e² studio

Quick Start Guide for the Linux Hosted Version of the e² studio

1. Overview

This quick start guide describes how to install the Linux version of the e² studio to run under Linux on a PC to serve as a host and to register the related toolchains and the e² studio. The target engineers of this guide are those who are developing software for Renesas MCUs or MPUs by using the e² studio in a Linux environment and who have already learned the basics of operating Ubuntu. This guide explains the steps from installing the Linux host through to construction of the environment. The methods for operating the e² studio after having started it are the same as those for the Windows version. For those methods, refer to the quick start guide for the Windows version with the title given below on the product page of the e² studio (https://www.renesas.com/e2studio).

Title: "e² studio Quick Start Guide for RX/RL78/RH850/RISC-V MCU Family"

2. Differences between the e² studio for Linux and the e² studio for Windows

The e² studio for Linux and the e² studio for Windows differ in the following ways.

Table 1 Range of Support by the e² studio for Windows and for Linux (Based on the 2024-04 Versions)

	For Windows	**For Linux**
Supported devices	RA, RL78, RX, RZ, RH850 families and DA devices, **RISC-V MCU**	RA, RL78, RX, RZ, RH850 families and DA devices
Supported toolchains	• Compilers from Renesas — CC-RH — CC-RL — CC-RX • Open-source toolchains — GCC for RL78 — LLVM for RL78 — GCC for RX — ARM GNU for RA and RZ families — LLVM Embedded Toolchain for Arm	• Compilers from Renesas — CC-RH — CC-RL — CC-RX • Open-source toolchains — GCC for RL78 — LLVM for RL78 — GCC for RX — ARM GNU for RA and RZ families — LLVM Embedded Toolchain for Arm
Supported emulators*	• Emulators from Renesas — E2 emulator — E2 emulator Lite — **E1 emulator** — **E20 emulator** • Emulator from partners — J-Link from Segger	• Emulators from Renesas — E2 emulator — E2 emulator Lite • Emulator from partners — J-Link from Segger

Note: For details on the emulators for each device and family, see "Additional Details" on the product pages of the e² studio for individual families listed in table 2.

Table 2 List of Product Pages of the e² studio for Individual Families

Family Name	**URL for the Product Page of the e² studio for Individual Families**
RA family	https://www.renesas.com/software-tool/e2studio-information-ra-family
RH850 family	https://www.renesas.com/software-tool/e2studio-information-rh850-family
RL78 family	https://www.renesas.com/software-tool/e2studio-information-rl78-family
RX family	https://www.renesas.com/software-tool/e2studio-information-rx-family
RZ family	https://www.renesas.com/software-tool/e2studio-information-rz-family
DA Devices	https://www.renesas.com/software-tool/e-studio

3. Operating Environment

The following operating environments were used in creating this quick start guide.

- e² studio 2024-04 Linux: https://www.renesas.com/software-tool/e-studio
- Ubuntu Desktop 22.04 LTS: https://ubuntu.com/download/desktop

4. Installation

4.1 Downloading an Installer

If you are using a product of the RL78 family, RX family, RZ family, RH850 family or DA devices, download the e² studio for Linux from the following product page.

https://www.renesas.com/software-tool/e-studio

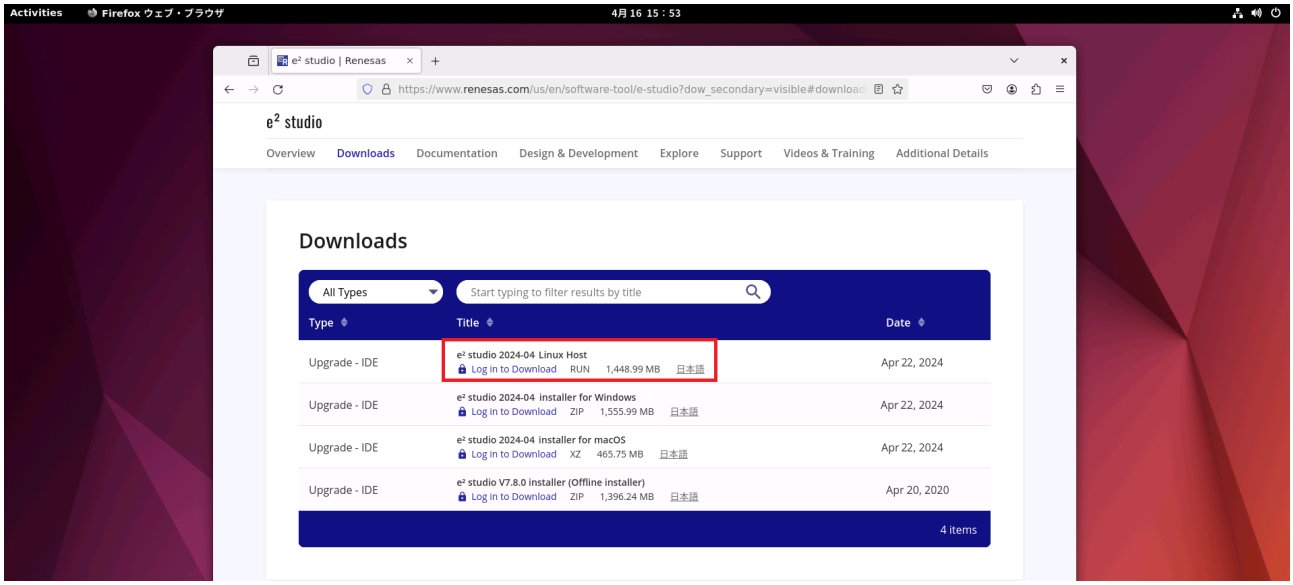

Figure 1 Product Page of the e² studio

For the users of MCUs of the RA family, we recommend downloading the platform installer from the tag page of the Flexible Software Package (FSP) version you will use on the FSP page for the RA family among the Renesas GitHub pages. The page is shown below.

https://github.com/renesas/fsp

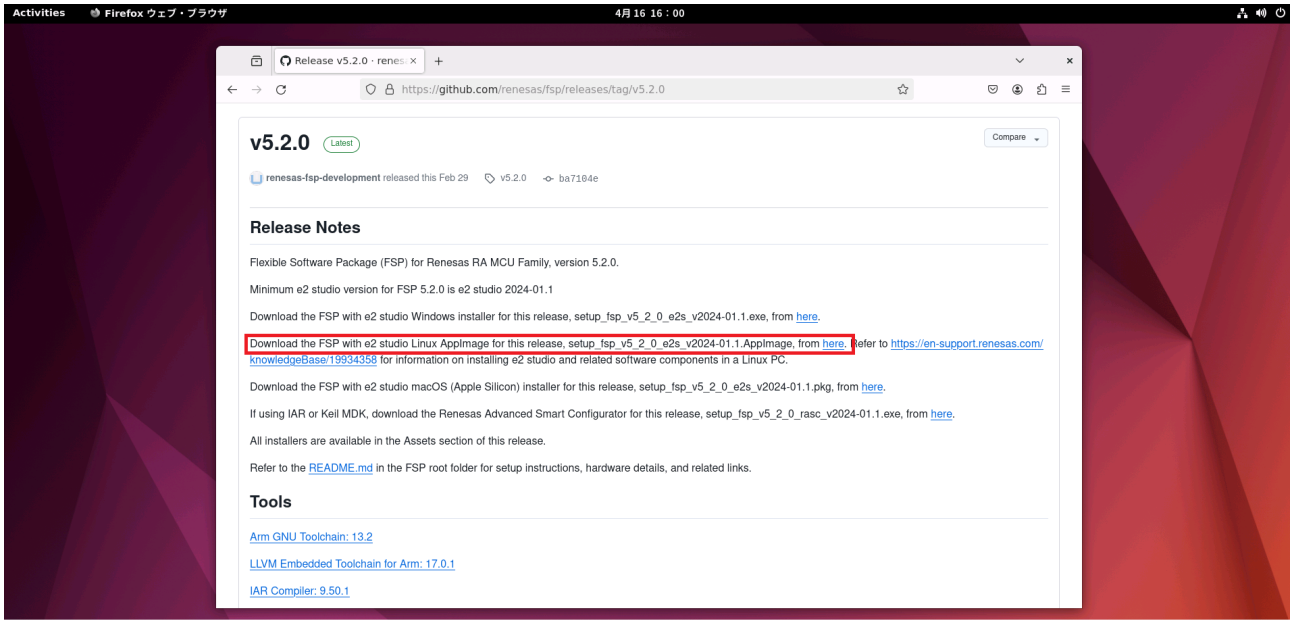

Figure 2 Flexible Software Package (FSP) Page for the RA Family (Example of the v5.2.0 Tag Page)

4.2 Installing the Required Libraries

The following Linux libraries are required for operation of the e² studio for Linux.

- Python library version 2.7
- Python library version 3.10
  (when executing the e² studio 2023-07 or a later version under Ubuntu LTS 20.24)
- New curses library version 5

Install the libraries by entering the following commands from a terminal.

```
sudo add-apt-repository ppa:deadsnakes/ppa
sudo apt update
sudo apt install libpython2.7 libncurses5 libncurses5:i386
sudo apt install libpython3.10
```

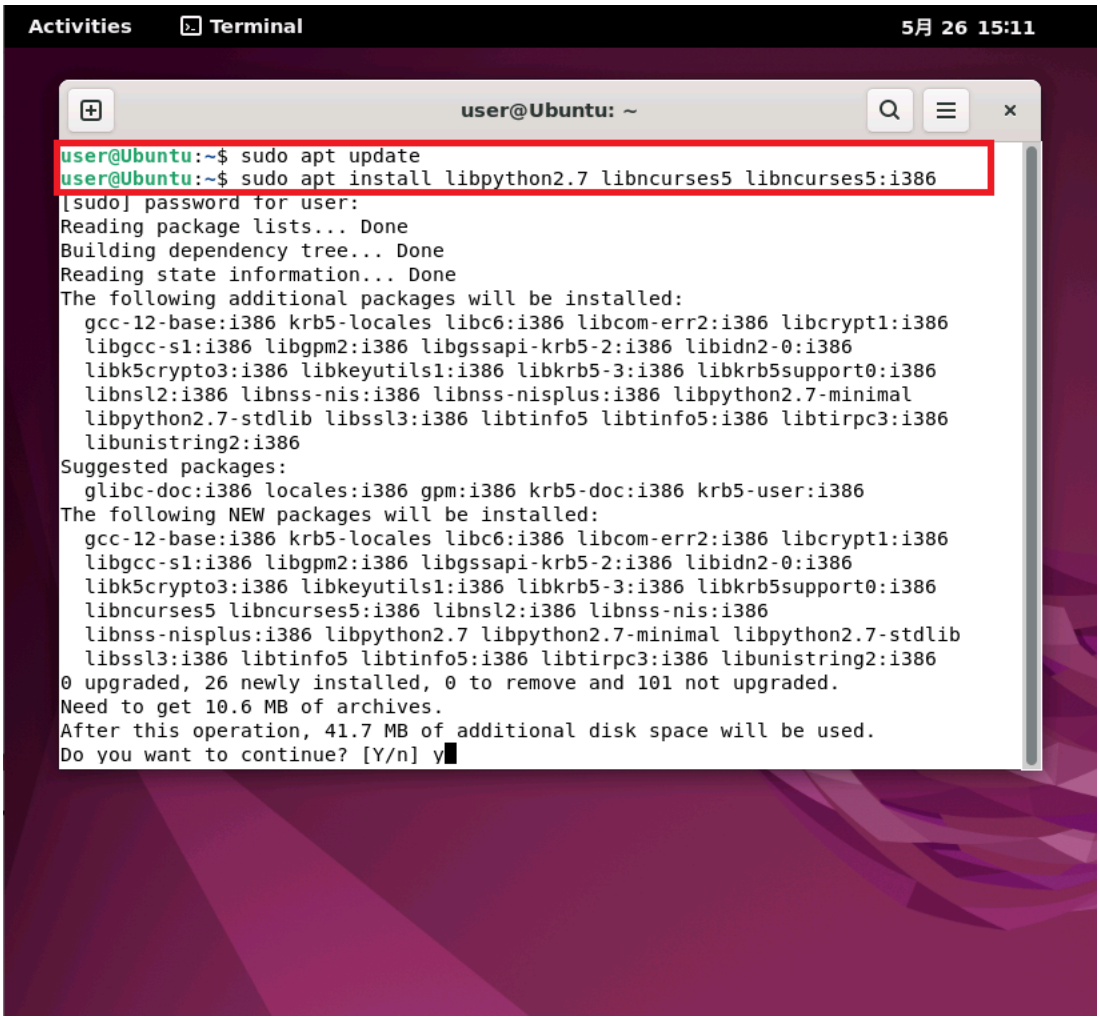

Figure 3 Installing the Required Libraries

4.3 Running the Installer

Double-click on the downloaded installer file or enter the name of the installer file in the terminal.

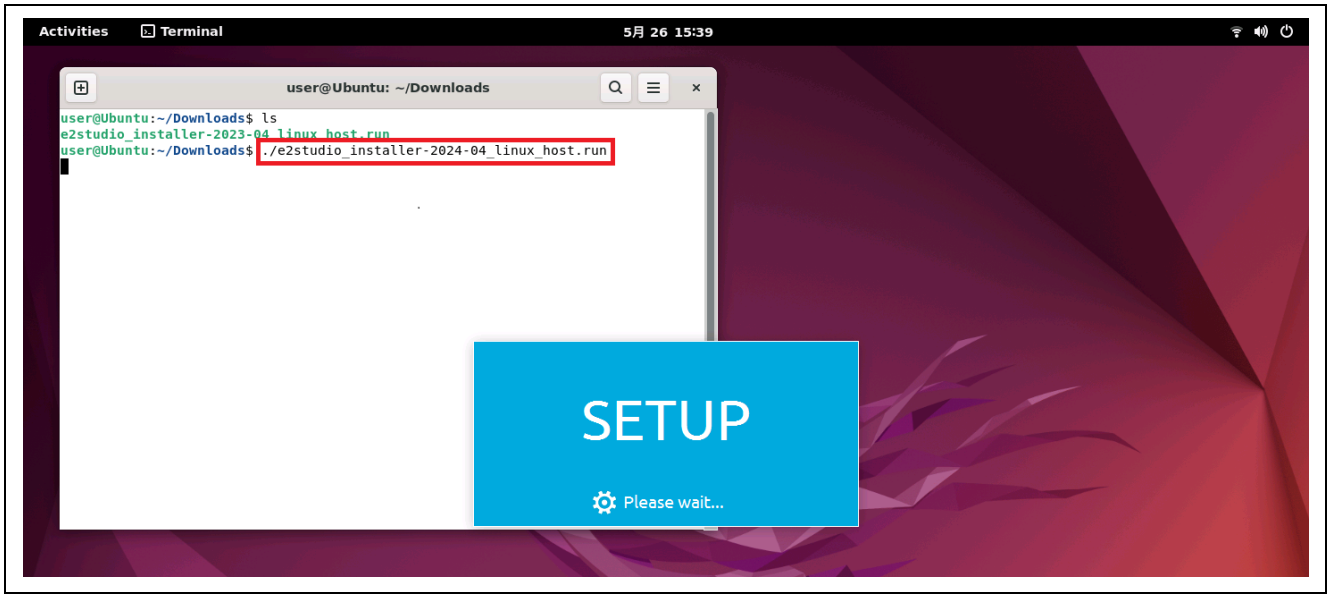

Figure 4 Running the Installer in a Terminal under Ubuntu (Example: Entering the Name of the Installer File)

If the installer does not run, confirm that permission for execution has been given for the e² studio installer file. If not, enter the following chmod command to set permission for execution of the installer file.

chmod + x <name of the e² studio installer file>

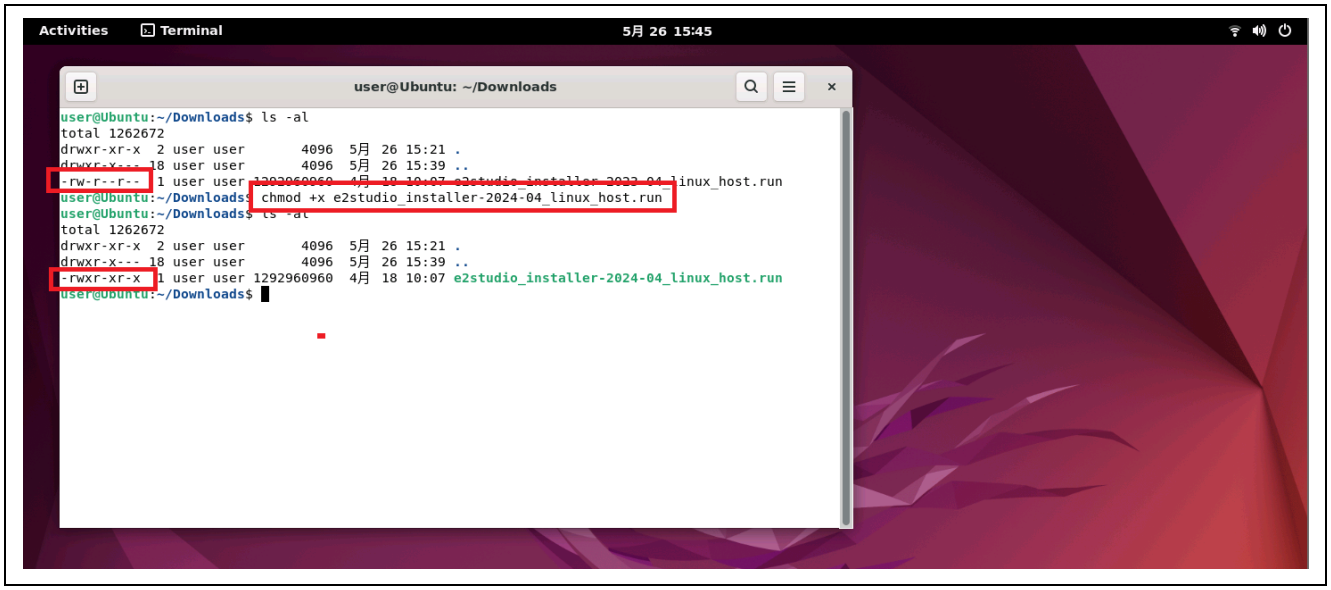

Figure 5 Confirming the Permission for Execution of the Installer File and Setting it with the 'chmod' Command

4.4 Starting Installation

(1) Selecting an installation type

Launch the e² studio installer. For e² studio 2023-07 and later, there are three (Lite/Standard/Custom) types of new installations. Select any of the items and click [Install].

- Lite installs the minimum functionality required to build and debug your project.
- Standard can install extended functionality.
- Any function can be installed in Custom.

Clicking on the "Click here" link displayed on the first page of the installer will show a list of the functions that will be installed by Lite and Standard, so please confirm it before proceeding.

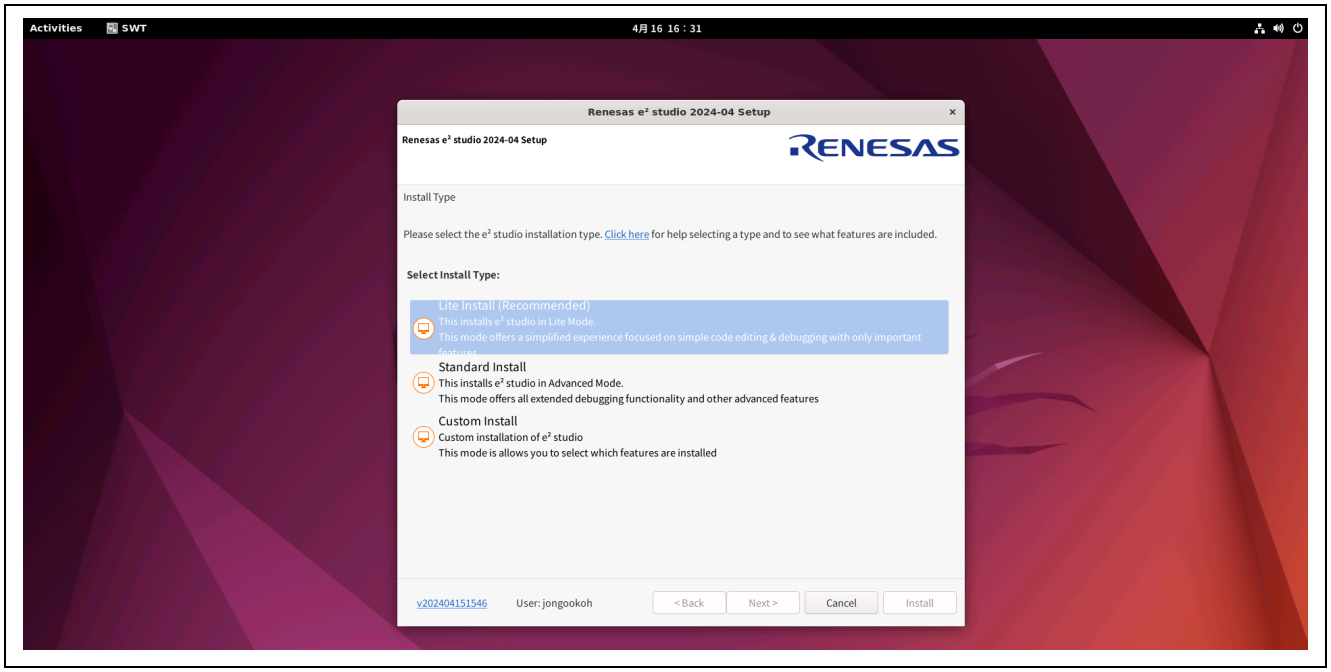

Figure 6-1 Selecting an Installation Type (Common Installer)

For users of RA family devices, select “Quick Install”.

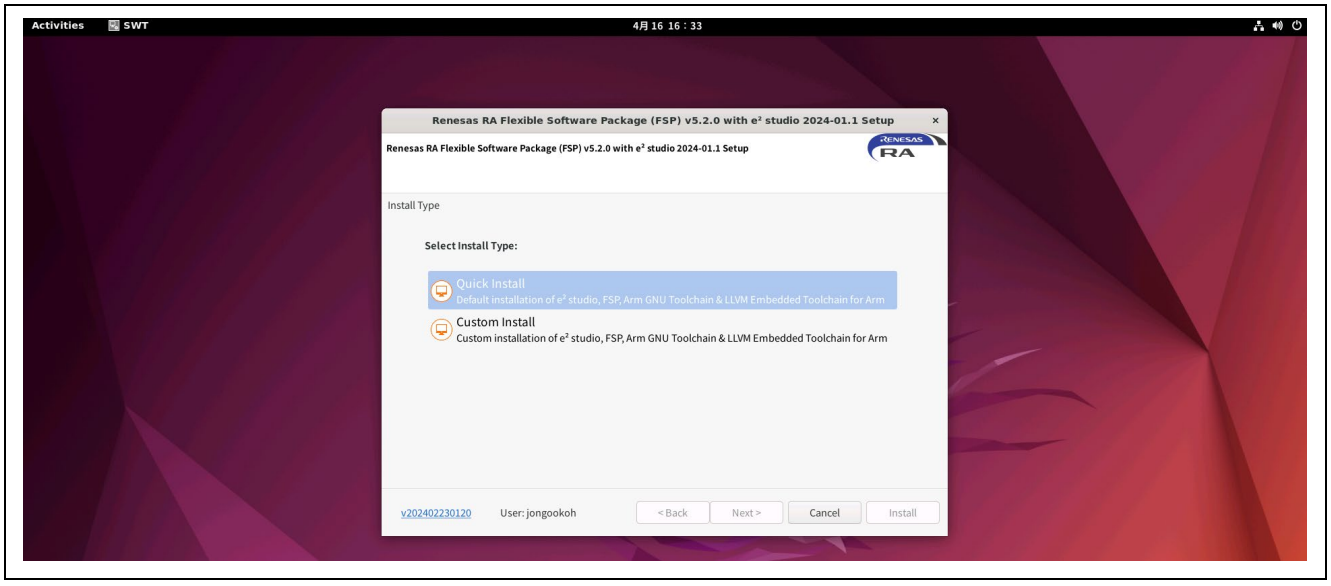

Figure 6-2 Selecting an Installation Type (Platform Installer)

(2) [Welcome]

Click on [Change…] if you wish to specify a different installation directory, then click on [Next >].

Note: If you have run the installer of the platform for the RA family, go to “(7) [Licenses]”.

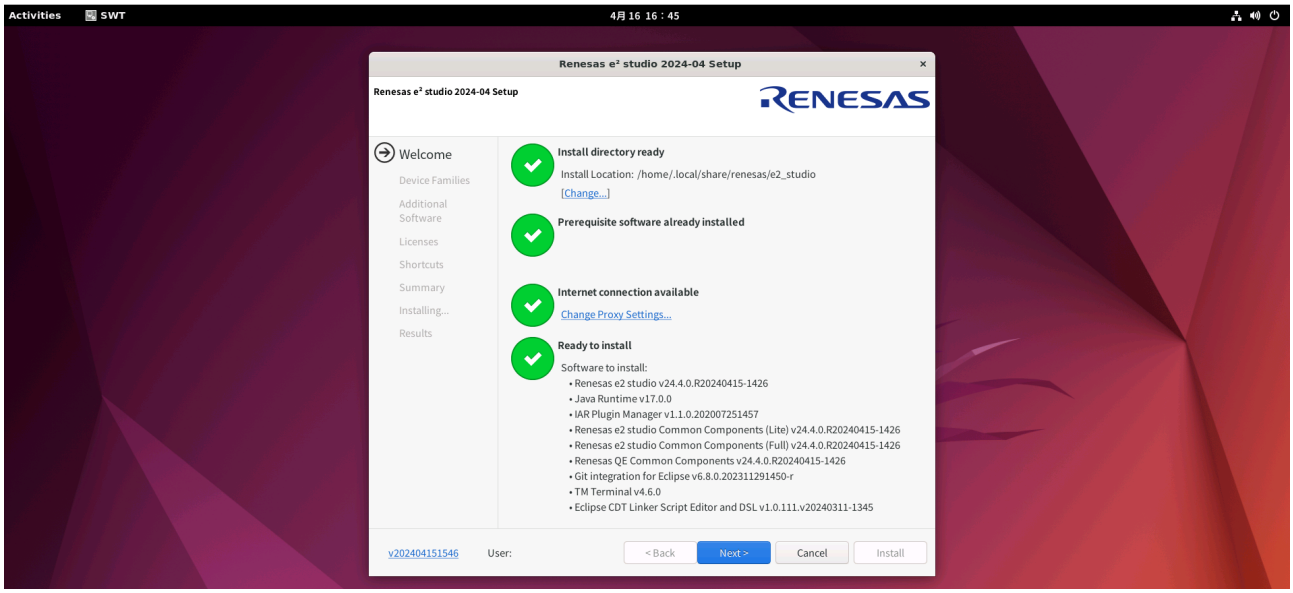

Figure 7 [Welcome]

Notes: 1. If you wish to install multiple versions of the e² studio, click on [Change…] to specify the installation directory.

2. Specify a folder path including English characters, numeric characters, and underscores for the installation directory.

If an account name for Ubuntu includes characters other than English characters, numeric characters, and underscores, the e² studio may malfunction. Accordingly, we also recommend using only English characters, numeric characters, and underscores in the account name for Ubuntu.

(3) [Device Families]
You can select multiple device families for installation. Select the checkboxes and click on [Next >].

Note: If you have run the installer of the platform for the RA family, this window will only display the RA family.

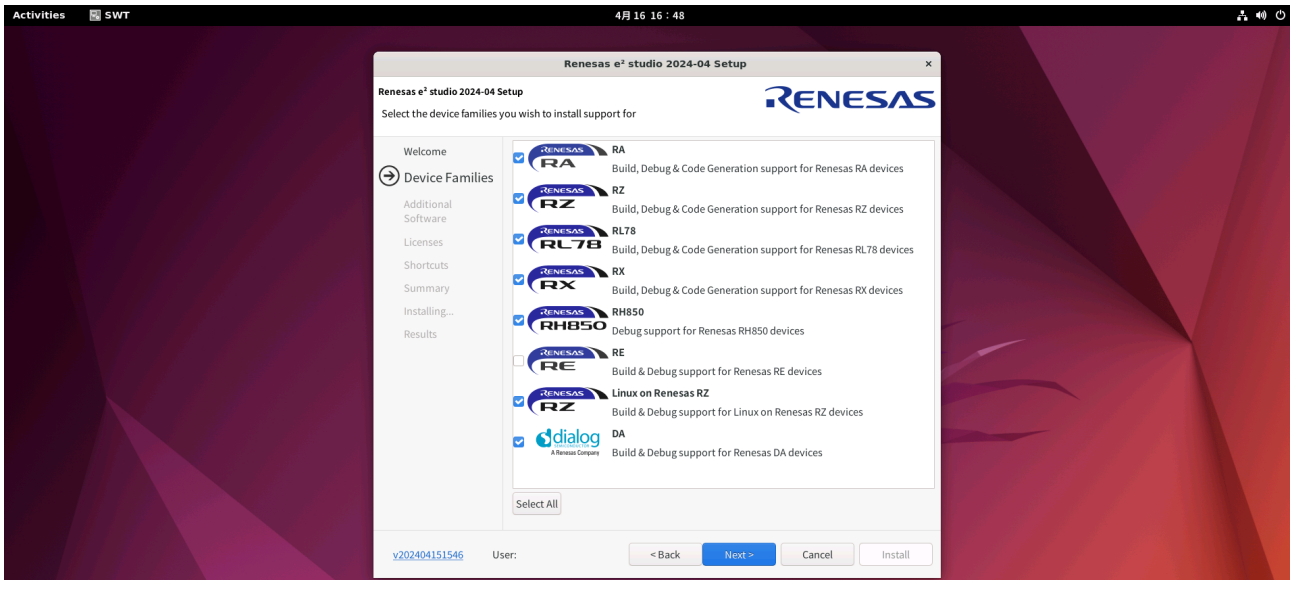

Figure 8 Selecting Device Families

(4) [Extra Features]
Select the additional components to be installed (language packs or support for Git).
Click on [Next >].

Note: Specify the Japanese language pack if you wish to view the menus in Japanese.

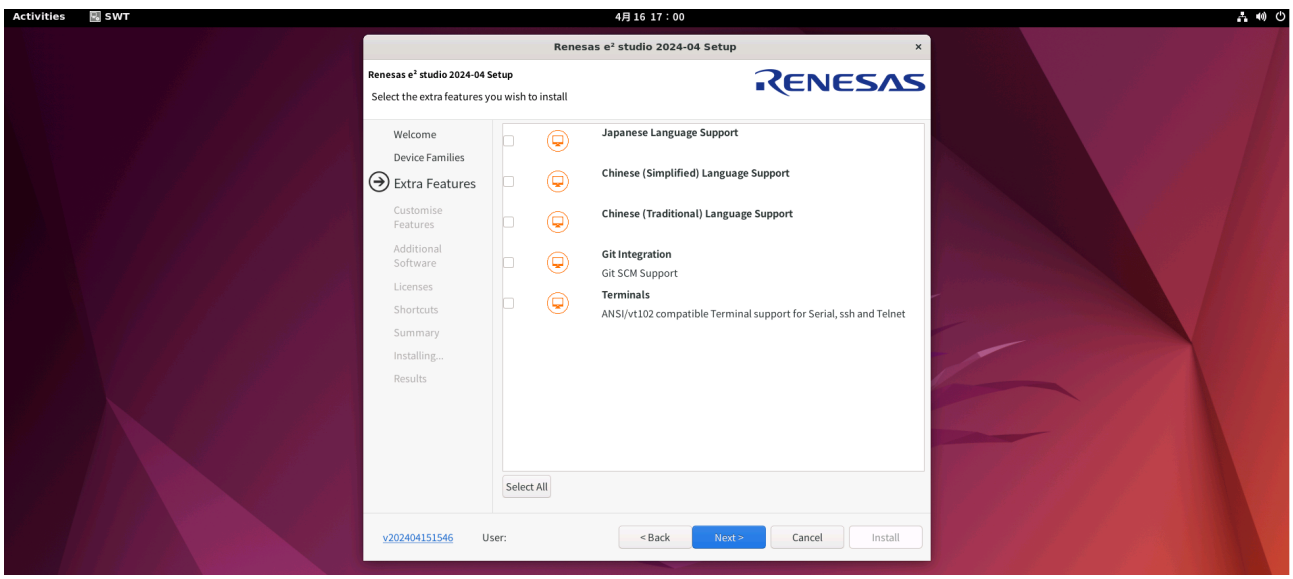

Figure 9 [Extra Features]

(5) Components

All required components for the selections in [Device Families] are automatically selected. Confirm the selected components and click on [Next >].

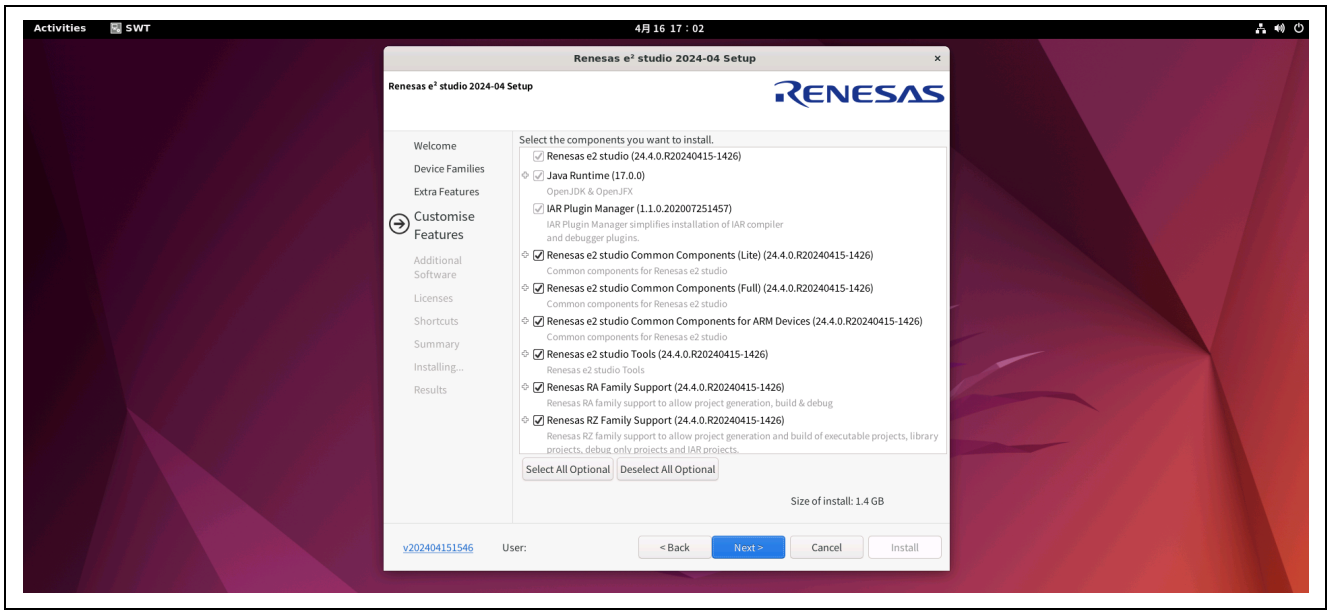

Figure 10 [Customise Features]

(6) [Additional Software]

In this stage, you can select additional software such as the Renesas FSP, Renesas AI and ARM GNU toolchain (indicated as GCC ARM Embedded in the installer).

In general, the required software for the device family which was selected in “(3) [Device Families]” is selected. Click on [Next >] and go to the next step.

If you will be using the ARM GNU toolchain or another version of the Renesas FSP which is not included in the list, install them. Refer to chapter 6, Custom Installation and Registration of Toolchains.

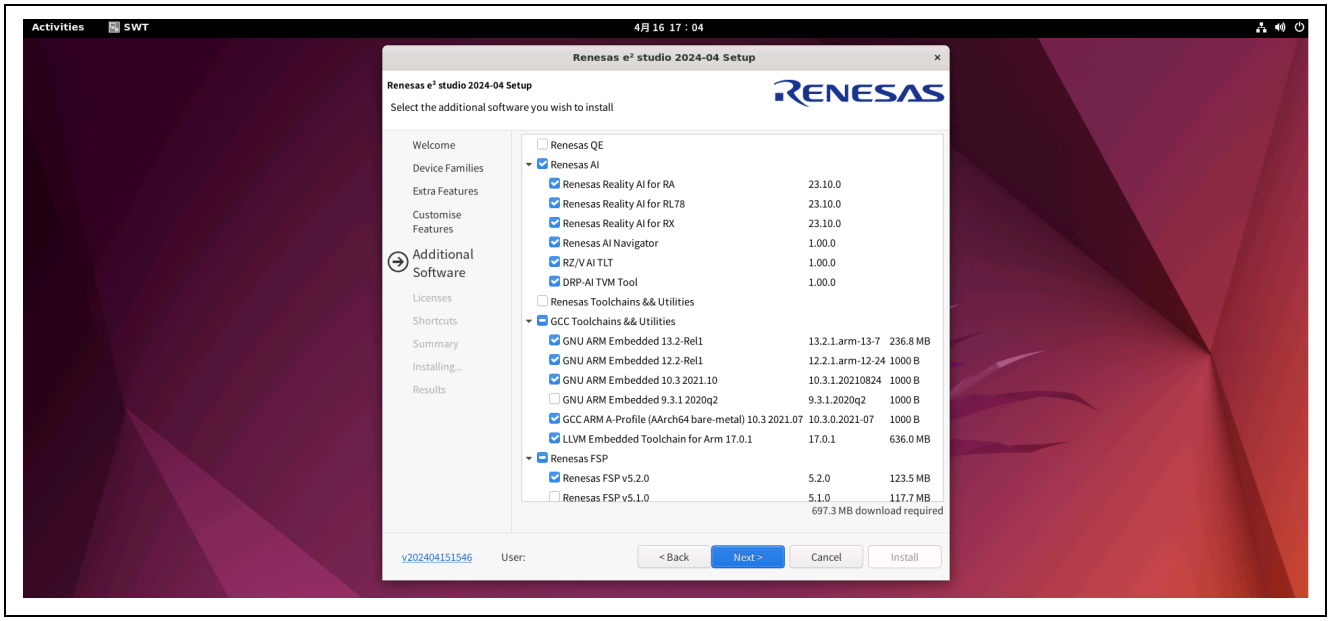

Figure 11 [Additional Software]

(7) [Licenses]

After you have read and agreed with the license agreement, click on [Next >].

If you do not agree with the license agreement, you cannot continue with installation.

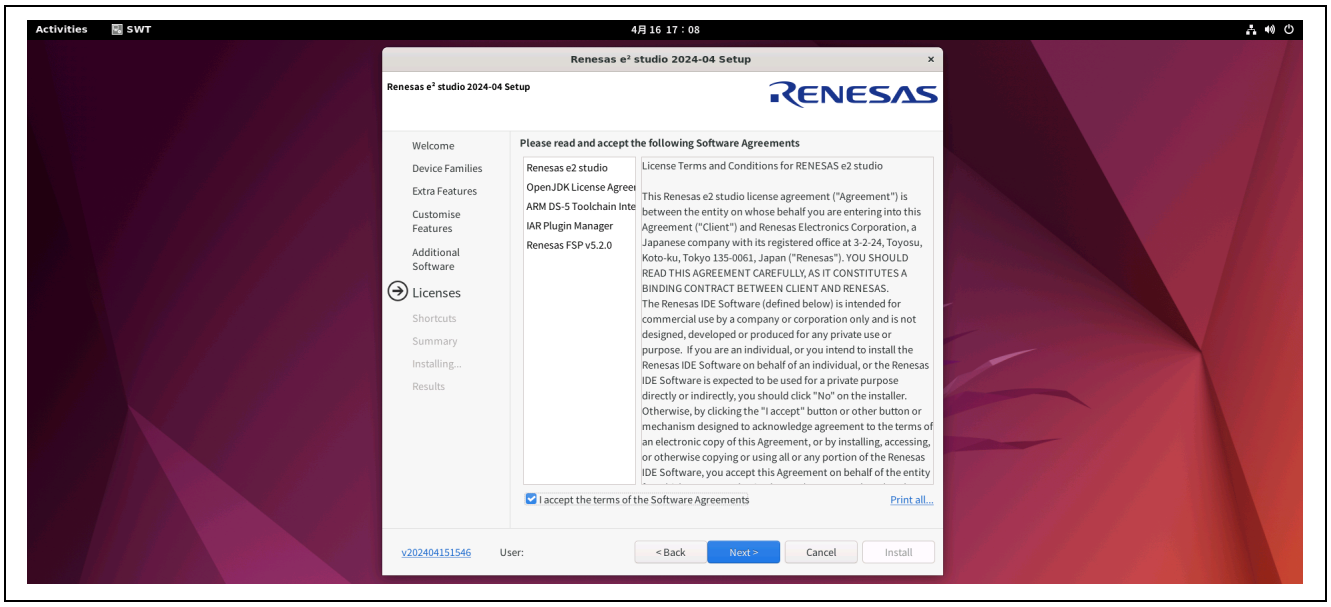

Figure 12 [Licenses]

(8) [Shortcuts]

Select the [In the application launcher] checkbox and click on [Next >].

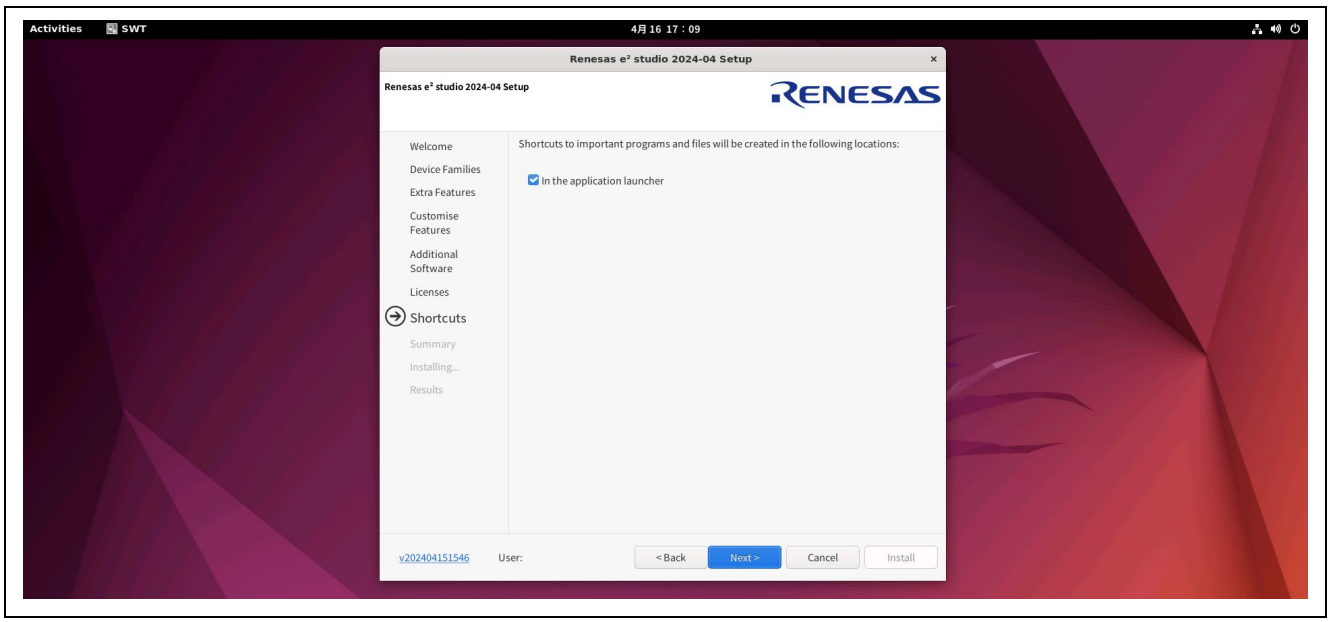

Figure 13 [Shortcuts]

(9) [Summary], [Installing], and [Results]
Click on [Install] to install the e² studio.

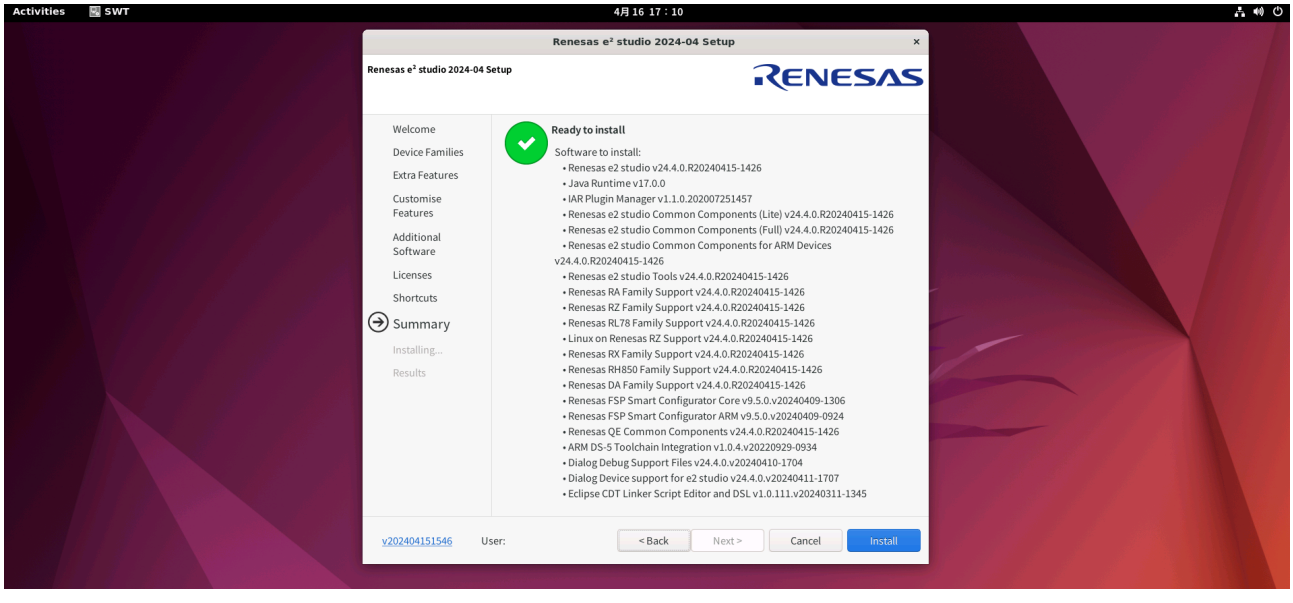

Figure 14 [Summary]

When installation has finished, the results are displayed. Confirm that there are no error messages.

When toolchains such as the FSP or GCC ARM Embedded have been installed, link paths to the folders where they have been installed are displayed.

Clicking on [OK] finishes the installation process.

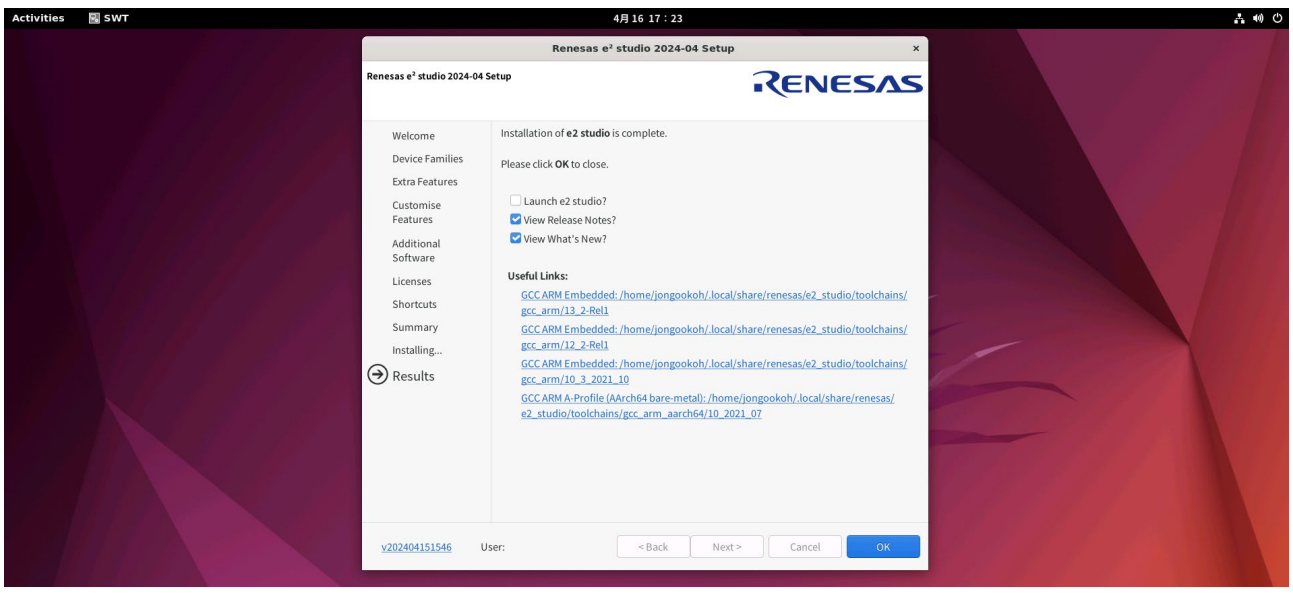

Figure 15 [Results]

5. Running the e² studio

Open a terminal window. Go to the path where the e² studio has been installed and enter the command for the executable file.

Example:

```
cd ~/renesas/e2_studio/eclipse
./e2studio
```

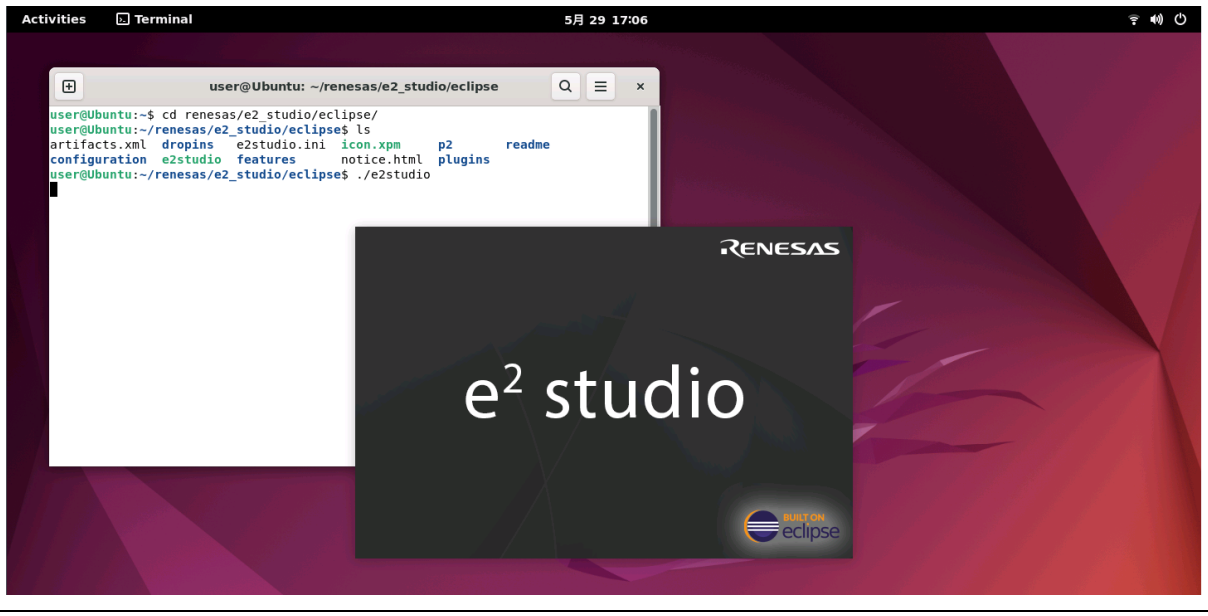

Figure 16 Running the e² studio: Entering the Command

If you created a shortcut during installation, you can also run the e² studio by clicking on the icon for the e² studio in the [Show Applications] menu shown below.

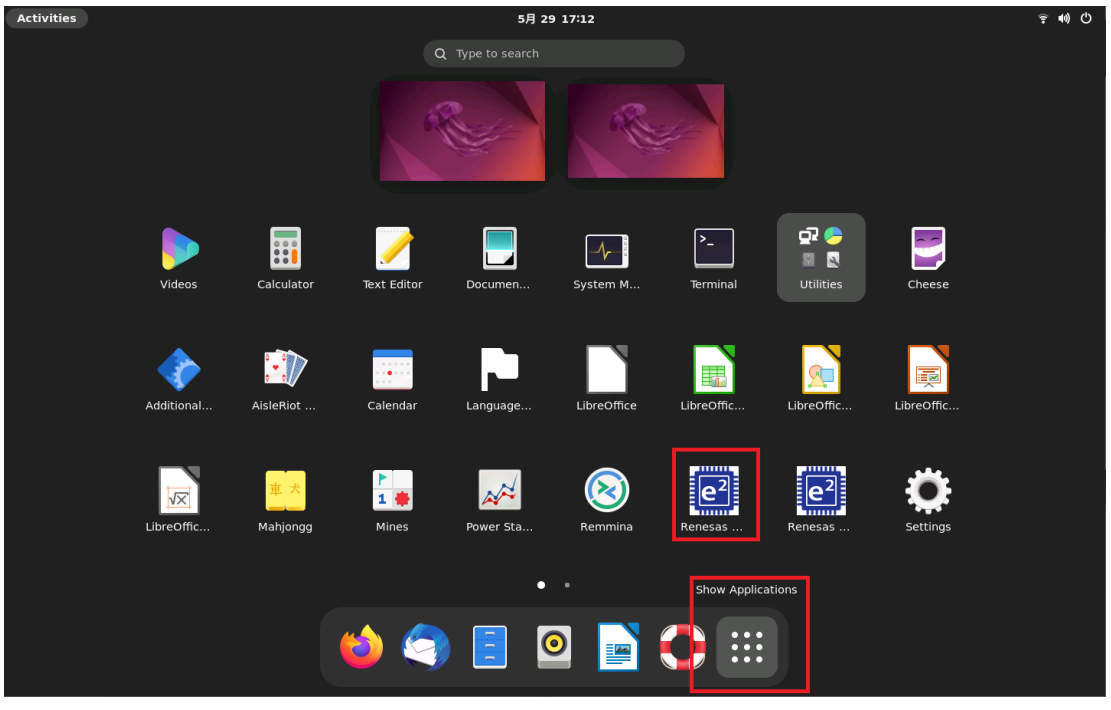

Figure 17 Running the e² studio: Double-clicking on the Icon

After you run the e² studio, specify the path for the workspace for use in [Workspace] (example: /home/user/e2_studio/workspace) and click on [Launch].

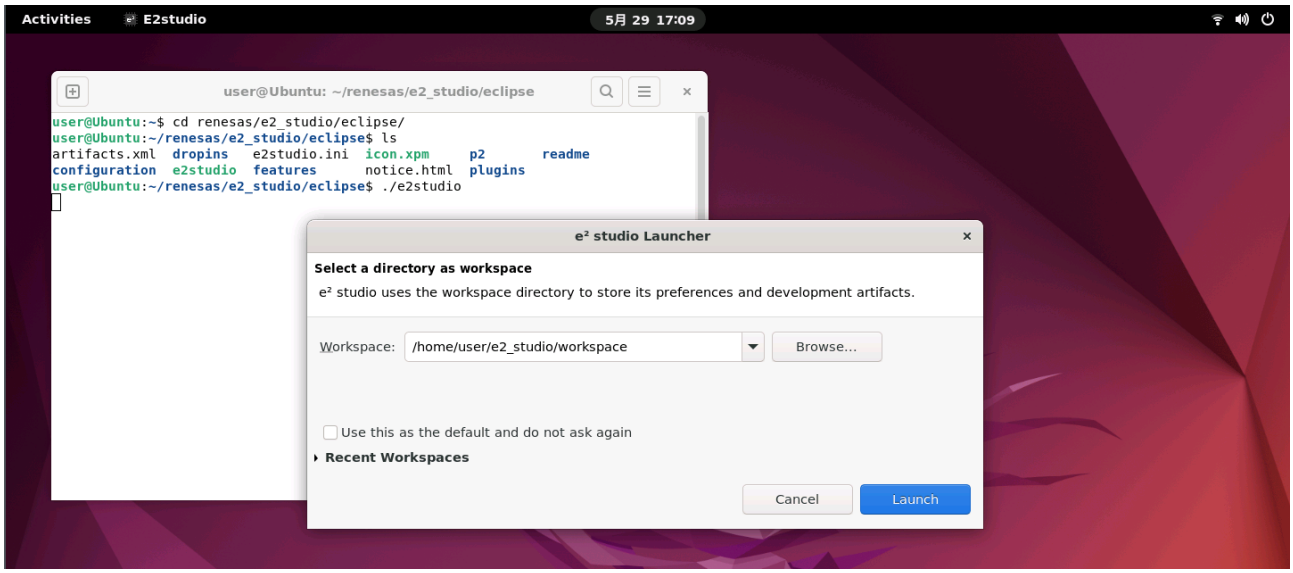

Figure 18 Running the e² studio: Selecting a Workspace

6. Custom Installation and Registration of Toolchains

In the following cases, you will need to obtain an installer for the toolchain and install and register it with the e² studio.

(1) You will be using RL78, RX, RH850 family devices.
(2) You will be using a version of the FSP that is not included in the installer for the e² studio.
(3) You will be using a version of the ARM GNU toolchain that is not included in the installer for the e² studio.

6.1 Installing Renesas License Manager

To use the Renesas compilers, it is necessary to install the Linux version of Renesas License Manager. It is available from the Renesas compilers product pages below.

C Compiler Package for RH850 Family [CC-RH]
https://www.renesas.com/software-tool/c-compiler-package-rh850-family

C Compiler Package for RL78 Family [CC-RL]
https://www.renesas.com/software-tool/c-compiler-package-rl78-family

C Compiler Package for RX Family [CC-RX]
https://www.renesas.com/software-tool/cc-compiler-package-rx-family

Refer to the release notes of the Renesas License Manager or the "Renesas Compiler Installation Guide" web page (https://www.renesas.com/software-tool/compiler_installation_guide) about installation.

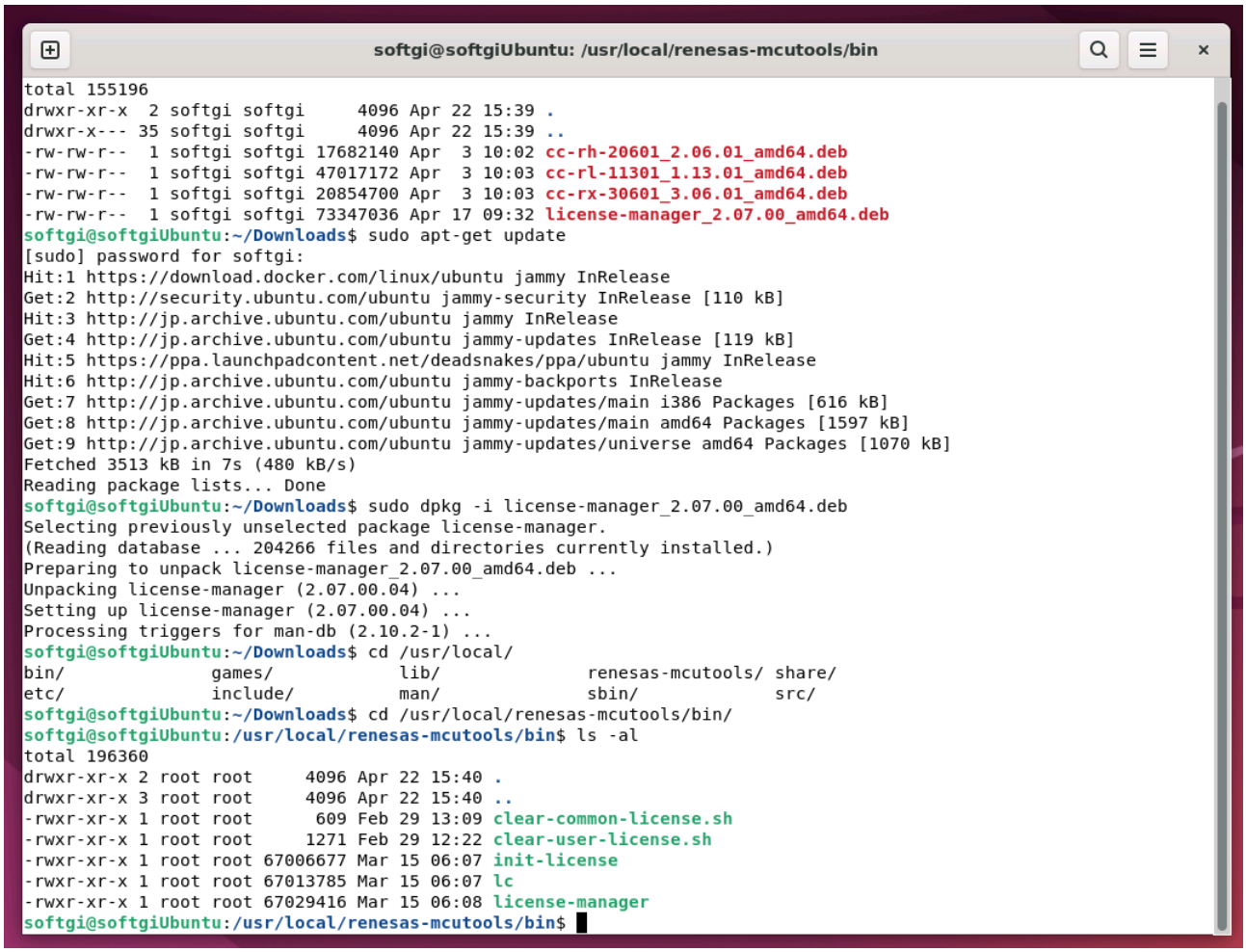

Figure 19 Installation example of the Renesas License Manager

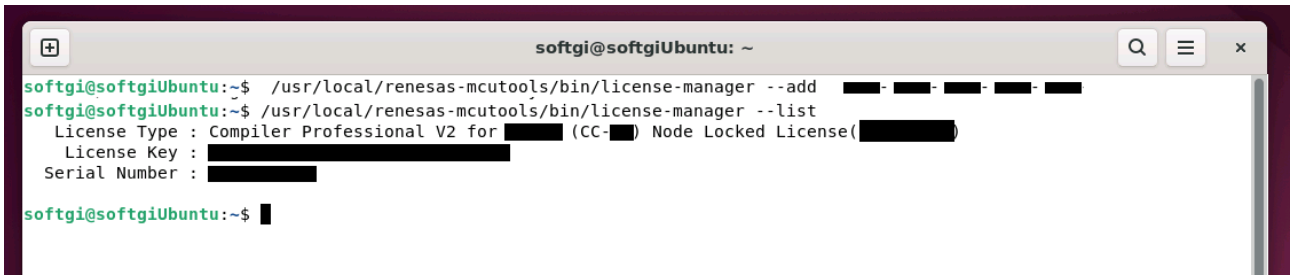

Figure 20 License key registration example of the Renesas License Manager

6.2 Toolchains for the RL78 Family

When a software product for use on a device of the RL78 family is to be built in the e² studio, CC-RL, GCC for Renesas RL78 or LLVM for Renesas RL78 is required.

The CC-RL installer is available from Renesas product page (https://www.renesas.com/software-tool/c-compiler-package-rl78-family). In addition, the Renesas License Manager is necessary to use CC-RL. Please refer to chapter 6.1 for installation of the Renesas License Manager.

Installers of GCC for Renesas RL78 and LLVM for Renesas RL78 are available from the “Open Source Tools for Renesas” site (https://llvm-gcc-renesas.com/, downloading some toolchains requires user registration).

6.2.1 Installing and Registering the CC-RL

Please refer to the “Readme” file enclosed in the CC-RL installer or the "Renesas Compiler Installation Guide" web page (https://www.renesas.com/software-tool/compiler_installation_guide) for CC-RL installation.

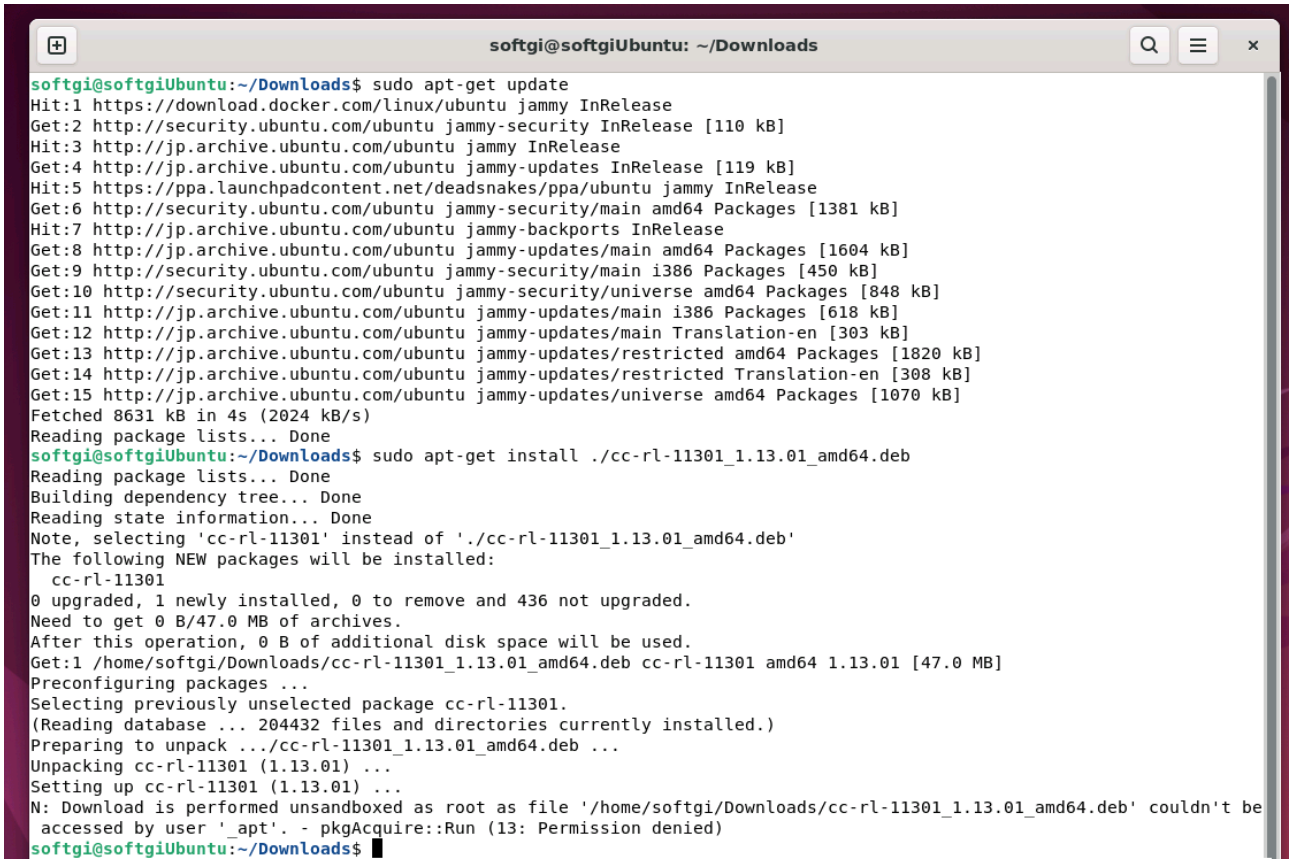

Figure 21 Installation example of the CC-RL

After the installation is complete, start e² studio, execute the [Help – Add Renesas Toolchains] menu, and select "Add..."Press the button and enter the path where CC-RL is installed to register.

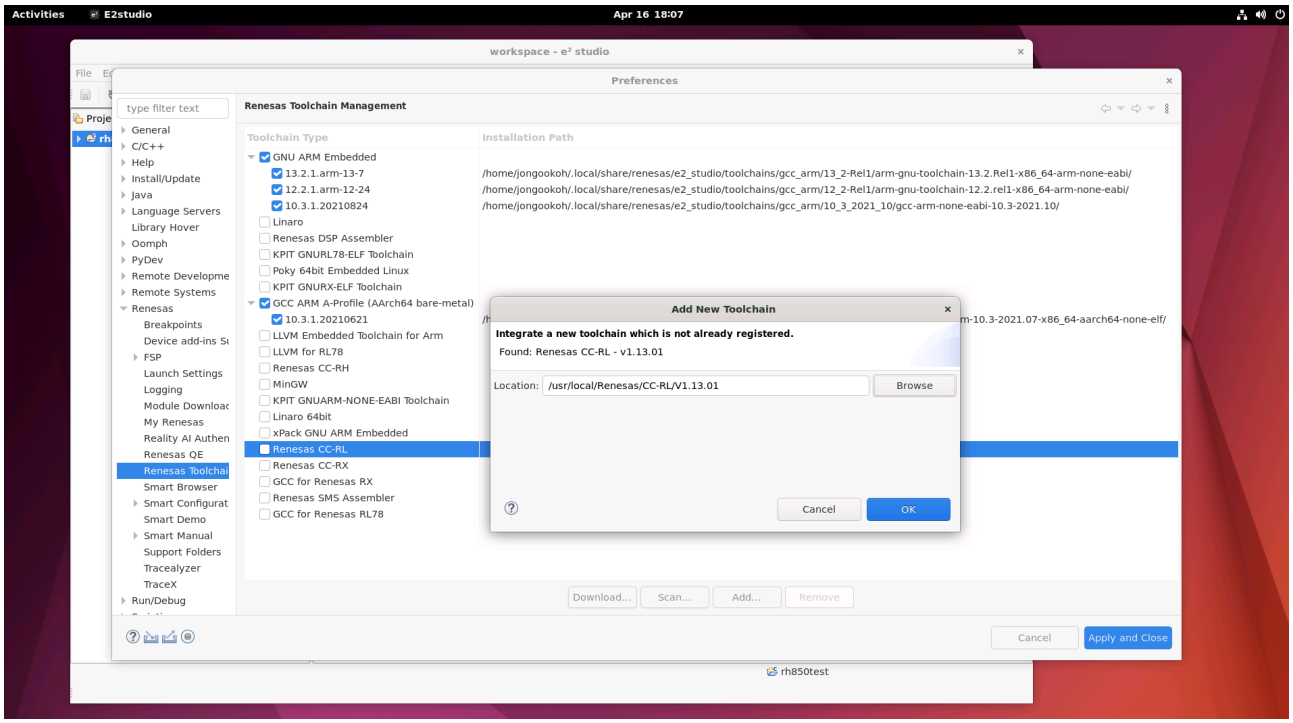

Figure 22 Registering CC-RL

6.2.2 Installing and Registering the LLVM for Renesas RL78

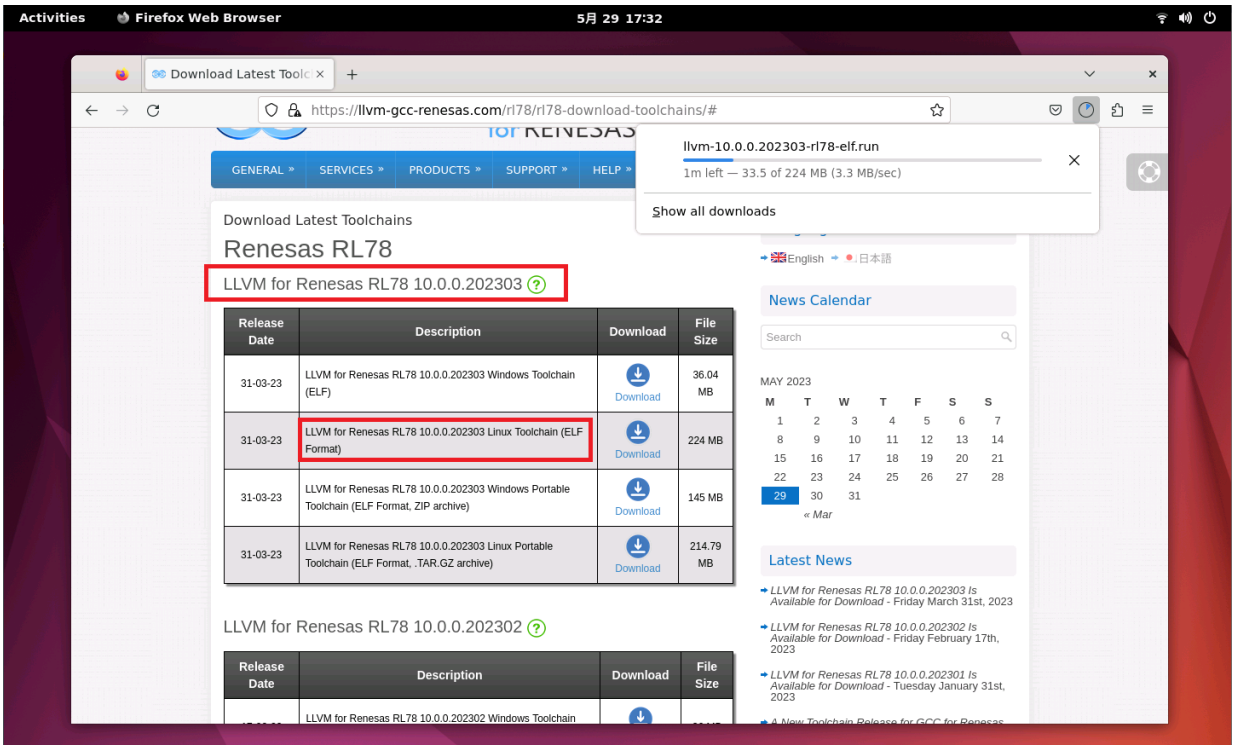

Figure 23 Open Source Tools for Renesas: LLVM for Renesas RL78

After downloading the installer, confirm the permission to execute it. Enter the required command and then run the installer.

Example:

```
cd ~/Downloads
chmod +x llvm-10.0.0.202303-rl78-elf.run
./llvm-10.0.0.202303-rl78-elf.run
```

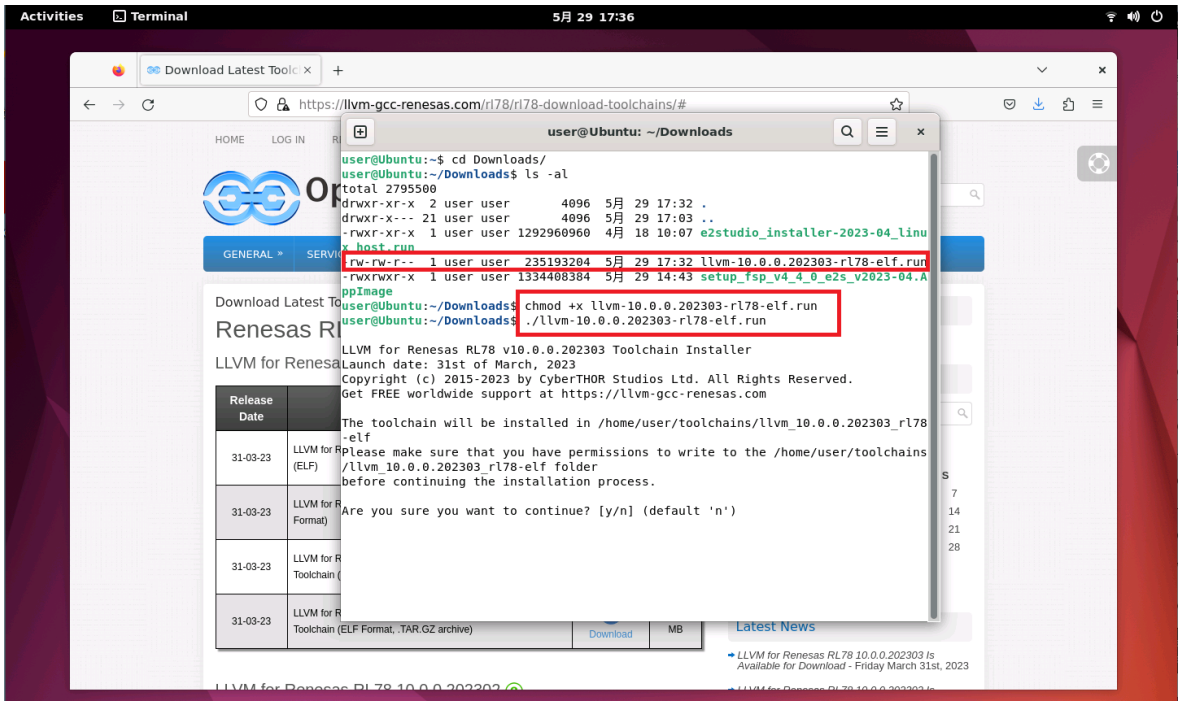

Figure 24 Running the Installer for LLVM for Renesas RL78

After the installation has finished, register the installer by starting the e² studio, selecting the [Help] menu and the [Add Renesas Toolchains] item, clicking on the [Add…] button with [LLVM for RL78] selected, and entering the path where LLVM for Renesas RL78 has been installed.

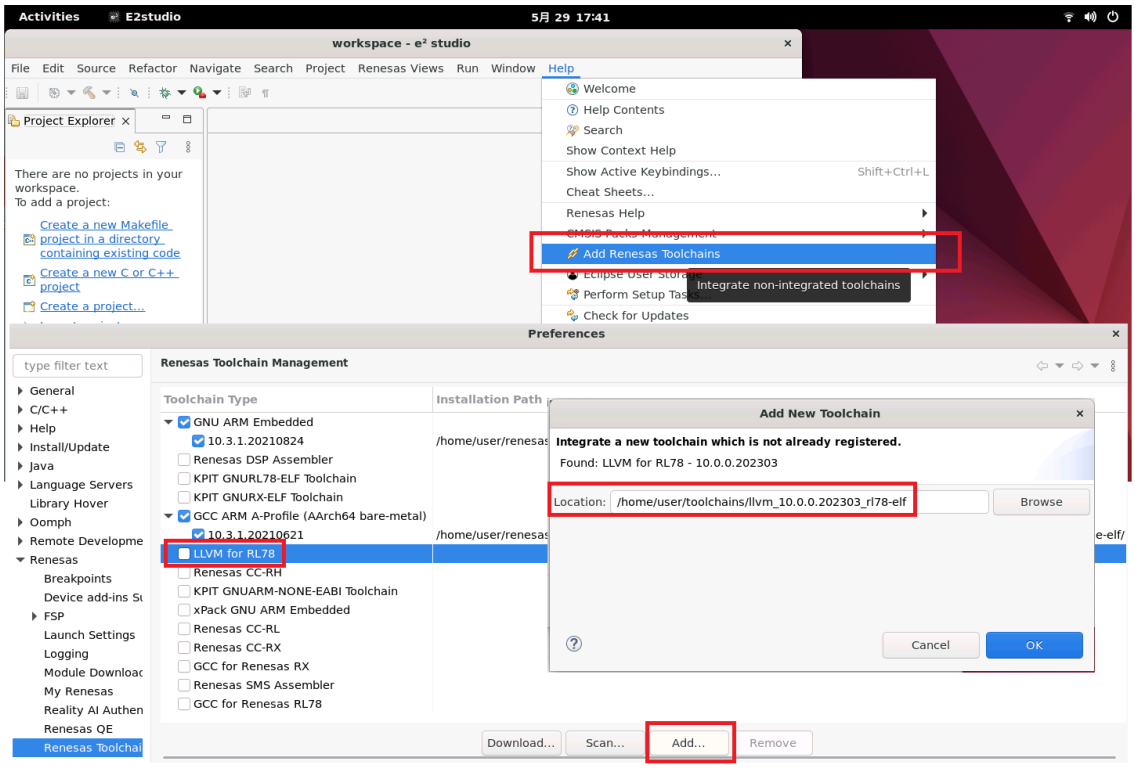

Figure 25 Registering LLVM for Renesas RL78

In the case of GCC for Renesas RL78, also download the installer from the “Open Source Tools for Renesas” site and register it by following the same procedure as that described above.

6.3 Toolchains for the RX Family

When a software product for use on a device of the RX family is to be built in the e² studio, CC-RX or GCC for RX is required.

The CC-RX installer is available from Renesas product page (https://www.renesas.com/software-tool/cc-compiler-package-rx-family). In addition, the Renesas License Manager is necessary to use CC-RX. Please refer to chapter 6.1 for installation of the Renesas License Manager.

Installer of GCC for RX is available from the “Open Source Tools for Renesas” site (https://llvm-gcc-renesas.com/, downloading some toolchains requires user registration).

6.3.1 Installing and Registering the CC-RX

Please refer to the “Readme” file enclosed in the CC-RX installer or the "Renesas Compiler Installation Guide" web page (https://www.renesas.com/software-tool/compiler_installation_guide) for CC-RX installation.

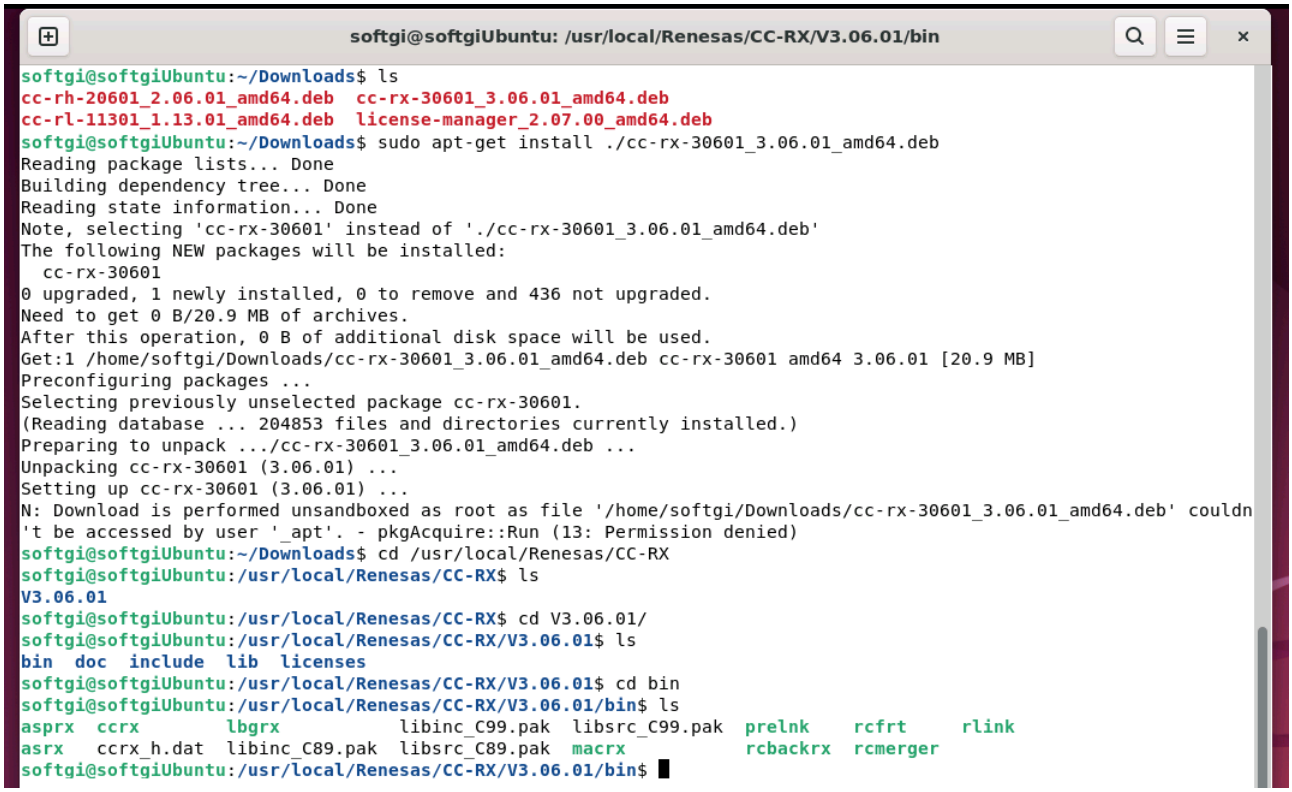

Figure 26 Installation example of the CC-RX

After the installation is complete, start e² studio, execute the [Help – Add Renesas Toolchains] menu, and select "Add..."Press the button and enter the path where CC-RX is installed to register.

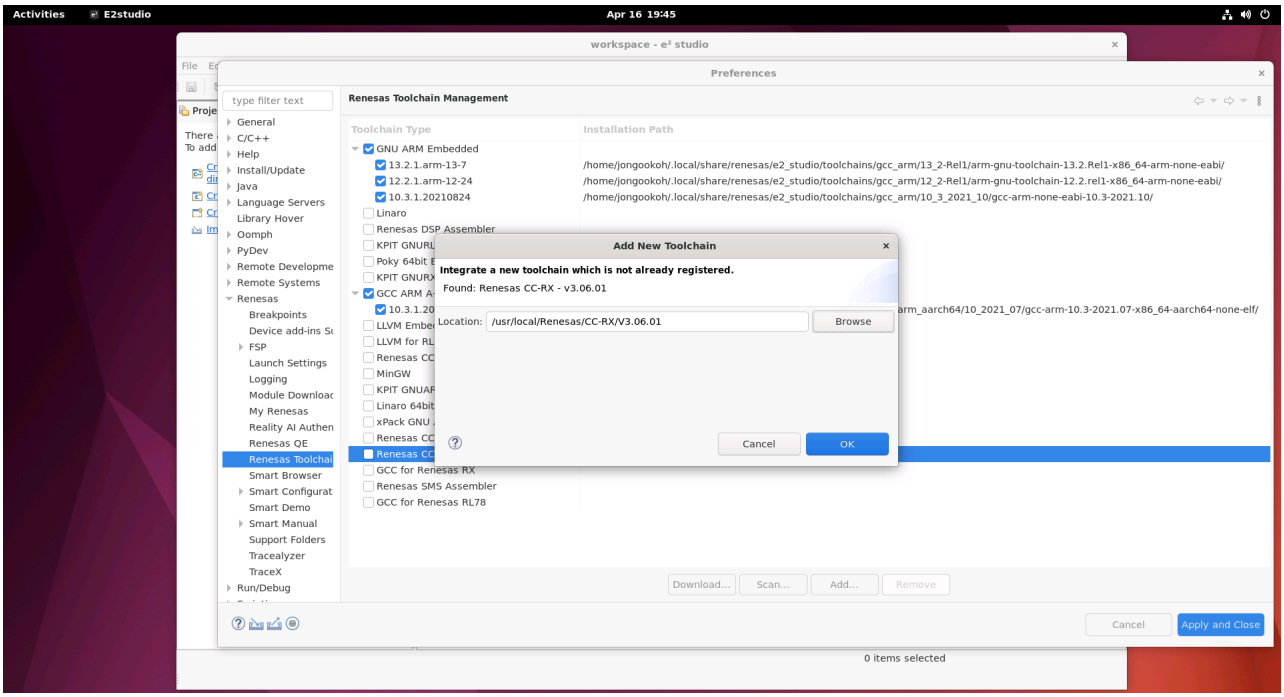

Figure 27 Registering CC-RX

6.3.2 Installing and Registering the GCC for Renesas RX

In the case of GCC for Renesas RX, also download the installer from the “Open Source Tools for Renesas” site and register it with the e² studio by following the same procedure as that described in section 6.1.

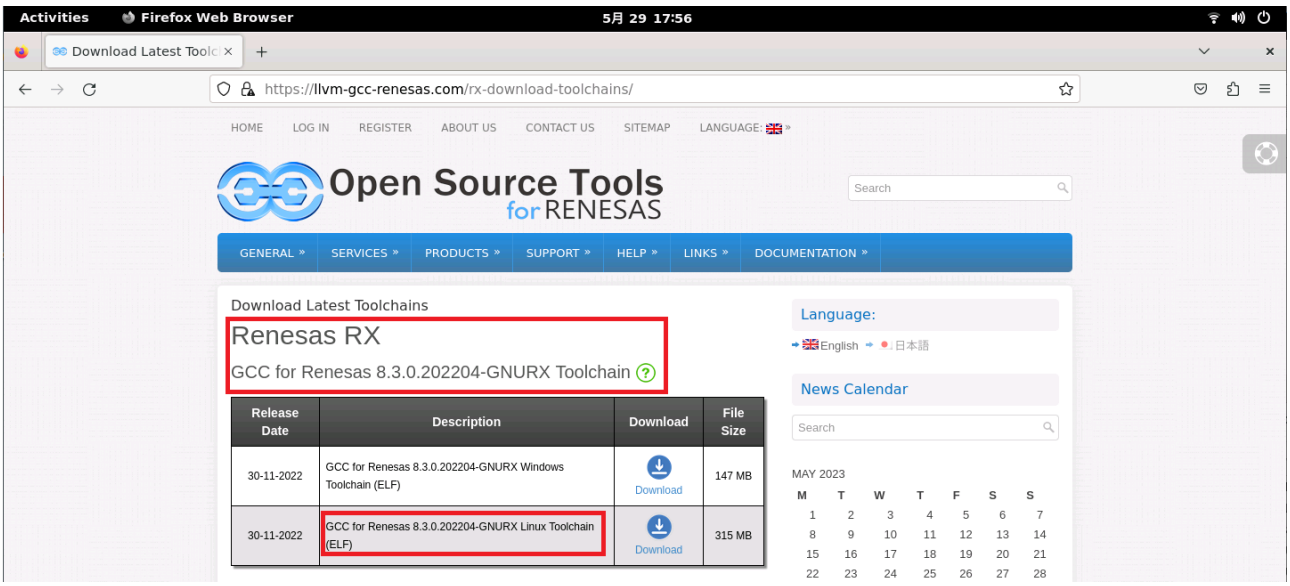

Figure 28 Open Source Tools for Renesas: GCC for Renesas RX

After downloading the installer, confirm the permission to execute it. Enter the required command and then run the installer.

Example:

```
cd ~/Downloads
chmod +x gcc-8.3.0.202204-GNURX-ELF.run
./gcc-8.3.0.202204-GNURX-ELF.run
```

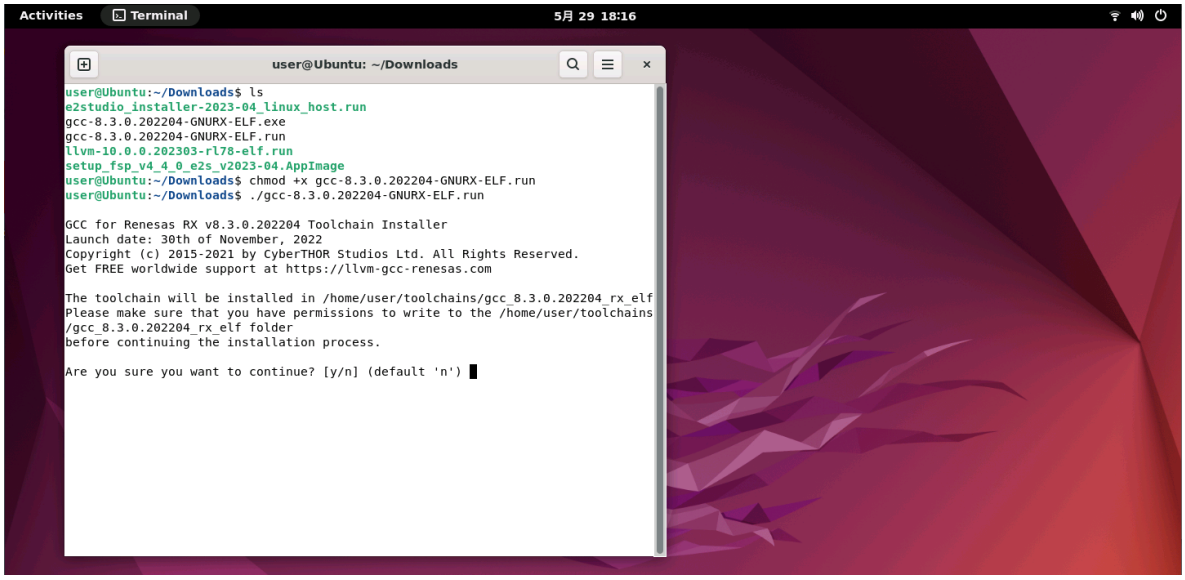

Figure 29 Running the Installer for GCC for Renesas RX

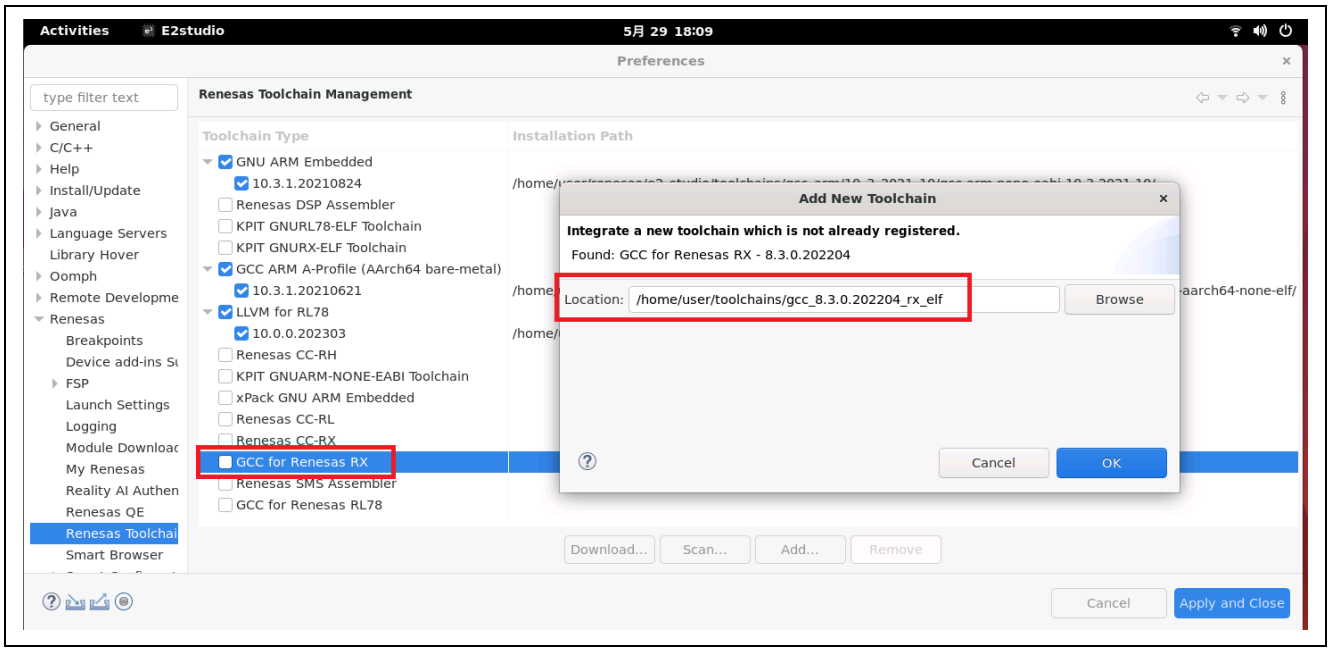

Figure 30 Registering GCC for Renesas RX

6.4 Toolchain for RH850 Family

When a software product for use on a device of the RH850 family is to be built in the e² studio, CC-RH is required.

The CC-RH installer is available from Renesas product page (https://www.renesas.com/software-tool/c-compiler-package-rh850-family). In addition, the Renesas License Manager is necessary to use CC-RH. Please refer to chapter 6.1 for installation of the Renesas License Manager.

6.4.1 Installing and Registering the CC-RH

Please refer to the “Readme” file enclosed in the CC-RH installer or the "Renesas Compiler Installation Guide" web page (https://www.renesas.com/software-tool/compiler_installation_guide) for CC-RH installation.

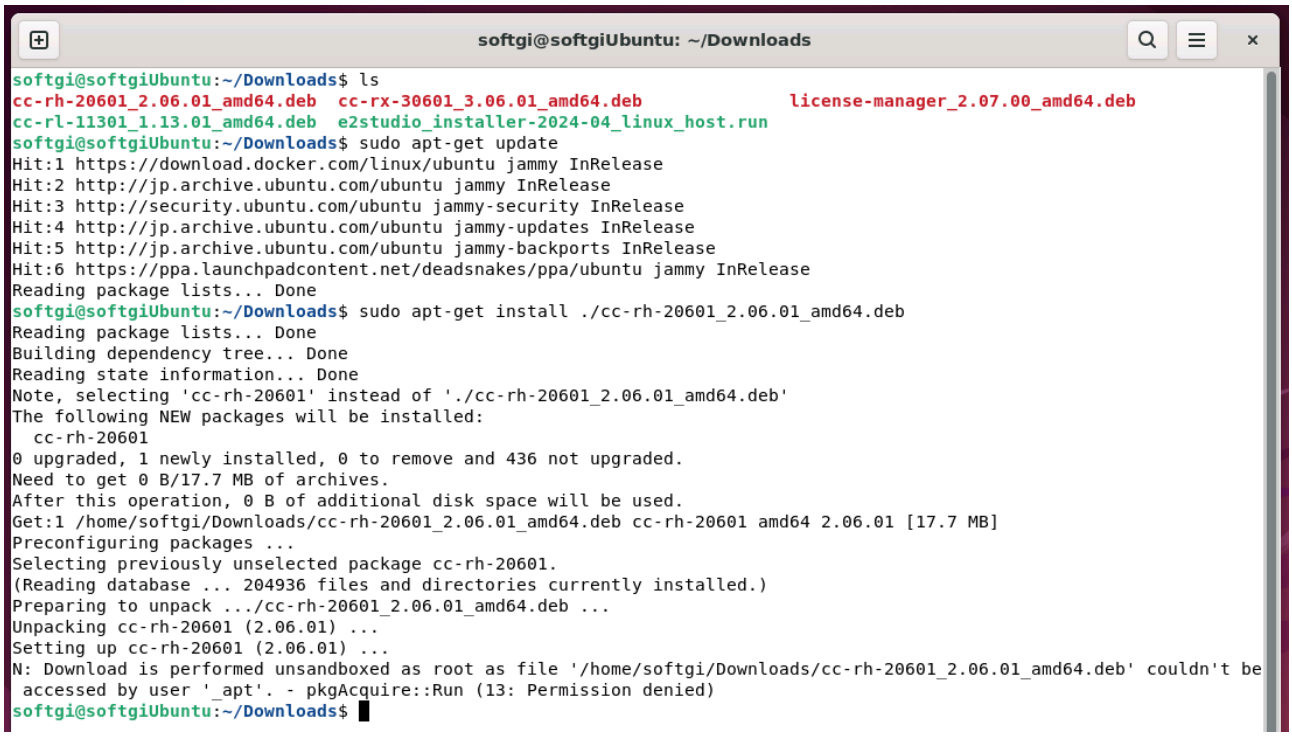

Figure 31 Installation example of the CC-RH

After the installation is complete, start e² studio, execute the [Help – Add Renesas Toolchains] menu, and select "Add..."Press the button and enter the path where CC-RH is installed to register.

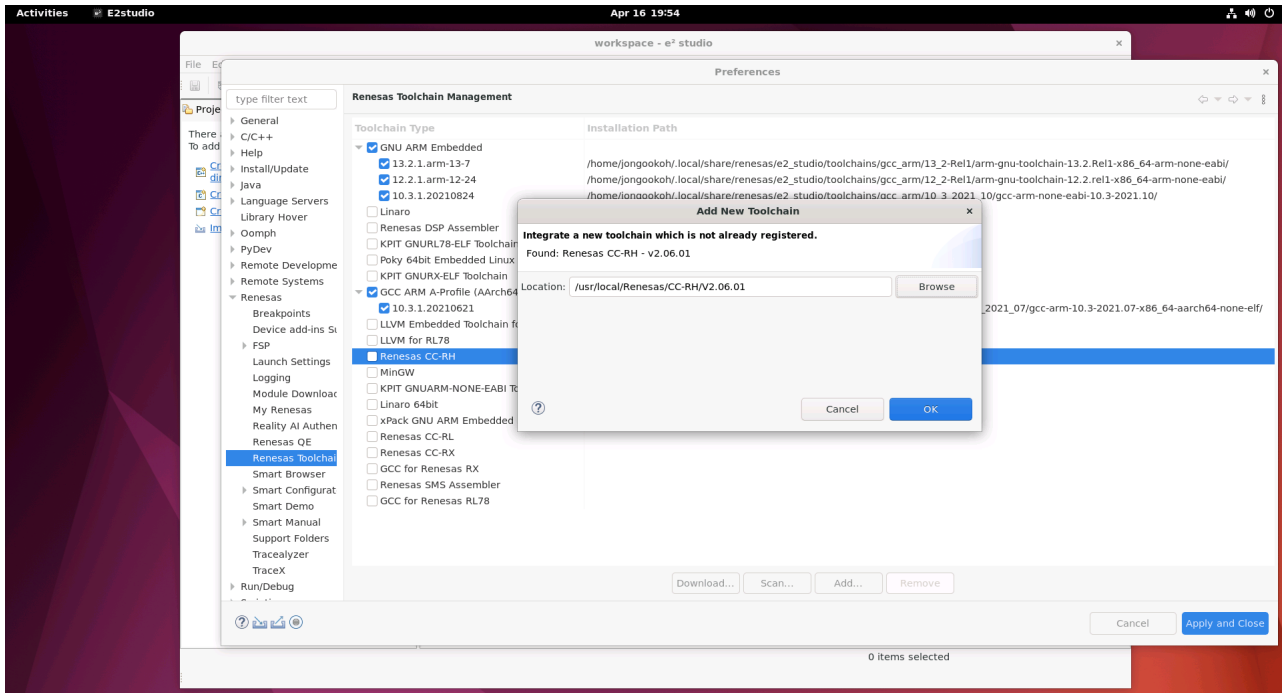

Figure 32 Registering CC-RH

6.5 Installing and Registering the FSP

When a version of the FSP that is not included in the installer for the e² studio Linux is to be installed, unzip the zip-format package file obtained from the FSP page, copy the folder “internal” and its contents to the installation directory of the e² studio, and restart the e² studio.

Example:

```
cd ~/Downloads
unzip FSP_Packs_v5.2.0.zip
cp ./internal ~/renesas/e2_studio/ -rf
```

6.6 Installing and Registering the ARM GNU Toolchain

When a version of the ARM GNU toolchain that is not included in the installer for the e² studio is to be installed, register it through the following method.

Download the ARM GNU toolchain obtained from the Web page of ARM (https://developer.arm.com/downloads/-/arm-gnu-toolchain-downloads).

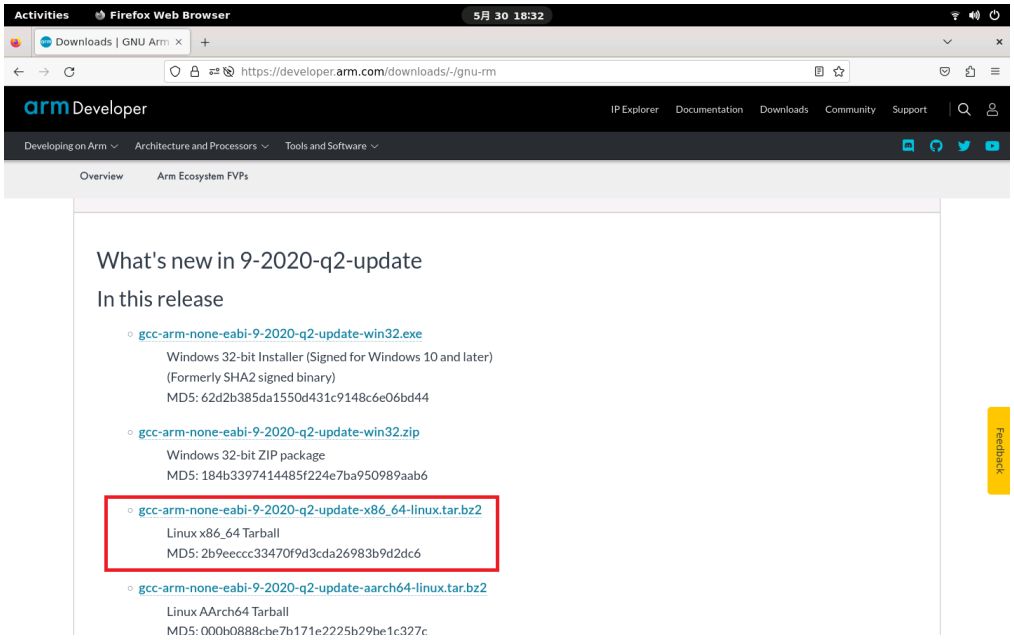

Figure 33 Example: Linux Installer for the x86_64 Architecture of the 9-2020-q2-update ARM GNU Toolchain

Extract the downloaded compressed file to the appropriate path.

Example:

```
cd ~/Downloads
tar -xvf gcc-arm-none-eabi-9-2020-q2-update-x86_64-linux.tar.bz2 -C ~/toolchains/
```

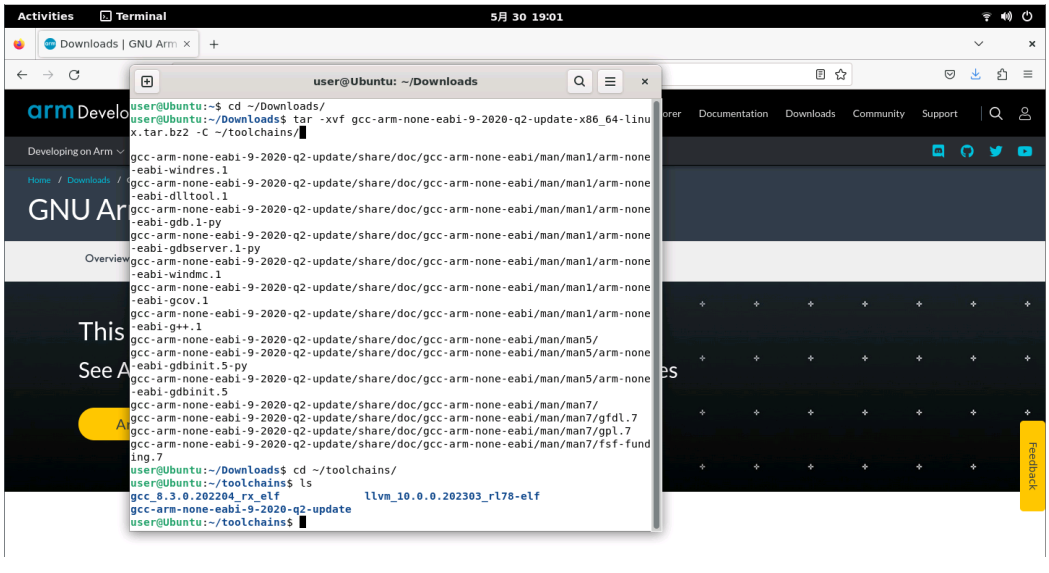

Figure 34 Example of Extraction of a Compressed File: ‘tar’ Command

After having extracted the compressed file, register the toolchain by starting the e² studio, selecting the [Help] menu and the [Add Renesas Toolchains] item, clicking on the [Add…] button with [GNU ARM Embedded] selected, and entering the path where the GNU ARM toolchain has been extracted.

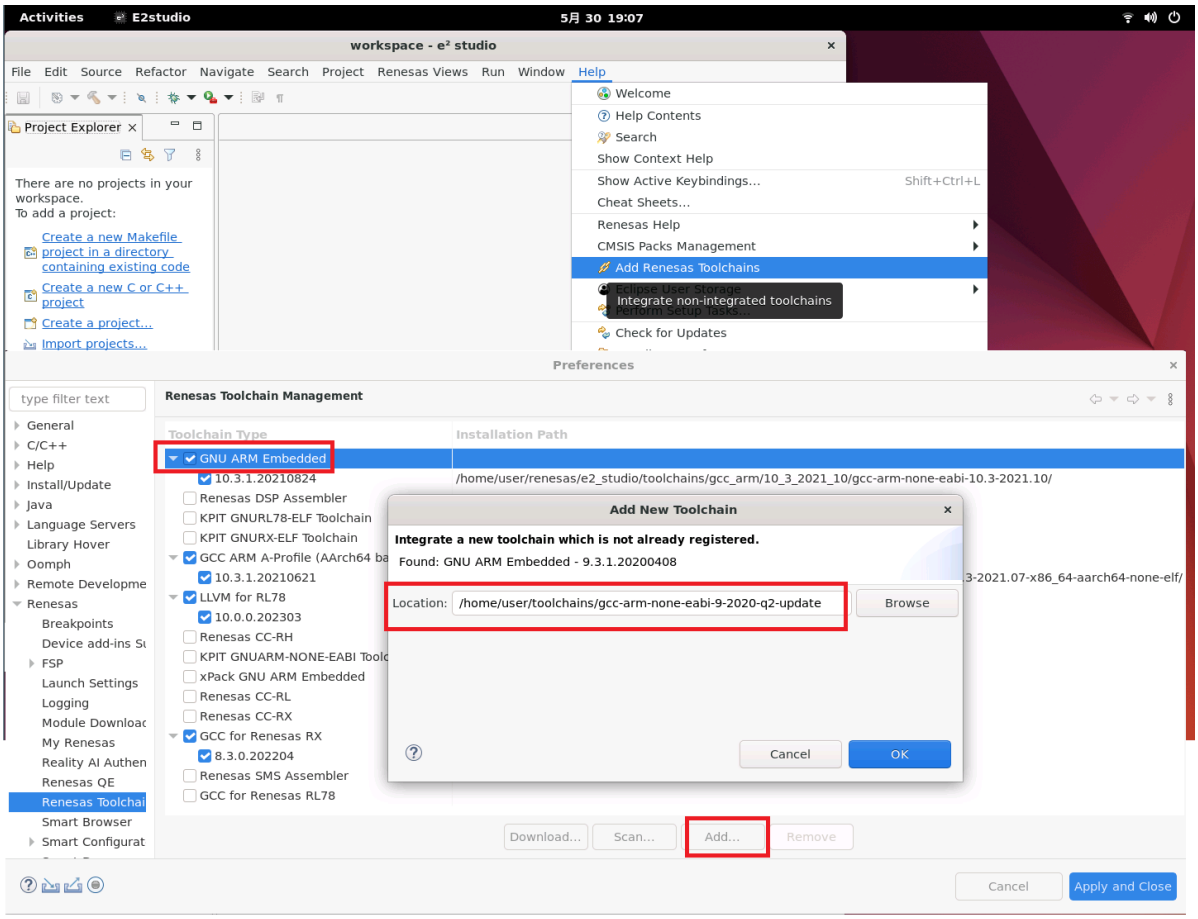

Figure 35 Registering the ARM GNU Toolchain

6.7 Installing Libgen Update

We provide “Libgen Update for GNU ARM Embedded Toolchains” for the building of newlib by users of the ARM GNU toolchain. It can be obtained from the “Open Source Tools for Renesas” site (https://llvm-gcc-renesas.com/; downloading some toolchains requires user registration).

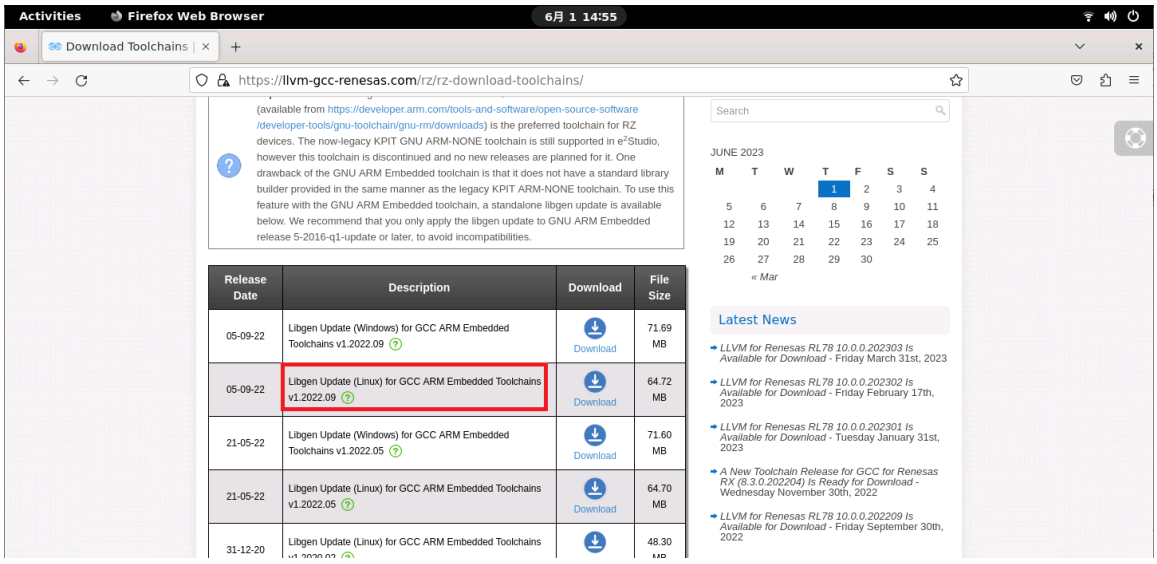

Figure 36 Open Source Tools for Renesas: Libgen Update for GNU ARM Embedded Toolchains

After downloading the installer, confirm the permission to execute it. Enter the required command and then run the installer.

Example:

```
cd ~/Downloads
chmod +x LibgenUpdateInstall_v1.2022.09.run
sudo ./LibgenUpdateInstall_v1.2022.09.run
< Enter the path where the ARM GNU toolchain has been installed.
Example: /home/user/toolchains/gcc-arm-none-eabi-9-2020-q2-update/ >
```

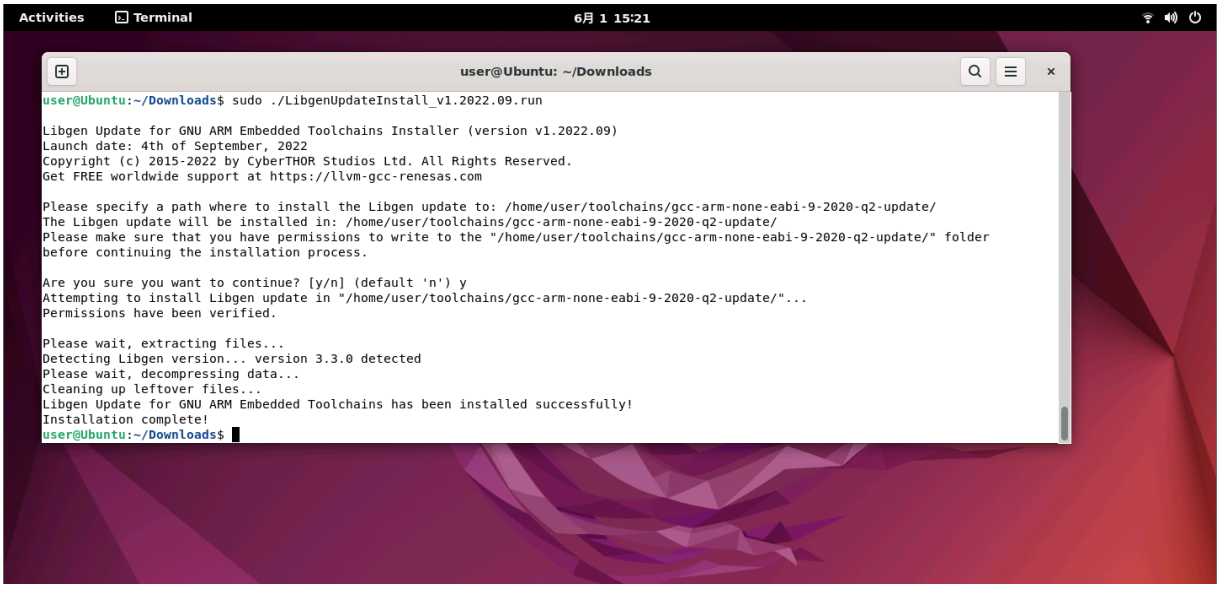

Figure 37 Running Libgen Update

7. Installing Emulator Drivers

When you are using an emulator for debugging, install a Linux driver for the emulator.

7.1 E2 emulator and E2 emulator Lite

Download the E2 emulator driver for Linux from the product page of the E2 emulator.

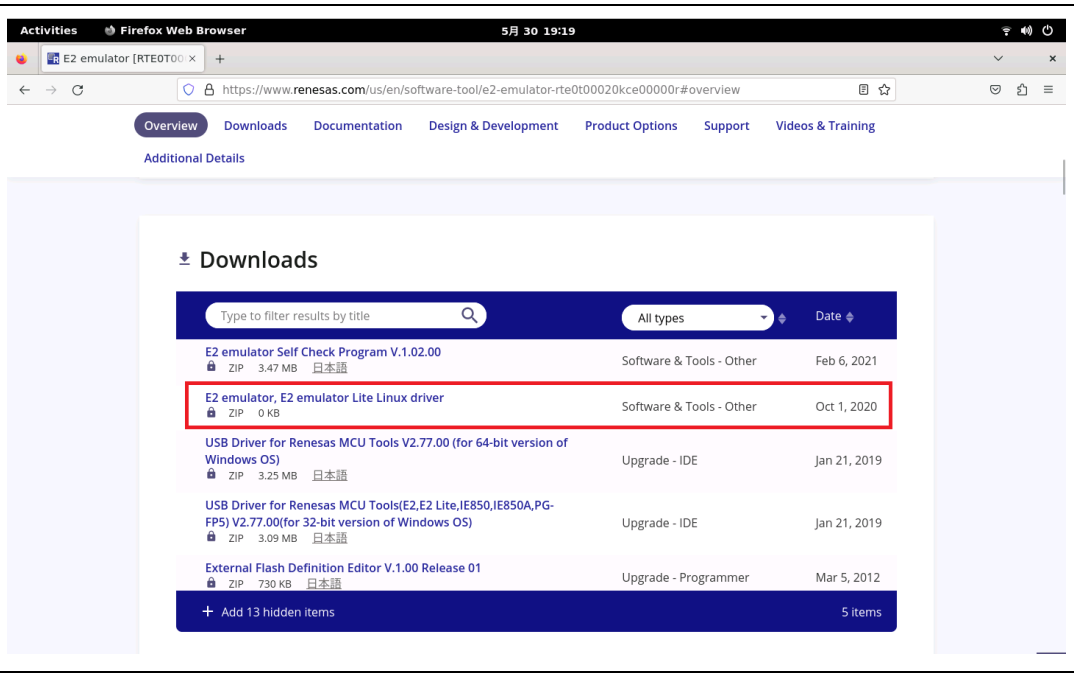

Figure 38 Downloading an Emulator Driver

Unzip the downloaded zip file and register the driver with Linux, referring to the user's manual (.md file).

Example:

```
cd ~/Downloads
sudo cp 99-renesas-emu.rules /etc/udev/rules.d/
service udev restart
```

After the emulator has been connected to the PC, run the lsusb command to confirm the state of the emulator having been recognized.

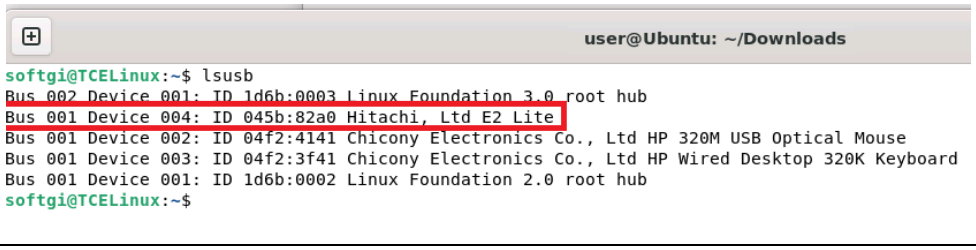

Figure 39 Confirming the State of the Emulator Having been Recognized

7.2 Segger J-Link

Download the J-Link driver for Linux from the product page of Segger.

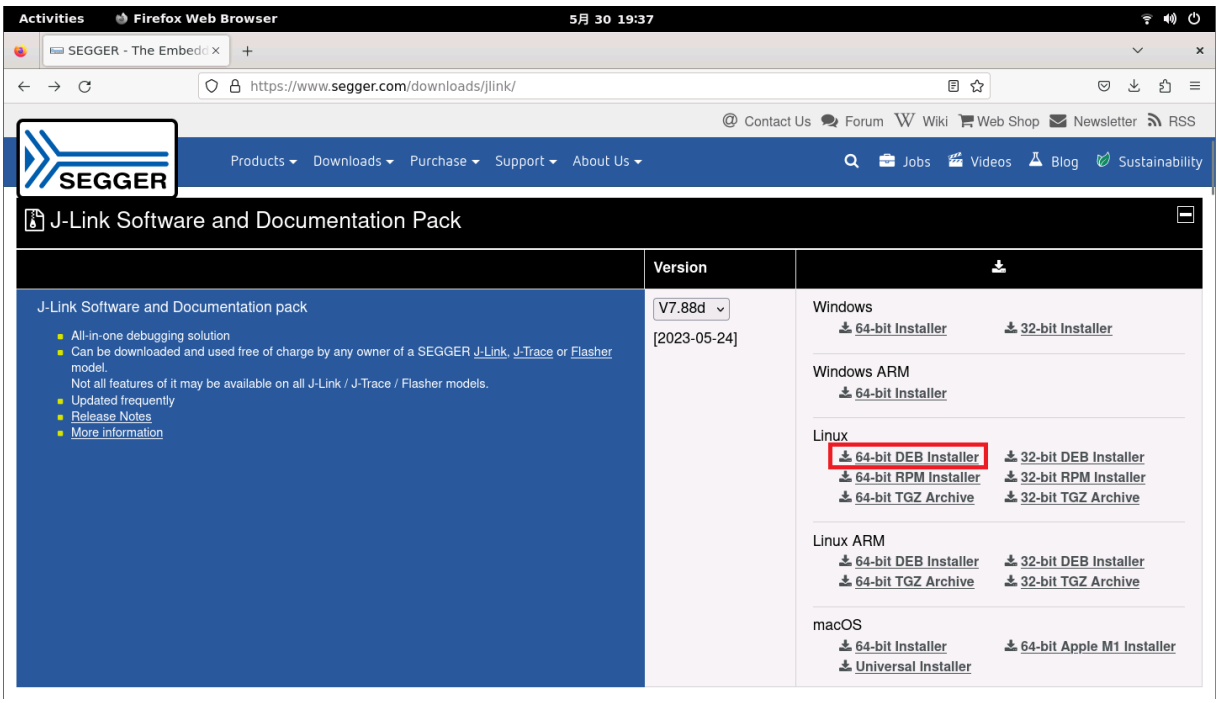

Figure 40 Downloading a J-Link driver for Linux

After downloading the installer, confirm the permission to execute it. Enter the required command and then run the installer.

Example:

```
cd ~/Downloads
chmod +x JLink_Linux_V788d_x86_64.deb
sudo apt install ./JLink_Linux_V788d_x86_64.deb
```

After the emulator has been connected to the PC, run the lsusb command to confirm the state of the emulator having been recognized.

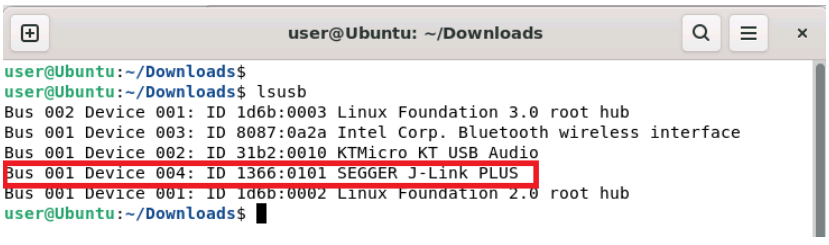

Figure 41 Confirming the State of the Emulator Having been Recognized

Revision History

Rev.	Date	Description	
		Page	Summary
1.0	Jun.30.23	—	First Edition issued
1.01	Oct.11.23	—	Fixed Page Layout (No correction of contents)
1.02	Apr.25.24	—	Revised based on e²studio 2024-04 (addition of DA devices, etc.) Added how to install CC-RL, RX, RH

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on

   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state

   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
4. Handling of unused pins

   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.
5. Clock signals

   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.
6. Voltage application waveform at input pin

   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).
7. Prohibition of access to reserved addresses

   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.
8. Differences between products

   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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(Rev.5.0-1 October 2020)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
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