formats with the following commands:

```bash
gst-launch-1.0 filesrc location=1280x720_30p.mp4 ! qtdemux ! h264parse ! omxh264dec ! nvvidconv ! 'video/x-raw(memory:NVMM), width=(int)640, height=(int)480, format=(string)I420' ! omxh264enc ! qtmux ! filesink location=test.mp4 -e

gst-launch-1.0 filesrc location=1280x720_30p.mp4 ! qtdemux ! h264parse ! omxh264dec ! nvvidconv ! 'video/x-raw(memory:NVMM), width=(int)640, height=(int)480, format=(string)RGBA' ! nvoverlaysink -e

gst-launch-1.0 nvarguscamerasrc ! 'video/x-raw(memory:NVMM), width=(int)1920, height=(int)1080, format=(string)NV12, framerate=(fraction)30/1' ! nvvidconv ! 'video/x-raw(memory:NVMM), width=(int)640, height=(int)480, format=(string)NV12' ! omxh264enc ! qtmux ! filesink location=test.mp4 -e
```
VIDEO CROPPING WITH GSTREAMER-1.0

The NVIDIA proprietary nvvidconv Gstreamer-1.0 plug-in also allows you to perform video cropping.

To crop video

- Crop video with the following commands:

```plaintext
gst-launch-1.0 filesrc location=<filename_1080p.mp4> ! qtdemux ! h264parse ! omxh264dec ! nvvidconv left=400 right=1520 top=200 bottom=880 ! nvoverlaysink display-id=1 -e
```

VIDEO TRANSCODE WITH GSTREAMER-1.0

You can perform video transcoding between the following video formats.

H.264 Decode to VP9 Encode (NVIDIA-accelerated decode to NVIDIA-accelerated encode)

```plaintext
gst-launch-1.0 filesrc location=<filename.mp4> ! qtdemux name=demux demux.video_0 ! queue ! h264parse ! omxh264dec ! omxvp9enc bitrate=20000000 ! matroskamux name=mux ! filesink location=<Transcoded_filename.mkv> -e
```

H.265 Decode to VP9 Encode (NVIDIA-accelerated decode to NVIDIA-accelerated encode)

```plaintext
gst-launch-1.0 filesrc location=<filename.mp4> ! qtdemux name=demux demux.video_0 ! queue ! h265parse ! omxh265dec ! omxvp9enc bitrate=20000000 ! matroskamux name=mux ! filesink location=<Transcoded_filename.mkv> -e
```

VP8 Decode to H.264 Encode (NVIDIA-accelerated decode to NVIDIA-accelerated encode)

```plaintext
gst-launch-1.0 filesrc location=<filename.mp4> ! qtdemux name=demux demux.video_0 ! queue ! omxvp8dec ! omxh264enc bitrate=20000000 ! qtmux name=mux ! filesink location=<Transcoded_filename.mp4> -e
```

VP9 Decode to H.265 Encode (NVIDIA-accelerated decode to NVIDIA-accelerated encode)

```plaintext
gst-launch-1.0 filesrc location=<filename.webm> ! matroskademux name=demux demux.video_0 ! queue ! omxvp9dec !
```
MPEG-4 Decode to VP9 Encode (NVIDIA-accelerated decode to NVIDIA-accelerated encode)

gst-launch-1.0 filesrc location=<filename.mp4> ! \
gtdemux name=demux demux.video_0 ! queue ! mpeg4videoparse ! \
omxmpeg4videodec ! omxvp9enc bitrate=20000000 ! qtmux name=mux ! \\
filesink location=<Transcoded_filename.mp4> -e

MPEG-4 Decode to H.264 Encode (NVIDIA-accelerated decode to NVIDIA-accelerated encode)

gst-launch-1.0 filesrc location=<filename.mp4> ! \
gtdemux name=demux demux.video_0 ! queue ! mpeg4videoparse ! \
omxmpeg4videodec ! omxh264enc bitrate=20000000 ! qtmux name=mux ! \\
filesink location=<Transcoded_filename.mp4> -e

H.264 Decode to MPEG-4 Encode (NVIDIA-accelerated decode to OSS software encode)

gst-launch-1.0 filesrc location=<filename.mp4> ! \
gtdemux name=demux demux.video_0 ! queue ! h264parse ! omxh264dec ! \
nvvidconv ! avenc_mpeg4 bitrate=4000000 ! qtmux name=mux ! \\
filesink location=<Transcoded_filename.mp4> -e

H.265 Decode to MPEG-4 Encode (NVIDIA-accelerated decode to OSS software encode)

gst-launch-1.0 filesrc location=<filename.mp4> ! \
gtdemux name=demux demux.video_0 ! queue ! h265parse ! omxh265dec ! \
nvvidconv ! avenc_mpeg4 bitrate=4000000 ! qtmux name=mux ! \\
filesink location=<Transcoded_filename.mp4> -e

VP8 Decode to MPEG-4 Encode (NVIDIA-accelerated decode to OSS software encode)

gst-launch-1.0 filesrc location=<filename.mp4> ! \
gtdemux name=demux demux.video_0 ! queue ! omxvp8dec ! nvvidconv ! \
avenc_mpeg4 bitrate=4000000 ! qtmux name=mux ! \\
filesink location=<Transcoded_filename.mp4> -e

VP9 Decode to MPEG-4 Encode (NVIDIA-accelerated decode to OSS software encode)

gst-launch-1.0 filesrc location=<filename.mkv> ! \
matroskademux name=demux demux.video_0 ! queue ! omxvp9dec ! \

H.264 Decode to Theora Encode (NVIDIA-accelerated decode to OSS software encode)

```
gst-launch-1.0 filesrc location=<filename.mp4> ! 
  qtdemux name=demux demux.video_0 ! queue ! h264parse ! omxh264dec ! 
  nvvidconv ! theoraenc bitrate=4000000 ! oggmux name=mux ! 
  filesink location=<Transcoded_filename.ogg> -e
```

H.264 Decode to H.263 Encode (NVIDIA-accelerated decode to OSS software encode)

```
gst-launch-1.0 filesrc location=<filename.mp4> ! 
  qtdemux name=demux demux.video_0 ! queue ! h264parse ! omxh264dec ! 
  nvvidconv ! 'video/x-raw, width=(int)704, height=(int)576, 
      format=(string)I420' ! avenc_h263 bitrate=4000000 ! qtmux ! 
  filesink location=<Transcoded_filename.mp4> -e
```

CUDA VIDEO POST-PROCESSING WITH GSTREAMER-1.0

This section describes Gstreamer-1.0 plug-ins for NVIDIA® CUDA® post-processing operations.

**gst-videocuda**

This GStreamer-1.0 plug-in performs CUDA post-processing operations on decoder-provided EGL images and render video using nveglglessink.

The following are sample pipeline creation and application usage commands.

**Sample decode pipeline**

```
gst-launch-1.0 filesrc location=<filename_h264_1080p.mp4> ! 
  qtdemux name=demux ! h264parse ! omxh264dec ! videocuda !
  nveglglessink max-lateness=-1 -e
```

**Sample decode command**

```
nvgstplayer-1.0 -i <filename_h264_1080p.mp4> --svd="omxh264dec" 
--svc="videocuda" --svs="nveglglessink # max-lateness=-1" 
--disable-vnative --no-audio --window-x=0 --window-y=0 
--window-width=960 --window-height=540
```
gst-nvivafilter

This NVIDIA proprietary GStreamer-1.0 plug-in performs pre/post and CUDA post-processing operations on CSI camera captured or decoded frames, and renders video using overlay video sink or video encode.

Sample decode pipeline

```bash
gst-launch-1.0 filesrc location=<filename.mp4> ! qtdemux ! h264parse ! omxh264dec ! nvivafilter cuda-process=true !
  customer-lib-name="libnvsample_cudaprocess.so" !
  'video/x-raw(memory:NVMM), format=(string)NV12' ! nvoverlaysink -e
```

Note

See nvsample_cudaprocess_src.tbz2 package for the libnvsample_cudaprocess.so library sources. A Sample CUDA implementation of libnvsample_cudaprocess.so can be replaced by a custom CUDA implementation.

VIDEO ROTATION WITH GSTREAMER-1.0

The NVIDIA proprietary `nvvidconv` Gstreamer-1.0 plug-in also allows you to perform video rotation operations.

The following table shows the supported values for the `nvvidconv flip-method` property.

<table>
<thead>
<tr>
<th>Flip Method</th>
<th>Property value</th>
</tr>
</thead>
<tbody>
<tr>
<td>identity - no rotation (default)</td>
<td>0</td>
</tr>
<tr>
<td>counterclockwise - 90 degrees</td>
<td>1</td>
</tr>
<tr>
<td>rotate - 180 degrees</td>
<td>2</td>
</tr>
<tr>
<td>clockwise - 90 degrees</td>
<td>3</td>
</tr>
<tr>
<td>horizontal flip</td>
<td>4</td>
</tr>
<tr>
<td>upper right diagonal flip</td>
<td>5</td>
</tr>
<tr>
<td>vertical flip</td>
<td>6</td>
</tr>
<tr>
<td>Flip Method</td>
<td>Property value</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>upper-left diagonal</td>
<td>7</td>
</tr>
</tbody>
</table>

Note: Get information on `nvvidconv flip-method` property with the `gst-inspect-1.0 nvvidconv` command.

To rotate video 90 degrees counterclockwise
- To rotate video 90 degrees in a counterclockwise direction, enter the following command:

```bash
gst-launch-1.0 filesrc location=<filename.mp4> ! qtdemux name=demux ! h264parse ! omxh264dec ! nvvidconv flip-method=1 !
    'video/x-raw(memory:NVMM), format=(string)I420' ! nvoverlaysink -e
```

To rotate video 90 degrees clockwise
- To rotate video 90 degrees in a clockwise direction, enter the following command:

```bash
gst-launch-1.0 filesrc location=<filename.mp4> ! qtdemux name=demux ! h264parse ! omxh264dec ! nvvidconv flip-method=3 !
    'video/x-raw(memory:NVMM), format=(string)I420' ! omxh264enc ! qtmux ! filesink location=test.mp4 -e
```

To rotate 180 degrees
- To rotate video 180 degrees, enter the following command:

```bash
gst-launch-1.0 nvarguscamerasrc!
    'video/x-raw(memory:NVMM), width=(int)1920, height=(int)1080, 
    format=(string)NV12, framerate=(fraction)30/1' !
    nvvidconv flip-method=2 !
    'video/x-raw(memory:NVMM), format=(string)I420' ! nvoverlaysink -e
```

To scale and rotate video 90 degrees counterclockwise
- To scale and rotate video 90 degrees counterclockwise, enter the following command:

```bash
gst-launch-1.0 filesrc location=<filename_1080p.mp4> ! qtdemux !
    h264parse ! omxh264dec ! nvvidconv flip-method=1 !
    'video/x-raw(memory:NVMM), width=(int)480, height=(int)640, 
    format=(string)I420' ! nvoverlaysink -e
```
To scale and rotate video 90 degrees clockwise

To scale and rotate video 90 degrees clockwise, enter the following command:

```
gst-launch-1.0 nvarguscamerasrc ! 
  'video/x-raw(memory:NVMM), width=(int)1920, height=(int)1080, 
  format=(string)NV12, framerate=(fraction)30/1' ! 
  nvvidconv flip-method=3 ! 'video/x-raw(memory:NVMM), 
  width=(int)480, height=(int)640, format=(string)I420' ! 
  nvoverlaysink -e
```

To scale and rotate video 180 degrees

To scale and rotate video 180 degrees, enter the following command:

```
gst-launch-1.0 filesrc location=<filename_1080p.mp4> ! 
  qtdemux ! h264parse ! omxh264dec ! nvvidconv flip-method=2 ! 
  'video/x-raw(memory:NVMM), width=(int)640, height=(int)480, 
  format=(string)I420' ! nvoverlaysink -e
```

Video Composition with Gstreamer-1.0

With the NVIDIA proprietary nvcompositor Gstreamer-1.0 plug-in, you can perform video composition operations on gst-omx video decoded streams.

**Note** nvcompositor supports video decode (gst-omx) with the overlay render pipeline for gst-1.14.

Prerequisites

- Install the following dependent gstreamer package.

  ```
  $ sudo apt-get install gstreamer1.0-plugins-bad
  ```

- Clear the registry cache file, in case there is an issue with gst-inspect-1.0 nvcompositor.

  ```
  $ rm .cache/gstreamer-1.0/registry.aarch64.bin
  ```

To composite different formats decoded streams

- Enter the following command:

  ```
  gst-launch-1.0 nvcompositor 
  name=comp sink_0::xpos=0 sink_0::ypos=0 sink_0::width=1920 
  ```
INTERPOLATION METHODS FOR VIDEO SCALING

The NVIDIA proprietary nvvidconv Gstreamer-1.0 plug-in allows you to choose the interpolation method used for scaling.

The following table shows the supported values for the nvvidconv interpolation-method property.

<table>
<thead>
<tr>
<th>Interpolation Method</th>
<th>Property Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>nearest</td>
<td>0</td>
</tr>
<tr>
<td>bilinear</td>
<td>1</td>
</tr>
<tr>
<td>5-Tap</td>
<td>2</td>
</tr>
<tr>
<td>10-Tap</td>
<td>3</td>
</tr>
<tr>
<td>smart (default)</td>
<td>4</td>
</tr>
<tr>
<td>Nicest</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: Get information on nvvidconv interpolation-method property with the gst-inspect-1.0 nvvidconv command.

To use bilinear interpolation method for scaling

- Enter the following command:

```bash
gst-launch-1.0 filesrc location=<filename_1080p.mp4>! \
  qtdemux name=demux ! h264parse ! omxh264dec ! \
  nvvidconv interpolation-method=1 ! \
  'video/x-raw(memory:NVMM), format=(string)I420, width=1280, \n  height=720' ! nvoverlaysink -e
```
EGLSTREAM PRODUCER EXAMPLE

The NVIDIA-proprietary nveglstreamsrc and nvidiaosink Gstreamer-1.0 plug-ins allow simulation of an EGLStream producer pipeline (for preview only.)

To simulate an EGLStream producer pipeline

- Enter the following command:

  nvgstcapture-1.0 --camsrc=3

EGL IMAGE TRANSFORM EXAMPLE

The NVIDIA proprietary nvegltransform Gstreamer-1.0 plug-in allows simulation of an EGLImage transform pipeline.

To simulate an EGL Image transform pipeline

- Enter the following command:

  gst-launch-1.0 filesrc location=<filename_h264_1080p.mp4> ! \
  qtdemux ! h264parse ! omxh264dec ! nvvidconv ! \n  'video/x-raw(memory:NVMM), width=(int)1280, height=(int)720, \n  format=(string)NV12' ! nvegltransform ! nveglglessink -e
This release contains the `gst-install` script to install a specific GStreamer version. This section provides a procedure for building current versions of GStreamer.

**To build GStreamer using gst-install**

1. Execute the following command:

```shell
gst-install [--prefix=<install_path>] [--version=<version>]
```

Where `<install_path>` is the location where you are installing GStreamer and `<version>` is the GStreamer version. For example:

```shell
gst-install --prefix=/home/ubuntu/gst-1.14.2 --version=1.14.2
```

2. Export environment variables with the following command:

```shell
export LD_LIBRARY_PATH=<install_path>/lib/aarch64-linux-gnu
export PATH=<install_path>/bin:$PATH
```

Where `<install_path>` is the location where you are installing GStreamer. For example:

```shell
export LD_LIBRARY_PATH=/home/ubuntu/gst-1.14.2/lib/aarch64-linux-gnu
export PATH=/home/ubuntu/gst-1.14.2/bin:$PATH
```

**To build GStreamer manually**

1. Download the latest version of gstreamer available at:

```
http://gstreamer.freedesktop.org/src/
```
The following are the files you need from version 1.14.2:

- gstreamer-1.14.2.tar.xz
- gst-plugins-base-1.14.2.tar.xz
- gst-plugins-good-1.14.2.tar.xz
- gst-plugins-bad-1.14.2.tar.xz
- gst-plugins-ugly-1.14.2.tar.xz

2. Install needed packages with the following command:

```bash
sudo apt-get install build-essential dpkg-dev flex bison \
    autotools-dev automake liborc-dev autopoint libtool \
    gtk-doc-tools libgstreamer1.0-dev
```

3. In the ~/ directory, create a gst_<version> directory, where <version> is the version number of gstreamer you are building.

4. Copy the downloaded tar.xz files to the gst_<version> directory.

5. Uncompress the tar.xz files in the gst_<version> directory.

6. Set the PKG_CONFIG_PATH with the following command:

```bash
export PKG_CONFIG_PATH=/home/ubuntu/gst_1.14.2/out/lib/pkgconfig
```

7. Build gstreamer (in this example, gstreamer-1.14.2) with the following commands:

```bash
./configure --prefix=/home/ubuntu/gst_1.14.2/out
make
make install
```

8. Build gst-plugins-base-1.14.2 with the following commands:

```bash
sudo apt-get install libxv-dev libasound2-dev libtheora-dev \
    libogg-dev libvorbis-dev
./configure --prefix=/home/ubuntu/gst_1.14.2/out
make
make install
```

9. Build gst-plugins-good-1.14.2 with the following commands:

```bash
sudo apt-get install libbz2-dev libv4l-dev libvpx-dev \
    libjack-jackd2-dev libsoup2.4-dev libpulse-dev
./configure --prefix=/home/ubuntu/gst_1.14.2/out
make
make install
```
10. Obtain and build gst-plugins-bad-1.14.2 with the following commands:

```bash
sudo apt-get install faad libfaad-dev libfaac-dev
./configure --prefix=/home/ubuntu/gst_1.14.2/out
make
make install
```

11. Obtain and build gst-plugins-ugly-1.14.2 with the following commands:

```bash
sudo apt-get install libx264-dev libmad0-dev
./configure --prefix=/home/ubuntu/gst_1.14.2/out
make
make install
```

12. Set the LD_LIBRARY_PATH environment variable with the following command:

```bash
export LD_LIBRARY_PATH=/home/ubuntu/gst_1.14.2/out/lib/
```

13. Copy the nvidia gstreamer-1.0 libraries to the gst_1.14.2 plugin directory using the following command:

```bash
cd /usr/lib/aarch64-linux-gnu/gstreamer-1.0/
cp libgstnv* libnvgst* libgstomx.so \n~/gst_1.14.2/out/lib/gstreamer-1.0/
```

The nvidia gstreamer-1.0 libraries include:

- libgstnargvarguscamera.so
- libgstnveglglessink.so
- libgstnveglstreamsrc.so
- libgstnvegltransform.so
- libgstnvivafilter.so
- libgstnvvidconv.so
- libgstnvgstvideosink.so
- libnvgstjpeg.so
- libgstomx.so
This section describes the options available in the `nvgstcapture-1.0` application.

### Note:

The `nvgstcapture-1.0` application default only supports ARGUS API using `nvarguscamerasrc` plugin. Legacy `nvcamerasrc` plugin support is deprecated.

## NVGSTCAPTURE APPLICATION OPTIONS

### Note:

Use “nvgstcapture-1.0 --help” to list supported options for `nvarguscamera`.

Nvgstcapture-1.0 command-line options for `nvarguscamera` are described in the following table.

<table>
<thead>
<tr>
<th>Application Options</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>--prev_res</td>
<td>Preview width and height, Range: 2 to 8 (3840x2160), e.g., --prev_res=3</td>
<td>-</td>
</tr>
<tr>
<td>--cus-prev-res</td>
<td>Custom preview width and height for CSI only, e.g., --cus-prev-res=1920x1080</td>
<td>-</td>
</tr>
<tr>
<td>--image_res</td>
<td>Image width and height, Range: 2 to 12 (5632x4224), e.g., --image_res=3</td>
<td>-</td>
</tr>
<tr>
<td>--video-res</td>
<td>Video width and height. Range: 2 to 9 (3896x2192) e.g., --video-res=3</td>
<td>-</td>
</tr>
<tr>
<td>Option</td>
<td>Description</td>
<td>Notes</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| --camsrc        | Camera source to use                       | 0=v4l2  
1=csi[default]  
2=videotest  
3=eglstream                     |
| -m, --mode      | Capture mode.                              | 1-Still  
2-Video                                                             |
| -v, --video_enc | Video encoder type.                        | 0=h264[HW]  
1=vp8[HW, not supported on Jetson Xavier]  
2=h265[HW]  
3=vp9[HW]                                                             |
| -b, --enc-bitrate | Video encoding Bit-rate (in bytes)        | Example: --enc-bitrate=4000000                                       |
| --enc-profile   | Video encoder profile (only for H.264)     | 0-Baseline  
1-Main  
2-High                                                               |
| -j, --image_enc | Image encoder type.                        | 0-jpeg_SW[jpegenc]  
1-jpeg_HW[nvjpegenc]                                                     |
| -k, --file_type | Container file type.                       | 0-MP4  
1-3GP  
2-MKV                                                               |
| --file-name     | Captured file name.                        | nvcamtest is used by default                                         |
| --color-format  | Color format to use                        | 0=I420  
1=NV12[For CSI only and default for CSI]  
2=YUY2[For V4L2 only, default for V4L2]                                |
| --orientation   | Camera sensor orientation value            | -                                                                  |
| -w, --whitebalance | Capture whitebalance value.               | -                                                                  |
| --timeout       | Capture timeout value                      | -                                                                  |
| --saturation    | Camera saturation value                    | -                                                                  |
| --sensor-id     | Camera Sensor ID value                     | -                                                                  |
### Application Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>--display-id</td>
<td>[For nvoverlaysink only] Display ID value</td>
<td>-</td>
</tr>
<tr>
<td>--overlayConfig</td>
<td>Overlay Configuration Options index and coordinates in (index, x_pos, y_pos, width, height) order</td>
<td>--overlayConfig=&quot;0, 0, 0, 1280, 720&quot;</td>
</tr>
</tbody>
</table>

### Help Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>-h, --help</td>
<td>Show help options.</td>
<td>-</td>
</tr>
<tr>
<td>--help-all</td>
<td>Show all help options.</td>
<td>-</td>
</tr>
<tr>
<td>--help-gst</td>
<td>Show Gstreamer options.</td>
<td>-</td>
</tr>
</tbody>
</table>

### CSI CAMERA SUPPORTED RESOLUTIONS

CSI camera supports the following image resolutions for Nvarguscamera:

- 640x480
- 1280x720
- 1920x1080
- 2104x1560
- 2592x1944
- 2616x1472
- 3840x2160
- 3896x2192
- 4208x3120
- 5632x3168
- 5632x4224

### CSI CAMERA RUNTIME COMMANDS

#### Options for Nvarguscamera

CSI camera runtime commands options for Nvarguscamera are described in the following table.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>h</td>
<td>Help</td>
<td>-</td>
</tr>
<tr>
<td>q</td>
<td>Quit</td>
<td>-</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
<td>Notes</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td>-------</td>
</tr>
<tr>
<td>mo:&lt;value&gt;</td>
<td>Set capture mode</td>
<td>1-image 2-video</td>
</tr>
<tr>
<td>gmo</td>
<td>Get capture mode</td>
<td>-</td>
</tr>
<tr>
<td>so:&lt;val&gt;</td>
<td>Set sensor orientation</td>
<td>0-none 1-Rotate counter-clockwise 90 degrees 2-Rotate 180 degrees 3-Rotate clockwise 90 degrees</td>
</tr>
<tr>
<td>gso</td>
<td>Get sensor orientation</td>
<td>-</td>
</tr>
<tr>
<td>wb:&lt;value&gt;</td>
<td>Set white balance mode</td>
<td>0-off 1-auto 2-incandescent 3-fluorescent 4-warm-fluorescent 5-daylight 6-cloudy-daylight 7-twilight 8-shade 9-manual</td>
</tr>
<tr>
<td>gwb</td>
<td>Get white balance mode</td>
<td>-</td>
</tr>
<tr>
<td>st:&lt;value&gt;</td>
<td>Set saturation</td>
<td>0-2, e.g., st:1.25</td>
</tr>
<tr>
<td>gst</td>
<td>Get saturation</td>
<td>-</td>
</tr>
<tr>
<td>j</td>
<td>Capture one image.</td>
<td>-</td>
</tr>
<tr>
<td>jx&lt;delay&gt;</td>
<td>Capture after a delay of &lt;delay&gt;, e.g., jx5000 to capture after a 5-second delay</td>
<td>-</td>
</tr>
<tr>
<td>j:&lt;value&gt;</td>
<td>Capture &lt;count&gt; number of images in succession, e.g., j:6 to capture 6 images.</td>
<td>-</td>
</tr>
<tr>
<td>0</td>
<td>Stop recording video</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>Start recording video</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Video snapshot (while recording video)</td>
<td>-</td>
</tr>
</tbody>
</table>
## USB CAMERA RUNTIME COMMANDS

USB Camera Runtime Commands

USB camera runtime commands are described in the following table.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>h</td>
<td>Help</td>
<td>-</td>
</tr>
<tr>
<td>q</td>
<td>Quit</td>
<td>-</td>
</tr>
<tr>
<td>mo:&lt;value&gt;</td>
<td>Set capture mode</td>
<td>1-image 2-video</td>
</tr>
<tr>
<td>gmo</td>
<td>Get capture mode</td>
<td>-</td>
</tr>
<tr>
<td>j</td>
<td>Capture one image.</td>
<td>-</td>
</tr>
<tr>
<td>jx&lt;delay&gt;</td>
<td>Capture after a delay of &lt;delay&gt;, e.g., jx5000 to capture after a 5-second delay</td>
<td>-</td>
</tr>
<tr>
<td>j:&lt;value&gt;</td>
<td>Capture &lt;count&gt; number of images in succession, e.g., j:6 to capture 6 images.</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>Start recording video</td>
<td>-</td>
</tr>
<tr>
<td>0</td>
<td>Stop recording video</td>
<td>-</td>
</tr>
<tr>
<td>pcr:&lt;value&gt;</td>
<td>Set preview resolution</td>
<td>0-176x144 1-320x240 2-640x480 3-1280x720</td>
</tr>
<tr>
<td>gpcr</td>
<td>Get preview resolution</td>
<td>-</td>
</tr>
<tr>
<td>gicr</td>
<td>Get image capture resolution</td>
<td>-</td>
</tr>
<tr>
<td>gvcr</td>
<td>Get video capture resolution</td>
<td>-</td>
</tr>
</tbody>
</table>
### Command Reference

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>br:&lt;value&gt;</td>
<td>Set encoding bit rate (in bytes)</td>
<td>e.g., br:4000000</td>
</tr>
<tr>
<td>gbr</td>
<td>Get encoding bit rate</td>
<td>-</td>
</tr>
</tbody>
</table>
| cdn:<value> | Set capture device node                        | 0-/dev/video0  
1-/dev/video1  
2-/dev/video2 |
| gcdn     | Get capture device node                         | -                          |

### Runtime Video Encoder Configuration Options

The following table describes runtime video encoder configuration options supported for Nvarguscamera.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>br:&lt;val&gt;</td>
<td>Sets encoding bit-rate (in bytes)</td>
<td>Example: br:4000000</td>
</tr>
<tr>
<td>gbr</td>
<td>Gets encoding bit-rate (in bytes)</td>
<td>-</td>
</tr>
</tbody>
</table>
| ep:<val> | Sets encoding profile (for H.264 only)          | Example: ep:1              
(0): Baseline  
(1): Main  
(2): High |
| gep      | Gets encoding profile (for H.264 only)          | -                          |
| Enter ‘f’ | Forces IDR frame on video encoder (for H.264 only) | -                         |

### NOTES

- The nvgstcapture-1.0 application generates image and video output files in the same directory as the application itself.
- Filenames for image and video content are in the formats, respectively:
  - nvcamtest_<pid>_<sensor_id>_<counter>.jpg
  - nvcamtest_<pid>_<sensor_id>_<counter>.mp4

Where:
- <pid> is the process ID.
• `<sensor_id>` is the sensor ID.
• `<counter>` is a counter starting from 0 every time you run the application.

Rename or move files between runs to avoid overwriting results you want to save.

- The nvgstcapture-1.0 application supports native capture(video only) mode by default.
- Advance features, like setting zoom, brightness, exposure, and whitebalance levels, are not supported for USB camera.
The Gstreamer-1.0-based gst-omx video encoders support the following features, respectively:

<table>
<thead>
<tr>
<th>Video Encoder Feature</th>
<th>H264enc</th>
<th>H265enc</th>
<th>Vp9enc</th>
</tr>
</thead>
<tbody>
<tr>
<td>profile (Baseline / Main / High)</td>
<td>✓ (all)</td>
<td>✓ (Main)</td>
<td>✓</td>
</tr>
<tr>
<td>level</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>bitrate</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>peak bitrate</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>stringent bitrate</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>insert-spsppsatidr</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>control-rate</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>iframeinterval</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>qp-range</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>temporal-tradeoff</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>bit-packetization</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>preset-level</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>low-latency</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>slice-header spacing</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>force-IDR</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Video Encoder Feature</td>
<td>H264enc</td>
<td>H265enc</td>
<td>Vp9enc</td>
</tr>
<tr>
<td>----------------------------</td>
<td>---------</td>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td>vbv-size</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>sliceintrafreshenable</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>sliceintrafreshinterval</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>EnableTwoPassCBR</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>num-B-Frames</td>
<td>✓</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
This section describes the supported cameras.

**CSI CAMERAS**

- Jetson Xavier can capture images from RAW Bayer sensors. Multiple sensors can be connected via the CSI interface. However, the current software version is validated to capture images from one sensor at a time.
- The platform is validated to capture images and video from the OV5693 sensor and IMX274 sensor module on L4T.
- The current software version is not validated to capture in HDR (High Dynamic Range) mode.
- The camera module is interfaced with the Tegra platform via MIPI-CSI.
- Tested using the nvgstcapture application.

**USB 2.0 CAMERAS**

The following camera has been validated on Tegra platforms for Android and L4T with USB 2.0 ports. This camera is UVC compliant.

- Logitech c920 (preferred)
  

**INDUSTRIAL CAMERA DETAILS**

The following USB 3.0 Industrial camera is validated on Jetson Xavier under L4T:

- See3CAM_CU130
  
- USB 3.0
- UVC compliant
- 3840 x 2160 at 30 FPS | 4224 x 3156 at 13 FPS
- Purpose - Embedded Navigation
- Test using the nvgstcapture app.
- Issues encountered:
  - FPS cannot be fixed. Changes based on exposure.
  - FPS cannot be changed. Needs payment to vendor to get the support added to their firmware.
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