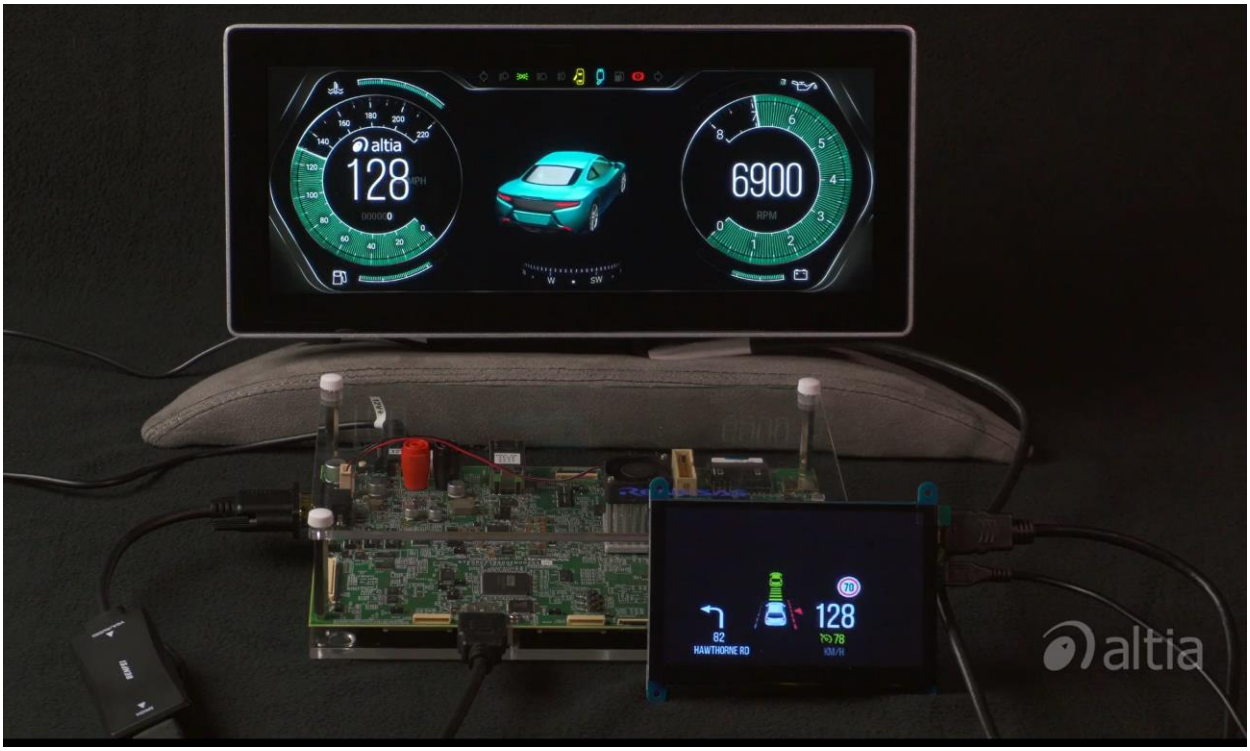
Cluster and HUD Demo for Renesas R-Car E3e

Quick Start Guide

Updated July 11, 2023

1 Overview

This guide describes the system requirements and how to program and execute the prebuilt instrument cluster and HUD applications (binary image) on the Renesas R-Car E3e Ebisu-4D evaluation board.



2 Demo System

- Board Required: Renesas R-Car E3e Ebisu-4D
- Cluster Display:
  - 1920x720
  - HMI by CR7/2D GPU (FreeRTOS)
  - 3D center content by CA53/3D GPU (Linux)
  - HDMI cable
- HUD Display
  - 800x480 (Recommend using ELECROW Raspberry Pi Touchscreen Monitor 5)
  - HMI by CR7/2D GPU (FreeRTOS)
  - VGA to HDMI adapter (from VGA on board to HDMI on LCD)
- Rendering: RGL for 2D and OpenGL ES 2.0 for 3D
- Download Size: Executable zip file: 13.8MB

3 How to Deploy Cluster and HUD Demo on R-Car E3e Ebisu-4D Board

This document describes how to deploy the cluster and HUD demos to an R-Car E3e Ebisu-4D evaluation board.

3.1 Pre-requisites

1. Renesas R-Car E3e Ebisu-4D HW (incl. Micro-USB to USB-A cable, and Power-Supply)
2. Running Installation of TeraTerm (PC terminal program)
3. A Linux-PC/VM running Ubuntu-Linux (like Ubuntu 20.04 LTS)
4. USB SDCard Reader + SDCard (min. 8 GB)

Download from Box.com:

5. LinuxImage.7z: https://altia.box.com/s/rqlc0h1h8pf6q92ztusvbvxr71mgr2oj
6. BootLoaderFiles.7z: https://altia.box.com/s/7rwn99hf9j0n61mwa1bf0akt708w391h
7. Mustangdemo_1920x720_3D_only.7z: https://altia.box.com/s/betdo3f7eaffp11b8no2awphs1gmwapz

3.2 Extract files

1. Extract LinuxImage.7z. It contains the following files:
   - core-image-weston-ebisu-20220517083701.rootfs.tar.bz2
   - Image
   - r8a77990-ebisu-4d_cr7_rproc.dtb
   - rproc-cr7-fw
2. Extract BootLoaderFiles.7z. It contains the following files:
   - altia_hmi.srec
   - bl2-ebisu-4d.srec
   - bl31-ebisu-4d.srec
   - bootparam_sa0-4d.srec
   - cert_header_sa6-4d.srec
   - tee-ebisu.srec

- u-boot-elf-ebisu.srec

3. Extract Mustangdemo_1920x720_3D_only.7z. It contains the following files:
   - Mustangdemo_1920x720_3D_only
   - reflash (folder)
   - powervr.ini

3.3 Setup SD Card

1. Connect the USB SD Card Reader to the Linux-PC.
2. Generate an ext4 file system on the SD Card (gparted can be used).
3. Mount the SD Card (It is assumed /dev/sdc1 here. If this is different on your system, replace /dev/sdc1 by the device file which represents your SD Card) to the Linux-PC file system (it is assumed /media/user/sdcard).
4. Extract the core-image-weston-ebisu-20220517083701.rootfs.tar.bz2 file that was extracted from LinuxImage.7z and setup the Linux Root File System on the SD Card by using the following commands:

   ```
   bunzip2 core-image-weston-ebisu-20220517083701.rootfs.tar.bz2
   ```

   ```
   tar xvf core-image-weston-ebisu-20220517083701.rootfs.tar
   /media/user/sdcard
   ```

   ```
   sync
   ```

5. Copy the Image file that was extracted from LinuxImage.7z to the SD Card Root File System using the following command:

   ```
   sudo cp Image /media/user/sdcard/boot/
   ```

6. Copy the r8a77990-ebisu-4d_cr7_rproc.dtb file that was extracted from LinuxImage.7z to the SD Card Root File System by using the following command:

   ```
   sudo cp r8a77990-ebisu-4d_cr7_rproc.dtb /media/user/sdcard/boot/
   ```

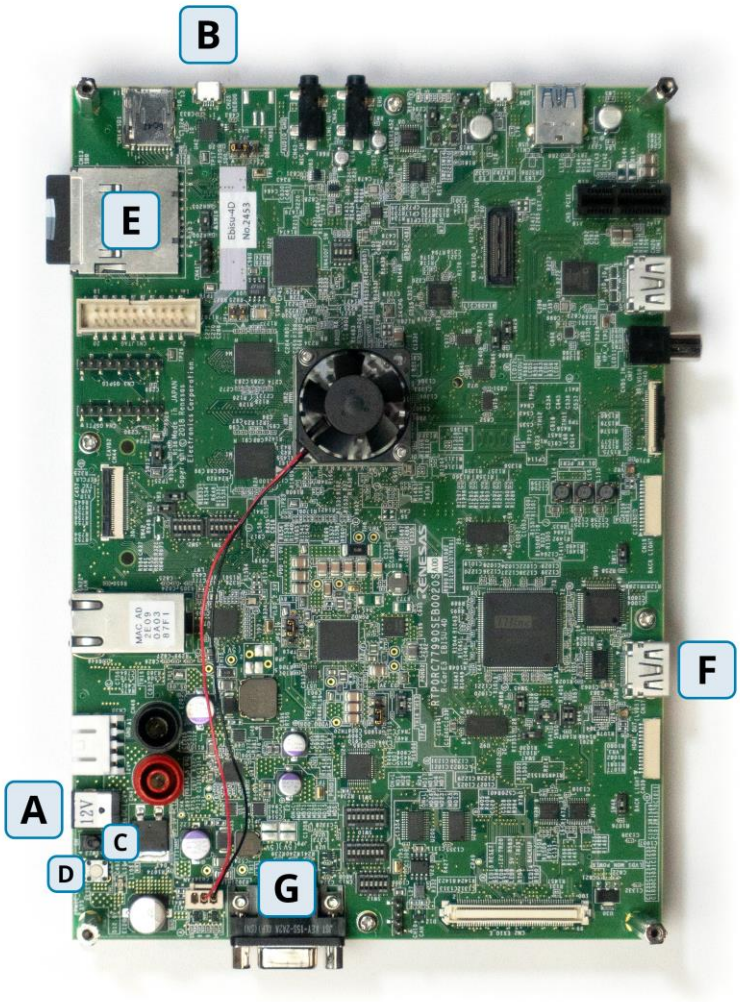
7. Copy the rproc-cr7-fw file that was extracted from LinuxImage.7z to the SD Card Root File System by using the following command:

   ```
   sudo cp rproc-cr7-fw /media/user/sdcard/lib/firmware
   ```

8. Copy the files extracted from Mustangdemo_1920x720_3D_only.7z onto the Linux image (for example to /home/root/Mustangdemo_1920x720_3D_part). It might be necessary to change the file properties to 755 (rwxr-xr-x). When this is done, the 3D part of the cluster demo can be started from the Linux console which will be explained later.

3.4 Program Boot Loader Files to the Board

1. Set up the connection and switches on board.



A: Connect Power-Supply to Renesas E3e Ebisu-4D HW (**NOTE**: DO NOT switch on board!)

B: Connect Renesas E3e Ebisu-4D HW via micro-USB-to-UBS-A cable (CN) to PC

C: Power-Switch

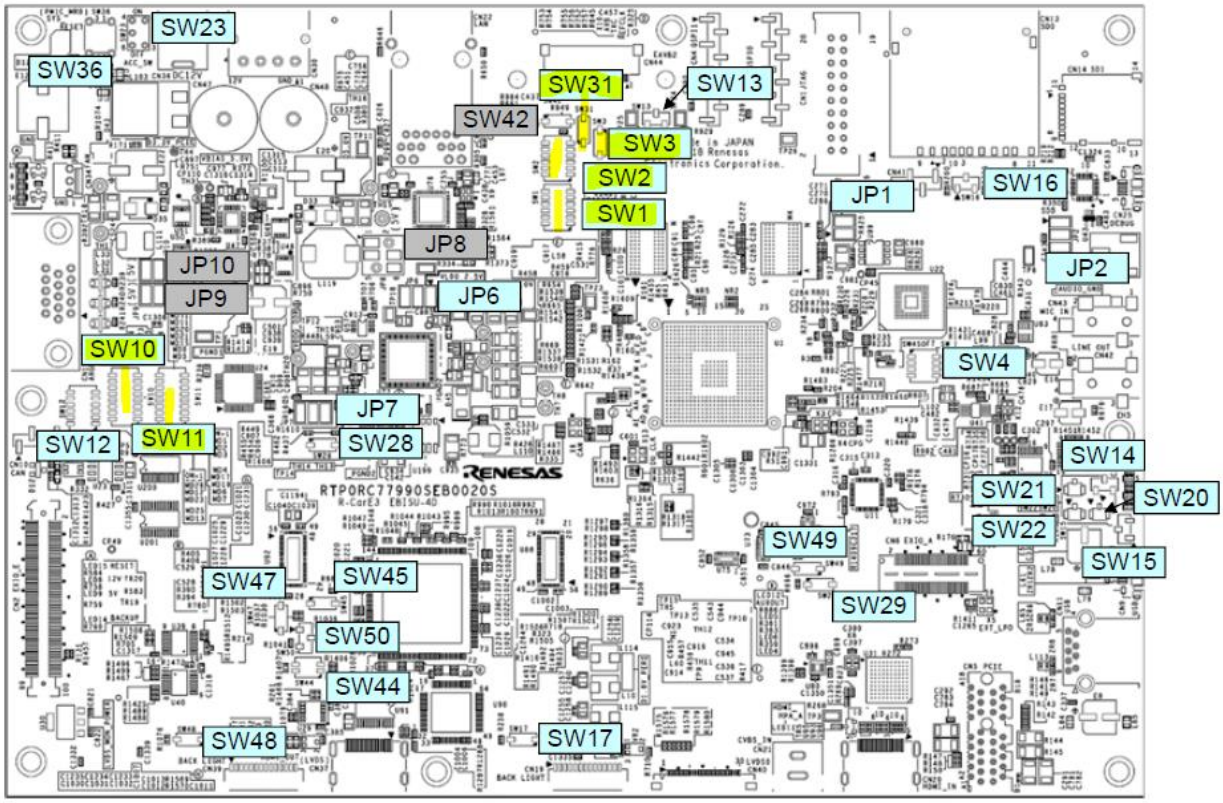
D: RESET Push-Button

E: SD Card Slot

F: HDMI-out

G: VGA-out

2. Extract the following diagrams from Renesas R-CarE3 System Evaluation Board Ebisu-4D Setup Manual (https://alt3ia.box.com/s/y75337u9hex01jj1wm43oaq6ketv16t5) to configure Renesas E3e Ebisu-4D HW to boot from QSPI-Flash (Mini-Monitor).



Switch Number	Switch Name	Side (C/S)	Pin 1 ▲	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
SW1	QSPI-A	C	All ON						-	-
SW2	QSPI-B	C	All ON						-	-
SW3	QSPI-C	C	✔ (OFF)		-	-	-	-	-	-
SW31	QSPI-D	C	✔ (OFF)		-	-	-	-	-	-
SW13	QSPI-E	C	✔	-		-	-	-	-	-
(SW42)	QSPI-F	C	---	---	-	-	-	-	-	-
SW4	SOFTSW	C	OFF	OFF	OFF	OFF	-	-	-	-
SW10	MODESW-A	C	ON	OFF	OFF	ON	ON	OFF	ON	ON
SW11	MODESW-B	C	OFF	ON	OFF	ON	ON	ON	ON	ON
SW12	MODESW-C	C	ON	ON	ON	ON	ON	-	-	-

3. Use the switch table above to configure ON or OFF for each switch on the board shown in the above first diagram.

4. Start TeraTerm (setup 115200 8N1) terminal program for the COM-port generated by the connection to the Renesas E3e Ebisu-4D HW and Power-On Renesas E3e Ebisu-4D (Switch "C"). The Renesas Mini-Loader menu in the terminal will be shown in the following gray box (this is copied from RENESAS_RCH3M3M3NE3D3_YoctoStartupGuide_UME_v5.5.0.pdf, https://altia.box.com/s/y0oncur7rcbngcm4z97ot49mtny5j1qo).

```
R-Car Gen3 Sample Loader V3.03 2017.08.25
 For Salvator, Kriek, and StarterKit.
 Board Judge          : Used Board-ID
 DDR_ Init            : 6oardcnf[7] Salvator / Starter Kit (H3SIP _VER2.0)
 INITIAL SETTING      : Salvator-XS / R-Car H3 ES3.0
 CPU                  : AArch64 CA57
 DRAM                 : LPDDR4 DDR3200
 DEVICE               : QSPI Flash(S25FS128) at 40MHz DMA
 BOOT                 : Normal Boot
 BACKUP               : DDR cord Boot
 jump to 0xE6330000

R-Car Gen3 MiniMonitor V3.03 2017.08.25
 Work Memory: SystemRAM
 Board Name: Salvator-XS
 Product Code: R-Car H3 ES3.0
>xls2
===== Qspi/HyperFlash writing of Gen3 Board Command=============
Load Program to Spiflash
Writes to any of SPI address.
Please select FlashMemory.
        1: QspiFlash (US: S25FS128S)
        2: QspiFlash Board (CN3: S25FL512S)
        3: HyperFlash (SiP internal)
Select (1-3)>
```

NOTE: The following table contains all the files that need to be downloaded to the target along with their Program Top Address and QSPI/HyperFlash Save. **Warning:** Download of cr7-rtos.srec to HW takes about 45 mins.

Filename	Program Top Address	Flash Save Address	Description
bootparam_sa0.srec	E6320000	0x00000000	Loader (Boot parameter)
cr7_loader.srec	0xE6304000	0x00040000	Loader
cert_header_sa3.srec	0xE6320000	0x000C0000	Loader (Certificate)
altia_hmi.srec	0x70000000	0x00740000	CR7 FreeRTOS (incl 2D demo)
bl2.srec	0xE6304000	0x00140000	BL2
cert_header_sa6.srec	0xE6320000	0x00180000	Loader (Certificate)
bl31.srec	0x44000000	0x001C0000	BL31
tee.srec	0x44100000	0x00200000	op-tee
u-boot.srec	0x50000000	0x00640000	u-boot

5. Download each of the files listed above by following these commands in the terminal. For each file follow every step then repeat for the next file until finished. Note that you will need to set SW1 and 2 to all OFF and SW3 and 31 to ON when the prompt comes up for that. Leave these switches set from now on and only switch them back if you need to repeat this section.
    a. Input: **xls2**
    b. Input: **3**
    c. After "SWl SW2 All OFF! Setting OK? (Push Y key)" is displayed.
        - Input: **y**
    d. After "SW3 ON! Setting OK? (Push Y key)" is displayed
        - Input: **y**
    e. After "SW31 ON! Setting OK? (Push Y key) is displayed.
        - Input: **y**
    f. After "Please Input Program Top Address" is displayed.
        - Input the Program Top Address from the above table.
    g. After "Please Input Qspi/HyperFlash Save Address" is displayed.

- Input the Flash Save Address from the above table.

h. After "Please send! ('.' & CR stop load)" is displayed
   - In the case of Tera Term, transmit the desired srec file in by
     - "File -> Send file ... "

i. If there are some data in writing area, "SPI Data Clear(H'FF) Check :H'00000000-0003FFFF Clear OK?(y/n)" is displayed
   - Input: **y**

j. The download will be finished when "SAVE SPI-FLASH ..... complete!" is displayed, and the prompt returns.

k. If you have more srec files to download repeat steps a through j

6. Power OFF (Switch “C”)
7. Set dip Switches to “Hyper Flash Mode”.
   a. Leave SW1 and 2 as all OFF and SW3 and 31 as ON
   b. Set Switch SW10: (1) OFF, (2) OFF, (3) OFF, (4) ON, (5) ON, (6) ON, (7) OFF, (8) ON

3.5 Boot Linux Image to Start the Cluster and HUD Demos

1. Connect the 1920x720 display to HDMI-out on the R-Car E3 Ebisu-4D Board via the HDMI cable.
2. Connect the 800x480 display to VGA-out on the R-Car E3 Ebisu-4D Board via VGA to HDMI adapter and HDMI cable.
3. Put the SD Card into the SD Card slot of the Renesas R-Car E3 Ebisu-4D Board and power-cycle/reset the board.
4. Setup the below configuration of U-Boot to boot from the SD Card.

```
env set baudrate 115200

env set bootargs 'rw root=/dev/mmcblk1p1 rootwait'

env set bootcmd 'ext4load mmc 0:1 0x48080000 /boot/Image; ext4load mmc 0:1 0x48000000 /boot/r8a77990-ebisu-4d_cr7_rproc.dtb; booti 0x48080000 - 0x48000000'

env set bootdelay 2

env set bootm_size 0x10000000

env set ethaddr 2E:09:0A:03:87:F1

env set fdtcontroladdr abf25f80

env set fileaddr 48000000
```

```
env set filesize c5bb
env set ipaddr 192.168.1.225
env set loadaddr 0x58000000
env set platform r8a77990
env set serverip 192.168.1.222
env set stderr serial@e6e88000
env set stdin serial@e6e88000
env set stdout serial@e6e88000
env set usb_pgood_delay 2000
env set ver U-Boot 2020.10 (Nov 09 2021 - 20:22:03 +0000)
env save
```

5. When the Boot Loader Files have been written correctly, the 2D Part of the demo (Cluster and HUD) shall come up in less than one second after reset as shown below. In parallel, the Linux image is booted from the Linux Console after you

6. When the Linux image is booted, you now need to start the 3D part of the cluster demo. Do the following in the Linux Console.

```
cd < location of Mustang demo >
./Mustangdemo_1920x720_3D_only
```