Linux Driver Development for Embedded Processors

Practical Labs Hardware

Processor evaluation boards

The Linux drivers described in the lab sections of this book have been written to run in the following processor boards:

STMicroelectronics STM32MP157C-DK2. Linux drivers examples have been developed using Linux kernel v4.19 LTS. The documentation of this board can be found at https://www.st.com/en/evaluation-tools/stm32mp157c-dk2.html

Raspberry Pi 4 Model B. Linux drivers examples have been developed using Linux kernel v4.19 LTS. You can see Raspberry Pi 4 Tech Specs at https://www.raspberrypi.org/products/raspberry-pi-4-model-b/specifications/

Raspberry Pi 3 Model B. Linux drivers examples have been developed using Linux kernel v4.9 LTS. The documentation of this board can be found at https://www.raspberrypi.org/products/raspberry-pi-3-model-b/

NXP MCIMX7SABRE. Linux drivers examples have been developed using Linux kernel v4.9 LTS and Linux kernel v4.19 LTS. The documentation of this board can be found at https://www.nxp.com/design/development-boards/i-mx-evaluation-and-development-boards/sabre-board-for-smart-devices-based-on-the-i-mx-7dual-applications-processors:MCIMX7SABRE

Microchip SAMA5D27-SOM1-EK1. Linux drivers examples have been developed using Linux kernel v4.14 LTS. The documentation of this board can be found at https://www.microchip.com/developmenttools/ProductDetails/atsama5d27-som1-ek1

Microchip ATSAMA5D2B-XULT. Linux drivers examples have been developed using Linux kernel v4.9 LTS. The user guide of this board can be found at http://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-44083-32-bit-Cortex-A5-Microprocessor-SAMA5D2-Rev.B-Xplained-Ultra_User-Guide.pdf

Hardware needed for the labs

In this section, it will be described the hardware needed to run the labs on the different processor boards.

Chapter 5, Platform Drivers

This is the needed hw to run the labs in this chapter for each processor board:

1. **STMicroelectronics STM32MP157C-DK2**: LEDs included in the processor board.
2. **Raspberry Pi 4 Model B** and **Raspberry Pi 3 Model B**: Color click™ accessory board at https://www.mikroe.com/color-click

3. **NXP MCIMX7SABRE**: Color click™ accessory board at https://www.mikroe.com/color-click
4. **Microchip SAMA5D27-SOM1-EK1**: RGB LED included in the processor board.
5. **Microchip ATSAMA5D2B-XULT**: RGB LED included in the processor board.

Chapter 6, I2C Client Drivers

This is the needed hw to run the labs in this chapter for all the processor boards:

1. PCF8574 IO Expansion Board at https://www.waveshare.com/pcf8574-io-expansion-board.htm
2. Analog Devices LTC3206 I2C Multidisplay board DC749A at https://www.analog.com/en/products/ltc3206.html#product-evaluationkit

Chapter 7, Handling Interrupts in Device Drivers

This is the needed hw to run the labs in this chapter for each processor board:

1. **STMicroelectronics STM32MP157C-DK2**: LEDs and Buttons included in the processor board.
2. **Raspberry Pi 4 Model B** and **Raspberry Pi 3 Model B**: One Color click™ accessory board at https://www.mikroe.com/color-click and two Button R Click boards at https://www.mikroe.com/button-r-click
3. **NXP MCIMX7SABRE**: One Color click™ accessory board at https://www.mikroe.com/color-click and buttons included in the processor board.
4. **Microchip SAMA5D27-SOM1-EK1**: RGB LED included in the processor board and one Button R Click board at https://www.mikroe.com/button-r-click
5. **Microchip ATSAMA5D2B-XULT**: RGB LED included in the processor board and one Button R Click board at https://www.mikroe.com/button-r-click

Since the beginning of October 2020, a new lab has been added to the labs of Chapter 7 to reinforce the concepts of creating NESTED THREADED GPIO irqchips drivers, and apply in a practical way how to create a gpio controller with interrupt capabilities. You will also develop an user application that request GPIO interrupts from user space using the GPIOlib APIs. This new lab is included in the linux_5.4_CY8C9520A_driver.zip file and can be downloaded from this GitHub repository. The CY8C9520A driver is explained in the Linux_5.4_STM32MP1_practical_labs document included in this repository. A new low cost evaluation board based on the CY8C9520A device will be used, thus expanding the number of evaluation boards that can be adquired to practice with the theory explained in Chapter 7. The

hardware platforms used in this lab are the STM32MP157C-DK2 board from ST or the Raspberry Pi 4 Model B/ Raspberry Pi 3 Model B and the EXPAND 6 Click from MIKROE. The documentation of these boards can be found at
https://www.raspberrypi.org/products/raspberry-pi-4-model-b/specifications/
https://www.raspberrypi.org/products/raspberry-pi-3-model-b/?resellerType=home
https://www.st.com/en/evaluation-tools/stm32mp157c-dk2.html and
https://www.mikroe.com/expand-6-click

Chapter 10, Input Subsystem Framework for Device Drivers

In this chapter, you will use the ADXL345 Accel click mikroBUS™ accessory board to develop the drivers for all the processor boards; you can check the board at
http://www.mikroe.com/click/accel/

Chapter 11, Industrial I/O Subsystem for Device Drivers

In this chapter, you will use the Analog Devices DC934A evaluation board to develop the drivers for all the processor boards; you can check the board at
https://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/dc934a.html

You can adquire the DC934A alone or included in the Linduino DC2026C-KIT.

For the **Raspberry Pi 4 Model B** and **Raspberry Pi 3 Model B,** you will also need one Button R Click board at https://www.mikroe.com/button-r-click

Since the beginning of September 2020, a new lab has been added to the labs of Chapter 11 to reinforce the concepts of creating IIO drivers, and apply in a practical way the creation of a gpio controller driver, reinforcing thus the theory developed during Chapter 5. This new driver will control the Maxim MAX11300 PIXI device. This lab can be downloaded from the Github repository of this book. The MAX11300 PIXI device driver is explained in the Linux_5.4_STM32MP1_practical_labs document included in this repository. The hardware platforms used in this lab are the STM32MP157C-DK2 board from ST or the Raspberry Pi 4 Model B/ Raspberry Pi 3 Model B and the PIXI™ CLICK from MIKROE. The documentation of these boards can be found at
https://www.raspberrypi.org/products/raspberry-pi-4-model-b/specifications/
https://www.raspberrypi.org/products/raspberry-pi-3-model-b/?resellerType=home
https://www.st.com/en/evaluation-tools/stm32mp157c-dk2.html and
https://www.mikroe.com/pixi-click

Chapter 12, Using the Regmap API in Linux Device Drivers

In this chapter, you will use the ADXL345 Accel click mikroBUS™ accessory board to develop the drivers for all the processor boards; you can check the board at http://www.mikroe.com/click/accel/

Chapter 13, Linux USB Device Drivers

The Linux USB device drivers have only been tested in the **Microchip SAMA5D27-SOM1-EK1** board, although they can be easily migrated to the rest of the processor boards. The user guide and design files for the Microchip board can be found at https://www.microchip.com/developmenttools/ProductDetails/atsama5d27-som1-ek1

You will also need the **Microchip Curiosity PIC32MX470** Development Board to create a fully functional USB HID device. The documentation of this board can be found at https://www.microchip.com/DevelopmentTools/ProductDetails/dm320103#additional-summary