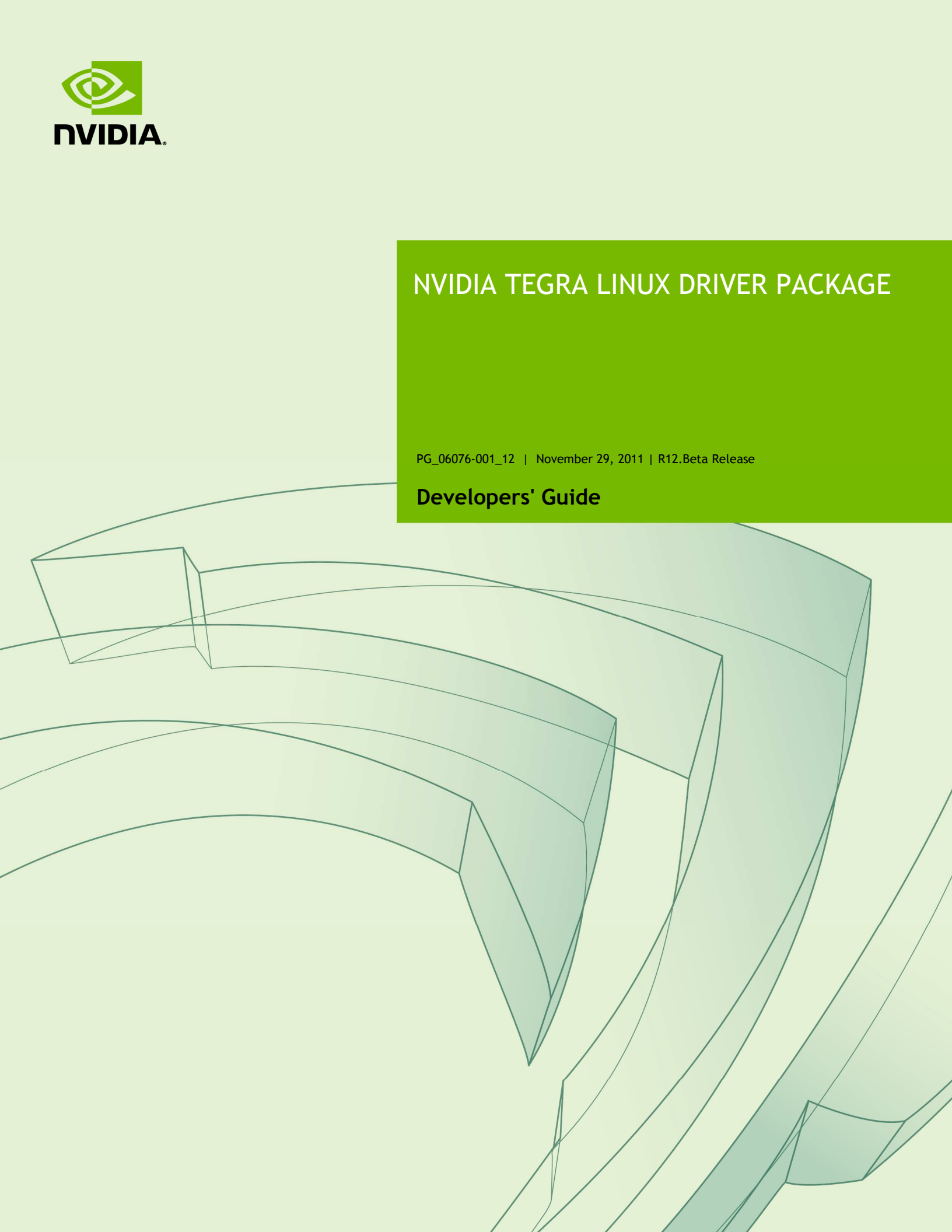

NVIDIA TEGRA LINUX DRIVER PACKAGE

PG_06076-001_12 | November 29, 2011 | R12.Beta Release

Developers' Guide

Note: Apparent hyperlinks in this document are a legacy of the HTML version and may not operate as expected in the PDF version.

Overview

Welcome to *NVIDIA Tegra Linux Driver Package Developers' Guide*. Engineers can use this document to learn about working with NVIDIA® Tegra® Linux Driver Package (sometimes referred to as **Linux for Tegra**).

> **Important**: This documentation is preliminary and subject to change. Please see your customer engineer for additional information and to request documentation updates.

Read the following sections to get started using NVIDIA® Tegra® Linux Driver Package.

- Package Manifest—describes the top level directories and files installed when expanding the release tar file.
- Getting Started—provides requirements and set up information to help you get started using the package.
- Software Features—describes the software features supported by the release.
- Licenses—provides license information for Tegra and 3rd-party software.
- Glossary—provides definitions of key terms.

Package Manifest

The NVIDIA® Tegra® Linux Driver Package is provided in the following tar file:

`Tegra-Linux-R12.beta.1.0.tbz2`

The following table lists the top level directories and files that are created when you expand the tar file.

Filename	Description
./rootfs	Directory containing `README.txt`.
./rootfs/README.txt	This file explains how to copy the sample filesystem here.
./kernel	-
./bootloader	-
./bootloader/<platform>	-
./bootloader/<platform>/BCT	-
./bootloader/<platform>/cfg	-
./nv_tegra	-
./nv_tegra/x	-
./apply_binaries.sh	A script to apply `nv_tegra` components.
./flash.sh	A script that flashes the boot loader and kernel from the package.

Note: The `<platform>` in `/bootloader/<platform>` specifies the development system. For Tegra 2 series code-name “harmony” or “ventana”, for Tegra 3 series code-name “cardhu”.

Documentation

Tegra Linux Driver Package also includes the following documentation:

- Tegra_Linux_Driver_Package_Release_Notes_<ver>.pdf
- Tegra_Linux_Driver_Package_Documents_<ver>.tar

  Where <ver> is the version of the release, such as R12.Beta.

Section Overview

This section provides information about the contents of the tar file in the Tegra Linux Driver Package and includes the following topics:

Kernel

This section describes the major components included in the `./kernel` directory.

Filename	Description
./install_3rdparty.sh	A script to download the CodeSourcery toolchain to the local computer.
./zImage	A kernel binary image.
./kernel_sync.sh	A script to download the source code that the kernel binary image was built from.
./LICENSE	A license file for "GNU GENERAL PUBLIC LICENSE".
./kernel_supplements.tbz2	Loadable kernel modules specific to the kernel def-config enabled for the device.

Boot Loader

This section describes the files provided in the `./bootloader` directory.

Filename	Description
./mkbootimg	A tool used for img creation.
Applies to: Harmony only: ./mkyaffs2image	A tool used for NAND file system creation
./nvflash	The NVIDIA flashing tool.
Applies to: Harmony only: ./LICENSE	A license file for "GNU GENERAL PUBLIC LICENSE".
./LICENSE.mkbootimg	A license file for the mkbootimg tool.
./<platform>	<platform> specifies the development system, either harmony or ventana for Ventana T2T, or cardhu for Ventana T3T devices.
./<platform>/fastboot.bin	The bootloader binary file.
./<platform>/BCT/cardhu_12Mhz_H5TC2G83BFR_333Mhz_1GB_emmc_SDIN5C2-16G_x8.bct	BCT for Cardhu.
./<platform>/BCT/E1186_Hynix_1GB_H5TC2G83BFR-PBA_375MHz_110622_sdmmc4_x8.bct	BCT for Cardhu.

./<platform>/BCT/ventana_A03_12MHz_EDB8132B1PB6DF_300Mhz_1GB_emmc_THGBM1G6D4EBAI4.bct	BCT for Ventana.
./<platform>/BCT/harmony_12Mhz_H5PS1G83EFR-S5C_150Mhz_512MB_2K8Nand_HY27UF084G2B-TP.bct	BCT for Harmony.
./<platform>/BCT/harmony_12Mhz_H5PS1G83EFR-S5C_150Mhz_512MB_emmc_THGBM1G6D4EBAI4.bct	BCT for Harmony.
./<platform>/BCT/harmony_12Mhz_H5PS1G83EFR-S5C_150Mhz_512MB_emmc_THGBM1G6D4EBAI4_x8.bct	BCT for Harmony.
./<platform>/BCT/harmony_12Mhz_H5PS1G83EFR-S5C_300Mhz_512MB_2K8Nand_HY27UF084G2B-TP.bct	BCT for Harmony.
./<platform>/BCT/harmony_12Mhz_H5PS1G83EFR-S5C_300Mhz_512MB_emmc_THGBM1G6D4EBAI4.bct	BCT for Harmony.
./<platform>/BCT/harmony_12Mhz_H5PS1G83EFR-S5C_300Mhz_512MB_emmc_THGBM1G6D4EBAI4_x8.bct	BCT for Harmony.
./<platform>/BCT/harmony_12Mhz_H5PS1G83EFR-Y5C_150Mhz_1GB_2K8Nand_HY27UF084G2B-TP.bct	BCT for Harmony.
./<platform>/BCT/harmony_12Mhz_H5PS1G83EFR-Y5C_150Mhz_1GB_emmc_THGBM1G6D4EBAI4.bct	BCT for Harmony.
./<platform>/BCT/harmony_12Mhz_H5PS1G83EFR-Y5C_150Mhz_1GB_emmc_THGBM1G6D4EBAI4_x8.bct	BCT for Harmony.
./<platform>/BCT/harmony_12Mhz_H5PS1G83EFR-Y5C_300Mhz_1GB_2K8Nand_HY27UF084G2B-TP.bct	BCT for Harmony.
./<platform>/BCT/harmony_12Mhz_H5PS1G83EFR-Y5C_300Mhz_1GB_emmc_THGBM1G6D4EBAI4.bct	BCT for Harmony.
./<platform>/BCT/harmony_12Mhz_H5PS1G83EFR-Y5C_300Mhz_1GB_emmc_THGBM1G6D4EBAI4_x8.bct	BCT for Harmony.
./<platform>/BCT/harmony_a02_12Mhz_H5PS1G83EFR-S5C_333Mhz_1GB_2K8Nand_HY27UF084G2B-TP.bct	BCT for Harmony.
./<platform>/BCT/harmony_a02_12Mhz_H5PS1G83EFR-S5C_333Mhz_1GB_emmc_THGBM1G6D4EBAI4.bct	BCT for Harmony.
./<platform>/BCT/harmony_a02_12Mhz_H5PS1G83EFR-S5C_333Mhz_1GB_emmc_THGBM1G6D4EBAI4_x8.bct	BCT for Harmony.
./<platform>/BCT/harmony_a02_12Mhz_H5PS1G83EFR-S5C_333Mhz_512MB_2K8Nand_HY27UF084G2B-TP.bct	BCT for Harmony.
./<platform>/BCT/harmony_a02_12Mhz_H5PS1G83EFR-S5C_333Mhz_512MB_emmc_THGBM1G6D4EBAI4.bct	BCT for Harmony.
./<platform>/BCT/harmony_a02_12Mhz_H5PS1G83EFR-S5C_333Mhz_512MB_emmc_THGBM1G6D4EBAI4_x8.bct	BCT for Harmony.
./<platform>/BCT/harmony_a02_12Mhz_H5PS1G83EFR-S6C_333Mhz_1GB_2K8Nand_HY27UF084G2B-TP.bct	BCT for Harmony.
./<platform>/BCT/harmony_a02_12Mhz_H5PS1G83EFR-S6C_333Mhz_1GB_emmc_THGBM1G6D4EBAI4.bct	BCT for Harmony.
./<platform>/BCT/harmony_a02_12Mhz_H5PS1G83EFR-S6C_333Mhz_1GB_emmc_THGBM1G6D4EBAI4_x8.bct	BCT for Harmony.
./<platform>/cfg/gnu_linux_fastboot_emmc_full.cfg	CFG for Cardhu.
./<platform>/cfg/gnu_linux_fastboot_emmc.cfg	CFG for Cardhu.
./<platform>/cfg/gnu_linux_fastboot_emmc_full.cfg	CFG for Harmony.
./<platform>/cfg/gnu_linux_fastboot_microboot_emmc_full.cfg	CFG for Harmony.

./<platform>/cfg/gnu_linux_fastboot_microboot_nand_full.cfg	CFG for Harmony.
./<platform>/cfg/gnu_linux_fastboot_nand.cfg	CFG for Harmony.
./<platform>/cfg/gnu_linux_fastboot_nand_flashboot_full.cfg	CFG for Harmony.
./<platform>/cfg/gnu_linux_fastboot_nand_full.cfg	CFG for Harmony.
./<platform>/cfg/gnu_linux_fastboot_emmc.cfg	CFG for Ventana.
./<platform>/cfg/gnu_linux_fastboot_emmc_full.cfg	CFG for Ventana.

NV Tegra

This section describes the major components included in the `./nvtegra` directory.

Filename	Description
./LICENSE	A license file for the Tegra software license.
./x/tegra_drv.abi5.so	Tegra X driver ABI 5.
./x/tegra_drv.abi6.so	Tegra X driver ABI 6.
./x/tegra_drv.abi7.so	Tegra X driver ABI 7.
./x/tegra_drv.abi8.so	Tegra X driver ABI 8.
./x /tegra_drv.abi10.so	Tegra X driver ABI 10.
./x /tegra_drv.abi11.so	Tegra X driver ABI 11.
./base.tgz	The NVIDIA driver components.

Base TGZ

This section describes the files included in the `./base.tgz` file.

Filename	Description
./etc	-
./etc/wpa_supplicant.conf	Configuration file for wpa_supplicant.
./home	-
./lib	-
./system	-
./usr	-
./etc/X11	-
./etc/X11/xorg.conf	The xorg configuration file.
./home/ubuntu	-
./lib/firmware/	-
./lib/firmware/nvmm_jpegenc.axf	JPEG Encoder. Not included in the base release available through a separate software license agreement.
./lib/firmware/nvmm_manager.axf	Multimedia Manager Kernel driver. Not included in the base release

	available through a separate software license agreement.
./lib/firmware/nvmm_aacdec.axf	AAC decoder. Not included in the base release available through a separate software license agreement.
./lib/firmware/nvmm_adtsdec.axf	ADTS decoder running on AVP. Not included in the base release available through a separate software license agreement.
./lib/firmware/nvmm_mp3dec.axf	MP3 decoder. Not included in the base release available through a separate software license agreement.
./lib/firmware/nvmm_audiomixer.axf	Multimedia audio mixer avp library.
./lib/firmware/nvmm_mpeg4dec.axf	MPEG-4 video decoder. Not included in the base release available through a separate software license agreement.
./lib/firmware/nvrm_avp.bin	AVP kernel firmware.
./lib/firmware/nvmm_h264dec2.axf	H.264 video decoder driver. Not included in the base release available through a separate software license agreement.
./lib/firmware/nvmm_service.axf	NVIDIA multimedia services firmware. Not included in the base release available through a separate software license agreement.
./lib/firmware/nvmm_jpegdec.axf	JPEG image decoder. Not included in the base release available through a separate software license agreement.
./lib/firmware/nvmm_wavdec.axf	WAV decoder. Not included in the base release available through a separate software license agreement.
./lib/firmware/nvrm_avp*.bin	AVP kerenel firmware.
./lib/modules/	-
./usr	-
./usr/lib	-
./usr/lib/xorg	-
./usr/lib/libcgdrv.so	NVIDIA Tegra OpenGL ES 2.0 shader compiler.
./usr/lib/libEGL.so	OpenGL ES driver file.
./usr/lib/libGLESv1_CM.so	OpenGL ES driver file.
./usr/lib/libGLESv2.so	OpenGL ES driver file.
./usr/lib/libKD.so	OpenKODE driver.
./usr/lib/libnvapputil.so	Host (x86) shared object for application utilities.
./usr/lib/libnvcwm.so	Compositing Window Manager library.
./usr/lib/libnvdc.so	DC driver file.
./usr/lib/libnvddk_2d.so	DDK 2D.
./usr/lib/libnvddk_2d_v2.so	DDK 2D.

./usr/lib/libnvddk_disp.so	Display abstraction driver file.
./usr/lib/libnvddk_mipihsi.so	High-speed interface for MIPI.
./usr/lib/libnvddk_misc.so	Low-level user space NVIDIA driver (UART, I²C).
./usr/lib/libnvdioconverter.so	Multimedia DIO converter.
./usr/lib/libnvdispatch_helper.so	NvRM daemon dispatch helper.
./usr/lib/libnvdispmgr_d.so	Display Manager interface.
./usr/lib/libnvdispmgr_impl_do.so	Server-side Display manager driver file.
./usr/lib/libnvflash.so	NvFlash helper library.
./usr/lib/libnvmm_audio.so	Audio codecs and components.
./usr/lib/libnvmm_camera.so	Multimedia camera driver file.
./usr/lib/libnvmm_contentpipe.so	Content pipe implementation (file source abstraction).
./usr/lib/libnvmm_image.so	Image codecs.
./usr/lib/libnvmm_manager.so	Multimedia Manager kernel driver.
./usr/lib/libnvmm_misc.so	Miscellaneous multimedia components.
./usr/lib/libnvmm_parser.so	Parser.
./usr/lib/libnvmm_service.so	Multimedia Framework kernel services HAL.
./usr/lib/libnvmm.so	NVIDIA Multimedia Framework.
./usr/lib/libnvmm_utils.so	Multimedia Framework utilities.
./usr/lib/libnvmm_videorenderer.so	Shared object that delivers video frames to display (internal renderer).
./usr/lib/libnvmm_video.so	NVIDIA Multimedia Framework.
./usr/lib/libnvmm_writer.so	3GP writer block on CPU.
./usr/lib/libnvodm_disp.so	ODM kit display driver.
./usr/lib/libnvodm_dtvtuner.so	Applies to: Ventana and Cardhu releases: Tegra development platform ODM adaptation for digital TV tuner.
./usr/lib/libnvodm_hdmi.so	ODM kit HDMI driver.
./usr/lib/libnvodm_imager.so	Tegra development platform ODM adaptation for imager.
./usr/lib/libnvodm_misc.so	ODM kit.
./usr/lib/libnvodm_query.so	ODM Query interface.
./usr/lib/libnvomxilclient.so	OpenMAX IL client.
./usr/lib/libnvomx.so	OpenMAX IL implementation.
./usr/lib/libnvos.so	NVIDIA OS abstraction library.
./usr/lib/libnvrm_graphics_impl.so	API layer in RM daemon
./usr/lib/libnvrm_graphics.so	Resource Manager (NvRM) graphics host, AVP communication library, and graphics drivers
./usr/lib/libnvrm_impl.so	NvRm.
./usr/lib/libnvrm.so	Resource Manager kernel interface.

./usr/lib/libnvsm.so	NVIDIA shader manager library.
./usr/lib/libnvtestio.so	Target (ARM) shared object for test I/O utilities.
./usr/lib/libnvtestresults.so	Test results shared object.
./usr/lib/libnvtvmr.so	Multimedia Tegra video mixer/renderer.
./usr/lib/libnvwinsys_kd.so	OpenKODE winsys interface.
./usr/lib/libnvwinsys.so	Winsys library.
./usr/lib/libnvwsi.so	NVIDIA windowing system integration for EGL.
./usr/sbin	-
./usr/lib/xorg/modules/drivers	-
./usr/lib/xorg/modules/drivers/tegra_drv.so	Tegra X driver.

Getting Started

This section contains information to help you get started using this pre-release of NVIDIA® Tegra® Linux Driver Package. It covers the following topics:

Requirements

The following lists the requirements to use this Tegra Linux Driver Package release:

- Host PC running Linux. Ubuntu 10.04 is used in examples in this document, but other distributions should also work.
- A kernel image (zImage). Tegra Linux Driver Package does contain a kernel image (zImage), and you can also download and rebuild from source. For more information, see Synchronizing the Kernel Sources and Tool Chain in this guide.
- Fastboot utility. Flashing on Tegra 3 series (code-named Cardhu) and Tegra 2 series (code-named Harmony and code-named Ventana) developer board requires the Fastboot utility, which is included in this release.
- A rootfs device which can be an SD card or a USB stick formatted to EXT3, or it is also possible to use the target device's internal memory, or your Linux Host PC hard-drive through NFS.
- (Cardhu) A USB Micro-B plug to USB Std A female cable to plug into the board's recovery port.
- (Harmony) A mini-B USB male-to-USB Std A female cable to plug into the board's recovery port [J3].
- (Ventana) A USB Micro-B plug to Std A female cable to plug into the board's recovery port [J10].

Boot Options

It is currently possible to boot Tegra Linux Driver Package Tegra 2 series Harmony or Ventana developer board, as well as Tegra 3 series Cardhu with a root file system from:

- USB stick or USB hard disk
- SD card
- eMMC (on Ventana and Cardhu only)
- Network file system (NFS)
- NAND (on Harmony only)

Setting Up Your Environment

The following subsections contain information to help you get started using this pre-release of Tegra Linux Driver Package. They cover the following topics:

Extracting Tegra Linux Driver Package

Note: The procedures in this document assume you extract the release package in ~/.

To extract Tegra Linux Driver Package

- Extract the package manually by executing the following command:

```
$ sudo tar -vxjf Tegra-linux-12.beta.1.0.tbz2
```

Setting Up Your Board

Tegra Linux Driver Package requires a Tegra 2 series developer board (Harmony with a NAND module or Ventana), or a Tegra 3 series (Cardhu) as well as a host PC running Linux. The procedure in this section describes the steps to configure the Tegra 2 series Harmony board. Please consult your board documentation for steps on how to setup and configure your board.

Prerequisites

- You need a USB disk formatted to EXT3. (It can be a memory card with a USB adapter, or a USB key.) You also need a mini-B USB male-to-USB Std A female cable to plug into the board's recovery port [J3].
- In your environment for the developer board:
  - If your developer board is Harmony set:

```
$ export TARGET_BOARD=harmony
```

- If your developer board is Ventana set:

  ```
  $ export TARGET_BOARD=ventana
  ```

- If your developer board is Cardhu set:

  ```
  $ export TARGET_BOARD=cardhu
  ```

To set up your Harmony developer board

1. Connect the power cord to the power jack [J15].
2. Connect a USB cable from the host PC to the recovery port [J3].
3. Connect an RS-232 null-modem cable between the host PC and the UART1 connector.

   The Harmony developer board UART can be found on the satellite board.
4. Open a terminal on the host PC and set it up at:
   - 115200 baud
   - 8-bit
   - Parity none
   - 1 stop bit

Setting Up Your File System

This section describes the steps for setting up your file system. You must set up the root file system and copy the file system to USB disk.

About the Root File System

To replicate the sample file system, the `ttyS0.conf` and `nv.conf` files have been added. Both are accessible from the provided sample file system and are placed in the user-generated file system, should you decide to replicate the rootfs.

The provided sample root file system was created with Rootstock 0.1.99.4 using this command:

```
$ sudo rootstock --fqdn tegra-ubuntu --login ubuntu --password
ubuntu --imagesize 1G -d natty --seed ubuntu-minimal,xserver-
xorg-core,xinit,xterm,alsa-utils,wireless-
tools,wpasupplicant,x11-xserver-utils,openssh-client,openssh-
server
```

This creates a file system with the hostname `tegra-ubuntu`, the username `ubuntu`, and the password `ubuntu`.

We have also made the following changes:

- Added: `/etc/init/{ttyS0.conf, nv*, wpa_supplicant.conf}`
- Modified: `/etc/{init/ssh.conf, X11/Xwrapper.conf, resolve.conf}`
- Deleted: `/etc/ssh/ssh_host_*`

To replicate these changes in your own rootstock file-system, copy or make similar modifications from those files to your own rootstock filesystem.

The following packages are installed by default:

- ubuntu-minimal
- xserver-xorg-core
- x11-xserver-utils
- xinit
- xterm
- alsa-utils
- wireless-tools
- wpasupplicant
- opens-client
- openssh-server

Installing Additional Packages

You may want to install additional packages as described in this section. For example, ssh will be useful if you need remote login.

Prerequisite

You must attach an Ethernet cable to the device through either the Ethernet port (if available) or through the USB Ethernet adaptor, or connect through Wi-Fi if the appropriate driver and firmware are enabled and installed.

To install more packages

1. Boot the target device.
2. Turn on networking by executing:

   ```
   $ sudo dhclient
   ```

3. Install packages using `apt-get`. For example, to install `wget` execute this command:

   ```
   $ sudo apt-get install wget
   ```

Setting Up the Root File System

The next step in booting the target board is to configure the root file system. Follow the procedures in this section to set up the rootfs and to copy the file system to the rootfs device.

Note: The instructions below use the sample file system that is provided by NVIDIA as the base. If you would like to use your own, set the LDK_ROOTFS_DIR environment variable to point to where your rootfs is located and skip Steps 1 and 2.

To set up the rootfs

1. Download the sample rootfs that NVIDIA provided.
2. Extract that rootfs to the rootfs directory included in this package.
3. Run the `apply_binaries.sh` script to copy the NVIDIA user space libraries into the target file system:

   ```
   $ ./apply_binaries.sh
   ```

   If you are using a different rootfs, or if you already have configured your rootfs, you can apply the NVIDIA user space libraries by setting the LDK_ROOTFS_DIR environment variable to point to your rootfs. Then run the script, as shown above, to copy the binaries into your target file system.

   To install a different X driver Application Binary Interface (ABI):

   - Use the `apply_binaries.sh script` and pass the –abi <NUMBER> flag by executing:

     ```
     $ sudo ./apply_binaries.sh –abi <NUMBER>
     ```

     where <NUMBER> is the ABI version to install, either 5, 6, 7, 8, 10, or 11. The ABI default value for the X driver is 'X ABI version 10' and it is the version that works in the provided sample file system. You can find the version to use in the sample file system by following the directions listed below.

   To determine the X driver ABI of the X server used in the root file system:

   - Start X once on the Tegra device.
   - Examine the resulting file `/var/log/Xorg.0.log`, which will contain something like the following:

     ```
     (II) Module ABI versions:
     X.Org ANSI C Emulation: 0.4
     X.Org Video Driver: 8.0
     ```

     The X.Org Video Driver line reports the ABI version. The sample Ubuntu 11.04-based root file system uses X driver ABI 10.
4. Load the target file system that you have generated onto the first partition of a device (either a USB stick, an SD card, or a USB hard drive) and attach that device to the target board.
5. Power on the target board and the image should load.

6. Set up access to the board over a serial port by opening a terminal on the host PC and setting:
   - 115200 baud
   - 8-bit
   - Parity none
   - 1 stop bit

To copy the file system to the external rootfs device

1. Plug your rootfs device into the host PC.
2. Format it with an Ext3 file system and mount it, if necessary. We assume it is mounted to `<mntpoint>`.
3. Copy the file system. If LDK_ROOTFS_DIR is set, execute this command:

   ```
   $ sudo cp -r -p $LDK_ROOTFS_DIR/* <mntpoint>
   ```

   If it is not set, copy the rootfs directory that is included in the release by executing the following command:

   ```
   $ sudo cp -r -p <<LDK-directory>>/rootfs/* <mntpoint>
   ```

Once you have flashed your board, you can then unmount the disk and plug it to the board. For more information about flashing, see the Flashing the Boot Loader and Kernel in this section. For information about plugging in the board, see the hardware documentation for your developer board.

Configuring NFS Root on the Linux Host

To boot the target device from NFS, you must provide an NFS root mount point on your Linux host machine. The procedure in this section describes the basic steps to do so.

Prerequisites

- You must have Ethernet connection to install packages on the host.
- You must have an Ethernet connection on the target, as well.

To configure NFS root on the Linux host

1. Install the `nfs` components on your host machine:

   ```
   $ sudo apt-get install nfs-common nfs-kernel-server
   ```

2. The NFS server needs to know which directories you want to 'export' for clients. This information is specified in the `/etc/exports` file.
   - Modify `/etc/exports` to look somewhat like this:

     ```
     $ /nfsroot
     *(rw,nohide,insecure,no_subtree_check,async,no_root_squash)
     ```

- After adding the entry, restart using the following command:

  ```
  $ sudo /etc/init.d/nfs-kernel-server restart
  ```

3. Create an `/nfsroot` directory on your Linux host machine:

   ```
   $ sudo mkdir /nfsroot
   ```

4. Copy the file system to the `nfsroot` directory:

   ```
   $ cd ./rootfs
   $ sudo tar -cpf - * | ( cd /nfsroot ; sudo tar -xpf - )
   ```

5. Export the root point:

   ```
   $ sudo exportfs -a
   ```

   Alternatively, you can export or unexport all directories by using the -a and -u flags. The following command un-exports all directories:

   ```
   $ sudo exportfs -au
   ```

6. (Optional) If the Ubuntu firewall blocks NFS root access, it must be disabled depending upon your configuration. You can do so with the following command:

   ```
   $ sudo ufw disable
   ```

7. To verify everything is configured properly on a booted target, it should then be possible to mount the NFS root point:

   ```
   $ sudo mount -v -o nfsvers=3 <IP-ADDR>:/nfsroot rootfs
   ```

   Where <IP-ADDR> is the IP address of the Linux Host machine as taken from the 'ifconfig' command.

To boot the target with the NFS root point, see Flashing the Boot Loader and Kernel section and be sure to include the `-N` option for the nfs root point.

Flashing the Boot Loader and Kernel

This section describes the steps that must be taken to boot the target board (Harmony, Ventana, or Cardhu) and provides usage information for the `flash.sh` script.

Flash Procedure

The first step is to flash the board with the boot loader and kernel.

Prerequisites

The following directories must be present:

- /bootloader—boot loader plus flashing tools (NvFlash, CFG, BCTs, etc.)
- /kernel—a kernel zImage plus scripts to sync/build the kernel
- /rootfs—the root filesystem that you download
- /nv_tegra—NVIDIA® Tegra® user space binaries

To flash the boot loader and kernel

1. You must first put the target board into reset/recovery mode. Do so by first powering on the board and then holding the recovery button and pressing the reset button.
2. Now run the `flash.sh` script that is in the top level directory of this release. The script must be supplied with the device name that it will have in the root file system:

   ```
   $ sudo ./flash.sh <target_board> <rootdev>
   ```

   - If the root file system will be on a USB disk, execute the script as follows:

     ```
     $ sudo ./flash.sh <target_board> sda1
     ```

     Otherwise, if the root file system will be on an SD card, execute the script as follows:

     ```
     $ sudo ./flash.sh <target_board> mmcblk0p1
     ```

   Where <target_board> is harmony, ventana, or cardhu depending upon your target device.

   The boot loader and kernel will load.

Flash Script Usage

You can find the most up-to-date usage information by running the `flash.sh` script included in the release. The basic usage information is as follows.

Usage

```
sudo ./flash.sh [options] <target_board> <rootdev>
```

Where you specify the required parameters and one or more of the options shown in the following table.

Parameters	Description	
<target_board>	Is one of harmony, ventana, or cardhu.	
<rootdev>	Is one of following:	
	For Harmony	
	mtdblock1	Specifies internal NAND flash.
	mmcblk0p1	Specifies external SD card or eMMC card without SD card inserted.
	mmcblk1p1	Specifies external eMMC card when SD card is inserted.
	sda1	Specifies external USB device (such as, USB memory stick or HDD).
	usb0	Specifies nfsroot via RJ45 Ethernet port.
	eth0	Specifies nfsroot via external USB Ethernet interface.
	For Ventana	
	mmcblk0p1	Specifies internal eMMC.

	mmcblk1p1	Specifies external SDCARD.
	sda1	Specifies external USB device (such as, USB memory stick or HDD).
	eth0	Specifies nfsroot via external USB Ethernet interface.
	For Cardhu	
	mmcblk0p1	Specifies internal eMMC.
	mmcblk1p1	Specifies external SDCARD.
	sda1	Specifies external USB device (such as, USB memory stick or HDD).
	eth0	Specifies nfsroot via external USB Ethernet interface.

Options	**Description**
-h	Specifies to print this usage information.
-b <bctfile>	Specifies the NvFlash Boot Configuration Table (BCT) file.
-c <cfgfile>	Specifies the NvFlash configuration file.
-k <partition id>	Specifies the kernel partition ID to be updated (minimum = 5).
-n <nfs args>	Specifies the static NFS network assignments: `<Client IP>:<Server IP>:<Gateway IP>:<Netmask>`

-o <odmdata>	Specifies the ODM data value:
	`0x300d8011 (harmony)`
	`0x30098011 (ventana)`
	`0x300d8011 (seaboard)`
	`0x80080105 (Cardhu A01)`
	`0x40080105 (Cardhu A02)`

-t <rootfs type>	Specifies YAFFS2. Valid only for Harmony internal NAND.
-L <bootloader>	Specifies the boot loader, such as fastboot.bin.
-C <cmdline>	Specifies the kernel command line. **Warning**: This manual kernel command line should be *FULL SET*. Upon detecting the manual command line, the boot loader overrides the entire kernel command line with this `<cmdline>` input.
-D <boot Device>	Specifies eMMC or NAND.
-K <kernel>	Specifies the kernel image, such as zImage.
-I <initrd>	Specifies `initrd` file. Null `initrd` is the default.
-R <rootfs dir>	Specifies the sample rootfs directory.
-N <nfsroot>	Specifies the nfsroot, for example: `<my IP addr>:/my/exported/nfs/rootfs`
-S <size>	Specifies the rootfs size in bytes. This is valid only for internal rootdev.
-B <tegra binary>	Specifies the Tegra binary TGZ file.

-X <xabi tgz>	Specifies the X driver ABI TBZ2 file.
-O <xrog.conf file>	Specifies the `xorg.conf` file to override the default.

Synchronizing the Kernel Sources and Tool Chain

You can manually rebuild the kernel used for this package. Internet access is required to do so. All the related scripts are located in the kernel directory.

Prerequisites

- You must install Git. This can be done on Ubuntu 10.04 by running the following command:

  ```
  $ sudo apt-get install git-core
  ```

- Your system must have the default Git port 9418 open for outbound connections.

To rebuild the kernel

1. Get the kernel source by running the `kernel_sync.sh` script:

   ```
   $ cd ./kernel/
   $ ./kernel_sync.sh
   ```

   —Or—

   You can also manually sync the sources, as follows:

   ```
   $ cd <myworkspace>
   $ git clone git://nv-tegra.nvidia.com/linux-2.6.git
   kernel_sources
   $ cd kernel_sources
   $ git checkout <LDK_KERNEL_CHANGEID>
   ```

   Where <LDK_KERNEL_CHANGEID> is the `LDK_KERNEL_CHANGEID` variable inside of the `kernel_sync.sh` script.

   You can also sync to known Linux tags. To see a list of the available release tags, use:

   ```
   $ git tag –l ‘tegra-l4t*
   ```

2. Install the tool chain by running the `install_3rdparty.sh` script:

   ```
   $ ./install_3rdparty.sh
   ```

Building the NVIDIA Kernel

Follow the steps in this procedure to build the NVIDIA kernel.

Prerequisites

- You have downloaded the kernel source code.

To build the Tegra Kernel

1. Export the following environment variables:

   ```
   $ export CROSS_COMPILE=<crossbin>
   $ export TEGRA_KERNEL_OUT=<outdir>
   $ export ARCH=arm
   ```

   where:

   - <crossbin> is the prefix applied to form the path to the tool chain for cross compilation, e.g., `gcc`. For the CodeSourcery tool chain, it will look something like:

     ```
     <csinstall>/arm-2009q1-203-arm-none-linux-gnueabi/bin/arm-none-linux-gnueabi-
     ```

   - <outdir> is the desired destination for the compiled kernel.

2. Execute the following commands:

   ```
   $ cd <myworkspace>/kernel
   $ mkdir $TEGRA_KERNEL_OUT
   ```

   - For Tegra 2, Harmony and Ventana, use:

     ```
     $ make O=$TEGRA_KERNEL_OUT tegra_defconfig
     ```

   - For Tegra 3, Cardhu, use:

     ```
     $ make O=$TEGRA_KERNEL_OUT tegra3_defconfig
     ```

   Where <myworkspace> is the parent of the Git root.

Using Example Applications

This section describes two example applications you can use to test multimedia and OpenGL/EGL functionality on NVIDIA Tegra platforms.

OpenGL/EGL Gears Test Application

If you would like to run a sample OpenGL/EGL test application, you can run the open-source Gears application.

To install and run Gears test application

1. Boot the target system with Ethernet connection and install the `mesa-utils-extra` package.

   ```
   $ sudo apt-get install mesa-utils-extra
   ```

2. Manually create the sym-links in the target root file-system for `/usr/lib/libEGL.so.1` and `/usr/lib/libGLESv2.so.2`.

   ```
   $ ln -s /usr/lib/libEGL.so /usr/lib/libEGL.so.1
   $ln -s /usr/lib/libGLESv2.so /usr/lib/libGLESv2.so.2
   ```

3. At this point you should be able to run the application with the following steps:

   ```
   $ export DISPLAY=:0
   $ X&
   $ /usr/bin/es2gears
   ```

GStreamer and NvGstPlayer

You can use the GStreamer open source multimedia framework and NvGstPlayer for testing multimedia. This section tells you how to install and use these applications. This section includes the following sub-topics.

- Installing GStreamer
- Using NvGstPlayer
- NvGstPlayer Examples

Installing GStreamer

You install the GStreamer pipleline from the Internet directly on target. There is a wrapper library called `gst-openmax` that is an interface between GStreamer and OpenMAX, which enables us to encapsulate the accelerated NVIDIA plug-ins in the GStreamer framework

For more information about GStreamer, see the following website:

`http://gstreamer.freedesktop.org`

NvGstPlayer is a multimedia player test application.

To install GStreamer on the target

1. Execute:

   ```
   $ sudo apt-get -y install gstreamer-tools
   $ sudo apt-get -y install gstreamer0.10-plugins-good
   $ sudo apt-get install gstreamer0.10-plugins-base
   $ sudo apt-get -y install alsa-utils
   $ sudo apt-get -y install gstreamer0.10-alsa
   ```

2. Once this is installed you can see if the installation is complete by typing the following:

```
gst-inspect | grep qtdemux
```

To install GStreamer-0.10 on Cardhu

1. Execute the following command:

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

2. Place `nvgstplayer` from the `libraries` dir to `/home/ubuntu`.

3. Execute the following commands at the Ubuntu prompt, which specify the headset route and volume increase:

   ```
   xinit &
   export DISPLAY=:0
   amixer cset numid=45 1
   amixer cset numid=38 63,63
   ```

Using NvGstPlayer

NvGstPlayer is a command line media file player. It will play audio/video files encapsulated in MP4, 3GP, AVI, ASF, WMA, MKV, M2TS, WEBM, MOV. This section describes NvGstPlayer usage, runtime commands, default settings, and important notes.

Usage

```
./nvgstplayer [OPTIONS]
```

Where you can specify one or more of the options shown in the following table.

Option	Description
-?, --help	Specifies to show help options.
--help-all	Specifies to show all help options.
--help-gst	Specifies to show GStreamer options.
-u, --urifile	Specifies the path of the file containing the URIs.
-i, --uri	Specifies the input URI.
-e, --elemfile	Specifies the element(s) (properties) file.
-n, --loop	Specifies the number of times to play the media.
--startper	Specifies the position is in % of duration, to start the media from.
-a, --start	Specifies the start of the segment in media, in milliseconds.
-d, --duration	Specifies the play duration of the segment in media, in milliseconds.
--no-sync	Specifies to disable audio/video synchronization.
--use-playbin	Specifies to use Playbin, which are ready made collections of elements provided by GStreamer.
--no-audio	Specifies to disable audio.
--no-video	Specifies to disable video.
--disable-anative	Specifies disable native audio rendering.

--enable-aparse	Specifies use audio elementary stream parser.
--enable-vparse	Specifies to use video elementary stream parser.
-x, --gap	Specifies the command interval in seconds, for automated testing.
-p, --pauses	Specifies the number of times to pause the media, -1 until EOS.
--seekper	Specifies the position is in % of duration, to seek the media to (segment).
-s, --seeks	Specifies the position in milliseconds, to seek the media (in segment), for example: `-s a:b:c`.
-w, --image-display-time	Specifies the image display time, in seconds.
--show-tags	Specifies to show tags (metadata), if available.
--stats	Specifies to show stream statistics, if enabled.

Runtime Commands

You can execute the following commands while running the test.

Option	Description
q	Quit the application.
Up Key,]	Go to next track.
c	Restart the current track.
Down Key, [	Go to the previous track.
i	Query for position.
d	Query for duration.
s:<val>	Seek to <val> position in milliseconds, for example: `s:45120`.
v:<val>	Seek to <val> percent of the duration, for example: `v:54`.
f:<val>	Seek by <val> milliseconds, relative to current position, for example: `f:23901`.
Left Key, <	Seek backwards by 10 seconds.
Right Key, >	Seek forward by 10 seconds.
p	Pause the media.
r	Resume the media.

Default Settings

The following shows the default settings.

Option	Default
seekper	0
gap	3 seconds
pause	2.5 seconds
videosink	nv_gl_eglimagesink

audiosink	alsasink

Important Notes

- Options—except elements path—can be given both from the command line as well as from a URI file.
- If options have been specified in a URI file, then the command line option will not work until the option from the configuration file finishes execution.
- If `p` is `-1` then playback will pause until the end of segment (EOS) with the interval of `gap` seconds.
- To create the pipeline, this application selects elements based on their ranks automatically. So if you want to stop this default behavior and want the application to use some particular elements, then specify those elements in `elements` file and use that file with `-e` option.
- All command line arguments will apply to all streams in the URIs file unless explicitly specified for a stream in URI file. For example:

  ```
  ./nvgstplayer -u uri -e elem --no-audio
  ```

  specifies all the streams in the URIs file will play without audio.

- If URI file is mentioned along with the command line URI, then only the command line URI will be executed.
- Command line URI is for quick testing of a URI.
- URI should have an absolute path.

NvGstPlayer Examples

This section provides example commands, elements file, and URIs file.

Example Commands

Option	Description	Example Command
--urifile	This file will have the streams, along with the options.	./nvgstplayer --urifile=uri_avi
--elemfile	This file will have elements (decoders, sink) and its properties.	./nvgstplayer -u uri_avi --elemfile=elems
--uri	This plays the stream as a command line argument.	./nvgstplayer --uri=/home/ubuntu/<filename>.mp4
--loop	This specifies the stream should be played 4 times.	./nvgstplayer --urifile=uri_avi --loop=4
--startper	This specifies to start the media from 1 percent of the duration, and to start the segment at 70 seconds.	./nvgstplayer --urifile=uri_avi --startper=1 --start=70000
--start	This specifies to start the	./nvgstplayer --urifile=uri_avi --start=10000

	segment in media at 10 seconds.	
--duration	Plays for a duration of 90 seconds.	./nvgstplayer --urifile=uri_avi --duration=90000
--no-sync	Disables all A/V sync.	./nvgstplayer --urifile=uri_avi --no-sync
--use-playbin	Uses Playbin.	./nvgstplayer --urifile=uri_avi --use-playbin
--no-audio	Disables audio.	./nvgstplayer --urifile=uri_avi --no-audio
--no-video	Disables video.	./nvgstplayer --urifile=uri_avi --no-video
--disable-anative	Disables native audio rendering.	./nvgstplayer --urifile=uri_avi --disable-anative
--enable-aparse	Forces the use of audio parser.	./nvgstplayer --urifile=uri_avi --enable-aparse
--enable-vparse	Forces the use of video parser.	./nvgstplayer --urifile=uri_avi --enable-vparse
--gap	This specifies to wait 5 seconds before executing the next command, and pauses 4 times.	./nvgstplayer --urifile=uri_avi --gap=5 --pause=4
--pauses	This specifies to pause 7 times.	./nvgstplayer --urifile=uri_avi --pause=7
--seekper	This specifies to seek to 1 percent of duration, 75 times.	/nvgstplayer --urifile=uri_avi --seekper=1 --seeks=75
--seeks	This specifies to seek the media to 15 seconds, 30 seconds, and 60 seconds.	./nvgstplayer --urifile=uri_avi --seeks=15000:30000:60000
--image-display-time	This specifies to display the image for 5 seconds.	./nvgstplayer --uri=/home/ubuntu/mickey.gif --image-display-time=5
--stats	This specifies to show the stream statistics, which are saved in the following file: `gst_statistics.txt`	./nvgstplayer -u uri --stats

Example Elements File

The following shows an example of an `elems` file, which is used in Number 2 in the below execution description.

```
#Decoders
[decode_videompeg4]
name=nv_omx_mpeg4dec

[decode_audioaac]
name=nv_omx_aacdec

[decode_audiomp3]
name=nv_omx_mp3dec

[decode_videoh264]
name=nv_omx_h264dec
```

```
#Sinks
[sink_video]
name=nv_gl_eglimagesink

[sink_audio]
name=alsasink
```

In the previous example `name` is the property of element. You can mention other properties of element followed by `name` property, each on separate line, if they exist. For example, you can mention as follows:

```
#Sinks
[sink_video]
name=nv_gstbin_videosink
rendertarget=1
```

Example URIs File

The following shows an example of `uris` file, which is used in Number 2 and Number 3 in the below execution descriptions.

```
 [/home/ubuntu/All_streams/<filename>_h263_aac.3gp]
seekper=1
seeks=25;0;65

[/home/ubuntu/All_streams/<filename>_mpeg2_mp2.mpg]
pauses = 5
gap = 7

[/home/ubuntu/All_streams<filename>_wmv9_wma9.wmv]
startper = 1
start = 50

[/home/ubuntu/All_streams/<filename>30fps_4M_mp3_128_44_1min.a
vi]
start = 20000
duration= 10000
```

Execution Descriptions

1. ./nvgstplayer -i Nokia_900.mp4

   The application will play the <filename>`_900.mp4` stream until end of stream (EOS) and will exit.

2. ./nvgstplayer -u uris -e elems

   - The stream <filename>`_h263_aac.3gp` will play with seeks to 25% duration, then 0% duration (i.e., start of stream) and then 65% duration of the stream. And then will play until EOS.
   - Then the next stream from `uris` file will be taken up, (i.e., <filename>`_mpeg2_mp2.mpg)`. This stream will pause 5 times with the gap of 7seconds between two consecutive pauses.

- Then the next stream from URIs file will be taken up, (i.e., <filename>_wmv9_wma9.wmv). This stream will
- Start from 50% duration of the stream.
- Then the next stream from URIs file will be taken up, (i.e., <filename>_divx_d1_30fps_4M_mp3_128_44_1min.avi).
- This stream will start from 00:00:20 and playback will happen for next 10 seconds.

3. ./nvgstplayer -u uris --no-sync

   All the streams from `uris` file will play without AV sync. All command line arguments will apply to all streams in the `uris` file, unless explicitly specified for a stream in `uris` file.

4. ./nvgstplayer -i <filename>.mp4 --loop=3 --pauses=4 seeks=10000:0:45000

   `Nokia.mp4` will be played 3 times, and each playback will pause for 4 times and will seek to 10th sec, then 0th sec, and then 45th sec of the playback.

5. ./nvgstplayer. -i <filename>.mp4 -p 2 -x 3 -s:10000:20000:30000:40000

   This playback will have 2 pauses and seeks to 10th second, then 20th second, then 30th second, then 40th second, and the consecutive pauses and seeks will have a gap of 3 seconds.

6. ./nvgstplayer -i rtsp://10.25.20.77/mp4/AAC/<filename>_80kbps_44khz_s.mp4

   Player provides RTSP/HTTP streaming support. The stream <filename>_80kbps_44khz_s.mp4 will be played until EOS.

Software Features

This section describes the software features expected to be supported with this release of NVIDIA® Tegra® Linux Driver Package, which provides users with a complete package to bring up Linux on certain Tegra devices.

This release supports NVIDIA® Tegra® 2 series: Tegra 250 (code-name Harmony), Ventana T2T (code-name Ventana). It also supports NVIDIA® Tegra® 3 series: Ventana T3T (code-name Cardhu). Additional application processors may be supported in a later release.

> **Note**: Always check the *Release Notes* for constraints related to these features.

Read the following sections to learn more about supported features in this release.

Linux

Kernel	Notes
Linux Kernel	2.6.36
Kernel Native Drivers	**Notes**
Audio	ALSA
External SD card	-
USB	Keyboard/mouse, mass storage device (MSD)
Wi-Fi	Firmware provided separately for Cardhu and Ventana; fully included for Harmony.
Boot Devices	**Notes**
eMMC	Cardhu and Ventana
NAND	Harmony
Additional Notes	
Unless otherwise noted, all features pertain to Cardhu, Harmony, and Ventana.	

Graphics and Multimedia

Media APIs	Notes
EGL 1.4	-
GStreamer OpenMAX plug-in	-
Open GL ES path extensions	-
OpenGL ES 1.1	-
OpenGL ES 2.0	-
Open GL ES path extensions	-
OpenMAX IL 1.1 decoding	Deprecated
OpenMAX AL	Targets a future release TBD
X11	ABI: 5, 6, 7, 8, 10, 11
X Resize, Rotate and Reflect Extension (RandR) 1.3	-
Additional Notes	
Unless otherwise noted, all features pertain to Cardhu, Harmony, and Ventana.	

Audio Decoders (Tegra 2/Tegra 3)

The features in this table are supported by both Tegra 2 and Tegra 3.

Audio Decode	Profile	Resolution	Bitrate
AAC+	AAC-LC with SBR; mono, stereo, and 2-channel mixing only	Up to 48 kHz	Up to 320 kilobits per second (Kbps)
AAC-LC	Mono, stereo, and 2-channel mixing only	Up to 48 kHz	Up to 320 Kbps
eAAC+	AAC-LC with SBR+PS; mono, stereo, and 2-channel mixing only	Up to 48 kHz	Up to 320 Kbps
AMR-NB	1 channel	Up to 8 kHz	Up to 12.2 Kbps
AMR-WB	1 channel	Up to 16 kHz	Up to 23.85 Kbps
MP3	2 channel	Up to 48 kHz	Up to 320 Kbps
MPEG-2 (MPEG-1 Layer 2)	Audio	Up to 48 kHz	Up to 320 Kbps
Vorbis	Ogg* Audio	Up to 48 kHz	Up to 256 Kbps
WAV a-law, mu-law	8-bit, mono channel	8 kHz	Up to 64 Kbps
WAV linear PCM	16-bit, 2 channels	Up to 48 kHz	-
WMA 9 Std.	Standard 2-channel	Up to 48 kHz	Up to 384 Kbps
WMA Lossless	Lossless: Up to N1 Profile; WMA 10: 2 channel	Up to 48 kHz	-
WMA 10 Pro LBR	M2 Profile; 6 channel [5.1]	Up to 96 kHz	Up to 768 Kbps

Video Decoders (Tegra 2)

The features in this table are supported by Tegra 2.

Video Decode	Profile and Level	Sampling Frequency and Bit rate/Frame rate	Supported Tools
DivX 4/5/6	HD 1080p Profile	Up to 1080p 30 fps Up to 12 Mbps	All tools; No Qpel; No interlace; No GMC
H.263	Baseline Profile 0	Up to 4CIF 30 fps Up to 8 Mbps peak	Baseline Profile 0 tools
H.264	Baseline Profile @ L4	Up to 1080p 30 fps Up to 20 Mbps peak	All tools; Baseline Profile; Main Profile + B frames + Progressive; No CABAC; No weighted prediction
H.264	Main Profile @ L2.2	Up to 720p 30 fps Up to 8 Mbps	CABAC; With weighted prediction
H.264	Main Profile @ L2.2	Up to D1 30 fps Up to 4 Mbps	MBAFF; interlaced content; no deblocking
H.264	Main Profile @ L3.1	Up to 720p 30 fps Up to 8 Mbps	CABAC; No weighted prediction
H.264	High Profile @ L3.1	Up to 720p 30 fps Up to 5 Mbps	CABAC; With weighted prediction
H.264	High Profile @ L3.1	Up to 720p 30 fps Up to 5 Mbps	CAVLC; No weighted prediction
H.264	High Profile @ L3.1	Up to D1 30 fps Up to 3 Mbps	Progressive; CAVLC; With weighted prediction
H.264	Main Profile/ High Profile @ L2.2	Up to D1 60i Up to 4 Mbps	Main Profile and High Profile tools; Interlaced; CABAC; No deblocking
MPEG-4	Simple Profile @ L3	Up to CIF 30 fps Up to 1 Mbps	All tools
MPEG-4	Advanced Simple Profile @ L5	Up to 1080p 30 fps Up to 12 Mbps	All tools; No Qpel; No interlace; No GMC
VC-1	Simple Profile/ Main Profile/ Advanced Profile	Up to 1080p 30 fps Up to 20 Mbps	All tools; Progressive

Xvid	Highdef Profile	Up to 1080p 30 fps Up to 12 Mbps	All tools; No Qpel; No interlace; No GMC

Video Decoders (Tegra 3 only)

The features in this table are supported by Tegra 3.

Video Decode	Profile and Level	Sampling Frequency and Bit rate/Frame rate	Supported Tools
DivX 4/5/6	1080p HD Profile	Up to 1080p @ 30 fps Up to 12 Mbps	All tools; No Qpel; No interlace; No GMC
H.263	Baseline Profile 0	Up to 4CIF @ 30 fps Up to 8 Mbps	Baseline Profile 0 Tools
H.264 AVC	Baseline Profile @ L4.1	Up to 1080p @ 30p Up to 62.5 Mbps	All tools from Baseline Profile
H.264 AVC	Main Profile/ High Profile @ L4.1	Up to 1080p @ 30p/60i Up to 62.5 Mbps	All tools from Main Profile and High Profile; Full Blu-ray compliant (both 1SD & 1HD)
H.264 AVC	Baseline Profile/ Main Profile/ High Profile @ L4.1	Up to 1080p @ 60p Up to 40 Mbps	All tools from Baseline Profile, Main Profile, and High Profile
H.264 AVC	Baseline Profile/ Main Profile/ High Profile @ L4.1	Up to 720 @ 60p Up to 12 Mbps	All tools from Baseline Profile, Main Profile, and High Profile
H.264 AVC	Baseline Profile/ Main Profile/ High Profile @ L4.1	Up to 1440 @ 24p/48i Up to 40 Mbps	All tools from Baseline Profile, Main Profile, and High Profile
MPEG-2	Main Profile @ High Level	Up to 720 @ 60p Up to 80 Mbps	Full Blu-ray, HD-DVB, and ATSC (HDTV) compliant
MPEG-2	Main Profile @ High Level	Up to 1080p @ 30p/60i Up to 80 Mbps	Full Blu-ray, HD-DVB, and ATSC (HDTV) compliant
MPEG-4	Advanced Simple Profile @ L5	Up to 1080 @ 30p Up to 12 Mbps	All tools; No Qpel; No interlace; No GMC
VC-1	Simple Profile/ Main Profile/ Advanced Profile	Up to 1080p @ 30p Up to 45 Mbps	Blu-ray compliant
Xvid	Highdef Profile	Up to 1080p @ 30 fps Up to 12 Mbps	All tools; No Qpel; No interlace; No GMC

Reader Container Formats

Codes are provided by GStreamer. You can download GStreamer codecs from the gstreamer opensource project at:

http://gstreamer.freedesktop.org

Or you can use `apt-get` in the provided Ubuntu-derived sample file system.

Hardware codecs are not included in the base release but can be provided separately under a software license agreement.

AMR	Audio Codecs	Video Codecs
Provided by GStreamer (GP)	AMR-NB	n/a
	AMR-WB	
ASF/WMV	**Audio Codecs**	**Video Codecs**
Provided by GStreamer (UP)	WMA 10	VC-1
	WMA Pro	
	WMA Lossless	
AVI	**Audio Codecs**	**Video Codecs**
Provided by GStreamer (GP)	AC3	DivX
	AAC	H.263
	AAC+	H.264 AVC
	eAAC+	MPEG-4
	MP3	Xvid
	MPEG-2	
M2TS/MPEG-TS	**Audio Codecs**	**Video Codecs**
Provided by GStreamer (GP)	AAC	H.264
	AAC+	MPEG-2
	eAAC+	VC-1
M4A	**Audio Codecs**	**Video Codecs**
Provided by GStreamer (GP)	AAC	n/a
	AAC+	
	eAAC+	
MKA	**Audio Codecs**	**Video Codecs**
Provided by GStreamer (GP)	AC3	n/a
	AAC	
	AAC+	
	eAAC+	
	MP2	

	MP3	
MKV	Audio Codecs	Video Codecs
Provided by GStreamer (BP)	AC3	DivX
	AAC	H.264
	AAC+	MPEG-4
	eAAC+	Xvid
	MP3	
MP3	Audio Codecs	Video Codecs
Provided by GStreamer (GP)	MP3	n/a
MP4/3GP	Audio Codecs	Video Codecs
Provided by GStreamer (GP)	AAC	H.263
	AAC+	H.264 AVC
	eAAC+	H.264 MVC
	AMR-NB	MPEG-4
	AMR-WB	
MOV	Audio Codecs	Video Codecs
Provided by GStreamer (GP)	AAC	H.263
	AAC+	H.264 AVC
	eAAC+	MPEG-4
	AMR-NB	
	AMR-WB	
MPEG-PS/VOB	Audio Codecs	Video Codecs
Provided by GStreamer (GP)	AAC	H.264
	AAC+	MPEG-2
	eAAC+	VC-1
OGG	Audio Codecs	Video Codecs
Provided by GStreamer (GP)	Vorbis	n/a
RIFF	Audio Codecs	Video Codecs
Provided by GStreamer (GP)	WAVE	n/a
WEBM	Audio Codecs	Video Codecs
Provided by GStreamer (BP)	Vorbis	VP8
WMA	Audio Codecs	Video Codecs
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	WMA Pro	
	WMA Lossless	

Streaming Protocols

Streaming protocols are provided by GStreamer. You can download GStreamer codecs from the gstreamer opensource project at:

http://gstreamer.freedesktop.org

Or you can use `apt-get` in the provided Ubuntu-derived sample file system.

Hardware codecs are not included in the base release but can be provided separately under a software license agreement.

Protocol	Notes
HTTP 1.0	ASF, AVI,3GP, MOV, MP3, MP4, WMA, WMV
HTTP 1.1	ASF, AVI,3GP, MOV, MP3, MP4, WMA, WMV
RTP/RTSP/RTCP	3GP, MP3
SDP (RFC 4566)	3GP

Displays

General	Notes
HDMI®-1.3	Harmony and Ventana; See the *Release Notes* for known issues.
HDMI®-1.4a	Cardhu

Power

General	Notes
DVFS	Cardhu and Ventana
Ultra-Low Power Standby	**Notes**
Suspend (LP1)	-
Deep Sleep (LP0)	-
USB Suspend during Deep Sleep	TBD
Additional Notes	
Unless otherwise noted, all features pertain to Cardhu, Harmony, and Ventana.	

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Sample File System

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Version 2, June 1991

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3

3G

Third generation mobile phone standard/technology, based on standards defined by the International Telecommunication Union (ITU).

3G2

A standard for 3GP format for CDMA-based phones (3GPP2) and container format with filename extension (.3gp).

3GP

Simplified version of MPEG-4 Part 14 (.mp4) container format.

3GPP

3rd Generation Partnership Project. A collaboration among telecommunications associations to define globally applicable third generation (3G) mobile phone system specifications. For more information, see http://www.3gpp.org.

3P

Platform Programming Protocol, developed by NVIDIA for client-server communications between PC and device.

4

4CIF

4 x CIF (704 x 576), Common International Format (CIF) for horizontal and vertical resolutions of YCbCr.

A

A2DP

Advanced Audio Distribution Profile. For streaming stereo or mono audio from one device to another over Bluetooth. For more information, see http://www.atheros.com/.

AAC

Advanced Audio Coding. A lossy compression and encoding standard for digital audio.

AAC-LC

Advanced Audio Coding-Low Complexity. A standardized, lossy compression and encoding scheme for digital audio.

AAC+

Advanced Audio Coding Plus, or aacPlus. Same as High Efficiency AAC (HE-AAC), which extends the Low Complexity AAC (AAC LC) optimized for low-bit rate applications such as streaming audio.

ADB

Android Debug Bridge. A client-server tool for managing an emulator instance or Android-based device. For more information, see http://developer.android.com/guide/developing/tools/adb.html.

ADMA

Advanced Direct Memory Access.

ADPCM

Adaptive DPCM (differential pulse-code modulation).

AE

Auto exposure.

AES

Advanced Encryption Standard.

AF

Auto focus.

AGC

Automatic gain control.

ALSA

Advanced Linux Sound Architecture.

AMR

Adaptive multi-rate. An audio data compression scheme optimized for speech coding.

AMR-NB

Adaptive multi-rate (AMR) narrow band.

AMR-WB

Adaptive multi-rate wide band.

ANR

In Android, “Application Not Responding” error.

In camera, advanced noise reduction.

AP

Application Processor. An application processor is a computer that processes data (as opposed to one that controls data flow, like a database server). The Tegra® series application processors offer low power, high performance ARM® processors that handle 2D, 3D, audio, and high-definition (HD) video data streams. These decoding and encoding functionalities are provided by a set of interfaces including multiple memory, storage, video, audio, and peripheral interfaces.

AVC

Advanced Video Coding.

AVI

Audio Video Interleave. A multimedia container format, special-case Resource Interchange File Format (RIFF) file that can contain both audio and video data; this format enables synchronous audio-with-video playback. For more information, see http://msdn.microsoft.com/en-us/library/ms779631(VS.85).aspx.

AWB

Container format for AMR-WB speech encoding with filename extension (.awb).

B

BCB

Boot Control Block.

BCT

NVIDIA Boot Configuration Table.

bitblt

A graphics operation that combines several bitmap patterns into one, typically using a raster operator.

Bpp

Bytes per pixel, used to specify pixel depth (color depth).

bpp

Bits per pixel, used to specify pixel depth (color depth).

Bluetooth

Wireless standard for data exchange over short distances. For more information, see http://www.bluetooth.com/English/Pages/default.aspx.

BSAC

Bit Sliced Arithmetic Coding. An MPEG-4 standard (ISO/IEC 14496-3 subpart 4) for scalable audio coding.

BusyBox

Utility providing small versions of common UNIX utilities in a single executable. For more information, see http://www.busybox.net.

C

CABAC

Context-adaptive binary arithmetic coding. A type of entropy coding used in H.264/MPEG-4 AVC video encoding.

CBR

Constant bit rate.

CDC

USB Communications Device Class.

CDMA

Code division multiple access. Channel access method for radio communication.

CE

NVIDIA customer engineer.

Cg

C for Graphics. A high-level shading language for programming vertex and pixel shaders, created by NVIDIA Corporation.

CIF

Common International Format (352 x 288), standardizes horizontal/vertical resolutions for video.

color space

Specifies how color is represented, such as YUV, RGB, or gray scale.

D

D3DM

Microsoft Direct3D Mobile technologies.

DCC

Debug communications channel.

DCT

Discrete cosine transform. A Fourier-related transform similar to the discrete Fourier transform (DFT), but using only real numbers.

DDI

Device driver interface for Windows CE.

DDK

NVIDIA® Driver Development Kit.

deprecated

This feature is slated to be removed at a later release. Developers should begin to remove dependencies on this feature in preparation for its eventual removal.

development system

Board with NVIDIA® Tegra® processor used to do engineering work, which is typically focused on firmware/software development. Development boards have a user manual but may or may not include detailed documents, like schematics.

DFS

Dynamic frequency scaling.

DIDIM

Dynamic Image-based Display Intensity Modulation.

DivX

Codec by DivX, Inc., that uses lossy MPEG-4 Part 2 compression to compress lengthy video into small sizes with high visual quality and is often used for "ripping". For more information, see http://www.divx.com.

DMO

Microsoft DirectX Media Object. For more information, see http://msdn2.microsoft.com/en-us/library/ms783356.aspx.

DPB

In H.264, Decode Picture Buffer.

DRC

Dynamic range compression.

DSI

Display Serial Interface a communication protocol specification by the Mobile Industry Processor Interface (MIPI) Alliance for reducing cost of displays in mobile devices.

DVB-H

Digital video broadcasting—handheld.

DVB-T

Digital video broadcasting—terrestrial.

DVFS

Dynamic voltage frequency scaling.

DVS

Dynamic voltage scaling.

E

eAAC+

Enhanced AAC+. Combines HE-AAC v1 (or AAC+) coupled with Parametric Stereo to 3GPP.

ECI

NVIDIA Embedded Controller Interface. Communication interface between NVIDIA® Tegra® processor and an embedded controller (EC) for netbook/smartbook applications.

EGL

Embedded-Systems Graphics Library. For OpenGL ES.

eMMC

Embedded MMC. Developed by JEDEC and MMCA for embedded flash memory applications. For more information, see http://www.mmca.org.

EQ

Equalizer.

Escape code base + value

Microsoft supports definition of additional driver-specific escape codes, starting at an `ESCAPECODEBASE` of decimal value 100,000. So an NVIDIA-defined escape code whose value is 7 is actually 100007. (`100000 + 7 = 100007`)

Exif

Exchangeable image file format. A specification for digital camera image file formats.

Ext2

Second extended file system for the Linux kernel, designed to replace the extended file system (ext).

Ext3

Third extended file system. A journaling file system often used by the Linux kernel, the default file system for some distributions.

F

Fastboot

Software supporting a protocol for updating flash file systems and unsigned partition images for Android-based devices.

Flash 11

Adobe multimedia platform enabling animation and interactivity on Web pages. For more information, see http://get.adobe.com/flashplayer.

FMO

Flexible macroblock ordering. Technique for restructuring the ordering of the representation of the fundamental regions in pictures, known as macroblocks. FMO is also referred to as slice groups and arbitrary slice ordering (ASO).

FOV

In photography, field of view.

G

GLES

See OpenGL ES.

GLSL

OpenGL Shading Language. A high level, C-language shading language.

GPIO

General purpose input/output.

GPS

Global positioning system.

GPU

Graphics processing unit.

H

H.263

A video codec standard for low-bit rate compressed format videoconferencing, designed by the ITU-T in a project ending in 1995/1996. For more information, see http://en.wikipedia.org/wiki/H.263.

H.264

A standard for video compression, also known as MPEG-4 Part 10, or AVC (for Advanced Video Coding). For more information, http://en.wikipedia.org/wiki/H.264/MPEG-4_AVC.

HD

High-definition.

HDCP

High-bandwidth Digital Content Protection. Digital copy protection technology developed by Intel Corporation to protect digital audio and video content as it travels across connections. For more information, see http://www.digital-cp.com.

HDMI

High-Definition Multimedia Interface. A compact audio/video connector interface used to connect HDMI-enabled digital audio devices for transmitting uncompressed digital streams. NVIDIA® Tegra® BSP incorporates support for HDMI® technology.

HID

Human interface device. A computer device that receives human input and may deliver output.

HSMMC

High-speed MultiMediaCard (MMC).

HTTP

Hypertext transfer protocol. A client-server communications protocol used for hyperlinked text documents on the Internet.

I

I2C

Inter-Integrated Circuit. A serial computer bus used to attach low-speed peripherals to an embedded system or cell phone.

I2S

Inter-IC Sound (or Integrated Interchip Sound). A serial bus interface standard for connecting to digital audio devices.

ID3

Metadata container typically used with MP3 formatted content.

IIR

Infinite impulse response, a property of signal processing systems.

ISDB-T

Terrestrial Integrated Services Digital Broadcasting.

ISP

File extension for NVIDIA Image Signal Processing pipeline (.isp) configuration files.

ISV

Independent software vendor.

J

JPEG

Method for compressing photographic images. For more information, see http://www.jpeg.org.

JTAG

Joint Test Action Group (JTAG). Common term used for the IEEE 1149.1 standard "Standard Test Access Port and Boundary-Scan Architecture" for testing printed circuit boards. In embedded development, in-circuit emulators use JTAG as a transport mechanism to provide a way into the embedded system for debugging.

L

LBR

Low bit rate.

LCD

Liquid crystal display.

LP

Low power, or low power filter bank.

M

M4A

Multimedia MPEG-4 container format file extension (.m4a), first popluarized by Apple to assure presence of audio/video content as distinguished from .mp4 files which may or may not have video content.

M4B

Multimedia MPEG-4 container format file extension (.m4b) for audio book and podcast files. Typically contain metadata for chapters, images, and hyperlinks.

Meebo

An instant messaging program based on Ajax and libpurple free/open source library. For more information, see http://www.meebo.com and http://www.pidgin.im.

MIDI

Musical instrument digital interface. For synchronization of electronic musical instrument and computer communications of digital data events (such as for pitch and volume) in realtime.

MIO

Modular input/output. Enables adding peripheral cards to laser printers. For more information, see http://www.hp.com/.

MJPEG

Motion JPEG (M-JPEG) are video formats where video frames/ interlaced fields in digital video is compressed separately as a JPEG image.

MLC

Multilevel cell. Flash memory that stores more than one bit per cell by using voltage levels.

MMC

MultiMediaCard. Removable solid-state memory card for use in mobile devices. For more information, see http://www.mmca.org.

MOV

File format for QuickTime that functions as a multimedia container file containing one or multiple tracks that stores audio, video, effects, or text.

moviNAND

High-density MLC NAND Flash combined with MMC controller. For more information, see http://www.samsung.com/global/business/semiconductor/products/fusionmemory/Products_MoviNAND.html.

MP

Megapixel.

MP3

MPEG-1 Audio Layer 3. Also the container format or filename extension (.mp3) for MPEG-1 Audio Layer 3 files.

MP4

Container format or filename extension (.mp4) for MPEG-4 Part 14 files.

MPEG-2

Generic coding standard for movies, which specifies a combination of lossy video compression and lossy audio compression (audio data compression).

MPEG-4

MPEG-4 Part 2 video compression technology. A DCT compression standard belonging to the MPEG-4 ISO/IEC standard (ISO/IEC 14496-2). For more information, see http://www.mpeg.org.

MSC

Mass storage device class. USB Implementers Forum computing communications protocols for the Universal Serial Bus (USB). For more information, see http://www.usb.org/developers/devclass_docs/usb_msc_overview_1.2.pdf.

MSD

Mass storage device.

MSDN

Microsoft Developer Network. For more information, see http://msdn2.microsoft.com/en-us/default.aspx.

MTD

Memory technology device, used by Linux to interact with flash memory.

MVC

Multiview Video Coding (MVC), amends H.264/MPEG-4 AVC standard to enable encoding simultaneously from multiple cameras using a single video stream.

N

NAND

Type of flash memory, typically used in USB devices and memory cards.

NB

Narrow band.

NDK

Android toolset enabling embedded components to use native code in Android applications. For more information, see http://developer.android.com/sdk/ndk/overview.html.

Netflix

Provides rental-by-mail of digital video content as well as Internet streaming on demand. For more information, see https://www.netflix.com.

NFS

Network File System, an open standard protocol.

Nv3P

NVIDIA platform programming protocol (includes 3P server and 3P client).

NvBL

NVIDIA Boot Library.

NvDDK

NVIDIA Driver Development Kit.

NVIDIA production mode

This is the mode in which Tegra chips are provided from NVIDIA. In this mode, fuses can still be programmed via recovery mode. Boot configuration tables (BCTs) and boot loaders are signed with a key of all 0's, but are not encrypted.

NvRM

NVIDIA Resource Manager.

O

OAL

OEM adaptation layer for Windows CE.

ODM

Original design or device manufacturer.

ODM non-secure mode

This is the mode in which ODMs ship products without stringent security mechanisms.; however, in this mode, fuses can no longer be programmed. As in NVIDIA production mode, boot configuration tables (BCTs) and boot loaders are signed with a key of all 0's and not encrypted. This mode is sometimes called ODM production mode.

ODM secure mode

This is the mode in which ODMs ship products with strict security measures in force. Fuses cannot be programmed, and all boot configuration tables (BCTs), boot loaders, and microboots must be signed and encrypted with the secure boot key (SBK).

OEM

Original equipment manufacturer.

OGA

Container for Vorbis audio-only files. For more information, see http://xiph.org.

Ogg

Container for Vorbis codec. For more information, see http://xiph.org.

Ogg Vorbis

A free/open source, lossy audio codec (Vorbis) and its container (Ogg). For more information, see http://xiph.org.

OGM

Early file format for embedding video into Ogg. Use of this format is currently discouraged by Xiph. For more information, see http://xiph.org.

ONFI

Open NAND Flash Interface, an industry workgroup that build, design-in, or enable NAND Flash memory.

OpenAL

Free cross-platform audio API (resembling OpenGL API style) for efficient rendering of multichannel three dimensional positional audio.

OpenGL ES

A subset of OpenGL 3D graphics API designed for embedded systems, defined by the Khronos Group. For more information, see http://www.khronos.org.

OpenKODE

A set of APIs for handheld games and media applications providing a cross-platform abstraction layer for other "open" media technologies. For more information, see http://www.khronos.org.

OpenSL ES

Open Sound Library for Embedded Systems. A royalty-free, cross-platform, hardware-accelerated audio API for 2D and 3D audio. For more information, see http://www.khronos.org.

OpenMAX

An application programming interface that provides abstractions for routines especially useful for computer graphics, video, and sound, defined by the Khronos Group. For more information, see http://www.khronos.org.

OpenMAX IL

OpenMAX Integration Layer. Provides an abstraction layer API between a media framework, such as DirectShow, and a set of multimedia components, such as audio and video codecs. For more information, see http://www.khronos.org.

OpenVG

A standard API for hardware-accelerated 2D vector graphics, defined by the Khronos Group. For more information, see http://www.khronos.org.

OTA

Over-the-air or wireless.

OTG

USB On-The-Go.

P

<platform>

The code name of an NVIDIA® Tegra® development system, such as `cardhu` for Ventana T3T, `enterprise` for Ventana T3S, or `ventana` for Ventana T2T.

PAN

Personal area networking. A Bluetooth profile. For more information, see http://www.atheros.com/.

PCM

Pulse-code modulation.

PIP

Picture-in-picture.

PMU

Power Management Unit.

pixel depth

Number of bits per pixel (bpp).

PS

Parametric stereo.

Q

QCELP

Qualcomm Code Excited Linear Prediction, also known as Qualcomm PureVoice. Speech codec that increases the speech quality of the IS-96A codec used in CDMA. For more information, see http://www.qualcomm.com/qct.

QP

Quantization Parameter.

QuickTime

Apple multimedia framework for digital multimedia, text, animation, etc., playback/streaming. For more information, see http://www.apple.com/quicktime/download.

R

RCK

Recovery kernel.

RCM

Recovery mode messages.

RFC

Request for Comments.

RIL

Radio Interface Layer.

RNDIS

Remote NDIS. A specification for network devices on buses such as USB. For more information, see http://www.microsoft.com/whdc/device/network/NDIS/rmNDIS.mspx.

ROP

Raster operator.

RTC

Real-time clock.

RTP

Real-time transport protocol for delivering A/V content over the Internet.

RTSP

Real time streaming protocol allowing clients to issue transport commands and control a streaming media server remotely.

S

SBC

Sub-band codec. For breaking signals into different frequency bands to encode them independently.

SBK

Secure boot key.

SBR

Spectral band replication.

scan code

The physical key on the keypad.

SCO

Synchronous Connection Oriented link. For a mono, PCM audio channel.

SD

Secure Digital card. Non-volatile memory card. For more information, see http://www.sdcard.org/home.

SDHC

Secure Digital High Capacity. For more information, see http://www.sdcard.org/home.

SDHCI

Secure Digital Host Controller Interface.

SDIO

Secure Digital Input Output. SD card combined with an I/O device. For more information, see http://www.sdcard.org/home.

SDRAM

Synchronous dynamic random access memory.

SDP

Session Description Protocol, an IETF Proposed Standard that describes streaming communication sessions to announce and invite the session and to negotiate parameters.

secure boot

A common term used to refer to a boot loader that uses enhanced security, such as asymmetric encryption (public key encryption). For more information, see the Windows CE 6.0 Technical Article "Secure Download Boot Loader in Windows Embedded CE" at http://msdn2.microsoft.com/en-us/library/bb643805.aspx.

SHOUTcast

Cross-platform media-streaming server (freeware), developed by Nullsoft, which enables Internet radio network creation. For more information, see http://www.shoutcast.com.

SIP

Session Initiation Protocol. Signaling protocol from the Internet Engineering Task Force (IETF) used to control multimedia communication sessions for voice and video over Internet protocol (VoIP).

S-LINK

Simple link interface. A high-performance data acquisition standard where data will be collected and stored by computers at both ends of the link. For more information, see http://hsi.web.cern.ch/HSI/s-link.

SLC

Single-level cell. Flash memory that stores one bit per cell.

SMP

Symmetric multiprocessing.

SMS

Short Message Service. Allows sending short text messages between mobile telephone devices.

SNR

Signal-to-noise ratio.

Sorenson

Sorenson codec (http://www.sorensonmedia.com/) used in Apple's QuickTime and in Adobe Flash.

SOC

System-on-chip, which integrates computer components and other electronics into a single integrated circuit or chip. Also SoC.

S/PDIF

Sony/Philips Digital Interface.

SPI

Serial Peripheral Interface bus. A full-duplex mode, synchronous serial data link.

SPI flash

Small, low-power flash memory that uses a serial interface (usually SPI) for sequential data access.

SRC

Sample rate conversion.

SSK

Unique, per-chip Secure Storage Key used to protect customer-defined data. Typically a 128-bit key computed from the following fuse settings:

- 128-bit customer-programmed SBK.
- 32-bit customer-programmed Device Key (DK).
- 64-bit NVIDIA-programmed Unique ID (UID), which is different for every chip.

Stagefright

Media framework new in Android 2.2. For more information see http://developer.android.com/sdk/android-2.2-highlights.html#PlatformTechnologies.

T

Tegra

The world's first mobile super chip. The families of Tegra chipsets for mobile devices include:

- Tegra 3
- Tegra 2
- Tegra APX

THD

Total harmonic distortion.

TVO

Television output.

U

UART

Universal asynchronous receiver/transmitter. Computer hardware that translates data between parallel and serial forms, usually used for computer or peripheral device serial communications over a serial port.

U-Boot

Das U-Boot, a free (GNU GPL software) bootstrap loader for embedded systems. For more information, see http://www.denx.de/wiki/U-Boot.

Ubuntu

Supported Linux operating system by certain Tegra-based development products. For the specific Ubuntu version supported, see your *Release Notes*. For more information about Ubuntu, see http://www.ubuntu.com.

UIP

Update Image Partition.

ULP

Ultra low power.

USB

Universal serial bus. A standard that allows connections of many peripherals via a standardized interface socket. For more information, see http://www.usb.org.

USBNET

Linux usbnet driver. For more information, see http://www.linux-usb.org/usbnet/.

USP

Update Staging Partition.

V

VAD

Voice activation detection.

VBO

An OpenGL extension for faster rendering of triangles.

VBR

Variable bit rate.

VC-1

Common name of the SMPTE 421M video codec standard from Microsoft. For more information, see http://www.microsoft.com/windows/windowsmedia/howto/articles/vc1techoverview.aspx.

VoIP

Voice-over-Internet protocol. Transmits voice through the Internet or other packet-switched networks.

Vorbis

A free/open source, lossy audio codec (Vorbis). For more information, see http://xiph.org.

VP6

TrueMotion VP6 video codec developed by On2 Technologies used in broadcasting, as well as by Adobe Flash and Flash Video files. For more information, see http://www.on2.com.

W

WAV

Microsoft and IBM waveform audio format for storing audio bitstreams.

WEP

Wired Equivalent Privacy. Secures IEEE 802.11 wireless networks.

WMA

Microsoft Windows Media Audio technologies. Also the compressed audio file format (.wma).

WMA Lossless

Microsoft Window Media Audio lossless audio codec, provides duplication of original audio so that no data are lost.

WMA Pro

Microsoft Windows Media Audio Professional technologies.

WMA Pro LBR

Low bit rate mode of Microsoft Windows Media Audio Professional technologies.

WMV

Microsoft Windows Media Video technologies. Also the compressed video file format (.wmv).

WPA

Wi-Fi Protected Access. Certified security for wireless computer networks.

X

Xvid

Free video codec library based on the MPEG-4 standard. Xvid uses MPEG-4 Advanced Simple Profile (ASP) compression with video encoded with MPEG-4 ASP video, and so can be decoded by all MPEG-4 ASP-based decoders. For more information, see http://www.xvid.org.

Y

YAFFS

Yet Another Flash File System. The first file system designed for NAND flash.

Z

zImage

Conventional (but not required) name for the uncompressed kernel boot image file in Linux. **bzImage** is the compressed or “big” zImage file for systems requiring the kernel image to be under a certain size.

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