



# ACCELERATED GSTREAMER USER GUIDE

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**Release 31.0**



## DOCUMENT CHANGE HISTORY

DA\_07303-3.8

Version	Date	Authors	Description of Change
v1.0	01 May 2015	NVIDIA	Initial release.
v1.1	30 Jun 2015	mzensius	Added rotation and scaling commands, other new content.
v1.2	03 Nov 2015	emilyh	Changes for 23.1
v1.3	19 Nov 2015	mzensius	Added note for display export.
v1.4	17 Dec 2015	hlang	Updated gst-nvivafilter sample pipelines. Updated steps to build gstreamer manually.
v1.5	08 Jan 2016	kstone	Added nvvidconv interpolation method.
v1.5	29 Jan 2016	hlang	Additional syntax changes for 23.2 release
v2.0	11 May 2016	mzensius	Minor change to nvgstcapture options.
v3.0	11 Aug 2016	mzensius	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.
v3.1	06 Oct 2016	mzensius	Minor updates to video encoder features.
v3.1.1	21 Nov 2016	mzensius	Changed title of document.
V3.2	12 Jan 2017	mzensius	Adds H.264/H.265 encoder documentation. Also corrects the Gstreamer-1.0 installation procedure.
3.2	03 Mar 2017	hlang	Update date/moniker for L4T 27.1 release. No other updates.
3.3	13 Jul 2017	mzensius	Minor edit to command syntax, and update of date/moniker for L4T 28.1 release.
3.4	01 Dec 2017	mzensius	Includes support for Jetson TX1, previously documented elsewhere. Also includes Overlay Sink information, and formatting enhancements.

3.5	23 Feb 2018	kstone	Added support for the nvarguscamerasrc plugin. Corrected erroneous path. Reformatted commands for line breaks.
3.5	28 Feb 2018	hlang	Update the GStreamer installation and setup table to add nvcompositor.
3.6	20 April 2018	kstone	Added prerequisites for Video Composition.
3.7	23 July 2018	jsachs	Add steps to be performed when testing Wayland based GST Plugin, playing video, or running Wayland based apps on Wayland display server.
3.8	29 August 2018	jsachs	Updates for L4T release 31 & GStreamer version 1.14.

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# ACCELERATED GSTREAMER USER GUIDE

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:

```
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:

```
gst-inspect-1.0 --version
```

## Gstreamer-1.0 Plugin Reference

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

Video Decoder	Description
omxh265dec	OpenMAX IL H.265 Video Decoder
omxh264dec	OpenMAX IL H.264 Video Decoder
omxmpeg4videodec	OpenMAX IL MPEG4 Video Decoder
omxvp8dec	OpenMAX IL VP8 Video Decoder
omxvp9dec	OpenMAX IL VP9 video decoder

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

Video Encoders	Description
omxh264enc	OpenMAX IL H.264/AVC video encoder
omxh265enc	OpenMAX IL H.265/AVC video encoder
omxvp9enc	OpenMAX IL VP9 video encoder (Supported with Jetson TX2 and Jetson Xavier. Not supported with Jetson TX1.)

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

Video Sink	Description
nvoverlaysink	OpenMAX IL videosink element

Gstreamer version 1.0 includes the following EGL image video sink:

Video Sink	Description
nveglglessink	EGL/GLES videosink element, both the X11 and Wayland backends

Gstreamer version 1.0 includes the following DRM video sink:

Video Sink	Description
nvdrmvideosink	DRM videosink element

Gstreamer version 1.0 includes the following proprietary NVIDIA plugins:

NVIDIA Proprietary Plugin	Description
nvarguscamerasrc	Camera plugin for ARGUS API

NVIDIA Proprietary Plugin	Description
nvvidconv	Video format conversion & scaling
nvcompositor	Video compositor
nveglstreamsrc	Acts as Gstreamer Source Component, accepts EGLStream from EGLStream producer
nvvideosink	Video Sink Component. Accepts YUV-I420 format and produces EGLStream (RGBA)
nvegltransform	Video transform element for NVMM to EGLImage (supported with nvegllessink only)

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

JPEG	Description
nvjpegenc	JPEG encoder element
nvjpegdec	JPEG decoder element

#### 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> ! \
  qtdemux 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> ! \
  qtdemux 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> ! \
  qtdemux 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)

```
gst-launch-1.0 filesrc location=<filename.mp4> ! \
  qtdemux name=demux demux.video_0 ! queue ! mpeg4videoparse ! \
  omxmpeg4videodec ! nveglglessink -e
```

## Image Decode

```
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)

```
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)

```
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)

```
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)

```
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

```
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)

```
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)

```
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)

```
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

```
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

```
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)

```
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:

Mode	Description
0	Disable
1	Drop 1 in 5 frames
2	Drop 1 in 3 frames
3	Drop 1 in 2 frames
4	Drop 2 in 3 frames

### Set rate control mode

```
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:

Mode	Description
0	Disable
1	Variable bit rate
2	Constant bit rate
3	Variable bit rate with frame skip. The encoder skips frames as necessary to meet the target bit rate.
4	Constant bit rate with frame skip

## Set peak bitrate

```
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:

```
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

```
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:

Mode	Description
0	UltraFastPreset
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

```
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:

Profile	Description
1	Baseline profile
2	Main profile
8	High profile

## Set level

```
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 `bit-packetization=0` configures the network abstraction layer (NAL) packet as macroblock (MB)-based, and `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 `bit-packetization=1` configures the network abstraction layer (NAL) packet as size-based, and `slice-header-spacing=1024` configures each NAL packet as 1024 bytes at maximum.

# CAMERA CAPTURE WITH GSTREAMER-1.0

For `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.

USB Camera Support	Feature
YUV	Preview display
	Image capture (VGA, 640 x 480)
	Video capture (480p, 720p, H.264/H.265/VP9 encode)

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)

**Note:** 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.
#                          // 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=1 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 `nveglglesink` 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
```

## nveglglsink (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:

```
sudo XDG_RUNTIME_DIR=/tmp/xdg weston --idle-time=0 &
```

*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 ! nveglglesink 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> ! \
  qtdemux name=demux ! h264parse ! omxh264dec ! nvdrmvideosink -e
```

## Properties

`nvdrmvideosink` supports the following properties:

Property name	Description
<code>conn_id</code>	Set connector ID for display.
<code>plane_id</code>	Set plane ID.
<code>set_mode</code>	Set default mode (resolution) for playback.

The following command illustrates the use of these properties:

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

```
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:

Input Format	Output Format
NV12	NV12
I420, I420_10LE, I420_12LE	I420, I420_10LE
	RGBA

To scale between NVIDIA formats

- Scale between NVIDIA Formats with the following commands:

```
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:

```
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)

```
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)

```
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)

```
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)

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



```
omxh265enc bitrate=20000000 ! qtmux name=mux ! \
filesink location=<Transcoded_filename.mp4> -e
```

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

```
gst-launch-1.0 filesrc location=<filename.mp4> ! \
  qtdemux 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> ! \
  qtdemux 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> ! \
  qtdemux 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> ! \
  qtdemux 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> ! \
  qtdemux 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 ! \
```

```
nvvidconv ! avenc_mpeg4 bitrate=4000000 ! qtmux name=mux ! \
filesink location=<Transcoded_filename.mp4> -e
```

## 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

```
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
```

### Sample CSI Camera pipeline

```
gst-launch-1.0 nvarguscamerasrc ! \
  'video/x-raw(memory:NVMM), width=(int)3840, height=(int)2160, \
  format=(string)NV12, framerate=(fraction)30/1' ! \
  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.

Flip Method	Property value
identity - no rotation (default)	0
counterclockwise - 90 degrees	1
rotate - 180 degrees	2
clockwise - 90 degrees	3
horizontal flip	4
upper right diagonal flip	5
vertical flip	6

Flip Method	Property value
upper-left diagonal	7

**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.

```
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:

```
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:

```
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:

```
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 \
```

```

sink_0::height=1080 sink_1::xpos=0 sink_1::ypos=0 \
sink_1::width=1600 sink_1::height=1024 sink_2::xpos=0 \
sink_2::ypos=0 sink_2::width=1366 sink_2::height=768 \
sink_3::xpos=0 sink_3::ypos=0 sink_3::width=1024 \
sink_3::height=576 ! nvoverlaysink display-id=1 \
filesrc location=<filename_h264_1080p_30fps.mp4> ! qtdemux ! \
h264parse ! omxh264dec ! comp. filesrc \
location=< filename_h265_1080p_30fps.mp4> ! qtdemux ! h265parse ! \
\
omxh265dec ! comp. filesrc \
location=< filename_vp8_1080p_30fps.webm> matroskademux ! \
omxvp8dec ! \
comp. filesrc location=<filename_vp9_1080p_30fps.webm> ! \
matroskademux ! omxvp9dec ! comp. -e

```

## 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.

Interpolation Method	Property Value
nearest	0
bilinear	1
5-Tap	2
10-Tap	3
smart (default)	4
Nicest	5

### 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:

```

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, \
height=720' ! nvoverlaysink -e

```

## EGLSTREAM PRODUCER EXAMPLE

The NVIDIA-proprietary `nveglstreamsrc` and `nvvideosink` 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 ! \
  'video/x-raw(memory:NVMM), width=(int)1280, height=(int)720, \
  format=(string)NV12' ! nvegltransform ! nveglglessink -e
```

# GSTREAMER BUILD INSTRUCTIONS

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:

```
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:

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

2. Export environment variables with the following command:

```
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:

```
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:

```
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:

```
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:

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

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

```
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:

```
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:

```
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:

```
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:

```
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:

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

The `nvidia gstreamer-1.0` libraries include:

```
libgstnvarguscamera.so
libgstnveglglessink.so
libgstnveglstreamsrc.so
libgstnvegltransform.so
libgstnvivafilter.so
libgstnvvidconv.so
libgstnvvideosink.so
libnvgstjpeg.so
libgstomx.so
```

# NVGSTCAPTURE-1.0 OPTION REFERENCE

This section describes the options available in the `nvgstcapture-1.0` application.

**Note:** `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.

Application Options		
Option	Description	Notes
<code>--prev_res</code>	Preview width and height, Range: 2 to 8 (3840x2160), e.g., <code>--prev_res=3</code>	-
<code>--cus-prev-res</code>	Custom preview width and height for CSI only, e.g., <code>--cus-prev-res=1920x1080</code>	-
<code>--image_res</code>	Image width and height, Range: 2 to 12 (5632x4224), e.g., <code>--image_res=3</code>	-
<code>--video-res</code>	Video width and height. Range: 2 to 9 (3896x2192) e.g., <code>--video-res=3</code>	-

Application Options		
Option	Description	Notes
--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		
Option	Description	Notes
--display-id	[For nvoverlaysink only] Display ID value	-
--overlayConfig	Overlay Configuration Options index and coordinates in (index, x_pos, y_pos, width, height) order	--overlayConfig="0, 0, 0, 1280, 720"
Help Options		
Option	Description	Notes
-h, --help	Show help options.	-
--help-all	Show all help options.	-
--help-gst	Show Gstreamer options.	-

## 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.

Command	Description	Notes
h	Help	-
q	Quit	-

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

Command	Description	Notes
gpcr	Get preview resolution	-
gicr	Get image capture resolution	-
gvcr	Get video capture resolution	-

## USB CAMERA RUNTIME COMMANDS

### USB Camera Runtime Commands

USB camera runtime commands are described in the following table.

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

Command	Description	Notes
br:<value>	Set encoding bit rate (in bytes)	e.g., br:4000000
gbr	Get encoding bit rate	-
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.

Command	Description	Notes
br:<val>	Sets encoding bit-rate (in bytes)	Example: br:4000000
gbr	Gets encoding bit-rate (in bytes)	-
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.

# VIDEO ENCODER FEATURES

The Gstreamer-1.0-based gst-omx video encoders support the following features, respectively:

Video Encoder Feature	H264enc	H265enc	Vp9enc
profile (Baseline / Main / High)	✓ (all)	✓ (Main)	✓
level	✓	✓	-
bitrate	✓	✓	✓
peak bitrate	✓	✓	-
stringent bitrate	✓	✓	-
insert-spsppsatidr	✓	✓	✓
control-rate	✓	✓	✓
iframeinterval	✓	✓	✓
qp-range	✓	✓	✓
temporal-tradeoff	✓	✓	✓
bit-packetization	✓	✓	✓
preset-level	✓	✓	✓
low-latency	✓	✓	✓
slice-header spacing	✓	✓	-
force-IDR	✓	✓	✓

Video Encoder Feature	H264enc	H265enc	Vp9enc
vbv-size	✓	✓	✓
sliceintrarefreshenable	✓	✓	-
sliceintrarefreshinterval	✓	✓	-
EnableTwoPassCBR	✓	✓	✓
num-B-Frames	✓	-	-

# SUPPORTED CAMERAS

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)  
<http://www.logitech.com/en-in/product/hd-pro-webcam-c920>

## INDUSTRIAL CAMERA DETAILS

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

- ▶ See3CAM\_CU130  
<http://www.e-consystems.com/UltraHD-USB-Camera.asp>

- 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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