

OMX Integration Guide

Integration Guide: for Linux

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— Preliminary —

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OMX Integration Guide for Linux

1. Overview

1.1. About This Document

This document describes how to install the OMX Media Component into your system.

1.2. Summary

The integration of the OMX Media Component consists of the following steps.

1. Setup the build environment (see section 3).
2. Prepare the dependent modules(see section 4)
3. Prepare the UDF part(see section 5)
4. Install the OMX Media Component Libraries and the required files(see section 6)

When you use yocto recipe package files, refer to the yocto startup guide document to build and install the OMX Media Components and the related modules.

Since the settings such as the thread priority and the scheduling policy depend on the system requirement, the UDF part needs to be customized. For the details, see section 7.

1.3. Terminology

Table 1-1 lists the terms that are used in this document.

Table 1-1 Terminology

Term	Abbreviation	Description
OpenMAX IL	OMX	In this document, OMX means the Renesas implementation that is based on OpenMAX IL specifications.
OMX Media Component	-	An OpenMAX IL Component that has multi-media functions such as decoding and encoding.
Configuration File	-	A text file describes the information about the OMX Media Component configuration.
Base Configuration File	-	The base configuration file is the configuration file whose name is "omxr_config_base.txt". The base configuration file has the description to include all the other configuration files.
Multi-Media Package	MMP	Multi-Media Package is the software package that provides multi-media functions for R-Car Series.
UVCS	-	Renesas proprietary video codec software module that provides multi-processing function for video decoding and encoding.
Memory Manager	-	Memory Manager is a module in the MMP. Memory Manager provides the functions to allocate the dynamic memory area for H/W IPs.
S3CTRL Driver	-	S3CTRL Driver is a module in the MMP. S3CTRL Driver converts provides the functions to convert from tiled-addressed picture data to linear-addressed picture data.
FDP Manager	-	FDP Manager is a module in the MMP. FDP Manager provides the video functions for deinterlacing, color space conversion and so on.
User Defined Functions	UDF	Hardware/OS Abstraction Layer of the OMX Media Component. UDF is provided as a sample of the OMX Media Component product in source code format.

1.4. Related Documents

Table 1-2 lists the related documents.

Table 1-2 List of Related Documents

No.	Document Name	Remarks
[1]	UVCS Adapted for Linux Common Engine Library Sample Codes Manual	
[2]	Memory Manager for Linux User's Manual	
[3]	S3CTRL Driver for Linux User's Manual	
[4]	FDP Manager for Linux User's Manual	

2. Deliverables

2.1. OMX Product

Table 2-1 shows the OMX products and the dependencies between the products. Table 2-1 also defines the abbreviations for each product.

For example, *cmn*, *vdcmn*, *uvcscmn* and *h264d* are required to decode H.264 streams.

Table 2-1 OMX Product List

OMX Product Name	Abbrev.	Dependent Product
OMX Media Component Common Library for Linux	<i>cmn</i>	-
OMX Media Component Video Decoder Common Library for Linux	<i>vdcmn</i>	<i>cmn</i> , <i>uvcscmn</i>
OMX Media Component Video Encoder Common Library for Linux	<i>vecmn</i>	<i>cmn</i> , <i>uvcscmn</i>
OMX Media Component H.264 Decoder Library for Linux	<i>h264d</i>	<i>vdcmn</i>
OMX Media Component MPEG4 Decoder Library for Linux	<i>m4vd</i>	<i>vdcmn</i>
OMX Media Component VC-1 Decoder Library for Linux	<i>vc1d</i>	<i>vdcmn</i>
OMX Media Component MPEG2 Decoder Library for Linux	<i>m2vd</i>	<i>vdcmn</i>
OMX Media Component DivX Decoder Library for Linux	<i>dvxd</i>	<i>vdcmn</i>
OMX Media Component RealVideo Decoder Library for Linux	<i>rlvd</i>	<i>vdcmn</i>
OMX Media Component H.263 Decoder Library for Linux	<i>h263d</i>	<i>vdcmn</i>
OMX Media Component Sorenson H.263 Decoder Library for Linux	<i>soh263d</i>	<i>vdcmn</i>
OMX Media Component VP6 Decoder Library for Linux	<i>vp6d</i>	<i>vdcmn</i>
OMX Media Component VP8 Decoder Library for Linux	<i>vp8d</i>	<i>vdcmn</i>
OMX Media Component AVS Decoder Library for Linux	<i>avsd</i>	<i>vdcmn</i>
OMX Media Component H.264 Encoder Library for Linux	<i>h264e</i>	<i>vecmn</i>
UVCS Adapted for Linux Common Engine Library	<i>uvcscmn</i>	-

2.2. Contents

Table 2-2 describes the file contents of the OMX products. ‘Software’ directory is provided as tar archive which can be extracted by the tar command. All the OMX products have the same directory structure, except *uvcscmn*. For the details of *uvcscmn*, see related document [1].

Table 2-2 File Contents of OMX Products

Directory Name		Contents
Software	OMXR	
	config	Configuration files
	include	Header files
	lib	This directory has sub directories for each compiler tool chain. Each sub directory contains OMX library files that are built with the tool chain. Choose the libraries in accordance with the system requirement. For the details of the compiler tool chain, see each OMX product manual.
	UDF_Linux	Source codes and makefiles of UDF for Linux environment. Only <i>cmn</i> , <i>vdcmn</i> and <i>vecmn</i> have this directory. The source codes in this directory must be built to integrate the OMX product. For the details, see section 5.
Documentation	en	User's manual (English)

3. Build Environment Settings

3.1. BSP Environment

To set up the build environment, see the Linux BSP startup guide of the target board.

3.2. Prerequisites

GNU Autotools and autoreconf are required to build UDF part. Table 3-1 shows the confirmed tool versions.

Table 3-1 Confirmed Tool Versions

tool	Version
Host OS	Ubuntu 12.04.2 LTS
autoconf	Version 2.68
automake	Version 1.11.3
libtool	Version 2.4.2
autoreconf	Version 2.68

4. Preparation of Dependent Modules

4.1. MMP Modules

The UDF implementation depends on the modules of the MMP. Table 4-1 and Table 4-2 show the dependent modules for OMX Video Decoder (*vdcmn*) and OMX Video Encoder (*vecmn*), respectively. Please prepare the required modules previous to building the UDF part in accordance with related document [2], [3] and [4]. The required library files are supposed to be located in \$path2lib directory. The \$path2lib directory is an arbitrary directory on the Host PC.

Table 4-1 Required MMP modules for OMX Video Decoder (*vdcmn*)

Module Name	Note
Memory Manager	-
S3CTRL Driver	-
FDP Manager	-

Table 4-2 Required MMP modules for OMX Video Encoder (*vecmn*)

Module Name	Note
Memory Manager	-

To run OMX Video Decoder and OMX Video Encoder, the required libraries must be placed in the shared library search path of the target board. In addition, the kernel modules of these modules must be installed to Linux kernel. For the details of the procedure, see related document [2], [3] and [4].

4.2. UVCS Common Engine Library

The OMX Video Decoder (*vdcmn*) and OMX Video Encoder (*vecmn*) depends on the UVCS Common Engine Library (*uvscmn*). The *uvscmn* is a Linux kernel module and is provided as a sample source code. To run OMX Video Decoder and OMX Video Encoder, the *uvscmn* must be installed to Linux kernel. For the details of the source code implementation and the install procedure, see related document [1].

5. Preparation of UDF Part

This section describes how to build the UDF part. \$build_dir means a work directory path of the Host PC.

Step1: Setup Dependent Libraries and Headers

The libraries and header files of the dependent modules described in section 4.1 must be located in the Host PC. Table 5-1 shows the file names of the required libraries and the directory path. Table 5-2 shows the file names of the required header files and the directory path. \$path2lib and \$path2include in the tables are arbitrary directories on the Host PC.

Table 5-1 Required MMP libraries

Module Name	Library File Name (so name)	Library Path (Example)
Memory Manager	libmmgr.so	\$path2lib
S3CTRL Driver	libs3ctl.so	\$path2lib
FDP Manager	libfdpm.so	\$path2lib

Table 5-2 Required MMP Header Files

Module Name	Required Header Files	Include Path (Example)
Memory Manager	mmngr_user_public.h	\$path2include/mmngr/user/include
S3CTRL Driver	s3ctl_user_public.h	\$path2include/s3ctl/user/include
FDP Manager	fdpm_api.h fdpm_public.h fdpm_def.h	\$path2include/fdpm/user/include \$path2include/fdpm/kernel/include

Step2: Setup the UDF build tree

In this step, copy the OMX source files from each deliverable directory to \$build_dir directory. \$cmn_dir, \$vdcmn_dir and \$vecmn_dir mean 'Software' directory of the *cmn*, *vdcmn* and *vecmn* deliverables, respectively.

At first, copy the directory that contains the OMX header files from the *cmn* deliverable to \$build_dir.

```
$ cd $build_dir
$ cp -r $cmn_dir/OMXR/include ./
```

Then, copy the UDF source code from the *cmn*, *vdcmn* and *vecmn* deliverables to \$build_dir.

```
$ cd $build_dir
$ cp -r $cmn_dir/UDF_Linux/* ./
$ cp -r $vdcmn_dir/UDF_Linux/* ./ # When you install vdcmn
$ cp -r $vecmn_dir/UDF_Linux/* ./ # When you install vecmn
```

Step 3: Generate configure script

Generate the configure script as follows:

```
$ cd $build_dir
$ chmod u+x autogen.sh
$ ./autogen.sh
```

Step 4: Generate Makefile

Execute the script that is generated at the Step 3 with the arguments and the environmental variables that are described in Table 5-3 and Table 5-4.

Table 5-3 Command Argument for the Configure Script

Argument	Instruction
--prefix	Specify the path of the directory on the Host PC where the UDF libraries are installed.
--host	Specify 'arm-linux'.

Table 5-4 Environmental Variable for Configure Script

Environmental Variable Name	Instruction
CC	Specify the path of the C cross compiler of the build environment.
CFLAGS	Specify the path of the directories where the header files of the dependent modules are stored.
LDFLAGS	Specify the path of the directories where the library files of the dependent modules are stored.
OMXR_DEFAULT_CONFIG_FILE_NAME	Specify the path of the base configuration file in the roots of the target board. If not specified, the default is set as '/usr/lib/omxr_config_base.txt'.

The following is an example of the configure script execution. In this example, the target directory of the install is \$temp_installdir and let \$path2compiler be a directory in which the compiler tool chain is installed.

```
$ cd $build_dir
$ ./configure ¥
--prefix=$temp_installdir ¥
--host=arm-linux ¥
CC=$path2compiler/gcc-linaro-arm-linux-gnueabi-hf-4.7-2013.02-01-20130221_linux/bin/arm-linux-gnueabi-hf-gcc ¥
CFLAGS="" ¥
-I/$path2include/mmngr/user/include ¥
-I/$path2include/fdpm/user/include ¥
-I/$path2include/fdpm/kernel/include ¥
-I/$path2include/s3ctl/user/include" ¥
LDFLAGS= ¥
-L/$path2lib/lib ¥
OMXR_DEFAULT_CONFIG_FILE_NAME=/usr/lib/omxr_config_base.txt
```

Step 5: Build

Run make command by using the Makefile that is generated at the step 4.

```
$ cd $build_dir  
$ make
```

Step 6: Install

Install the UDF libraries to the target directory as follows. The library files will be generated in the directory that is specified by '--prefix' option at Step 4.

```
$ cd $build_dir  
$ make install
```

If the target directory is on the Host PC, copy the libraries to the library directory on the target board.

Table 5-5 lists the library files that are installed by this installation procedure.

Table 5-5 Installed Libraries

Deliverable	Library File Name
<i>cmn</i>	libomxr_utility.so*
<i>vdcmn</i>	libomxr_uvcs_udf.so* libomxr_videoconverter.so* libomxr_cnvosdep.so* libomxr_cnvpdfdp.so*
<i>vecmn</i>	ibomxr_uvcs_udf.so*

6. Installation of OMX Media Component

This section describes the installation procedure of the OMX Media Component.

Table 6-1 lists the library file names and the configuration file names for each OMX Media Component product that is to be installed.

For the dependencies between the OMX Media Component products, see section 2.1.

Table 6-1 OMX Media Component Libraries and Configuration Files

Product Name	Library File Name (Real Name)	Configuration File Name
<i>cmn</i>	libomxr_core.so.2.x.x libomxr_mc_cmn.so.2.x.x	omxr_config_base.txt (base configuration file)
<i>vdcmn</i>	libomxr_mc_vcmn.so.2.x.x libomxr_mc_vdcmn.so.2.x.x libuvcs_dec.so.1.x.x libvcp3_mcvd.so.1.x.x	omxr_config_vdcmn.txt
<i>vecmn</i>	libomxr_mc_vcmn.so.2.x.x libomxr_mc_vdemn.so.2.x.x libuvcs_enc.so.1.x.x libvcp3_mcve.so.1.x.x	omxr_config_vecmn.txt
<i>h264d,</i>	libomxr_mc_h264d.so.2.x.x libvcp3_avcd.so.1.x.x	omxr_config_h264d.txt
<i>m4vd</i>	libomxr_mc_m4vd.so.2.x.x libvcp3_m4vd.so.1.x.x	omxr_config_m4vd.txt
<i>vc1d</i>	libomxr_mc_vc1d.so.2.x.x libvcp3_vc1d.so.1.x.x	omxr_config_vc1d.txt
<i>m2vd</i>	libomxr_mc_m2vd.so.2.x.x libvcp3_m2vd.so.1.x.x	omxr_config_m2vd.txt
<i>dvxd</i>	libomxr_mc_divxd.so.2.x.x libvcp3_dvxd.so.1.x.x	omxr_config_divxd.txt
<i>rlvd</i>	libomxr_mc_rlvd.so.2.x.x libvcp3_rlvd.so.1.x.x	omxr_config_rlvd.txt
<i>h263d</i>	libomxr_mc_h263d.so.2.x.x libvcp3_hv3d.so.1.x.x	omxr_config_h263d.txt
<i>soh263d</i>	libomxr_mc_soh263d.so.2.x.x libvcp3_srsd.so.1.x.x	omxr_config_soh263d.txt
<i>vp6d</i>	libomxr_mc_vp6d.so.2.x.x libvcp3_vp6d.so.1.x.x	omxr_config_vp6d.txt
<i>vp8d</i>	libomxr_mc_vp8d.so.2.x.x libvcp3_vp8d.so.1.x.x	omxr_config_vp8d.txt
<i>avsd</i>	libomxr_mc_avsd.so.2.x.x libvcp3_avsd.so.1.x.x	omxr_config_avsd.txt
<i>h264e</i>	libomxr_mc_h264e.so.2.x.x libvcp3_avce.so.1.x.x	omxr_config_h264e.txt

To install the OMX Media Component deliverables, follow the following steps. In the following procedure, let \$installdir be a directory that is shared library path in the rootfs of the target board.

Step1: Copy the real name files to the target board

Copy the real name files of each OMX Media Component deliverable to \$installdir.

```
$ cd (Software/OMXR/lib directory of each OMX MediaComponent Deliverable)
$ cp libomxr_mc_vdcmn.so.2.x.x $installdir/
```

Step2: Create symbolic links to the real name files

Create symbolic links (so name and linker name) to each real name file. The following is an example to make symbolic links to libomxr_mc_vdcmn.so.2.x.x.

```
$ cd $installdir/
$ ln -s libomxr_mc_vdcmn_.so.2.x.x libomxr_mc_vdcmn.so.2 # so name
$ ln -s libomxr_mc_vdcmn..so.2 libomxr_mc_vdcmn.so # linker name
```

Step3: Copy the configuration files to the target board

\$config_path is a directory in which the configuration files are placed. The default path of this directory is specified in the UDF build procedure (see section 5). Copy the configuration file of each OMX Media Component deliverable to \$config_path.

```
$ cd (Software/OMXR/config directory of each OMX Media Component Deliverable)
$ cp omxr_config_*.txt $config_path/
```

All of the configuration files must be located in the same directory.

7. System Dependent Settings

7.1. Thread Setting

7.1.1. Thread Priority (Video)

This section describes how to set the appropriate priorities to threads of OMX Media Components in the user systems. An OMX Media Component calls the `OmxrCreateThread` function to create threads. Since `OmxrCreateThread` is defined in the UDF part, the user can set the thread priority and the scheduling policy for each thread. The following is the prototype of the `OmxrCreateThread` function:

```
OMX_ERRORTYPE OmxrCreateThread(OMX_U32 *pu32ThreadId, void *pFunction, OMX_PTR pvInfo,  
                                OMX_STRING strPriority, OMX_U32 u32Attribute)
```

To determine the thread priority between OMX Media Component threads, OMX Media Component passes the strings that indicate the thread priority as a parameter to `OmxrCreateThread` function. Table 7-1 shows the relation between threads and the thread priority and describes the basic role of each thread.

Table 7-1 Thread Priority

strPriority	Thread Priority	Role
"PRIORITY.HIGH.MC.CMN.ST"	High	The main thread of the OMX Media Component.
"PRIORITY.HIGH.MC.CMN.CB"	High	The callback thread of the OMX Media Component.
"PRIORITY.HIGH.ME.UDF.UVCS"	High	The listener thread for UVCS Common Engine Library. This thread is implemented in the UDF.
"PRIORITY.HIGH.CNV"	High	The main thread of the Converter module. This thread is implemented in the UDF.
"PRIORITY.LOW.ME.COPY"	Low	The thread for Video Decoder Component that copies an input stream to the internal stream buffer by memcpy.

7.2. Memory Requirement

7.2.1. Memory Areas Allocated by Memory Manager

This section describes memory areas allocated by Memory Manager in the UDF part. In order to allocate memory area which is accessible by hardware IPs, the UDF part uses Memory Manager. For the details of Memory Manager, see related document [2]. Table 7-2 and Table 7-3 show memory areas allocated by Memory Manager.

Table 7-2 Memory Areas Allocated by Memory Manager (video decoder)

Memory Type	Area
input buffer	CMA
output buffer	CMA
stream_work_0	CMA
stream_work_1	CMA
stream_work_2	MVBUF
stream_work_4	CMA
stream_work_5	CMA
frame_mem	OMXBUF

Table 7-3 Memory Areas Allocated by Memory Manager (video encoder)

Memory Type	Area
input buffer	CMA
output buffer	CMA
stream_work_0	CMA
stream_work_1	CMA
stream_work_2	CMA
stream_work_4	OMXBUF
stream_work_5	CMA

7.2.2. Memory Placement Restrictions

This section describes memory placement restrictions and the way to deal with them in the UDF part. Table 7-4 and Table 7-5 show memory-placement restrictions in UDF part of video decoder.

Table 7-4 Memory Placement Restrictions (video decoder)

Memory Type	Restrictions	Implementations
stream_work_2	This area should be allocated in the MVBUFF. For the details of MVBUFF, see related document [2].	This area is allocated as MVBUFF.
frame_mem	This area should be allocated in S3CTRL managed area, which is unit of power-of-2 sized bytes. For the details of S3CTRL, see related document [3]. Also, for restriction of image placement on frame memory, extra 65536bytes is required.	This area is allocated as OMXBUF, and its size is calculated by following formula. - <i>roundup_po2</i> (size + 65536) where <roundup_po2> is rounding up to the power of 2 (i.e. 256, 512, 1024 ...), and <size> is actual frame memory size.

Table 7-5 Memory Placement Restrictions (video encoder)

Memory Type	Restrictions	Implementations
stream_work_4	This area should be allocated in the OMXBUF. For the details of OMXBUF, see related document [2].	This area is allocated as OMXBUF.

7.2.3. Hardware Address

This section describes about ‘hardware address’ that is described in User’s Manual.

Use ‘hardware address’ as address that is accessible from hardware in case using the following hardware IPs: VCP, 2DDMAC, and FDP. On the other hand, in case using the other hardware IPs, must use physical address that is translated from ‘hardware address’ by MemoryManager. For the details of address translation of Memory Manager, see related document [2].

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Rev.	Date	Description	
		Page	Summary
0.06	Jan. 24, 2014	—	Draft revision based on Japanese User's Manual Rev.0.06.
0.07	Mar. 13, 2014	6	Modify description about file contents.
		9	Add permission setting to Step3.
0.0.8	Jul. 23, 2014	15	Add section 7.2 Memory Requirement
1.0.0	Jul. 29, 2014	15	Add section 7.2.1 Memory Areas Allocated by Memory Manager
	Aug. 8,2014	15	Fix Table 0-1, and add Table 7-5
	Aug. 21,2014	17	Add section 7.2.3.Hardware Address17

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