



# JETSON TK1/TEGRA LINUX DRIVER PACKAGE MULTIMEDIA USER GUIDE

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## DOCUMENT CHANGE HISTORY

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Version	Date	Authors	Description of Change
v1.0	10 June 2014	mzensius	Initial release.
v1.1	25 June 2014	mzensius	Corrections to Video Format conversions.
v1.2	8 July 2014	mzensius	Converted to non-confidential document.

## TABLE OF CONTENTS

<b>Jetson TK1/Tegra Linux Driver Package Multimedia User Guide .....</b>	<b>1</b>
Gstreamer Installation and Setup .....	2
Decode Examples Using gst-launch-0.10 .....	4
Audio Decode Examples .....	5
Video Decode Examples .....	6
Encode Examples Using gst-launch-0.10 .....	7
Audio Encode Examples .....	8
Video Encode Examples .....	9
Camera Capture .....	10
Video Playback .....	11
Video Format Conversion .....	12
raw-yuv Input Formats .....	13
raw-gray Input Formats .....	14
raw-yuv Output Formats .....	15
raw-gray Output Formats .....	16
RGB Output Formats .....	17
Video Scaling .....	18
raw-yuv Input Formats .....	19
raw-gray Input Formats .....	20
raw-yuv Output Formats .....	21
raw-gray Output Formats .....	22
RGB Output Formats .....	23
NVIDIA Input and Output Formats .....	24
Video Transcode .....	25

# JETSON TK1/TEGRA LINUX DRIVER PACKAGE MULTIMEDIA USER GUIDE

This document is a user guide for the Gstreamer v0.10-based accelerated solution included in NVIDIA® Tegra® Linux Driver Package for Ubuntu Linux 14.04 on the Jetson TK1 platform.

This document contains the following sections:

- ▶ [Gstreamer-0.10 Installation and Setup](#)
- ▶ [Decode Examples Using gst-launch-0.10](#)
- ▶ [Encode Examples Using gst-launch-0.10](#)
- ▶ [Camera Capture](#)
- ▶ [Video Playback](#)
- ▶ [Video Format Conversion](#)
- ▶ [Video Scaling](#)
- ▶ [Video Transcode](#)

## GSTREAMER INSTALLATION AND SETUP

This section describes how to install and configure Gstreamer v0.10.

### To install Gstreamer

- Install Gstreamer on the Jetson TK1 platform with the following command:

```
$ sudo apt-get install gstreamer-tools gstreamer0.10-alsa
gstreamer0.10-plugins-base gstreamer0.10-plugins-good
gstreamer0.10-plugins-bad gstreamer0.10-plugins-ugly gstreamer0.10-
ffmpeg
```

### To check the Gstreamer version

- Check the Gstreamer version with the following command:

```
$ gst-inspect-0.10 -version
```



**Note:** Gstreamer version 0.10 plugins are included pre-installed in Linux for Tegra (L4T) R19.3 release package for Jetson TK1.

Gstreamer version 0.10 includes the following gst-openmax video decoders:

Video Decoder	Description
nv_omx_h264dec	OpenMAX IL H.264/AVC video decoder
nv_omx_mpeg4dec	OpenMAX IL MPEG-4 video decoder
nv_omx_vp8dec	OpenMAX IL VP8 video decoder
nv_omx_h263dec	OpenMAX IL H.263 video decoder

Gstreamer version 0.10 includes the following gst-openmax video encoders:

Video Encoders	Description
nv_omx_h264enc	OpenMAX IL H.264/AVC video encoder
nv_omx_vp8enc	OpenMAX IL VP8 video encoder

Gstreamer version 0.10 includes the following gst-openmax video sinks:

Video Sink	Description
nv_omx_videosink	OpenMAX IL videosink element
nv_omx_hdmi_videosink	OpenMAX IL HDMI videosink element

Gstreamer version 0.10 includes the following gst-openmax audio decoders:

Audio Decoder	Description
nv_omx_aacdec	OpenMAX IL AAC audio decoder
nv_omx_mp3dec	OpenMAX IL MP3 audio decoder

## DECODE EXAMPLES USING GST-LAUNCH-0.10

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

## Audio Decode Examples

The following examples show how you can perform audio decode.

### AAC Decode (NVIDIA-accelerated decode)

```
$ gst-launch-0.10 filesrc location=<filename.mp4> ! qtdemux name=demux  
demux.audio_00 ! queue ! nv_omx_aacdec ! alsasink -v -e
```

### AAC Decode (OSS software decode)

```
$ gst-launch-0.10 filesrc location=<filename.mp4> ! qtdemux name=demux  
demux.audio_00 ! queue ! ffdec_aac ! alsasink -v -e
```

### AMR-WB Decode (OSS software decode)

```
$ gst-launch-0.10 filesrc location=<filename.mp4> ! qtdemux name=demux  
demux.audio_00 ! queue ! ffdec_amrwb ! audioconvert ! alsasink -v -e
```

### AMR-NB Decode (OSS software decode)

```
$ gst-launch-0.10 filesrc location=<filename.mp4> ! qtdemux name=demux  
demux.audio_00 ! queue ! ffdec_amrnb ! audioconvert ! alsasink -v -e
```

### MP3 Decode (NVIDIA-accelerated decode)

```
$ gst-launch-0.10 filesrc location=<filename.mp3> ! mpegaudioparse !  
ffdec_mp3 ! audioconvert ! alsasink -v -e
```



**Note:** To route audio over HDMI, set the alsasink property device to **aux\_plug**.



## Video Decode Examples

The following examples show how you can perform video decode.

### H.264 Decode (NVIDIA accelerated decode)

```
$ gst-launch-0.10 filesrc location=<filename.mp4> ! qtdemux name=demux
demux.video_00 ! queue ! nv_omx_h264dec ! nv_omx_hdmi_videosink -v -e
```

### VP8 Decode (NVIDIA accelerated decode)

```
$ gst-launch-0.10 filesrc location=<filename.mp4> ! qtdemux name=demux
demux.video_00 ! queue ! nv_omx_vp8dec ! nv_omx_hdmi_videosink -v -e
```

### MPEG-4 Decode (NVIDIA accelerated decode)

```
$ gst-launch-0.10 filesrc location=<filename.mp4> ! qtdemux name=demux
demux.video_00 ! queue ! nv_omx_mpeg4dec ! nv_omx_hdmi_videosink -v -e
```

### Image Decode

```
$ gst-launch-0.10 filesrc location=<filename.jpg> ! nvjpegdec ! freeze
! xvimagesink -v -e
```

## ENCODE EXAMPLES USING GST-LAUNCH-0.10

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

## Audio Encode Examples

The following examples show how you can perform audio encode.

### AAC Encode (OSS software encode)

```
$ gst-launch-0.10 audiotestsrc ! 'audio/x-raw-int, rate=(int)44100, channels=(int)2' ! ffenc_aac ! qtmux ! filesink location=test.mp4 -v -e
```

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

```
$ gst-launch-0.10 audiotestsrc ! 'audio/x-raw-int, rate=(int)16000, channels=(int)1' ! voamrbenc ! qtmux ! filesink location=test.mp4 -v -e
```

## Video Encode Examples

The following examples show how you can perform video encode.

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

```
$ gst-launch-0.10 videotestsrc ! 'video/x-raw-yuv, width=(int)1280, height=(int)720, format=(fourcc)I420' ! nv_omx_h264enc ! qtmux ! filesink location=test.mp4 -v -e
```

### VP8 Encode (NVIDIA accelerated encode)

```
gst-launch-0.10 videotestsrc ! 'video/x-raw-yuv, width=(int)1280, height=(int)720, format=(fourcc)I420' ! nv_omx_vp8enc ! qtmux ! filesink location=test.mp4 -v -e
```

### MPEG-4 Encode (OSS software encode)

```
$ gst-launch-0.10 videotestsrc ! 'video/x-raw-yuv, width=(int)1280, height=(int)720, format=(fourcc)I420' ! ffenc_mpeg4 ! qtmux ! filesink location=test.mp4 -v -e
```

### Image Encode

```
$ gst-launch-0.10 videotestsrc num-buffers=1 ! 'video/x-raw-yuv, width=(int)1280, height=(int)720, format=(fourcc)I420' ! nvjpegenc ! filesink location=test.jpg -v -e
```

## CAMERA CAPTURE

The default image capture application in the R19.3 release is `nvgstcapture-0.10`. For usage information enter the following command:

```
$ nvgstcapture-0.10 --help
```

The `nvgstcapture-0.10` 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/VP8 encode)
MJPEG	Preview display
	Image capture VGA, 640 x 480 720p, 1280 x 720
	Video capture (480p, 720p, 1080p, MJPEG encode)

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

```
$ gst-launch-0.10 v4l2src device="/dev/video0" ! "video/x-raw-yuv, width=640, height=480, format=(fourcc)I420" ! xvimagesink -v -e
```

## VIDEO PLAYBACK

The default playback application in the R19.3 release is `nvgstplayer-0.10`. For usage information enter the following command:

```
$ nvgstplayer-0.10 --help
```

Video can be output to HD displays using the HDMI connector on the Jetson TK1 platform. The `gst-launch-0.10` application supports currently the following video sinks:

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

```
$ gst-launch-0.10 filesrc location=<filename.mp4> ! qtdemux name=demux  
demux.video_00 ! queue ! nv_omx_h264dec ! nv_omx_hdmi_videosink -v -e
```

### Xvimagesink (Windowed video playback)

```
$ gst-launch-0.10 filesrc location=<filename.mp4> ! qtdemux name=demux  
demux.video_00 ! queue ! nv_omx_h264dec ! 'video/x-nv-yuv' ! nvvidconv  
! xvimagesink -v -e
```

## VIDEO FORMAT CONVERSION

The NVIDIA proprietary `nvvidconv` gstreamer-0.10 plug-in allows you to convert 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 following raw-yuv input formats: I420, YV12, YUY2, UYVY, YUYU, Y444, and NV12.

### Converting raw-yuv to nv-yuv

```
$ gst-launch-0.10 videotestsrc ! 'video/x-raw-yuv, width=(int)1280, height=(int)720, format=(fourcc)YUY2' ! nvvidconv ! 'video/x-nv-yuv' ! nv_omx_h264enc ! qtmux ! filesink location=test.mp4 -v -e
```

### Converting raw-yuv to nvrnm-yuv

```
$ gst-launch-0.10 videotestsrc ! 'video/x-raw-yuv, width=(int)1280, height=(int)720, format=(fourcc)YUY2' ! nvvidconv ! 'video/x-nv-yuv' ! nv_omx_h264enc ! qtmux ! filesink location=test.mp4 -v -e
```



## raw-gray Input Formats

Currently `nvvidconv` supports the GRAY8 raw-gray input format.

### Converting raw-gray to nv-yuv

```
$ gst-launch-0.10 videotestsrc num-buffers=300 ! 'video/x-raw-gray,
bpp=(int)8, depth=(int)8, width=(int)640, height=(int)480,
framerate=(fraction)30/1' ! nvvidconv ! 'video/x-nv-yuv,
format=(fourcc)I420' ! nv_omx_h264enc ! qtmux ! filesink
location=test.mp4 -v -e
```

### Converting raw-gray to nvrn-yuv

```
$ gst-launch-0.10 videotestsrc num-buffers=300 ! 'video/x-raw-gray,
bpp=(int)8, depth=(int)8, width=(int)640, height=(int)480,
framerate=(fraction)30/1' ! nvvidconv ! 'video/x-nvrn-yuv,
format=(fourcc)I420' ! nv_omx_h264enc ! qtmux ! filesink
location=test.mp4 -v -e
```

## raw-yuv Output Formats

Currently `nvvidconv` supports the following raw-yuv output formats: I420, YUY2, UYVY, and YVYU.

### Converting nv-yuv to raw-yuv

```
$ gst-launch-0.10 filesrc location=640x480_30p.mp4 ! qtdemux name=demux  
! nv_omx_h264dec ! 'video/x-nv-yuv' ! nvvidconv ! xvimagesink -v -e
```

### Converting nvrm-yuv to raw-yuv

```
$ gst-launch-0.10 filesrc location=640x480_30p.mp4 ! qtdemux name=demux  
! nv_omx_h264dec ! 'video/x-nvrm-yuv' ! nvvidconv ! 'video/x-raw-yuv,  
format=(fourcc)UYVY' ! xvimagesink -v -e
```

## raw-gray Output Formats

Currently `nvvidconv` supports the GRAY8 raw-gray output format.

### Converting nv-yuv to raw-gray

```
$ gst-launch-0.10 filesrc location=640x480_30p.mp4 ! qtdemux name=demux  
! nv_omx_h264dec ! 'video/x-nv-yuv' ! nvvidconv ! 'video/x-raw-gray' !  
ffmpegcolorspace ! xvimagesink -v -e
```

### Converting nvrn-yuv to raw-gray

```
gst-launch-0.10 filesrc location=640x480_30p.mp4 ! qtdemux name=demux !  
nv_omx_h264dec ! 'video/x-nvrn-yuv' ! nvvidconv ! 'video/x-raw-gray' !  
ffmpegcolorspace ! xvimagesink -v -e
```

## RGB Output Formats

Currently `nvvidconv` supports the following RGB output formats: BGRA, RGBA, BGRx, and RGBx.

### Converting nv-yuv to raw-rgb

```
$ gst-launch-0.10 filesrc location=640x480_30p.mp4! qtdemux name=mux !  
nv_omx_h264dec ! 'video/x-nv-yuv' ! nvvidconv ! ximagesink -v -e
```

### Converting nvrm-yuv to raw-rgb

```
$ gst-launch-0.10 filesrc location=640x480_30p.mp4! qtdemux name=mux !  
nv_omx_h264dec ! 'video/x-nvrm-yuv' ! nvvidconv ! ximagesink -v -e
```

## VIDEO SCALING

The NVIDIA proprietary `nvvidconv` gstreamer-0.10 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 following raw-yuv input formats for scaling: I420, YUY2, UYVY, YVYU, Y444, and NV12.

### Converting raw-yuv to nv-yuv with scaling

```
$ gst-launch-0.10 videotestsrc ! 'video/x-raw-yuv, width=(int)1280, height=(int)720, format=(fourcc)I420' ! nvvidconv ! 'video/x-nv-yuv, width=(int)640, height=(int)480' ! nv_omx_h264enc ! qtmux ! filesink location=test.mp4 -v -e
```

### Converting raw-yuv to nvrn-yuv with scaling

```
$ gst-launch-0.10 videotestsrc ! 'video/x-raw-yuv, width=(int)1280, height=(int)720, format=(fourcc)NV12' ! nvvidconv ! 'video/x-nvrn-yuv, width=(int)640, height=(int)480' ! nv_omx_h264enc ! qtmux ! filesink location=test.mp4 -v -e
```

## raw-gray Input Formats

Currently `nvvidconv` supports the GRAY8 raw-gray input format for scaling.

### Converting raw-gray to nv-yuv with scaling

```
$ gst-launch-0.10 videotestsrc num-buffers=300 ! 'video/x-raw-gray,
bpp=(int)8, depth=(int)8, width=(int)1280, height=(int)720,
framerate=(fraction)30/1' ! nvvidconv ! 'video/x-nv-yuv,
width=(int)640, height=(int)480, format=(fourcc)I420' ! nv_omx_h264enc
! qtmux ! filesink location=test.mp4 -v -e
```

### Converting raw-gray to nvrm-yuv with scaling

```
$ gst-launch-0.10 videotestsrc num-buffers=300 ! 'video/x-raw-gray,
bpp=(int)8, depth=(int)8, width=(int)1920, height=(int)1080,
framerate=(fraction)30/1' ! nvvidconv ! 'video/x-nvrm-yuv,
width=(int)640, height=(int)480, format=(fourcc)I420' ! nv_omx_h264enc
! qtmux ! filesink location=test.mp4 -v -e
```

## raw-yuv Output Formats

Currently `nvvidconv` supports the following raw-yuv output formats for scaling: I420, YUY2, UYVY, and YVYU.

### Converting nv-yuv to raw-yuv with scaling

```
$ gst-launch-0.10 filesrc location=1280x720_30p.mp4 ! qtdemux
name=demux ! nv_omx_h264dec ! 'video/x-nv-yuv' ! nvvidconv ! 'video/x-
raw-yuv, width=(int)640, height=(int)480, format=(fourcc)YUY2' !
xvimagesink -v -e
```

### Converting nvrn-yuv to raw-yuv with scaling

```
$ gst-launch-0.10 filesrc location=1280x720_30p.mp4 ! qtdemux
name=demux ! nv_omx_h264dec ! 'video/x-nvrn-yuv' ! nvvidconv !
'video/x-raw-yuv, width=(int)640, height=(int)480, format=(fourcc)UYVY'
! xvimagesink -v -e
```



## raw-gray Output Formats

Currently `nvvidconv` supports the GRAY8 raw-gray output format for scaling.

### Converting nv-yuv to raw-gray with scaling

```
$ gst-launch-0.10 filesrc location=1280x720_30p.mp4 ! qtdemux
name=demux ! nv_omx_h264dec ! 'video/x-nv-yuv' ! nvvidconv ! 'video/x-
raw-gray, bpp=(int)8, depth=(int)8, width=(int)320, height=(int)240' !
ffmpegcolorspace ! xvimagesink -v -e
```

### Converting nvrn-yuv to raw-gray

```
$ gst-launch-0.10 filesrc location=1280x720_30p.mp4 ! qtdemux
name=demux ! nv_omx_h264dec ! 'video/x-nvrn-yuv' ! nvvidconv !
'video/x-raw-gray, bpp=(int)8, depth=(int)8, width=(int)640,
height=(int)480' ! ffmpegcolorspace ! xvimagesink -v -e
```

## RGB Output Formats

Currently `nvvidconv` supports the following RGB output formats for scaling: BGRA, RGBA, BGRx, and RGBx.

### Converting nv-yuv to raw-rgb with scaling

```
$ gst-launch-0.10 filesrc location=1280x720_30p.mp4! qtdemux name=mux !  
nv_omx_h264dec ! 'video/x-nv-yuv' ! nvvidconv ! 'video/x-raw-rgb,  
width=(int)640, height=(int)480' ! ximagesink -v -e
```

### Converting nvrn-yuv to raw-rgb

```
$ gst-launch-0.10 filesrc location=1280x720_30p.mp4! qtdemux name=mux !  
nv_omx_h264dec ! 'video/x-nvrn-yuv' ! nvvidconv ! 'video/x-raw-rgb,  
width=(int)640, height=(int)480' ! ximagesink -v -e
```

## NVIDIA Input and Output Formats

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

Format	Description
NV12	NVIDIA <code>gst-openmax</code> decoder output format.
I420	NVIDIA <code>gst-openmax</code> encoder input format.

### Scaling nv-yuv

```
$ gst-launch-0.10 filesrc location=1280x720_30p.mp4 ! qtdemux name=mux
! nv_omx_h264dec ! 'video/x-nv-yuv' ! nvvidconv ! 'video/x-nv-yuv,
width=640, height=480' ! nv_omx_h264enc ! qtmux ! filesink
location=test.mp4 -v -e
```

### Converting nv-yuv to nvrn-yuv with scaling

```
$ gst-launch-0.10 filesrc location=1280x720_30p.mp4 ! qtdemux name=mux
! nv_omx_h264dec ! 'video/x-nv-yuv' ! nvvidconv ! 'video/x-nvrn-yuv,
width=640, height=480' ! nv_omx_h264enc ! qtmux ! filesink
location=test.mp4 -v -e
```

### Scaling nvrn-yuv

```
$ gst-launch-0.10 filesrc location=1280x720_30p.mp4 ! qtdemux name=mux
! nv_omx_h264dec ! 'video/x-nvrn-yuv' ! nvvidconv ! 'video/x-nvrn-yuv,
width=640, height=480' ! nv_omx_h264enc ! qtmux ! filesink
location=test.mp4 -v -e
```

### Converting nvrn-yuv to nv-yuv with scaling

```
$ gst-launch-0.10 filesrc location=1280x720_30p.mp4 ! qtdemux name=mux
! nv_omx_h264dec ! 'video/x-nvrn-yuv' ! nvvidconv ! 'video/x-nv-yuv,
width=640, height=480' ! nv_omx_h264enc ! qtmux ! filesink
location=test.mp4 -v -e
```

## VIDEO TRANSCODE

You can perform video transcoding between the following video formats.

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

```
$ gst-launch filesrc location=<filename.mp4> ! qtdemux name=demux
demux.video_00 ! queue ! nv_omx_h264dec ! nv_omx_vp8enc ! qtmux
name=mux ! filesink location=<Transcoded_filename.mp4> demux.audio_00 !
queue ! aacparse ! mux.audio_00 -v -e
```

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

```
$ gst-launch filesrc location=<filename.mp4> ! qtdemux name=demux
demux.video_00 ! queue ! nv_omx_vp8dec ! nv_omx_h264enc ! qtmux
name=mux ! filesink location=<Transcoded_filename.mp4> demux.audio_00 !
queue ! aacparse ! mux.audio_00 -v -e
```

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

```
$ gst-launch filesrc location=<filename.mp4> ! qtdemux name=demux
demux.video_00 ! queue ! nv_omx_mpeg4dec ! nv_omx_vp8enc ! qtmux
name=mux ! filesink location=<Transcoded_filename.mp4> demux.audio_00 !
queue ! aacparse ! mux.audio_00 -v -e
```

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

```
$ gst-launch filesrc location=<filename.mp4> ! qtdemux name=demux
demux.video_00 ! queue ! nv_omx_mpeg4dec ! nv_omx_h264enc ! qtmux
name=mux ! filesink location=<Transcoded_filename.mp4> demux.audio_00 !
queue ! aacparse ! mux.audio_00 -v -e
```

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

```
$ gst-launch filesrc location=<filename.mp4> ! qtdemux name=demux
demux.video_00 ! queue ! nv_omx_h264dec ! ffenc_mpeg4 ! qtmux
name=mux ! filesink location=<Transcoded_filename.mp4> demux.audio_00 !
queue ! aacparse ! mux.audio_00 -v -e
```

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

```
gst-launch filesrc location=<filename.mp4> ! qtdemux name=demux
demux.video_00 ! queue ! nv_omx_vp8dec ! ffenc_mpeg4 ! qtmux
name=mux ! filesink location=<Transcoded_filename.mp4> demux.audio_00 !
queue ! aacparse ! mux.audio_00 -v -e
```

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

```
$ gst-launch filesrc location=<filename.mp4> ! qtdemux name=demux
demux.video_00 ! queue ! nv_omx_h264dec ! theoraenc ! oggmux
name=mux ! filesink location=<Transcoded_filename.ogg> demux.audio_00 !
queue ! faad ! audioconvert ! vorbisenc ! mux. -v -e
```

### VP8 Decode to Theora Encode (NVIDIA-accelerated decode to OSS software encode)

```
$ gst-launch filesrc location=<filename.mp4> ! qtdemux name=demux
demux.video_00 ! queue ! nv_omx_vp8dec ! theoraenc ! oggmux
name=mux ! filesink location=<Transcoded_filename.ogg> demux.audio_00 !
queue ! faad ! audioconvert ! vorbisenc ! mux. -v -e
```

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

```
$ gst-launch filesrc location=<filename.mp4> ! qtdemux name=demux
demux.video_00 ! queue ! nv_omx_mpeg4dec ! theoraenc ! oggmux
name=mux ! filesink location=<Transcoded_filename.ogg> demux.audio_00 !
queue ! faad ! audioconvert ! vorbisenc ! mux. -v -e
```

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