

Linux Interface Specification Yocto recipe Start-Up Guide

User's Manual: Software

R-Car H3/M3 Series

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How to Use This Manual

- **[Readers]**

This manual is intended for engineers who develop products which use the R-Car H3/M3 processor.

- **[Purpose]**

This manual is intended to give users an understanding of the functions of the R-Car H3/M3 processor device driver and to serve as a reference for developing hardware and software for systems that use this driver.

- **[How to Read This Manual]**

It is assumed that the readers of this manual have general knowledge in the fields of electrical

— engineering, logic circuits, microcontrollers, and Linux.

→ Read this manual in the order of the CONTENTS.

— To understand the functions of a multimedia processor for R-Car H3/M3

→ See the R-Car H3/M3 User's Manual.

— To know the electrical specifications of the multimedia processor for R-Car H3/M3

→ See the R-Car H3/M3 Data Sheet.

- **[Conventions]**

The following symbols are used in this manual.

Data significance: Higher digits on the left and lower digits on the right

Note: Footnote for item marked with Note in the text

Caution: Information requiring particular attention

Remark: Supplementary information

Numeric representation: Binary ... xxxx, 0bxxxx, or xxxxB

Decimal ... xxxx

Hexadecimal ... 0xxxxx or xxxxH

Data type: Double word ... 64 bits

Word ... 32 bits

Half word ... 16 bits

Byte ... 8 bits

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Introduction

This start-up guide explains R-Car H3/M3 Yocto recipe package files, the system environments, the make method of kernel, the operating of U-Boot and so on.

This product R-Car H3/M3 Yocto recipe is a basic package to operate built-in Linux and basic middleware on the R-Car H3/M3 System Evaluation Board. Please contact Renesas Electronics person who provided this product to you in case of questions.

1. R-Car H3/M3 Linux BSP package files

This Yocto recipe will be taken

The U-Boot source code from:

`git://github.com/renesas-rcar/u-boot.git`

R-Car H3/M3 Linux source code from:

`git://git.kernel.org/pub/scm/linux/kernel/git/horms/renesas-bsp.git`

1.1 Reference (R-Car H3/M3)

document name	version
R-Car Series, 3rd Generation User's Manual: Hardware	Rev.0.51
R-CarH3-SiP System Evaluation Board Salvator-X Hardware Manual	Rev.1.03
R-CarM3-SiP System Evaluation Board Salvator-X Hardware Manual	Rev.0.03

2. ENVIRONMENTAL REQUIREMENT

2.1 Setting of parts

Host PC and terminal software are necessary for the operation of this product. Furthermore Ethernet cable is required to use NFS mount function. Please refer to Table 1.

Table 1 R-Car H3/M3 Linux BSP Environmental Requirement

Equipment	Explanation
Linux Host PC	Ubuntu 14.04 LTS (64bit) is recommended as OS. 32bit version is not supported. It is used as building and debugging environment. It is used as TFTP server and NFS server.
Windows Host PC	Windows 7 is recommended as OS. It is used as debugging environment. Terminal software and VCP driver are executed.
Terminal software	Please use following software. 1) TeraTerm (Confirmed with Japanese version of Tera Term 4.87 Available at http://sourceforge.jp/projects/ttssh2)
VCP driver	Please install in Windows Host PC. Execute CP210xVCPInstaller_x86/x64.exe for install before connect. USB become virtual COM port on terminal software. Please connect to CN25 (Serial-USB Bridge CP2102) on H3/M3 System Evaluation Board. (Available at http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx)
TFTP server software	It is used when Hyper Flash is written by U-Boot or Image is downloaded.
NFS server software	It is used when File system is mounted by NFS.

Recommended Environment

The following shows a Recommended Environment.

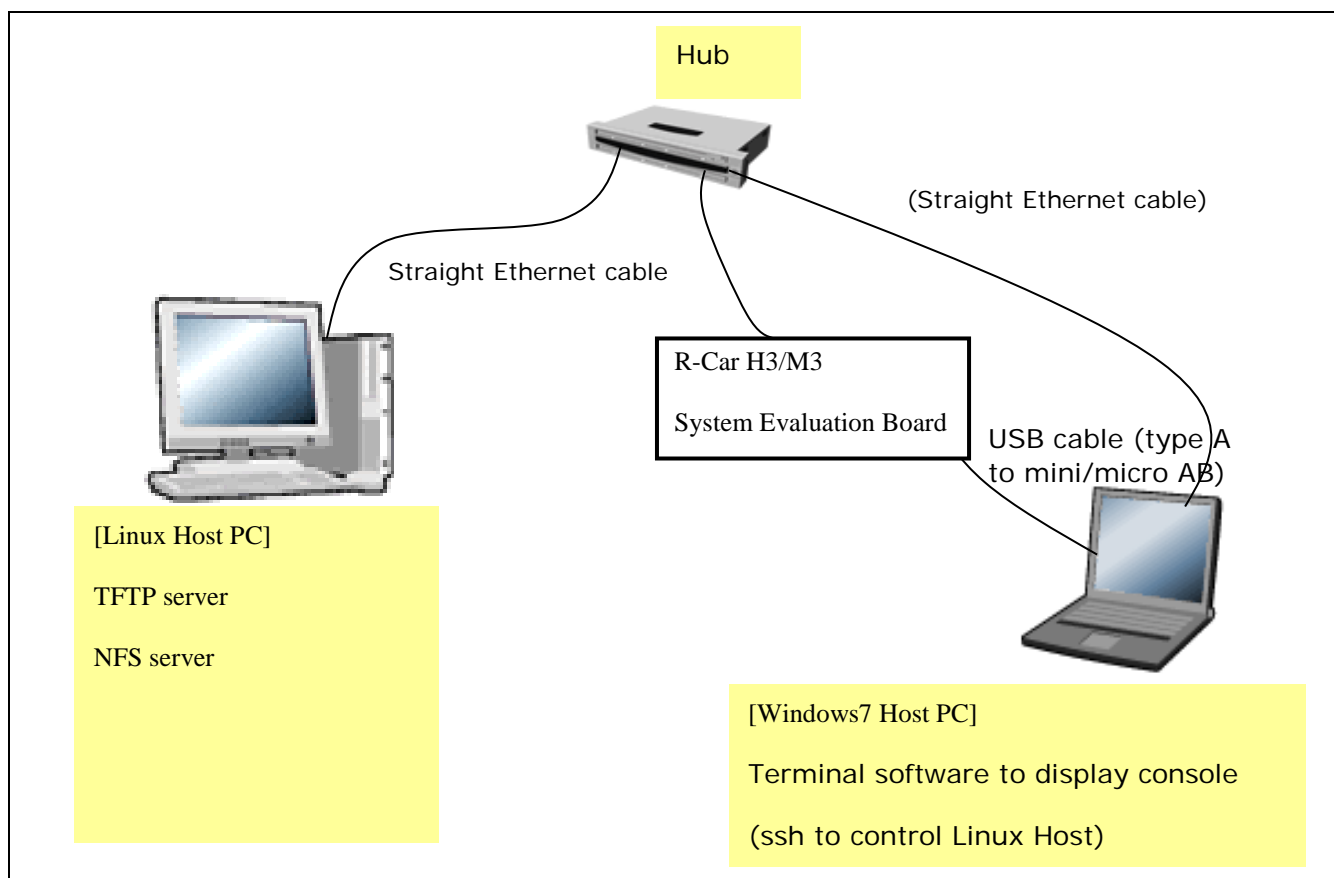


Figure 1 Recommended Environment for R-Car H3/M3 Linux BSP

Note) Functions in covered with () are optional.

2.2 Setting of dip switch

The setting of R-Car H3/M3 System Evaluation Board's dip switches is shown the following Table 2, Table 3, Table 4. Please refer to "R-CarH3-SiP System Evaluation Board RTP0RC7795SIPB0011S (Salvator-X) Setup Manual" for details.

Table 2 setting of Dip switches (R-Car H3 WS1.1)

Switch Number	Switch Name	Pin1	Pin2	Pin3	Pin4	Pin5	Pin6	Pin7	Pin8
SW1	QSPI-A	OFF	OFF	OFF	OFF	OFF	OFF	-	-
SW2	QSPI-B	OFF	OFF	OFF	OFF	OFF	OFF	-	-
SW3	QSPI-C		Set(ON)	-	-	-	-	-	-
SW13	QSPI-D	set	-		-	-	-	-	-
SW4	SOFTSW	OFF	OFF	OFF	OFF	-	-	-	-
SW5	GPIO/PWM1	set			-	-	-	-	-
SW6	GPIO/PWM2	set			-	-	-	-	-
SW7	DDRBKUP-A	set*1			-	-	-	-	-
SW8	DDRBKUP-B	OFF	OFF	OFF	OFF	-	-	-	-
SW9	TRST#			set	-	-	-	-	-
SW10	MODESW-A	ON	ON	OFF	ON	ON	ON	OFF	OFF
SW11	MODESW-B	OFF	ON	ON	ON*2	ON	ON	ON	ON
SW12	MODESW-C	OFF	ON	ON	ON	ON	ON	ON	ON
SW14	SSI78-M/S	set	-		-	-	-	-	-
SW15	USB-SW	set			-	-	-	-	-
SW16	SDHI0/DBG2-A	set	-		-	-	-	-	-
JP2	SDHI0/DBG2-B	set	-		-	-	-	-	-
SW28	VDDQVA_SD0	OFF	-	-	-	-	-	-	-
SW17	LVDS		set	-	-	-	-	-	-
SW20	TACTSW0		-	-	-	-	-	-	-
SW21	TACTSW1		-	-	-	-	-	-	-
SW22	TACTSW2		-	-	-	-	-	-	-
SW23	ACCSW	-	-	-	-	-	-	-	-
SW27	PRESET#		-	-	-	-	-	-	-
SW29	MIPI-SW	ON	ON	-	-	-	-	-	-
SW30	PHYAD	OFF	OFF	-	-	-	-	-	-

*1: In after Yocto BSP v2.12.0, it is necessary to enable BKUP_TRG signal for Suspend to RAM, please set SW7 Pin-1.

*2: If debugger is connected, please set SW11-4pin off.

Table 3 setting of Dip switches (R-Car H3 WS1.0)

Switch Number	Switch Name	Pin1	Pin2	Pin3	Pin4	Pin5	Pin6	Pin7	Pin8
SW10	MODESW-A	ON	ON	OFF	OFF	ON	ON	OFF	ON
SW11	MODESW-B	OFF	ON	ON	ON*1	ON	ON	ON	ON
SW12	MODESW-C	OFF	ON	OFF	OFF	ON	ON	ON	ON
Other	Same as H3 WS1.1								

*1: If debugger is connected, please set SW11-4pin off.

Table 4 setting of Dip switches (R-Car M3)

Switch Number	Switch Name	Pin1	Pin2	Pin3	Pin4	Pin5	Pin6	Pin7	Pin8
SW10	MODESW-A	ON	ON	ON	ON	ON	ON	OFF	OFF
SW11	MODESW-B	OFF	ON	ON	ON*1	ON	ON	ON	ON
SW12	MODESW-C	OFF	ON	ON	ON	ON	ON	ON	ON
Other	Same as H3 WS1.1								

3. Building Instructions

You can build BSP by using Yocto Project. Please execute following steps in \$WORK directory on Linux Host PC. Filesystem by making following instruction is the one for testing current BSP package in Renesas. Please note that Renesas has not been verified with any other build configuration or modified recipes except “core-image-weston” configuration which is based on upstream Yocto Project deliverables and some additional packages correspond to gstreamer.

Note) Renesas executed following instructions with clean \$WORK/build directory. You may use wipe-sysroot and/or bitbake -c cleansstate to reflect modifications of configuration files for Recipe as in open source Yocto Project’s standards, however Renesas strongly recommend to use recipe with clean \$WORK/build directory for each configurations because there are some implicit dependency for header files exist to keep compatibility between application build scheme with/without proprietary software.

Step 1 installation of required commands

Ubuntu is used as Linux Host PC since Yocto Project Quick Start specifies Ubuntu as one of the distribution. In case of that you can install the required commands as follows.

Please refer to <http://www.yoctoproject.org/docs/current/yocto-project-qs/yocto-project-qs.html> for detail.

```
$ sudo apt-get install gawk wget git-core diffstat unzip texinfo gcc-multilib \
build-essential chrpath socat libsdl1.2-dev xterm python-crypto
```

Note) There is a bitbake command in \$WORK/poky/scripts/. Command path is available after step 6.

Note) When you use terminal interactions to build such as menuconfig under non-X terminal (ssh, etc.), please install “screen” command package to Host PC

Note) Please set up user name and e-mail in Git. You can set up with ‘git config --global’. Please refer to online manual for git command.

Step 2 download of required files

Required files (poky, meta-linaro) are downloaded by git clone.

```
$ cd $WORK
$ git clone git://git.yoctoproject.org/poky
$ git clone git://git.linaro.org/openembedded/meta-linaro.git
$ git clone git://git.openembedded.org/meta-openembedded
$ git clone git://github.com/renesas-r-car/meta-renesas.git
```

Step 3 checkout

Please checkout available version of each git clone.

```
$ cd $WORK/poky
$ git checkout -b tmp 40376446904ae3529be41737fed9a0b650ed167d

$ cd $WORK/meta-linaro
$ git checkout -b tmp 9b1fd178309544dff1f7453e796a9437125bc0d9

$ cd $WORK/meta-openembedded
$ git checkout -b tmp 8ab04afbffb4bc5184cfe0655049de6f44269990

$ cd $WORK/meta-renesas
$ git checkout -b tmp 522efd09043aa8af1eec01af2b9e025df424d9a5
```

Note) tmp is a temporary name of a local branch. We can use checkout command without branch. Please note that HEAD refers directly to commit (detached HEAD).

Step 4 apply patch file

Because Renesas proprietary software is using linaro-GCC, it needs to apply. Please perform patch command.

```
$ cd $WORK/meta-renesas
$ export PATCH_DIR=meta-rcar-gen3/docs/sample/patch/patch-for-linaro-gcc
$ patch -p1 < \
    ${PATCH_DIR}/0001-rcar-gen3-add-readme-for-building-with-Linaro-Gcc.patch
$ unset PATCH_DIR
```

3.1 In case of BSP + 3D Graphics + Multimedia package

When you use proprietary Multimedia and 3D Graphics software from Renesas, please execute as following steps. Otherwise please skip to section 3.2 or 3.3.

Step 5 copy proprietary software into recipe directory structure

To use licensed 3D graphics software and Multimedia package from Renesas, please copy deliverables of those software into recipe directory structure. Renesas provide shell script to copy those software.

Copy All Proprietary Software Packages to \$PKGS_DIR:

```
$ mkdir $PKGS_DIR
```

```
$ cp <zip of Proprietary Software Package> $PKGS_DIR
```

Install them into recipe directory structure by shell script:

```
$ cd $WORK/meta-renesas
```

```
$ sh \
```

```
meta-rcar-gen3/docs/sample/copyscript/copy_proprietary_softwares.sh \
$PKGS_DIR
```

Note) Subdirectory is not supporting in \$PKGS_DIR. Please store all packages on the root of \$PKGS_DIR.

Note) Please use regular alphanumeric file name ([A-Za-z0-9_] e.g.) for \$PKGS_DIR due to restrictions of current copy script.

Step 6 execute source command

Please execute source command with oe-init-build-env for setting environment.

```
$ cd $WORK
```

```
$ source poky/oe-init-build-env
```

Step 7 copy bblayers.conf and local.conf

Please copy configuration files from deliverables.

```
$ cp $WORK/meta-renesas/meta-rcar-gen3/docs/sample/conf/<supported
board name>/linaro-gcc/mmp/*.conf ./conf/.
```

Note) <supported board name> is the one of the following: salvator-x

Step 8 enable 3D Graphics and Multimedia package to install GSX modules

To enable 3D Graphics packages which use GSX, please overwrite local.conf as following instructions or modify local.conf as descriptions in \$WORK/meta-renesas/meta-rcar-gen3/README.proprietary

To install GSX kernel module:

Overwrite local.conf

```
$ cp conf/local-wayland.conf conf/local.conf (For Wayland)
```

Step 9 enable Multimedia package

Please modify configurations in \$WORK/build/conf/local.conf by following instructions

Note) Please refer to \$WORK/meta-renesas/meta-rcar-gen3/README.proprietary

The following standard multimedia packages are enabled

No.	Functions	Explanation
1	MMNGR	Memory manager driver & shared libraries
2	VSPM	VSP driver & FDP driver & shared libraries
3	VSP2	VSP2 driver
4	OMX	OMX common parts

To enable optional multimedia functions, please add DISTRO_FEATURES_append to \$WORK/build/conf/local.conf as DISTRO_FEATURES_append = “ <function name>”.

Note) These configurations exist near the end of local.conf.

Note) DISTRO_FEATURES_append are commented out by the default. To enable functions, please uncomment it.

For example**[Disable]**

```
#DISTRO_FEATURES_append = " h264dec_lib"
```

[Enable (default)]

```
DISTRO_FEATURES_append = " h264dec_lib"
```

The following list is package name to enable/disable as optional multimedia functions

No.	Function name	Default value	Explanation
1	h264dec_lib	Enable	H264 decoder library RTM0AC0000XV264D30SL40C
2	h264enc_lib	Disable	H264 encoder library RTM0AC0000XV264E30SL40C
3	h265dec_lib	Disable	H265 decoder library RTM0AC0000XV265D30SL40C
4	mpeg2dec_lib	Disable	MPEG2 decoder library RTM0AC0000XVM2VD30SL40C
5	mpeg4dec_lib	Disable	MPEG4 decoder library RTM0AC0000XVM4VD30SL40C
6	vc1dec_lib	Disable	VC-1 decoder library RTM0AC0000XVVC1D30SL40C
7	divxdec_lib	Disable	DivX decoder library RTM0AC0000XVDVXD30SL40C
8	rvdec_lib	Disable	RealVideo decoder library RTM0AC0000XVRLVD30SL40C
9	aaclddec_lib	Enable	AAC-LC decoder library RTM0AC0000XAAACD30SL40C
10	aaclddec_mdw	Enable	AAC-LC 2ch decoder middleware library RTM0AC0000ADAACMZ1SL40C
11	aacpv2dec_lib	Disable	aacPlus V2 Decoder Library RTM0AC0000XAAAPD30SL40C
12	aacpv2dec_mdw	Disable	aacPlus V2 Decoder Middleware Library RTM0AC0000ADAAPMZ1SL40C
13	mp3dec_lib	Disable	MP3 decoder library RTM0AC0000XAMP3D30SL40C
14	mp3dec_mdw	Disable	MP3 decoder middleware library RTM0AC0000ADMP3MZ1SL40C
15	wmadec_lib	Disable	WMA decoder library RTM0AC0000XAWMAD30SL40C
16	wmadec_mdw	Disable	WMA decoder middleware library RTM0AC0000ADWMAMZ1SL40C
17	aaclcenc_lib	Disable	AAC-LC encoder library RTM0AC0000XAAACE30SL40C
18	aaclcenc_mdw	Disable	AAC-LC encoder middleware library RTM0AC0000AEAACMZ1SL40C
19	flacdec_lib	Disable	FLAC decoder library RTM0AC0000XAFLAD30SL40C
20	alacdec_lib	Disable	ALAC decoder library RTM0AC0000XAALAD30SL40C
21	dddec_lib	Disable	Dolby(R) Digital decoder library RTM0AC0000XADD5D30SL40C
22	dddec_mdw	Disable	Dolby(R) Digital decoder middleware library RTM0AC0000XADD5D30SL40C
23	cmsbcm	Disable	Basic Color Management Middleware for Linux RTM0AC0000JRCMBVCV0SL40C

No.	Function name	Default value	Explanation
24	cmsblc	Disable	CMM3 Backlight Control Middleware for Linux RTM0AC0000JRCMBLC0SL40C
25	cmsdgc	Disable	VSP2 Dynamic Gamma Correction Middleware for Linux RTM0AC0000JRCMDGV0SL40C
26	adsp	Disable	ADSP Interface for Linux RCG3AHIFL4001ZDP
27	avb	Disable	Ether-AVB

The following list is dependence package name

No.	Function name	Type Name	Independence Package
1	h264dec_lib	RTM0AC0000XV264D30SL40C	RCG3VUDRL4001ZDO RTM0AC0000XCMCTL30SL40C RTM0AC0000XVCMND30SL40C
2	h264enc_lib	RTM0AC0000XV264E30SL40C	RCG3VUDRL4001ZDO RTM0AC0000XCMCTL30SL40C RTM0AC0000XVCMNE30SL40C
3	h265dec_lib	RTM0AC0000XV265D30SL40C	RCG3VUDRL4001ZDO RTM0AC0000XCMCTL30SL40C RTM0AC0000XVCMND30SL40C
4	mpeg2dec_lib	RTM0AC0000XVM2VD30SL40C	RCG3VUDRL4001ZDO RTM0AC0000XCMCTL30SL40C RTM0AC0000XVCMND30SL40C
5	mpeg4dec_lib	RTM0AC0000XVM4VD30SL40C	RCG3VUDRL4001ZDO RTM0AC0000XCMCTL30SL40C RTM0AC0000XVCMND30SL40C
6	vc1dec_lib	RTM0AC0000XVVC1D30SL40C	RCG3VUDRL4001ZDO RTM0AC0000XCMCTL30SL40C RTM0AC0000XVCMND30SL40C
7	divxdec_lib	RTM0AC0000XVDVXD30SL40C	RCG3VUDRL4001ZDO RTM0AC0000XCMCTL30SL40C RTM0AC0000XVCMND30SL40C
8	rvdec_lib	RTM0AC0000XVRLVD30SL40C	RCG3VUDRL4001ZDO RTM0AC0000XCMCTL30SL40C RTM0AC0000XVCMND30SL40C
9	aacldcdec_lib	RTM0AC0000XAAACD30SL40C	RTM0AC0000XACMND30SL40C
10	aacldcdec_mdw	RTM0AC0000ADAACMZ1SL40C	-
11	aacpv2dec_lib	RTM0AC0000XAAAPD30SL40C	RTM0AC0000XACMND30SL40C
12	aacpv2dec_mdw	RTM0AC0000ADAAPMZ1SL40C	
13	mp3dec_lib	RTM0AC0000XAMP3D30SL40C	RTM0AC0000XACMND30SL40C
14	mp3dec_mdw	RTM0AC0000ADMP3MZ1SL40C	-
15	wmadec_lib	RTM0AC0000XAWMAD30SL40C	RTM0AC0000XACMND30SL40C
16	wmadec_mdw	RTM0AC0000ADWMAMZ1SL40C	-
17	aaclcenc_lib	RTM0AC0000XAAACE30SL40C	RTM0AC0000XACMND30SL40C
18	aaclcenc_mdw	RTM0AC0000AEAACMZ1SL40C	
19	flacdec_lib	RTM0AC0000XAFLAD30SL40C	RTM0AC0000XACMND30SL40C
20	alacdec_lib	RTM0AC0000XAALAD30SL40C	RTM0AC0000XACMND30SL40C
21	dddec_lib	RTM0AC0000XADD5D30SL40C	RTM0AC0000XACMND30SL40C RTM0AC0000XADD5D30SL40C
22	dddec_mdw	RTM0AC0000XADD5D30SL40C	
23	cmsbcm	RTM0AC0000JRCMBCV0SL40C	-
24	cmsblc	RTM0AC0000JRCMBLC0SL40C	-

No.	Function name	Type Name	Independence Package
25	cmsdgc	RTM0AC0000JRCMDGV0SL40C	-
26	adsp	RCG3AHIFL4001ZDP	RCG3AHFWN0101ZDP RCG3AHPDL4001ZDO
27	avb	-	-

Step 10 select SoC

To select SoC, please set SOC_FAMILY to \$WORK/build/conf/local.conf as SOC_FAMILY = "<soc type name>".

```
[H3]
SOC_FAMILY = "r8a7795"
[M3]
SOC_FAMILY = "r8a7796"
```

Step 11 building with bitbake

Please build as follows. The file system (core-image-weston-<supported board name>.tar.bz2) is created in \$WORK/build/tmp/deploy/images/<supported board name>/ directory.

Note) <supported board name> is the one of the following: salvator-x

Note) Build by bitbake might need several hours under the influence of Linux Host PC performance and network environment.

Note) The bitbake downloads some package while building. Then the bitbake might stop for network timeout or link error. In this case, please get applicable package in \$WORK/build/downloads directory whenever build stops by wget command, or please review timeout definitions of package download (wget, etc.) described in \$WORK/poky/meta/conf/bitbake.conf.

```
$ cd $WORK/build
$ bitbake core-image-weston (for Wayland)
```

3.2 In case of BSP + 3D Graphics (without Multimedia package)

When you use licensed 3D Graphics software but will not use proprietary Multimedia software from Renesas, please execute as following steps. Otherwise please skip to section 3.3.

Step 5 copy proprietary software into recipe directory structure

To use licensed 3D graphics software and Multimedia package from Renesas, please copy deliverables of those software into recipe directory structure. Renesas provide shell script to copy those software.

Copy All Proprietary Software Packages to \$PKGS_DIR:

```
$ mkdir $PKGS_DIR
```

```
$ cp <zip of Proprietary Software Package> $PKGS_DIR
```

Install them into recipe directory structure by shell script:

```
$ cd $WORK/meta-renesas
```

```
$ sh \
```

```
meta-rcar-gen3/docs/sample/copyscript/copy_proprietary_softwares.sh \
$PKGS_DIR
```

Note) Subdirectory is not supporting in \$PKGS_DIR. Please store all packages on the root of \$PKGS_DIR.

Note) Please use regular alphanumeric file name ([A-Za-z0-9_] e.g.) for \$PKGS_DIR due to restrictions of current copy script.

Step 6 execute source command

Please execute source command with oe-init-build-env for setting environment.

```
$ cd $WORK
```

```
$ source poky/oe-init-build-env
```

Step 7 copy bblayers.conf and local.conf

Please copy configuration files from deliverables.

```
$ cp $WORK/meta-renesas/meta-rcar-gen3/docs/sample/conf/<supported
board name>/linaro-gcc/gfx-only/*.conf ./conf/.
```

Note) <supported board name> is the one of the following: salvator-x

Step 8 enable 3D Graphics package to install GSX modules

To enable 3D Graphics packages which use GSX, please overwrite local.conf as following instructions or modify local.conf as descriptions in \$WORK/meta-renesas/meta-rcar-gen3/README.proprietary

To install GSX kernel module:

Overwrite local.conf

```
$ cp conf/local-wayland.conf conf/local.conf (For Wayland)
```

Step 9 select SoC

To select SoC, please set SOC_FAMILY to \$WORK/build/conf/local.conf as SOC_FAMILY = "<soc type name>".

```
[H3]
SOC_FAMILY = "r8a7795"
[M3]
SOC_FAMILY = "r8a7796"
```

Step 10 building with bitbake

Please build as follows. The file system (core-image-weston-<supported board name>.tar.bz2) is created in \$WORK/build/tmp/deploy/images/<supported board name>/ directory.

Note) <supported board name> is the one of the following: salvator-x

Note) Build by bitbake might need several hours under the influence of Linux Host PC performance and network environment.

Note) The bitbake downloads some package while building. Then the bitbake might stop for network timeout or link error. In this case, please get applicable package in \$WORK/build/downloads directory whenever build stops by wget command, or please review timeout definitions of package download (wget, etc.) described in \$WORK/poky/meta/conf/bitbake.conf.

```
$ cd $WORK/build
$ bitbake core-image-weston (for Wayland)
```

3.3 In case of BSP Only

When you will not use neither proprietary Multimedia software nor licensed 3D Graphics software from Renesas, please execute as following steps.

Step 5 execute source command

Please execute source command with oe-init-build-env for setting environment.

```
$ cd $WORK
$ source poky/oe-init-build-env
```

Step 6 copy bblayers.conf and local.conf

Please copy configuration files from deliverables.

```
$ cp $WORK/meta-renesas/meta-rcar-gen3/docs/sample/conf/<supported
board name>/linaro-gcc/bsp/*.conf ./conf/.
```

Note) <supported board name> is the one of the following: salvator-x

Note) core-image-weston is not supported even though local-wayland.conf is provided.

Step 7 select SoC

To select SoC, please set SOC_FAMILY to \$WORK/build/conf/local.conf as SOC_FAMILY = "<soc type name>".

```
[H3]
SOC_FAMILY = "r8a7795"
[M3]
SOC_FAMILY = "r8a7796"
```

Step 8 building with bitbake

Please build as follows. The file system (core-image-minimal-<supported board name>.tar.bz2) is created in \$WORK/build/tmp/ deploy/images/<supported board name>/ directory.

Note) <supported board name> is the one of the following: salvator-x

Note) Build by bitbake might need several hours under the influence of Linux Host PC performance and network environment.

Note) The bitbake downloads some package while building. Then the bitbake might stop for network timeout or link error. In this case, please get applicable package in \$WORK/build/downloads directory whenever build stops by wget command, or please review timeout definitions of package download (wget, etc.) described in \$WORK/poky/meta/conf/bitbake.conf.

```
$ cd $WORK/build  
$ bitbake core-image-minimal
```


4. Writing of IPL/Secure

4.1 Writing data

filename	Program Top Address	Flash Save Address	description
bootparam_sa0.srec	H'E6320000	H'000000	Loader(Boot parameter)
bl2-<board_name>.srec	H'E6302000	H'040000	Loader
cert_header_sa6.srec	H'E6320000	H'180000	Loader(Certification)
bl31-<board_name>.srec	H'44000000	H'1C0000	ARM Trusted Firmware
tee-<board_name>.srec	H'44100000	H'200000	OP-Tee
u-boot-elf.srec	H'49000000	H'640000	U-boot

Note) Please refer to Chapter 5 for u-boot.

4.2 Dip-Switch

a) QSPI Mode

Switch Number	Switch Name	Pin1	Pin2	Pin3	Pin4	Pin5	Pin6	Pin7	Pin8
SW1	QSPI-A	ON	ON	ON	ON	ON	ON	-	-
SW2	QSPI-B	ON	ON	ON	ON	ON	ON	-	-
SW3	QSPI-C	set(OFF)		-	-	-	-	-	-
SW10	MODESW-A	Refer to 2.2				ON	OFF	ON	ON

b) Hyper Flash Mode

Switch Number	Switch Name	Pin1	Pin2	Pin3	Pin4	Pin5	Pin6	Pin7	Pin8
SW1	QSPI-A	OFF	OFF	OFF	OFF	OFF	OFF	-	-
SW2	QSPI-B	OFF	OFF	OFF	OFF	OFF	OFF	-	-
SW3	QSPI-C		set(ON)	-	-	-	-	-	-
SW10	MODESW-A	Refer to 2.2							

4.3 How to write

Please connect R-Car H3/M3 System Evaluation Board, Windows Host PC with terminal software for console and Linux Host PC.

In case of R-Car H3/M3, Ethernet connector is CN22, serial connector is CN25.

Step 1 connect cable

Connect USB Host connector of Windows Host PC that is virtual COM port to CN25 of R-Car H3/M3 System Evaluation Board with USB cable for displaying console.

Step 2 setting the terminal software

Activate the Terminal Software on Windows Host PC. Configure the Terminal Software on Windows Host PC as followings. Please refer to Table 1 about the VCP driver for making a USB host connector into a virtual COM port

[setting value] baud rate 115200, 8bit data, parity none, stop 1 bit, flow control none

Step 3 write data file to Hyper Flash

A file is written in Hyper Flash in the following procedures.

- Set dip switch “QSPI Mode”.
- Reset board then start mini monitor.
- Set dip switch (Select Hyper Flash)
SW1: ALL OFF
SW2: ALL OFF
SW3: ON
Note) SW10 does not need to change.
- Execute xls2 command (load program to flash).

```
SALVATOR MiniMonitor V0.05 2015.08.25
Work Memory SystemRAM (H'E6328000-H'E632FFFF)
>xls2
===== Qspi/HyperFlash writing of Gen3 Board Command =====
Load Program to Spiflash
Writes to any of SPI address.
Please select,FlashMemory.
  1 : QspiFlash      (U5 : S25FS128S)
  2 : QspiFlash Board (CN3: S25FL512S)
  3 : HyperFlash     (SiP internal)
Select (1-3)>
```

- Select HyperFlash. Input “3”.
- After "SW31 ON! Setting OK? (Push Y key) [In the case of Kriek Board]" is displayed, input "y". (R-Car M3 only)
- After "SW1 SW2 All OFF! Setting OK? (Push Y key)" is displayed, input "y".
- After "SW3 ON! Setting OK? (Push Y key)" is displayed, input "y".
- After "Please Input Program Top Address" is displayed, input Program Top Address in 4.1 and "Enter".
- After "Please Input Qspi/HyperFlash Save Address" is displayed, input Flash Save Address in 4.1 and "Enter".
- After "Please send ! ('.' & CR stop load)" is displayed, In case of Tera Term, transmit u-boot-elf.srec by "file -> file transmission(S)".
- If there are some data in writing area, "SPI Data Clear(H'FF) Check :H'00000000-0003FFFF Clear OK?(y/n)" is displayed. Then input "y".
- After "SAVE SPI-FLASH complete!" is displayed, the prompt returns. It means finish.
- Please repeat the xls2 command, if other files are written.
- Power OFF
- Set dip switch to “Hyper Flash Mode”.
Note) SW1, SW2, and SW3 are already Hyper Flash mode. Please set SW10.

4.4 IPL/Secure write

Please write the file described in Chapter 4.1 to Hyper Flash.

The data file is stored in the \$WORK/build/tmp/deploy/images/<board_name> directory.

5. Confirm starting of U-Boot and Linux

Please connect R-Car H3/M3 System Evaluation Board, Windows Host PC with terminal software for console and Linux Host PC with TFTP and NFS server as Figure 1. Then please confirm normal starting of U-Boot and Linux with following step. Please refer to 2.2 for dip switch setting.

In case of R-Car H3/M3, Ethernet connector is CN22, serial connector is CN25, D-Sub connector is CN15.

Step 1 setting Linux Host PC

Please install TFTP server and NFS server in Linux Host PC with apt-get command and so on. Please set /etc/xinetd.d/tftp of TFTP server and /etc/exports of NFS server according to your environment.

Step 2 connect cable

Connect USB Host connector of Windows Host PC that is virtual COM port to CN25 of R-Car H3/M3 System Evaluation Board with USB cable for displaying console.

Step 3 setting the terminal software

Activate the Terminal Software on Windows Host PC. Configure the Terminal Software on Windows Host PC as followings. Please refer to Table 1 about the VCP driver for making a USB host connector into a virtual COM port.

[setting value] baud rate 115200, 8bit data, parity none, stop 1 bit, flow control none

Step 4 write U-Boot to Hyper Flash

filename	Program Top Address	Flash Save Address	description
u-boot-elf.srec	0x49000000	0x640000	U-boot

The data file is stored in the \$WORK/build/tmp/deploy/images/<board_name> directory.
Refer to Chapter 4.3 Step3 for write procedure.

Step 5 set U-Boot environment variables

Please refer to 2.2 for dip switch setting.

Please start U-Boot by board reset. Please set and save environment variable as follows.

```
=> setenv ethaddr xx:xx:xx:xx:xx:xx
=> setenv ipaddr 192.168.0.20
=> setenv serverip 192.168.0.1
=> setenv bootcmd 'tftp 0x48080000 Image;tftp 0x48000000 Image-
<SOC_FAMILY>-salvator-x.dtb;booti 0x48080000 - 0x48000000'
```

Note) <SOC_FAMILY> is the following: r8a7795, r8a7796

Step 6 change the bootargs by U-Boot

To change bootargs which passed to the kernel in boot sequence, please modify it by “setenv bootargs” command of u-boot.

```
=> setenv bootargs 'rw root=/dev/nfs nfsroot=192.168.0.1:/export/rfs  
ip=192.168.0.20'
```

Note) When the screen saver starts, the system halts. By adding “consoleblank=0” in bootargs, this problem is avoidable. Please refer to BSP release note for details.

Step 7 save environment variables

```
=> saveenv
```

Step 8 set file system

Please extract file system (core-image-weston-<supported board name>.tar.bz2). Please export /export directory of NFS server.

```
$ mkdir /export/rfs  
$ cd /export/rfs  
$ sudo tar xvf core-image-weston(minimal)-<supported board name>.tar.bz2
```

Note) <supported board name> is the following: salvator-x

Step 9 start Linux

After board reset, U-Boot is started. After countdown, Linux boot messages are displayed. Please confirm login prompt after Linux boot messages.

Note) When MAC Address is rewritten, it is necessary to reset.

Note) In core-image-weston, please connect input device (keyboard, mouse) to USB port (CN10). In R-Car M3, Only CN10 of USB2_2 port can be used.

Note) In core-image-weston, please set XDG_RUNTIME_DIR. “export XDG_RUNTIME_DIR=/run/user/root”.

6. Exporting Toolchains

Please refer Documents from Yocto Project to export Toolchains such as

<http://www.yoctoproject.org/docs/current/adt-manual/adt-manual.html>.

And please use build target of bitbake as “core-image-weston-sdk -c populate_sdk” to generate package.

Note) When you use “ld” directly but not via gcc (in case of building Kernel, Driver or u-boot), please disable LDFLAGS with ‘unset LDFLAGS’. Furthermore, in kernel build, ‘make menuconfig’ occurs error by ncurses. In this case, please disable PKG_CONFIG_PATH with ‘unset PKG_CONFIG_PATH’.

Note) Please do not use same shell environment to other compilation/debugging purpose (also make menuconfig of linux kernel, e.g.) but cross compilation for R-Car H3/M3 which shell environment with “source” command to setup environment variables for the SDK. Because some environment variables for cross compilation interferes execution of other tools on the same shell environment.

Example of instruction:

In following examples, it’s assumed that it’s already extracted and prepared recipe environment such as in the instructions of Section 3 (must done just before execution of bitbake, at least). You may reuse \$WORK/build while you reuse same configuration after executing bitbake as in Section 3 for this purpose.

Step 1 configure architectures of Host PC which are installed this toolchain

Please modify SDK_MACHINE description on \$WORK/build/conf/local.conf

On \$WORK/build/conf/local.conf

```
# This variable specified the architecture to build SDK/ADT items for and means
# you can build the SDK packages for architectures other than the machine you are
# running the build on (i.e. building i686 packages on an x86_64 host._
# Supported values are i686 and x86_64
#SDKMACHINE ?= "i686"
SDKMACHINE ?= "x86_64"
```

Note) 32bit Ubuntu 14.04 is not supported.

Step 2 building toolchain package with bitbake

```
$ cd $WORK/build
$ bitbake core-image-weston-sdk -c populate_sdk
$ cp tmp/deploy/sdk/poky-glibc-x86_64-core-image-weston-sdk-aarch64-
toolchain-2.0.2.sh (shared dir. where able to access from each Host PCs)
```

Note) Please perform “bitbake core-image-minimal -c populate_sdk” in BSP-only.

Step 3 Install toolchain on each Host PCs

```
$ sudo (shared dir. where able to access from each Host PCs)/poky-glibc-
x86_64-core-image-weston-sdk-aarch64-toolchain-2.0.2.sh
```

```
[sudo] password for (INSTALL person): (password of your account)
Enter target directory for SDK (default: /opt/poky/2.0.2): (just a return)
Extracting SDK...done
Setting it up...done
SDK has been successfully set up and is ready to be used.
```

Step 4 setup environment variables for each compilation on each Host PCs

Please setup environment variables as follows or integrate set-up sequence into your build script or Makefile.

```
$ cd (Your working directory)
$ source /opt/poky/2.0.2/environment-setup-aarch64-poky-linux
$ export LDFLAGS=""
$ $CC (Your source code).c .....
```

7. Memory map

Following Figure 2 to Figure 6 show memory map of this R-Car H3/M3 Linux BSP package.

Note)

- The volume of SDRAM is total 4GB.
- 2GB from 0x00_4000_0000 to 0x00_BFFF_FFFF is a shadow area from 0x04_0000_0000 to 0x04_7FFF_FFFF.
- The following regions are used as a secure region. It doesn't allow U-Boot and kernel to access those regions.
 - 63MB from 0x00_43F0_0000 to 0x00_47DF_FFFF in SDRAM
 - 8KB from 0x00_E630_0000 to 0x00_E630_1FFF in System RAM
- In case the configuration of BSP + 3D Graphics + Multimedia package, it doesn't allow to store any data in "CMA for Lossy comp" (default: 0x00_5400_0000 - 0x00_56FF_FFFF) region which is for media playback before kernel boots up. Any data stored in this region are read through the decompression module in AXI-Bus, so a normal data (not a decoded frame) will be corrupted.

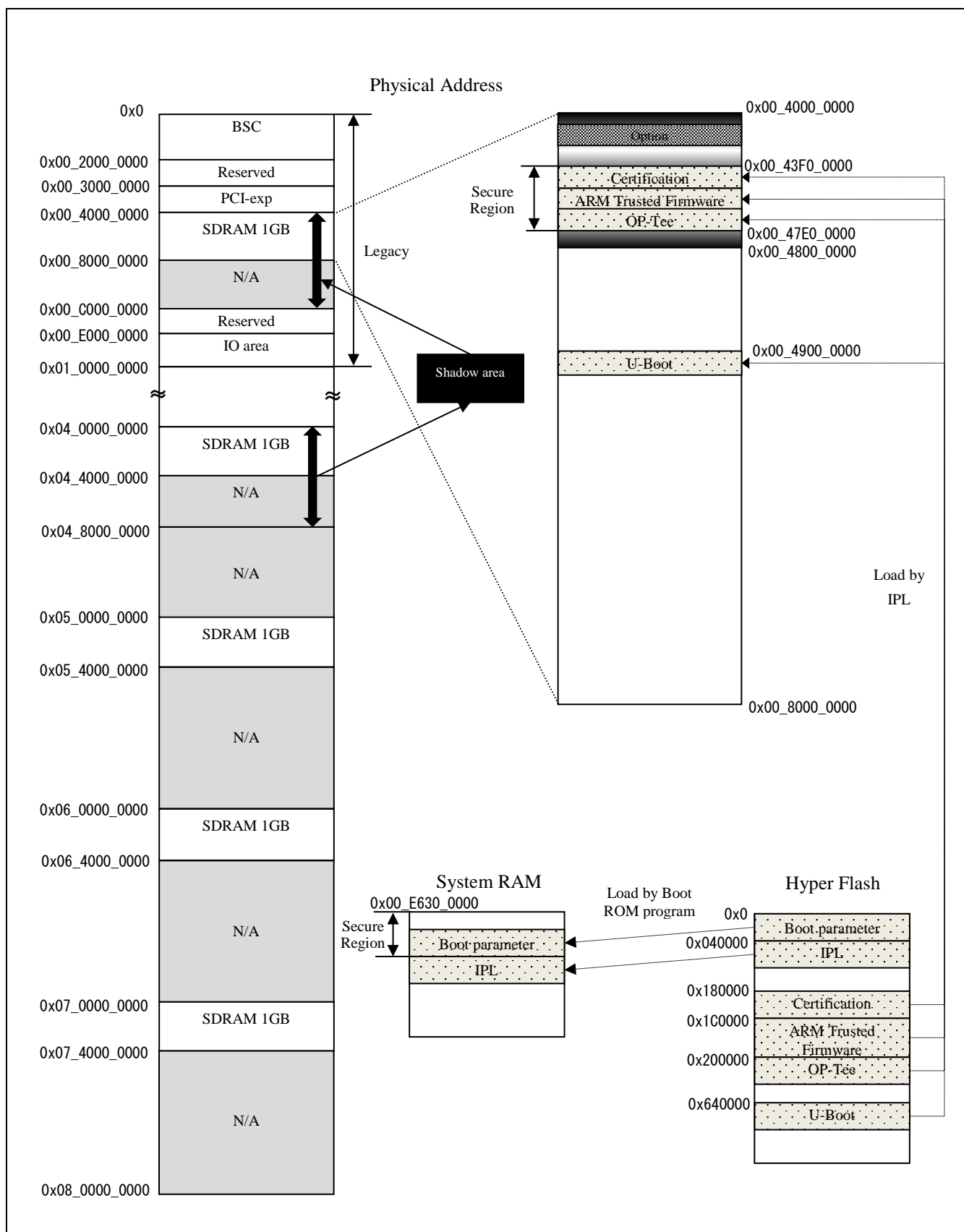


Figure 2 H3 memory map (Boot)

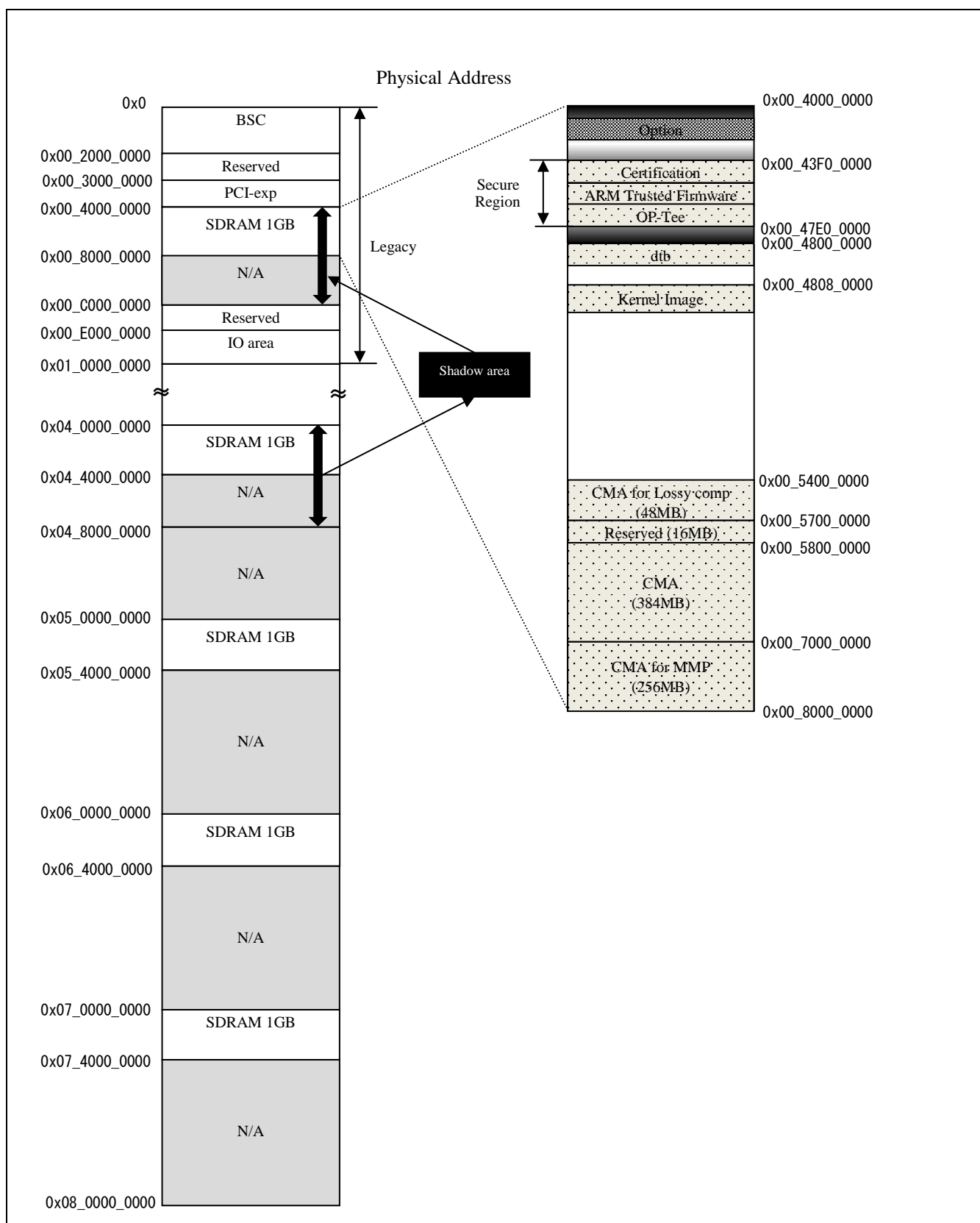


Figure 3 H3 memory map (Linux)

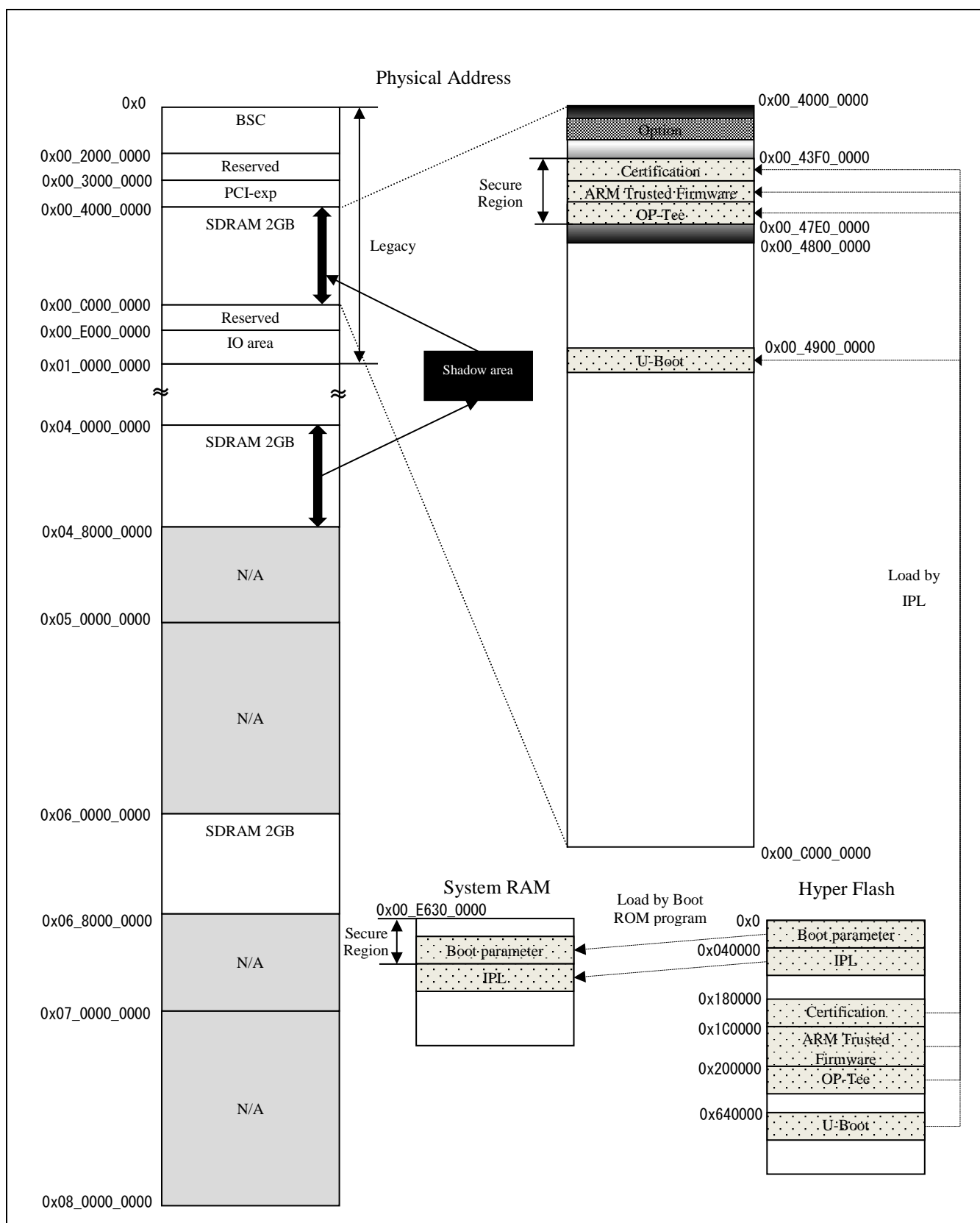


Figure 4 M3 memory map (Boot)

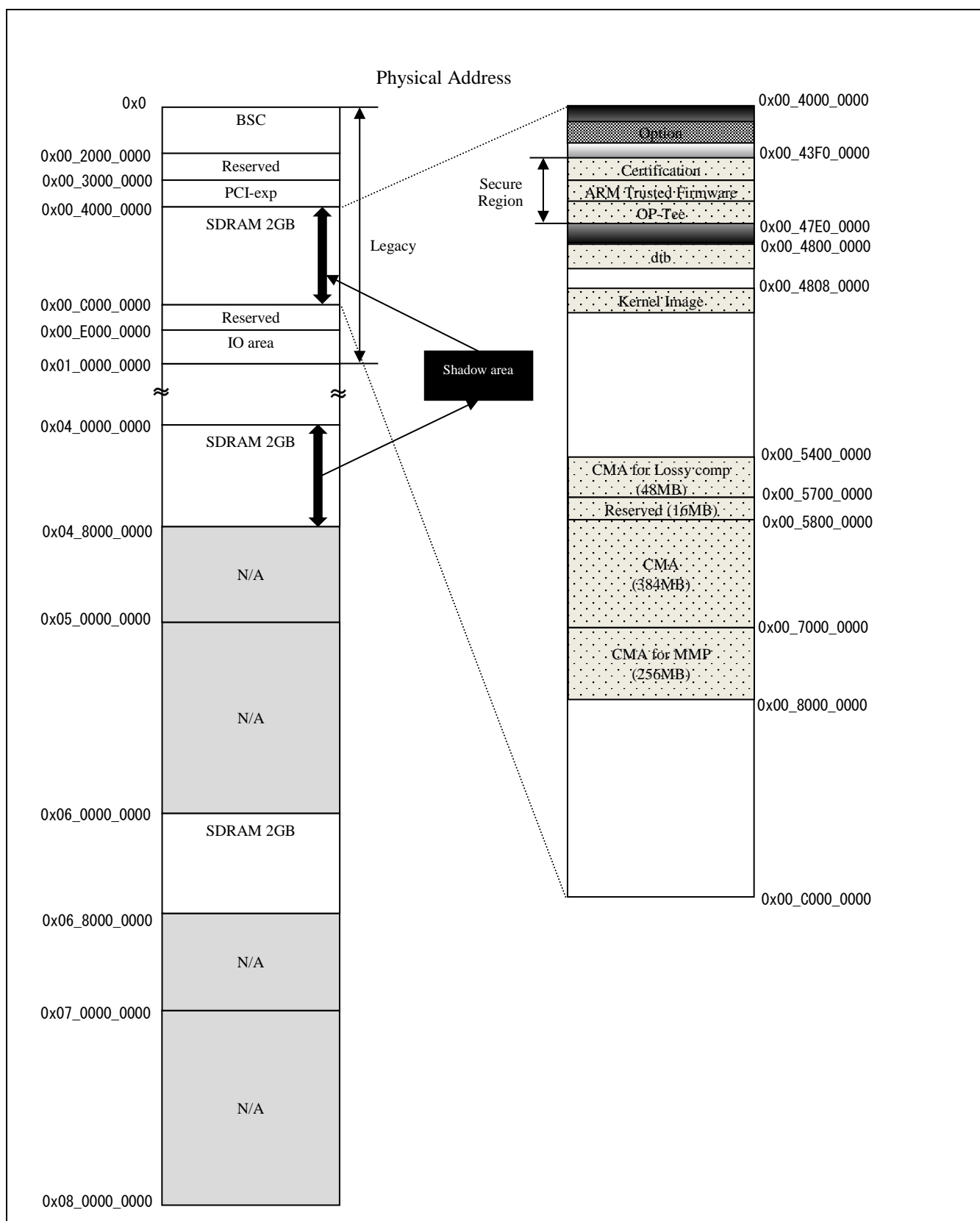


Figure 5 M3 memory map (Linux)

Note)

- Kernel region is assigned by Kernel device tree arch/arm64/boot/dts/renesas/xxx.dts and totally mapped to 4GB.
- Kernel region consists of 4 parts: (R-Car H3)
 - 896MB from 0x00_4800_0000 to 0x00_7FFF_FFFF
 - 1GB from 0x05_0000_0000 to 0x05_3FFF_FFFF
 - 1GB from 0x06_0000_0000 to 0x06_3FFF_FFFF
 - 1GB from 0x07_0000_0000 to 0x07_3FFF_FFFF
- Kernel region consists of 2 parts: (R-Car M3)
 - 1920MB from 0x00_4800_0000 to 0x00_BFFF_FFFF
 - 2GB from 0x06_0000_0000 to 0x06_7FFF_FFFF

There are three types of CMA regions.

They are defined in device tree (arch/arm64/boot/dts/renesas/xxxx.dts).

- Default CMA region: It is for kernel and general drivers.

```
linux,cma {
    compatible = "shared-dma-pool";
    reusable;
    reg = <0x00000000 0xFFFFFFFF 0x0 0xFFFFFFFF>;
    linux,cma-default;
};
```

0xFFFFFFFF is start address of CMA region.
0xFFFFFFFF is size of CMA region.

Note)

- The CMA region can be adjusted by changing the start address and the size.
- Should take care of the lack of memory allocated by kernel and general drivers when reducing the region size.
- CMA region for MMP: It is for multimedia package (specific H/Ws).

```
linux,multimedia {
    compatible = "shared-dma-pool";
    reusable;
    reg = <0x00000000 0xFFFFFFFF 0x0 0xFFFFFFFF>;
};
```

0xFFFFFFFF is start address of CMA region.
0xFFFFFFFF is size of CMA region.

Note)

- Refer to User's manual of Memory Manager in order to change CMA region for MMP.

- CMA region for Lossy comp: It is for storing data compressed by Frame Compression Near Lossless (FCNL) for media playback.

```
lossy_decompress: linux,lossy_decompress {
    no-map;
    reg = <0x00000000 0xFFFFFFFF 0x0 0xFFFFFFFF>;
};
```

0xFFFFFFFF is start address of CMA region.
0xFFFFFFFF is size of CMA region.

Note)

- Refer to User's manual of IPL in order to change CMA region for Lossy comp.

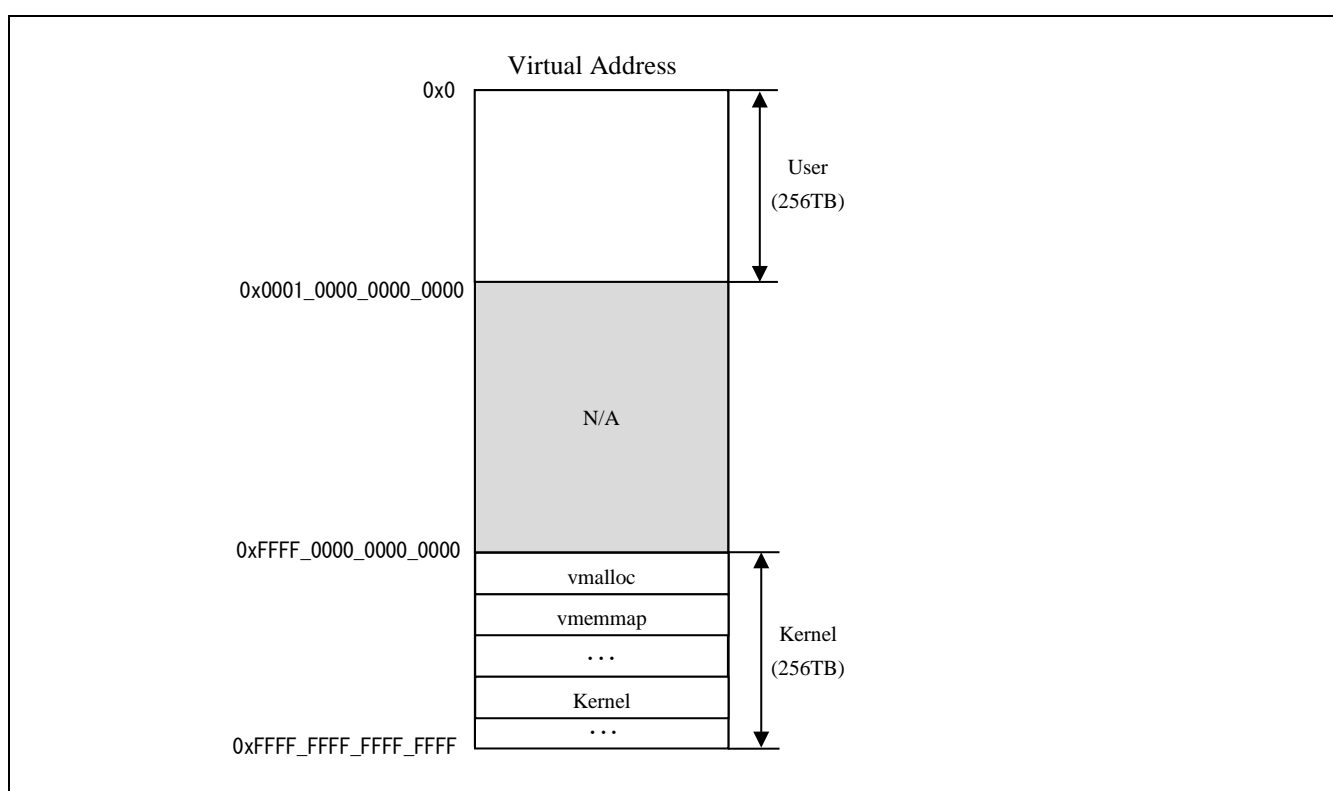


Figure 6 H3/M3 memory map (Virtual)

Note)

- Kernel uses 4KB page size (VA_BITS=48) and 4 levels of translation tables. Both regions of User and Kernel are 256TB. Refer to Documentation/arm64/memory.txt.
- Detail information about kernel memory map in virtual address space, refer to User's manual of Kernel.

8. U-Boot command

Please refer to U-Boot user's manual about available U-boot command for R-Car H3/M3 Linux BSP. The help or "?" command shows U-Boot command list, but be careful that it includes some unsupported command.

REVISION HISTORY	Linux Interface Specification Yocto recipe Start-Up Guide User's Manual: Software
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Rev.	Date	Description	
		Page	Summary
0.10	Sep 07. 2015	—	First Edition for Yocto Recipe Package with YP1.8, based on Start-Up Guide Rev 1.30 for Kernel 3.4 LTSI
0.20	Sep 30. 2015	2	1 Modified URL of U-boot and Linux source code.
		6	3 Deleted description about core-image-x11
		6	3 step2 Changed git repository URL
		9	3.2 Added note about not support 3D graphics package 3.2 step5,7 Changed command process
		12	4.1 Changed u-boot filename. u-boot.srec -> u-boot-elf.srec
		21, 22	7 Modified memory map (Fig2, 3)
0.30	Oct 30 2015	2	1.1 Modified document version
		3	2.1 Updated table1
		4	2.1 Updated Figure1
		7	3 Modified checkout commit id 3 step4 Updated apply patch command
		8-12	3.1 Added description build procedure for MMP and 3D Graphics
		14	4.4 Deleted note
		18	5 step6 Added mem=2048 to bootargs 5 step8 Added note
		19-21	6 Modified SDK revision 1.8 -> 1.8.1
		22	7 Modified the description of the address range. 0x00_C000_0000 -> 0x00_BFFF_FFFF 7 Modified the address range and size of a secure region.
		23	7 Modified the address of System RAM. 0x00_E630_0000 -> 0x00_E632_0000 7 Modified the load destination of Certification in HyperFlash. System RAM -> SDRAM
0.40	Nov 27 2015	24, 25	7 Modified memory map (Fig3) and update note about CMA 7 Added note about specifying mem=2048M 7 Added note about 3D graphics region
		26	7 Separated virtual memory map (Fig4) and note about virtual memory
0.40	Nov 27 2015	7	3 Modified checkout commit id 3 step4 Updated apply patch command
		18	5 step6 Added note about adding consoleblank=0 in bootargs 5 step7 Added description saveenv command 5 step9 Modified start Linux procedure
0.50	Dec 25 2015	6	3 step1 add python-crypto 3 setp2 add meta-openembedded
		7	3 Modified checkout commit id
		17	5 step5 delete note
		18	5 step9 add USB channel number
0.61	Jan 25 2016	7	3 Modified checkout commit id 3 step4 Changed patch command
		10	3.1 step10 Fix typo in captor name 3.1 step10 Deleted note for mem=2048M in bootargs
		12	3.2 step9 Deleted note for mem=2048M in bootargs

		14	4.1 Changed Hex notation. 0XXXXX -> H'XXXX
		18	5 step6 Deleted mem=2048M in bootargs 5 step9 Add note about XDG_RUNTIME_DIR
		19-21	Changed SDK version to 2.0 from 1.8.1
		20	6 step3 Add note about overwrite installation
0.70	Feb 25 2016	2	1.1 Modified document version
		7	3 Modified checkout commit id
		8	3.1 step5 Renewed description
		11	3.2 step5 Renewed description
		18	5 step8 Deleted console setting from bootargs 5 step9 Add note about writing MAC address
		19-21	Changed SDK version to 2.0.1 from 2.0
0.80	Mar 25 2016	5,6	2.2 Add R-Car H3 WS1.1 and changed setting value of SW11-4pin in WS1.0
		8	3 Modified checkout commit id
		10,11	3.1 step9 Add Type name of MMP and dependence package list
		18	5 Deleted note
		25	7 Modified memory map (Fig3) and remove the 3D Graphics specific region
		26	Deleted the description of "mem=" and update Kernel region
0.90	Apr 25 2016	all	Added description for R-Car M3. For example, R-Car H3 -> R-Car H3/M3
		2	1.1 Modified document version 1.1 Deleted "R-Car Series, 3 rd Generation Electorical Characteristics"
		6	2.2 Add table4 for R-Car M3
		8	3 Modified checkout commit id
		9	3.1 Added note for R-Car M3
		11-12	3.1 step9 Updated Multi Media Package list
		13	3.1 step10 Added select SoC
		15	3.2 step9 Added select SoC
		16	3.3 step7 Added select SoC
		21	5 step5 Changed description setenv command, and added note for SOC_FAMILY
		27,28	Modified memory map(Fig2 and Fig3) of H3
		29,30	Added memory map(Fig4 and Fig5) of M3
		31	Added description of M3 kernel region
		32	Added description of CMA region for Lossy comp
2.9.0	May 25 2016	-	Changed Revision number rule. Document revision number is Yocto Recipe version.
		6	2.2 Modify table4. RCar M3: DDR1600 -> DDR3200
		8	3 Modified checkout commit id
		9	3.1 deleted note for R-Car M3
		11-12	3.1 step9 Fix TYPO and added aacPlus V2 decoder, ADSP, Ether-AVB
2.10.0	Jun 27 2016	2	1 update linux source code URL
		8	3 Modified checkout commit id
		19	4 step3 add message for SW31 in R-Car M3
		23-25	6 Changed version of SDK. 2.0.1 -> 2.0.2
		26	Added note of "CMA for Lossy comp" region
		26,27, 29	Added description of 8KB Secure region from 0xE6300000 Modified memory map(Fig2 and Fig4) of H3/M3

		32	Changed virtual address space from 39-bit to 48-bit Modified memory map(Fig 6)
2.11.0	Jul 25 2016	2	1.1 Modified Reference
		8	3 Modified checkout commit id
		10	3 step9 Updated standard multimedia package table
		11-14	3 step9 Updated optional multimedia package table
		20	4.2 Updated Dip-Switch setting for R-Car H3 WS1.1 and M3 WS1.0
		23	5 Added description about refer to Dip-Switch setting
		24	5 step9 Modified note for USB connector. R-Car M3 support only CN10 of USB2_2
		23-24	5 Deleted description of 32bit environment
		25-26	6 Deleted description of 32bit SDK
		33	7 Updated device tree source code of CMA region for Lossy comp
2.12.0	Aug 25 2016	2	1 update linux source code URL
		2	1.1 Modified Reference
		3	2.1 Updated table 1
		5	2.2 Updated table 2
		7	3 step1 Added note about git config
		8	3 step3 Modified checkout commit id
		11-14	3 step9 Updated optional multimedia package table
		25	6 Updated note about environment variables
		25-26	6 Deleted description of 32bit SDK

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User's Manual: Software

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