

Getting Started with MCUXpresso SDK

1 Overview

The MCUXpresso Software Development Kit (SDK) provides comprehensive software support for Kinetis and LPC Microcontrollers. The MCUXpresso SDK includes a flexible set of peripheral drivers designed to speed up and simplify development of embedded applications. Along with the peripheral drivers, the MCUXpresso SDK provides an extensive and rich set of example applications covering everything from basic peripheral use case examples to full demo applications. The MCUXpresso SDK contains FreeRTOS, a USB host and device stack, and various other middleware to support rapid development.

For supported toolchain versions, see the MCUXpresso SDK Release Notes (document MCUXSDKRN).

For the latest version of this and other MCUXpresso SDK documents, see the MCUXpresso SDK homepage [MCUXpresso-SDK: Software Development Kit for MCUXpresso](#).

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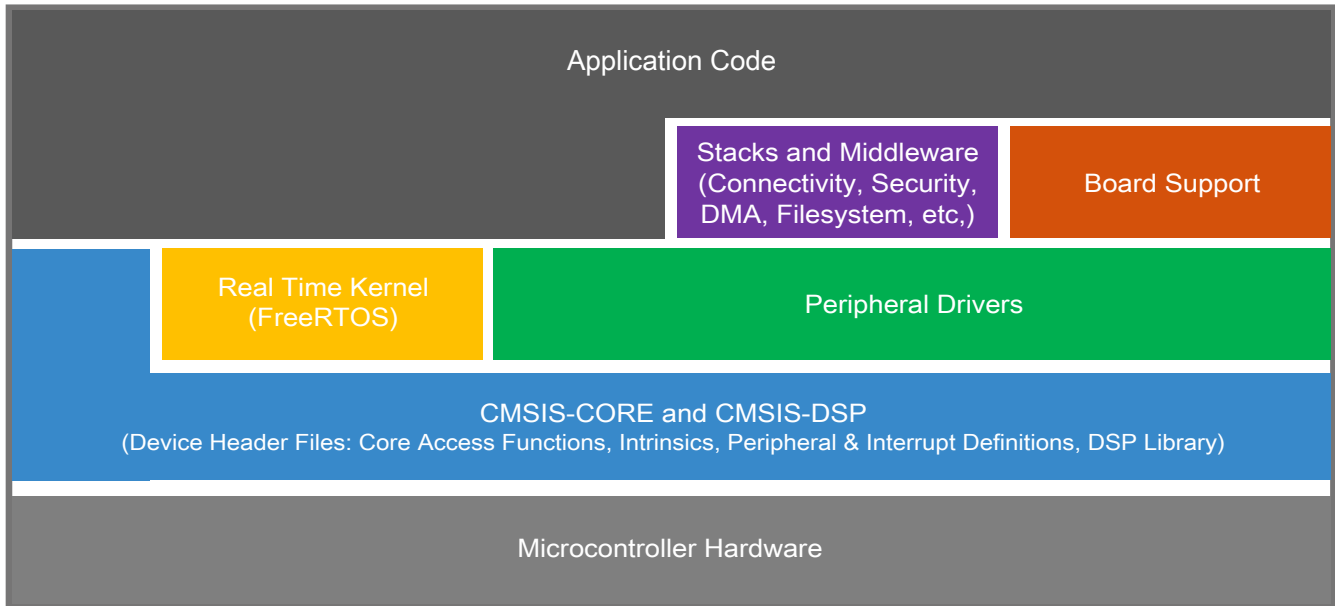


Figure 1. MCUXpresso SDK layers

2 MCUXpresso SDK Board Support Folders

MCUXpressoSDK board support provides example applications for NXP development and evaluation boards for ARM® Cortex®-M cores, including Freedom, Tower System, and LPCXpresso boards. Board support packages are found inside of the top level boards folder, and each supported board has its own folder (an MCUXpresso SDK package can support multiple boards). Within each <board_name> folder there are various sub-folders to classify the type of examples they contain. These include (but are not limited to):

- cmsis_driver_examples: Simple applications intended to concisely illustrate how to use CMSIS drivers.
- demo_apps: Full-featured applications intended to highlight key functionality and use cases of the target MCU. These applications typically use multiple MCU peripherals and may leverage stacks and middleware.
- driver_examples: Simple applications intended to concisely illustrate how to use the MCUXpresso SDK’s peripheral drivers for a single use case. These applications typically only use a single peripheral, but there are cases where multiple are used (for example, ADC conversion using DMA).
- emwin_examples: Applications that use the emWin GUI widgets.
- rtos_examples: Basic FreeRTOS™ OS examples showcasing the use of various RTOS objects (semaphores, queues, and so on) and interfacing with the MCUXpresso SDK’s RTOS drivers
- usb_examples: Applications that use the USB host/device/OTG stack.

2.1 Example Application Structure

This section describes how the various types of example applications interact with the other components in the MCUXpresso SDK. To get a comprehensive understanding of all MCUXpresso SDK components and folder structure, see the *MCUXpresso SDK API Reference Manual* document (MCUXSDKAPIRM).

Each <board_name> folder in the boards directory contains a comprehensive set of examples that are relevant to that specific piece of hardware. We’ll discuss the hello_world example (part of the demo_apps folder), but the same general rules apply to any type of example in the <board_name> folder.

In the hello_world application folder you see this:

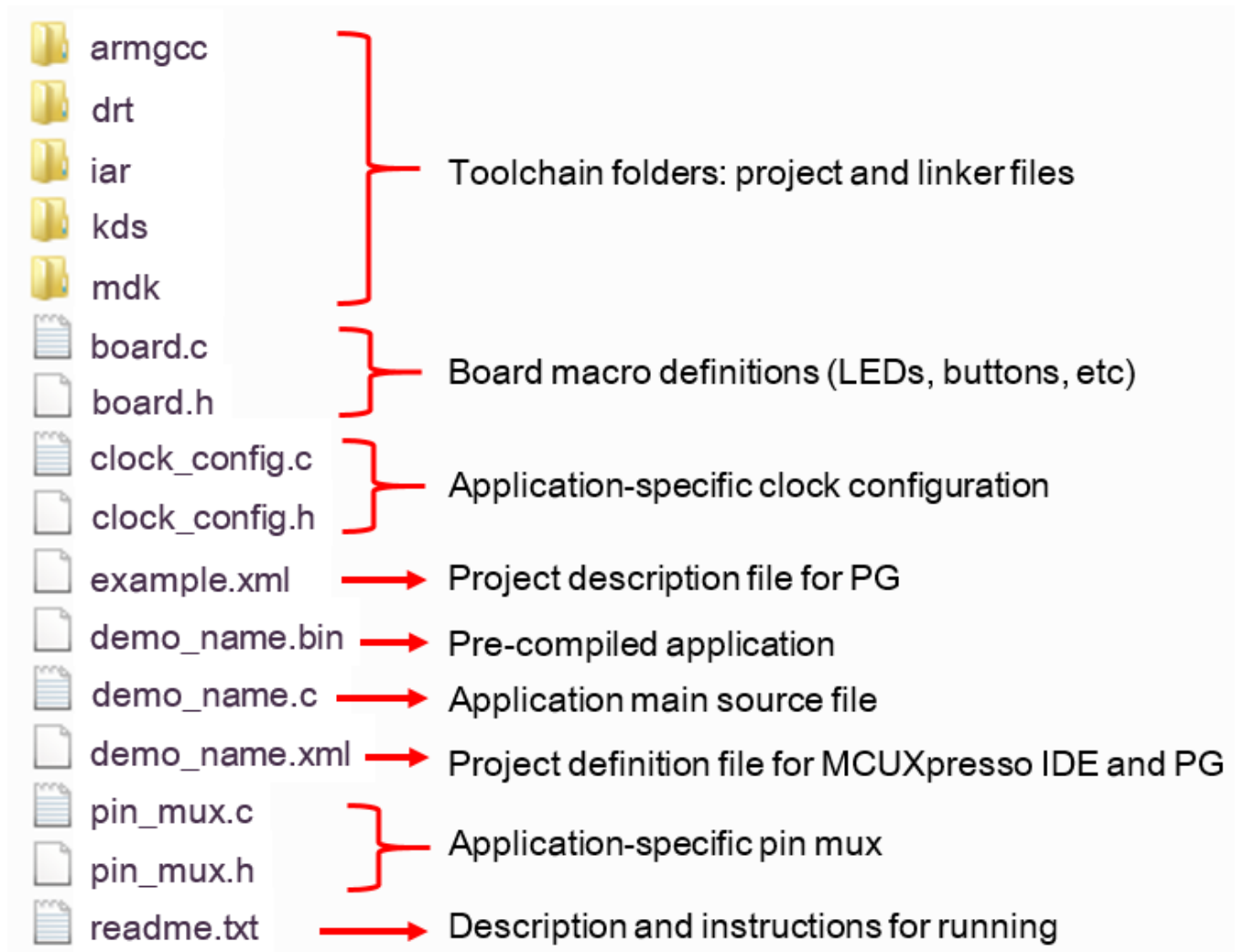


Figure 2. Application folder structure

All files in the application folder are specific to that example, so it's very easy to copy-paste an existing example to start developing a custom application based on a project provided in the MCUXpresso SDK.

2.2 Locating Example Application Source Files

When opening an example application in any of the supported IDEs, there are a variety of source files referenced. The MCUXpresso SDK *devices* folder is designed to be the "golden core" of the application and is, therefore, the central component to all example applications. Because it's a core component, all of the examples reference the same source files and, if one of these files is modified, it could potentially impact the behavior of other examples.

The main areas of the MCUXpresso SDK tree used in all example applications are:

- `devices/<device_name>`: The device's CMSIS header file, MCUXpresso SDK feature file and a few other things.
- `devices/<device_name>/cmsis_drivers`: All the CMSIS drivers for your specific MCU.
- `devices/<device_name>/drivers`: All of the peripheral drivers for your specific MCU.

Run a demo application using IAR

- `devices/<device_name>/<tool_name>`: Toolchain-specific startup code. Vector table definitions are here.
- `devices/<device_name>/utilities`: Items such as the debug console that are used by many of the example applications.

For examples containing middleware/stacks or a RTOS, there are references to the appropriate source code. Middleware source files are located in the *middleware* folder and RTOSes are in the *rtos* folder. Again, the core files of each of these are shared, so modifying them could have potential impacts on other projects that depend on them.

3 Run a demo application using IAR

This section describes the steps required to build, run, and debug example applications provided in the MCUXpresso SDK. The `hello_world` demo application targeted for the FRDM-K64F Freedom hardware platform is used as an example, although these steps can be applied to any example application in the MCUXpresso SDK.

3.1 Build an example application

The following steps guide you through opening the `hello_world` example application. These steps may change slightly for other example applications as some of these applications may have additional layers of folders in their path.

1. If not already done, open the desired demo application workspace. Most example application workspace files can be located using the following path:

```
<install_dir>/boards/<board_name>/<example_type>/<application_name>/iar
```

Using the FRDM-K64F Freedom hardware platform as an example, the `hello_world` workspace is located in

```
<install_dir>/boards/frdmk64f/demo_apps/hello_world/iar/hello_world.eww
```

2. Select the desired build target from the drop-down. For this example, select the “`hello_world – Debug`” target.

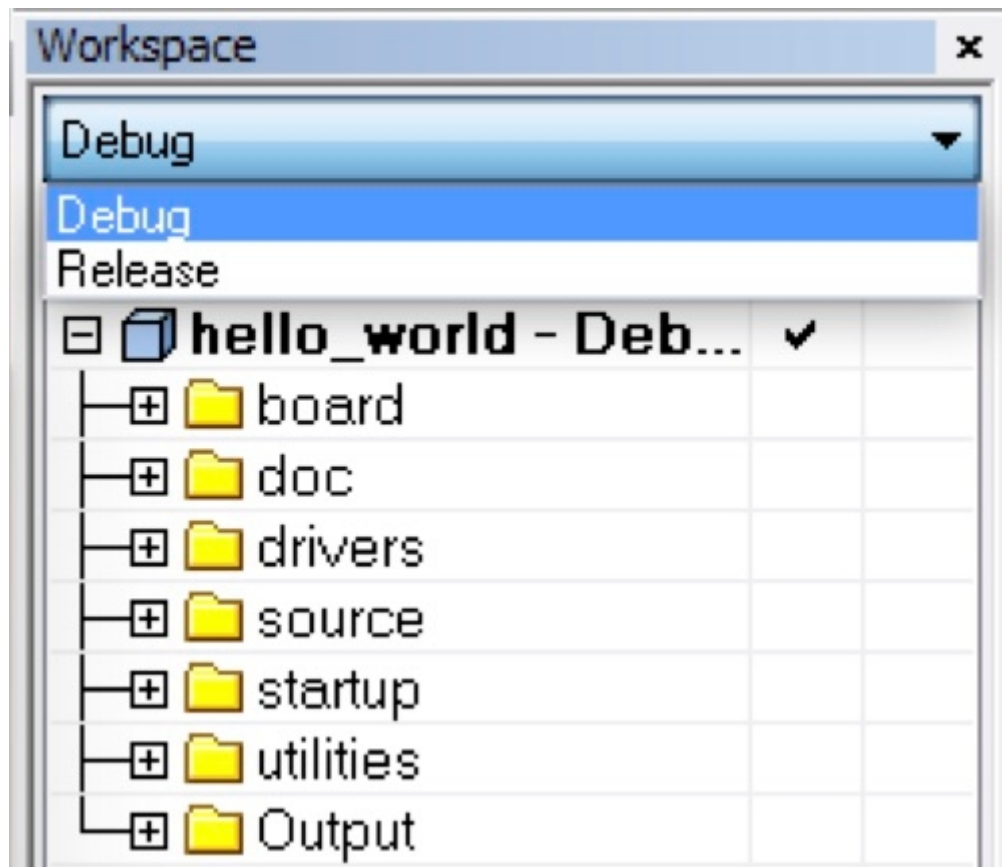


Figure 3. Demo build target selection

3. To build the demo application, click the “Make” button, highlighted in red below.

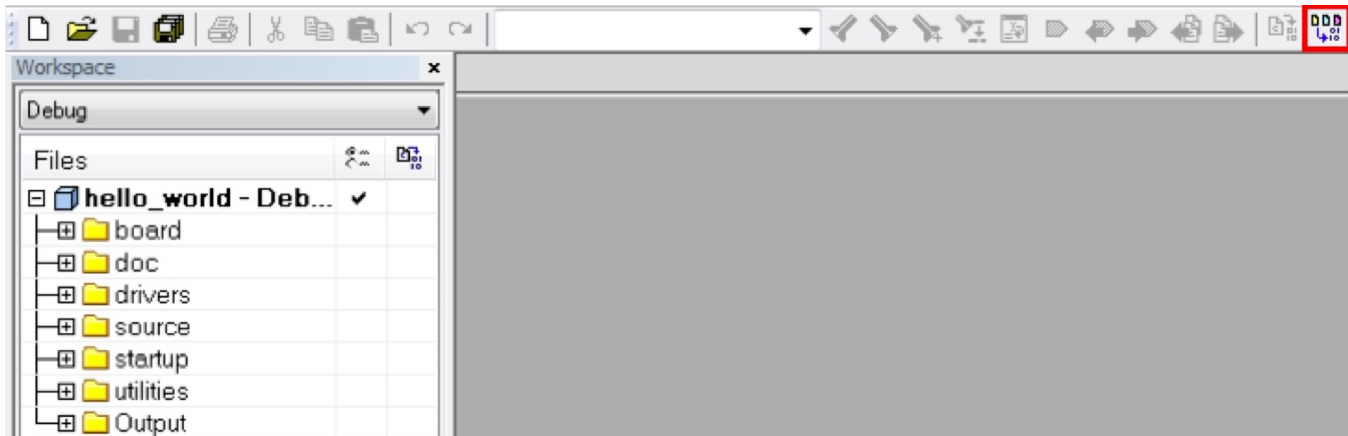


Figure 4. Build the demo application

4. The build completes without errors.

3.2 Run an example application

Run a demo application using IAR

To download and run the application, perform these steps:

1. Reference the table in Appendix B to determine the debug interface that comes loaded on your specific hardware platform.
 - For boards with CMSIS-DAP/mbed/DAPLink interfaces, visit developer.mbed.org/handbook/Windows-serial-configuration and follow the instructions to install the Windows® operating system serial driver. If running on Linux OS, this step is not required.
 - The user should install LPCScript or MCUXpresso IDE to ensure LPC board drivers are installed.
 - For boards with P&E Micro interfaces, visit www.pemicro.com/support/downloads_find.cfm and download the P&E Micro Hardware Interface Drivers package.
2. Connect the development platform to your PC via USB cable.
3. Open the terminal application on the PC, such as PuTTY or TeraTerm, and connect to the debug COM port (to determine the COM port number, see Appendix A). Configure the terminal with these settings:
 - a. 115200 or 9600 baud rate, depending on your board (reference BOARD_DEBUG_UART_BAUDRATE variable in board.h file)
 - b. No parity
 - c. 8 data bits
 - d. 1 stop bit

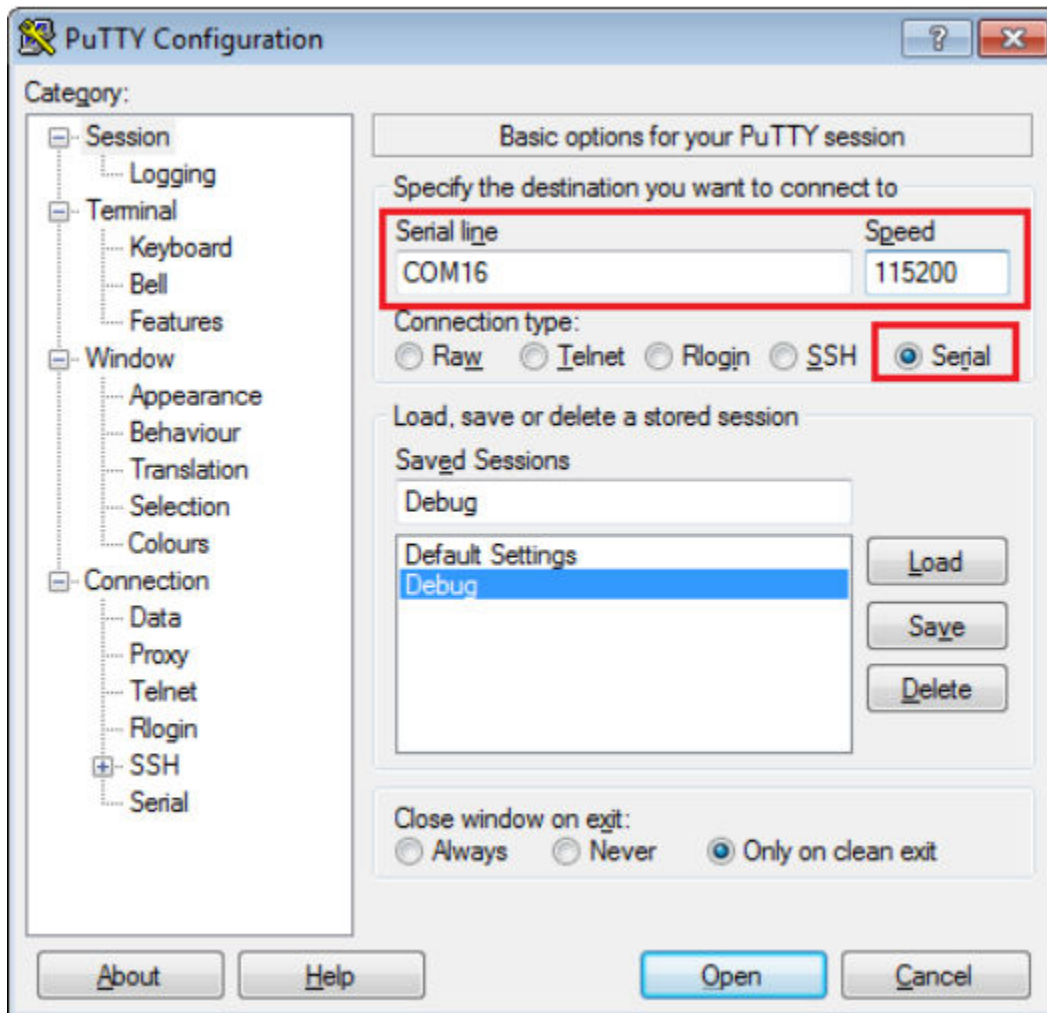


Figure 5. Terminal (PuTTY) configuration

4. In IAR, click the "Download and Debug" button to download the application to the target.



Figure 6. Download and Debug button

5. The application is then downloaded to the target and automatically runs to the main() function.

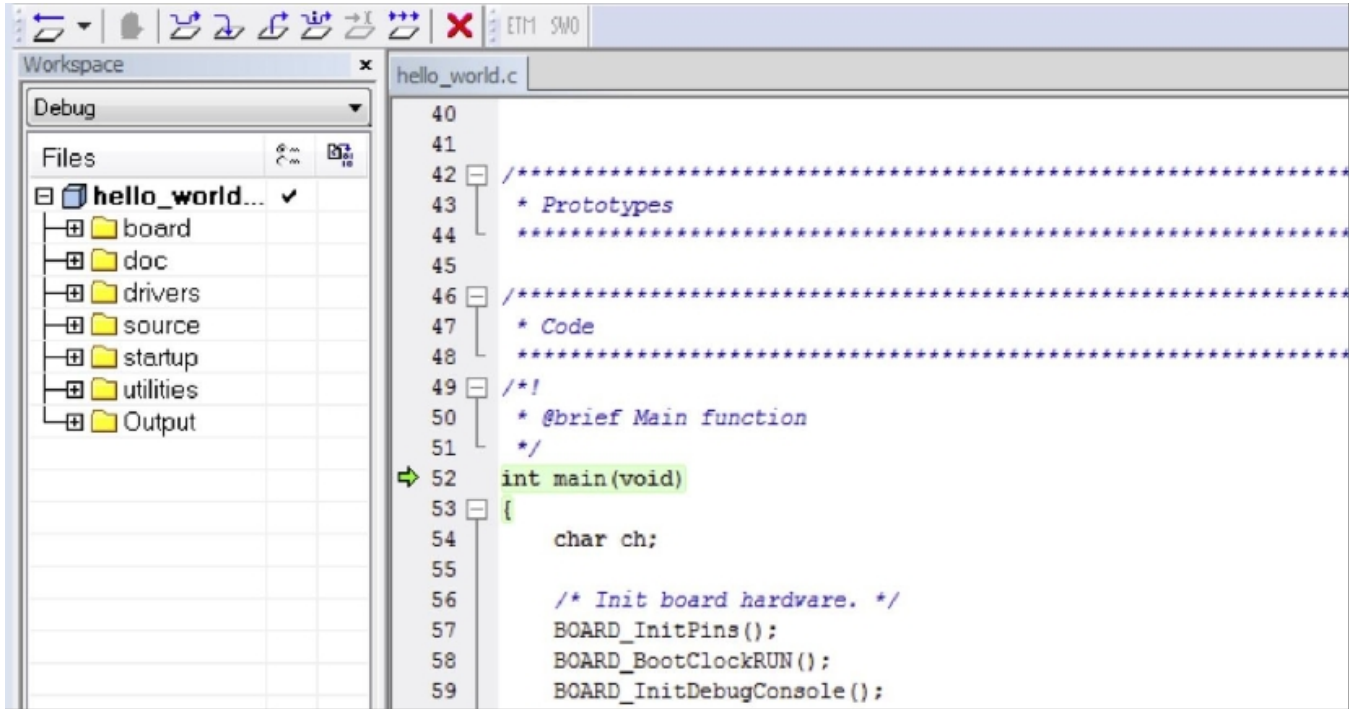


Figure 7. Stop at main() when running debugging

6. Run the code by clicking the "Go" button to start the application.

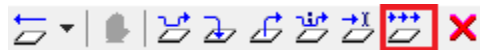


Figure 8. Go button

7. The hello_world application is now running and a banner is displayed on the terminal. If this is not true, check your terminal settings and connections.

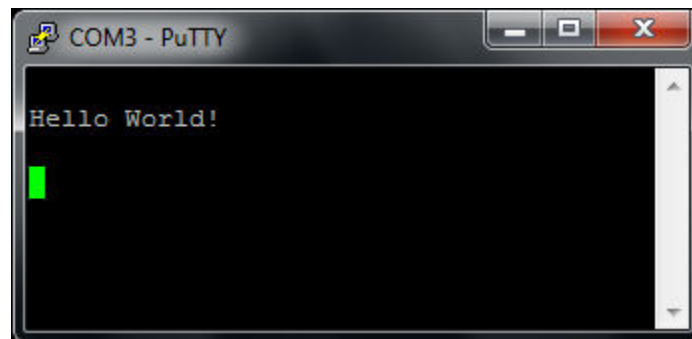


Figure 9. Text display of the hello_world demo

3.3 Build a multicore example application

This section describes the particular steps that need to be done in order to build and run a dual-core application. The demo applications workspace files are located in this folder:

```
<install_dir>/boards/<board_name>/multicore_examples/<application_name><core_type>/iar
```

Begin with a simple dual-core version of the Hello World application. The multicore Hello World IAR workspaces are located in this folder:

```
<install_dir>/boards/lpcxpresso54114/multicore_examples/hello_world/cm0plus/iar/hello_world_cm0plus.eww
```

```
<install_dir>/boards/lpcxpresso54114/multicore_examples/hello_world/cm4/iar/hello_world_cm4.eww
```

Build both applications separately by clicking the “Make” button. It is requested to build the application for the auxiliary core (cm0plus) first, because the primary core application project (cm4) needs to know the auxiliary core application binary when running the linker. It is not possible to finish the primary core linker when the auxiliary core application binary is not ready.

3.4 Run a multicore example application

The primary core debugger handles flashing of both the primary and the auxiliary core applications into the SoC flash memory. To download and run the multicore application, switch to the primary core application project and perform steps 1 – 4 as described in Section 3.2, “Run an example application”. These steps are common for both single core and dual-core applications in IAR.

After clicking the “Download and Debug” button, the auxiliary core project is opened in the separate EWARM instance. Both the primary and auxiliary image are loaded into the device flash memory, and the primary core application is executed. It stops at the default C language entry point in the *main()* function.

Run both cores by clicking the “Start all cores” button to start the multicore application.



Figure 10. Start all cores button

During the primary core code execution, the auxiliary core code is re-allocated from the flash memory to the RAM, and the auxiliary core is released from the reset. The hello_world multicore application is now running and a banner is displayed on the terminal. If this is not true, check your terminal settings and connections.

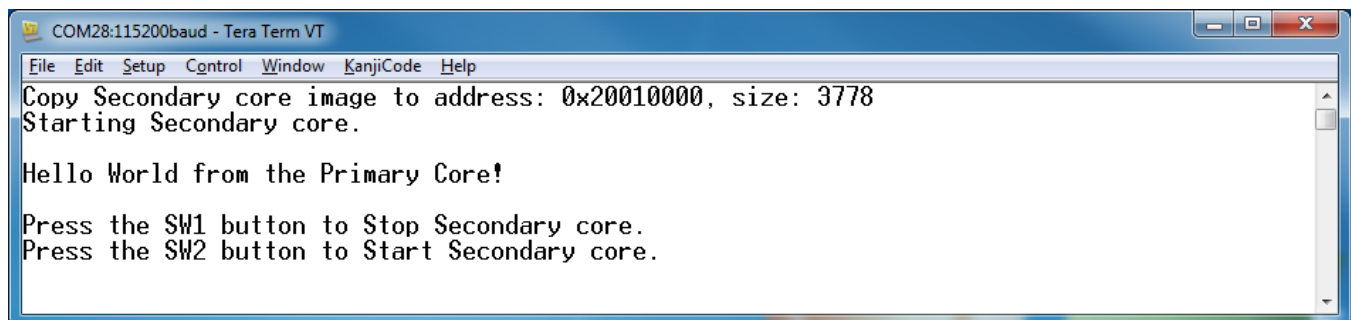


Figure 11. Hello World from primary core message

An LED controlled by the auxiliary core starts flashing, indicating that the auxiliary core has been released from the reset and is running correctly. When both cores are running, use the “Stop all cores” and “Start all cores” control buttons to stop or run both cores simultaneously.



Figure 12. "Stop all cores" and "Start all cores" control buttons

4 Run a demo using Keil® MDK/μVision

This section describes the steps required to build, run, and debug example applications provided in the MCUXpresso SDK. The hello_world demo application targeted for the FRDM-K64F Freedom hardware platform is used as an example, although these steps can be applied to any demo or example application in the MCUXpresso SDK.

4.1 Install CMSIS device pack

After the MDK tools are installed, Cortex® Microcontroller Software Interface Standard (CMSIS) device packs must be installed to fully support the device from a debug perspective. These packs include things such as memory map information, register definitions and flash programming algorithms. Follow these steps to install the appropriate CMSIS pack.

1. Open the MDK IDE, which is called μVision. In the IDE, select the "Pack Installer" icon.

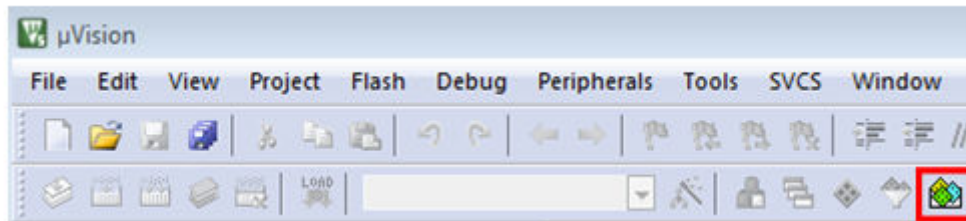


Figure 13. Launch the Pack installer

2. After the installation finishes, close the Pack Installer window and return to the μVision IDE.

4.2 Build an example application

- If not already done, open the desired example application workspace in: `<install_dir>/boards/<board_name>/<example_type>/<application_name>/mdk`

The workspace file is named `<demo_name>.uvmpw`, so for this specific example, the actual path is:

`<install_dir>/boards/frdmk64f/demo_apps/hello_world/mdk/hello_world.uvmpw`

- To build the demo project, select the "Rebuild" button, highlighted in red.



Figure 14. Build the demo

- The build completes without errors.

4.3 Run an example application

To download and run the application, perform these steps:

1. Reference the table in Appendix B to determine the debug interface that comes loaded on your specific hardware platform.
 - For boards with the CMSIS-DAP/mbed/DAPLink interface, visit [mbed Windows serial configuration](#) and follow the instructions to install the Windows operating system serial driver. If running on Linux OS, this step is not required.
 - The user should install LPCScrypt or MCUXpresso IDE to ensure LPC board drivers are installed.
 - For boards with a P&E Micro interface, visit www.pemicro.com/support/downloads_find.cfm and download and install the P&E Micro Hardware Interface Drivers package.
 - If using J-Link either a standalone debug pod or OpenSDA, install the J-Link software (drivers and utilities) from www.segger.com/jlink-software.html.
 - For boards with the OSJTAG interface, install the driver from www.keil.com/download/docs/408.
2. Connect the development platform to your PC via USB cable between the OpenSDA USB connector (may be named OSJTAG on some boards) and the PC USB connector.
3. Open the terminal application on the PC, such as PuTTY or TeraTerm, and connect to the debug serial port number (to determine the COM port number, see Appendix A). Configure the terminal with these settings:
 - a. 115200 or 9600 baud rate, depending on your board (reference BOARD_DEBUG_UART_BAUDRATE variable in board.h file)
 - b. No parity
 - c. 8 data bits
 - d. 1 stop bit

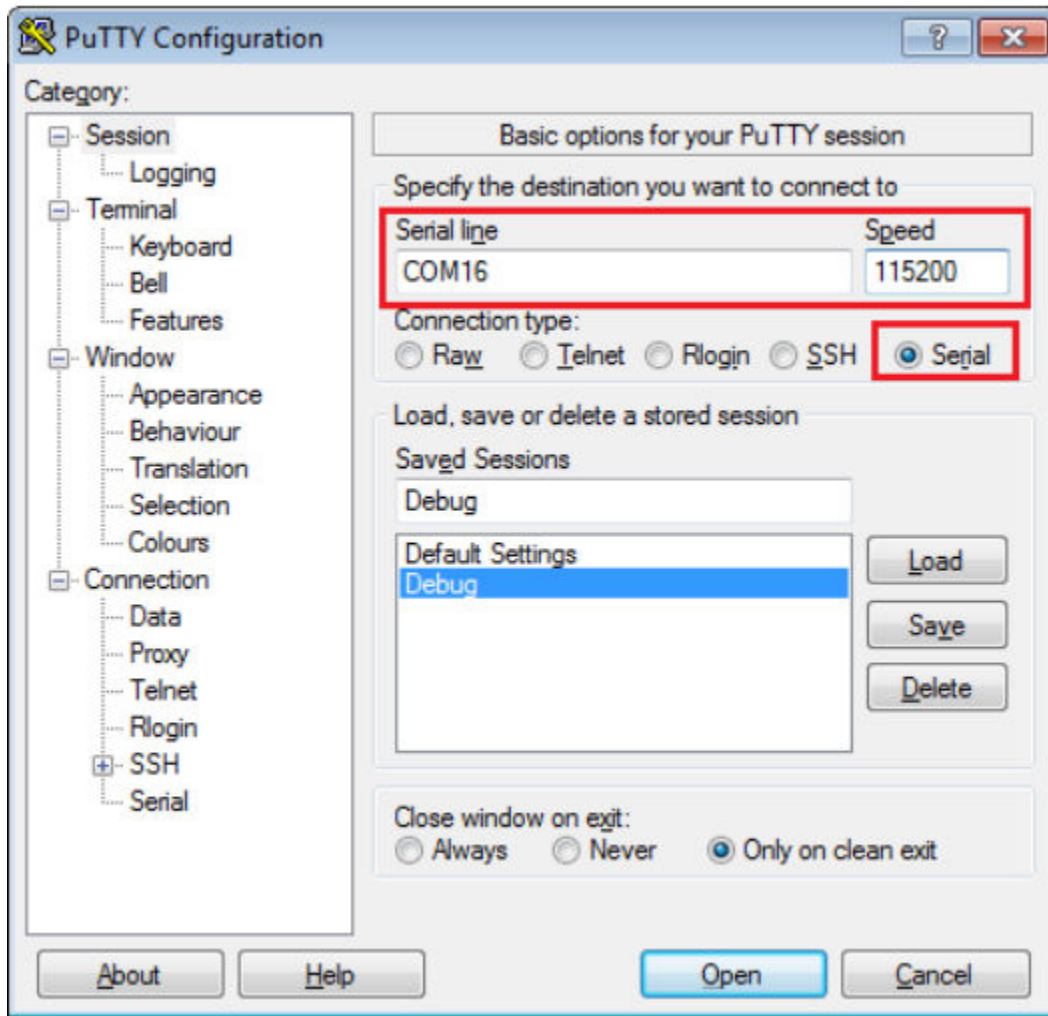


Figure 15. Terminal (PuTTY) configurations

- In μVision, after the application is properly built, click the "Download" button to download the application to the target.

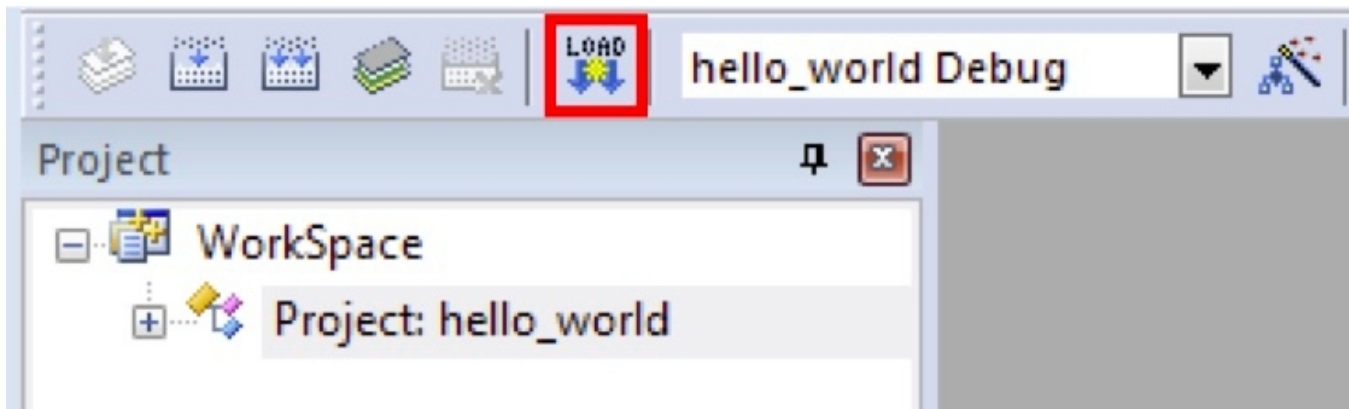


Figure 16. Download button

- After clicking the "Download" button, the application downloads to the target and should be running. To debug the application, click the "Start/Stop Debug Session" button, highlighted in red.

Run a demo using Keil® MDK/μVision

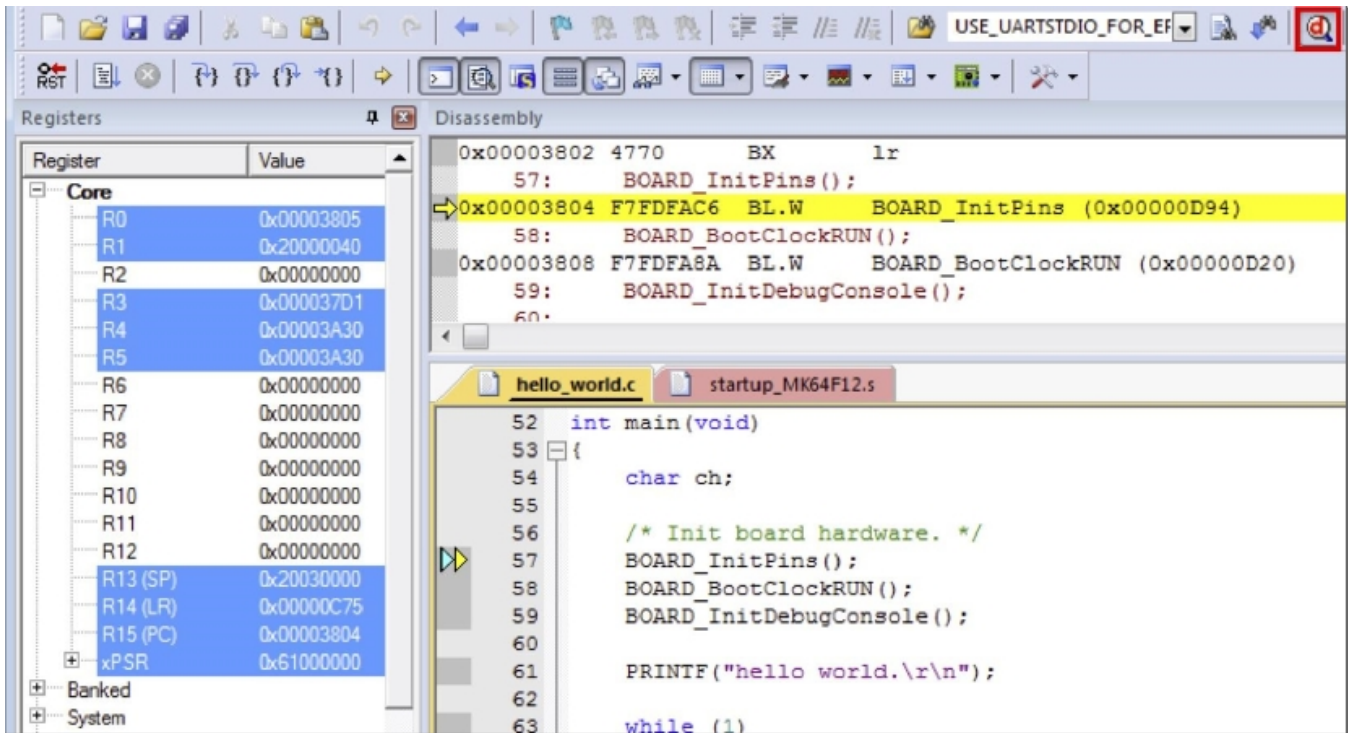


Figure 17. Stop at main() when run debugging

6. Run the code by clicking the “Run” button to start the application.

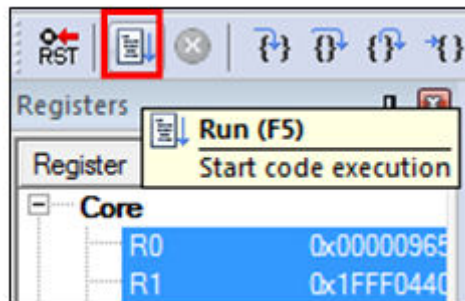


Figure 18. Go button

The hello_world application is now running and a banner is displayed on the terminal. If this is not true, check your terminal settings and connections.

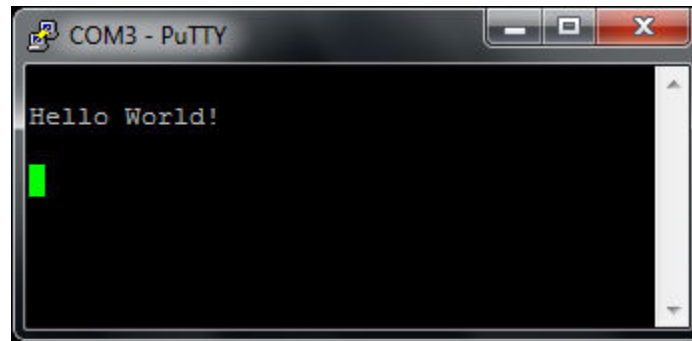


Figure 19. Text display of the hello_world demo

4.4 Build a multicore example application

This section describes the particular steps that need to be done in order to build and run a dual-core application. The demo applications workspace files are located in this folder:

```
<install_dir>/boards/<board_name>/multicore_examples/<application_name><core_type>/mdk
```

Begin with a simple dual-core version of the Hello World application. The multicore Hello World Keil MSDK/μVision workspaces are located in this folder:

```
<install_dir>/boards/lpcxpresso54114/multicore_examples/hello_world/cm0plus/mdk/hello_world_cm0plus.uvmpw
```

```
<install_dir>/boards/lpcxpresso54114/multicore_examples/hello_world/cm4/mdk/hello_world_cm4.uvmpw
```

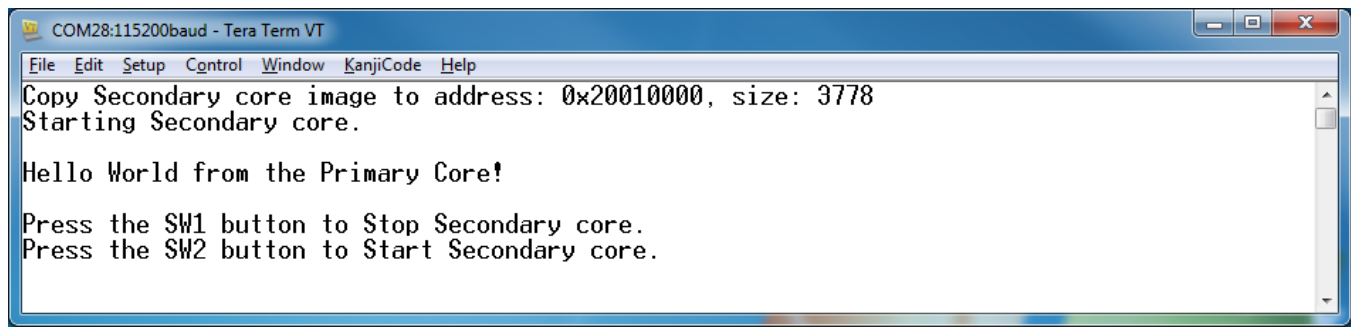
Build both applications separately by clicking the “Rebuild” button. Build the application for the auxiliary core (cm0plus) first, because the primary core application project (cm4) needs to know the auxiliary core application binary when running the linker. It is not possible to finish the primary core linker when the auxiliary core application binary is not ready.

4.5 Run a multicore example application

The primary core debugger handles flashing of both the primary and the auxiliary core applications into the SoC flash memory. To download and run the multicore application, switch to the primary core application project and perform steps 1 – 5 as described in Section 4.3, “Run an example application”. These steps are common for both single core and dual-core applications in μVision.

Both the primary and the auxiliary image is loaded into the device flash memory. After clicking the “Run” button, the primary core application is executed. During the primary core code execution, the auxiliary core code is re-allocated from the flash memory to the RAM, and the auxiliary core is released from the reset. The hello_world multicore application is now running and a banner is displayed on the terminal. If this is not true, check your terminal settings and connections.

Run a demo using Keil® MDK/μVision



```
COM28:115200baud - Tera Term VT
File Edit Setup Control Window KanjiCode Help
Copy Secondary core image to address: 0x20010000, size: 3778
Starting Secondary core.

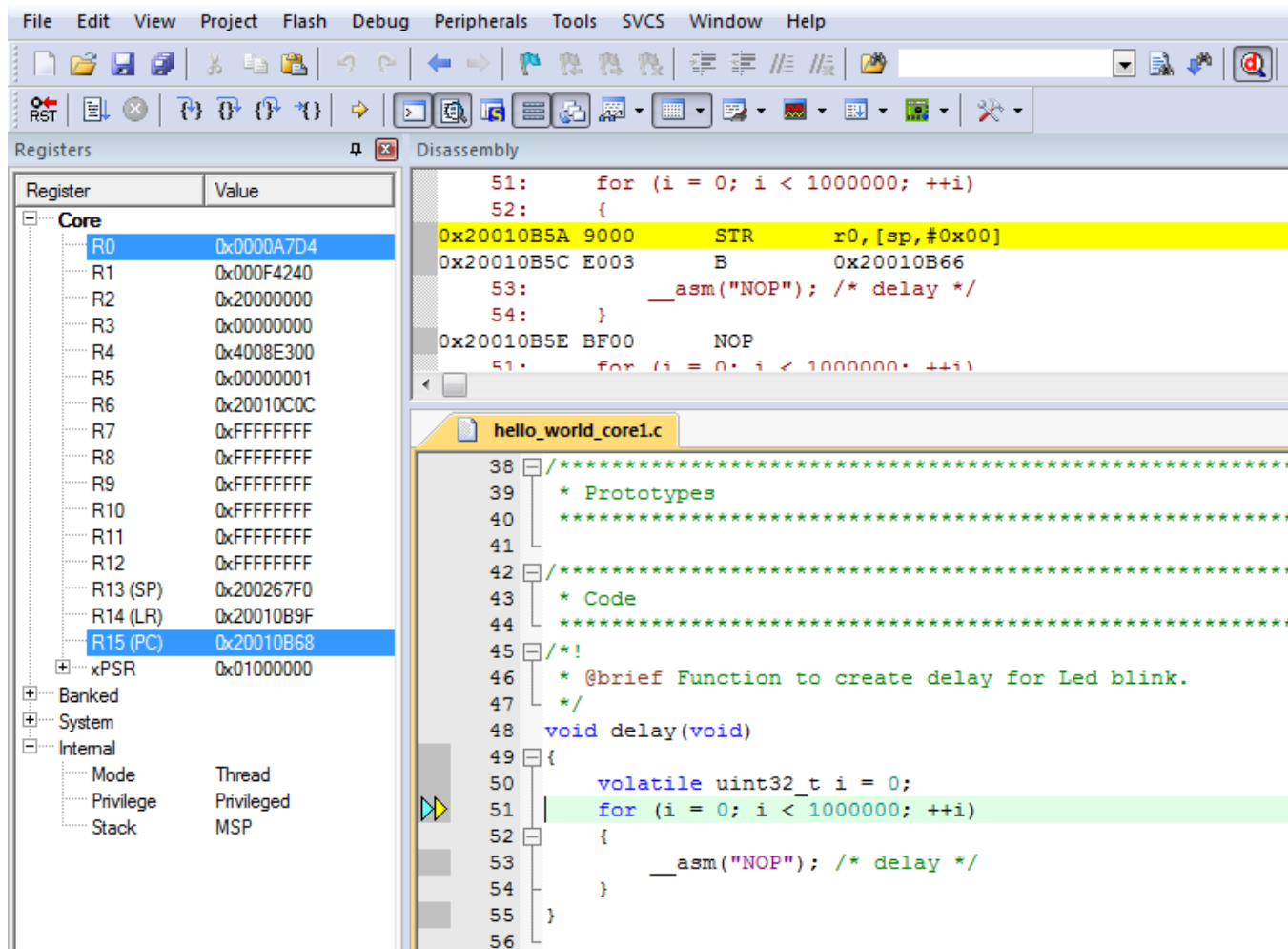
Hello World from the Primary Core!

Press the SW1 button to Stop Secondary core.
Press the SW2 button to Start Secondary core.
```

Figure 20. Hello World from primary core message

An LED controlled by the auxiliary core starts flashing, indicating that the auxiliary core has been released from the reset and is running correctly.

Attach the running application of the auxiliary core by opening the auxiliary core project in the second μVision instance, and clicking the “Start/Stop Debug Session” button. After doing this, the second debug session is opened and the auxiliary core application can be debugged.



```
File Edit View Project Flash Debug Peripherals Tools SVCS Window Help
RST
Registers Disassembly
Register Value
Core
R0 0x0000A7D4
R1 0x000F4240
R2 0x20000000
R3 0x00000000
R4 0x4008E300
R5 0x00000001
R6 0x20010C0C
R7 0xFFFFFFFF
R8 0xFFFFFFFF
R9 0xFFFFFFFF
R10 0xFFFFFFFF
R11 0xFFFFFFFF
R12 0xFFFFFFFF
R13 (SP) 0x200267F0
R14 (LR) 0x20010B9F
R15 (PC) 0x20010B68
xPSR 0x01000000
Banked
System
Internal
Mode Thread
Privilege Privileged
Stack MSP
51: for (i = 0; i < 1000000; ++i)
52: {
0x20010B5A 9000 STR r0, [sp, #0x00]
0x20010B5C E003 B 0x20010B66
53: __asm("NOP"); /* delay */
54: }
0x20010B5E BF00 NOP
51: for (i = 0; i < 1000000; ++i)
hello_world_core1.c
38 /*
39 * Prototypes
40 *
41 *
42 /*
43 * Code
44 *
45 /*!
46 * @brief Function to create delay for Led blink.
47 */
48 void delay(void)
49 {
50 volatile uint32_t i = 0;
51 for (i = 0; i < 1000000; ++i)
52 {
53 __asm("NOP"); /* delay */
54 }
55 }
56
```

Figure 21. Debugging the auxiliary core application

5 Run a demo using Kinetis Design Studio IDE

NOTE

Ensure that you selected the Kinetis Design Studio IDE toolchain when you generated the MCUXpresso SDK Package.

This section describes the steps required to configure Kinetis Design Studio (KDS) IDE to build, run, and debug example applications. The hello_world demo application targeted for the FRDM-K64F Freedom hardware platform is used as an example, though these steps can be applied to any example application in the MCUXpresso SDK.

5.1 Select the workspace location

The first time that KDS IDE launches, it prompts the user to select a workspace location. KDS IDE is built on top of Eclipse, which uses workspace to store information about its current configuration, and in some use cases, source files for the projects in the workspace. The location of the workspace can be anywhere, but it is recommended that the workspace be outside of the MCUXpresso SDK tree.

5.2 Updating the KDS IDE components

The user must update the KDS IDE installation before using the MCUXpresso SDK with it. How the update is performed depends on the KDS IDE version.

5.2.1 Update KDS IDE 3.0 and KDS IDE 3.1

NOTE

If you have previously installed New Project Wizard for MCUXpresso SDK to KDS IDE, update it using the instructions described in the subsequent section.

1. Select the menu Help -> Install New Software.

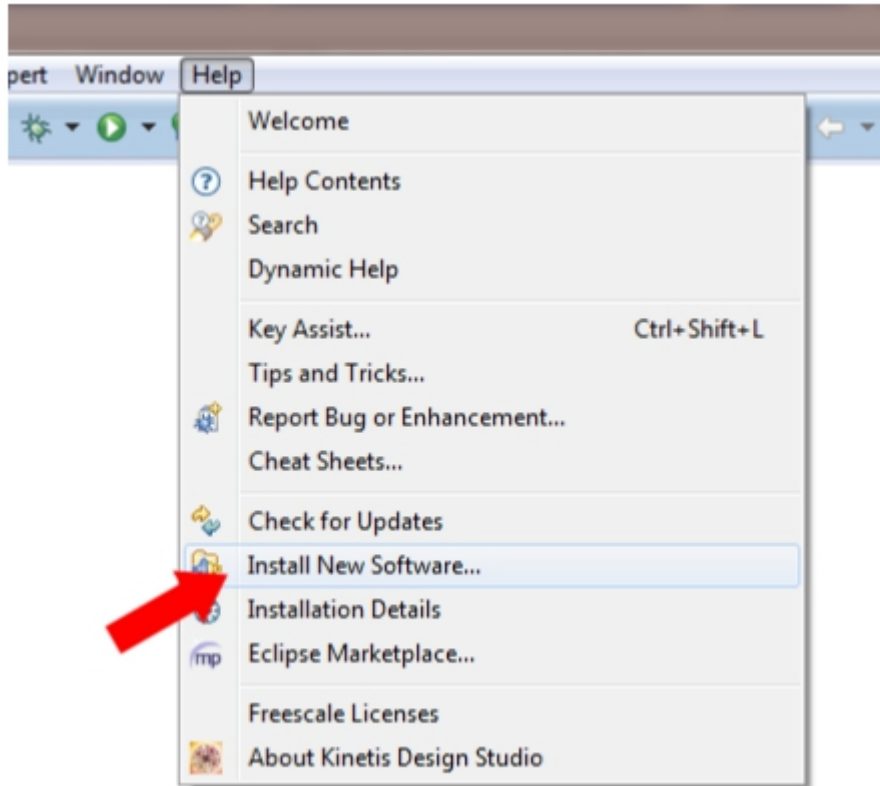


Figure 22. Install new software

2. Select "Freescale KDS Update Site" as the site to work with.

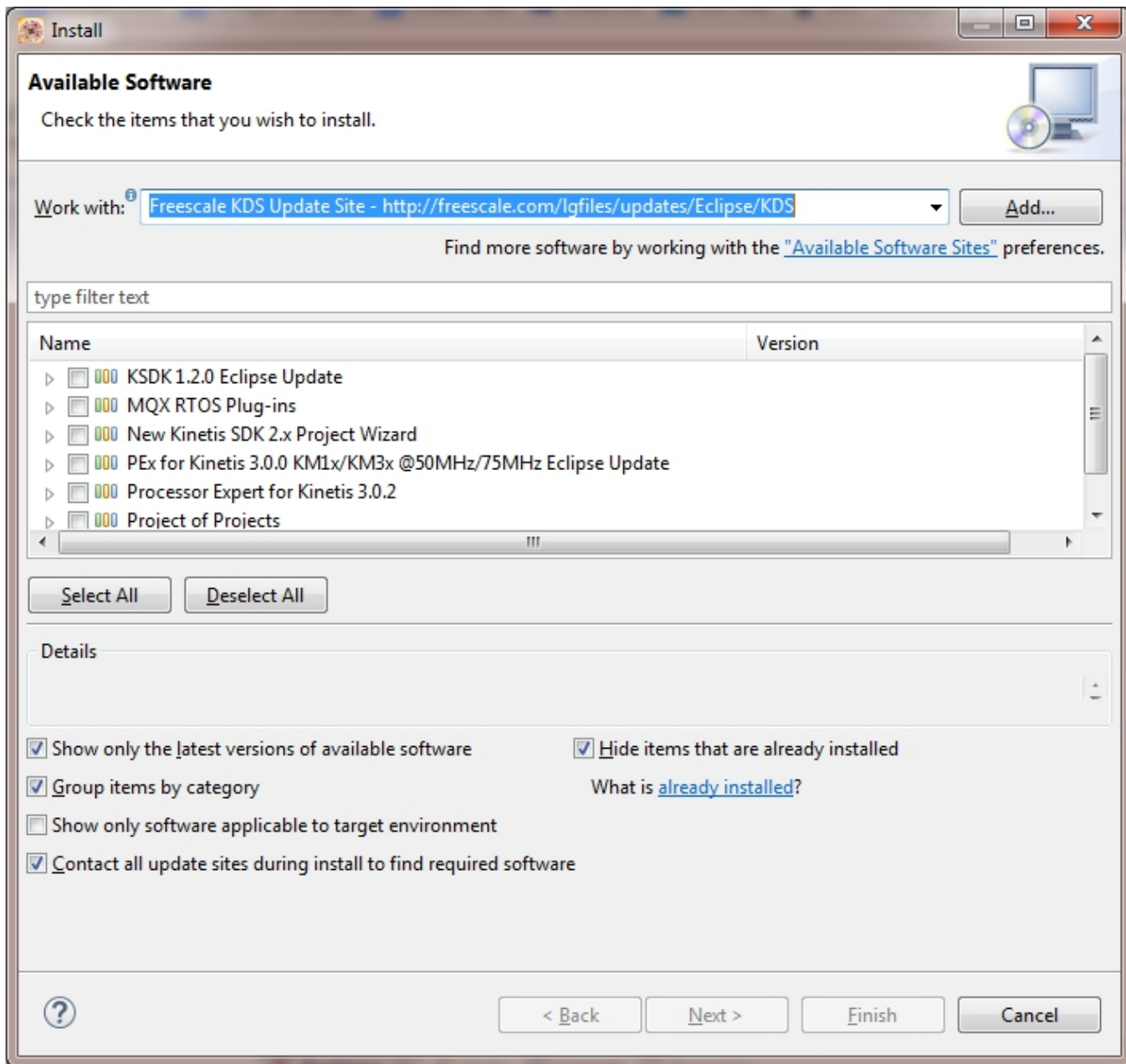


Figure 23. Select KDS IDE update site

3. Wait until the site content is displayed and select the "New Kinetis SDK 2.x Project Wizard".

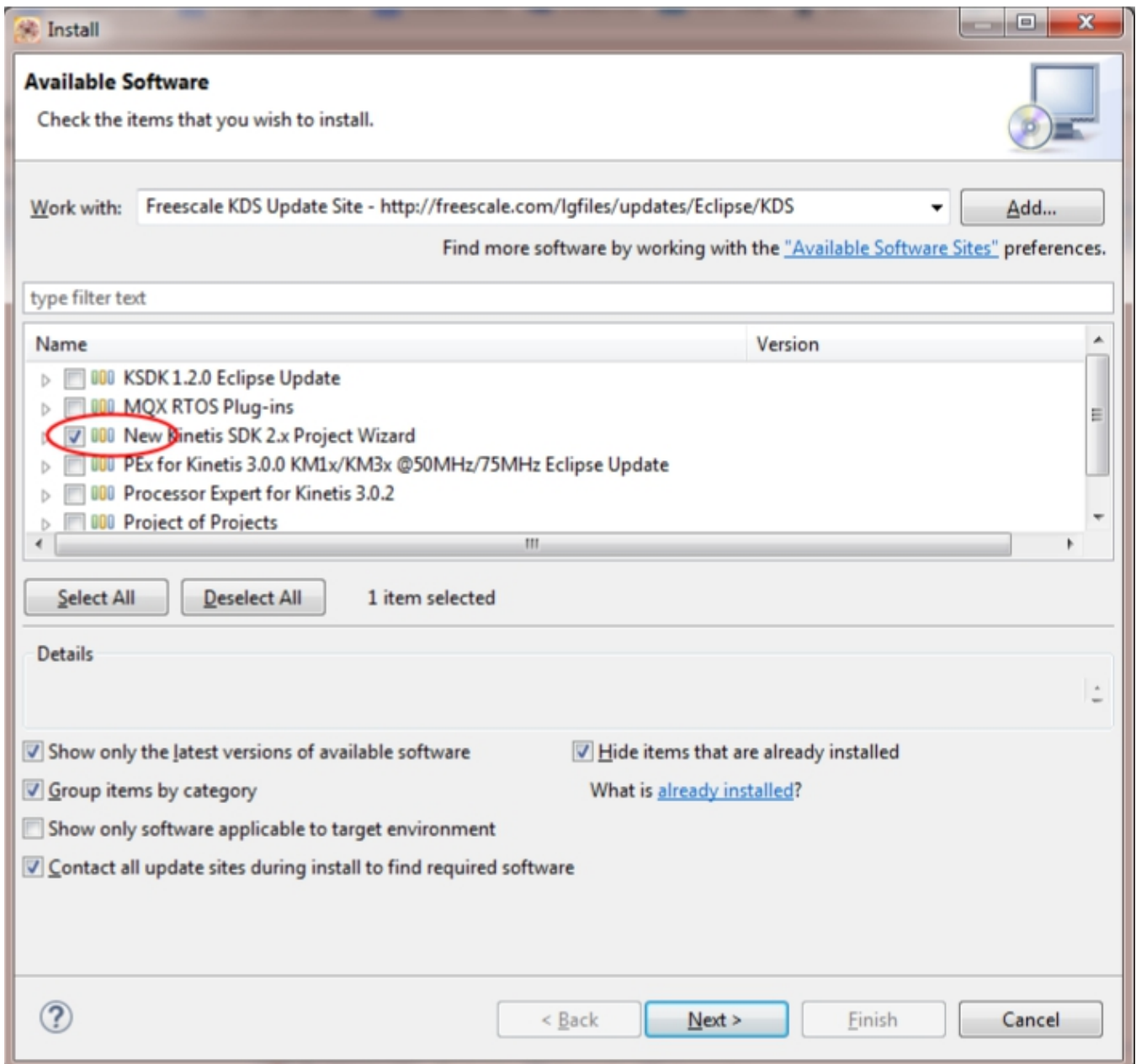


Figure 24. Select New Project Wizard

4. Confirm and complete installation.
5. Restart the IDE.

5.2.2 Update KDS IDE 3.2

1. Select the menu Help -> Check for Updates.

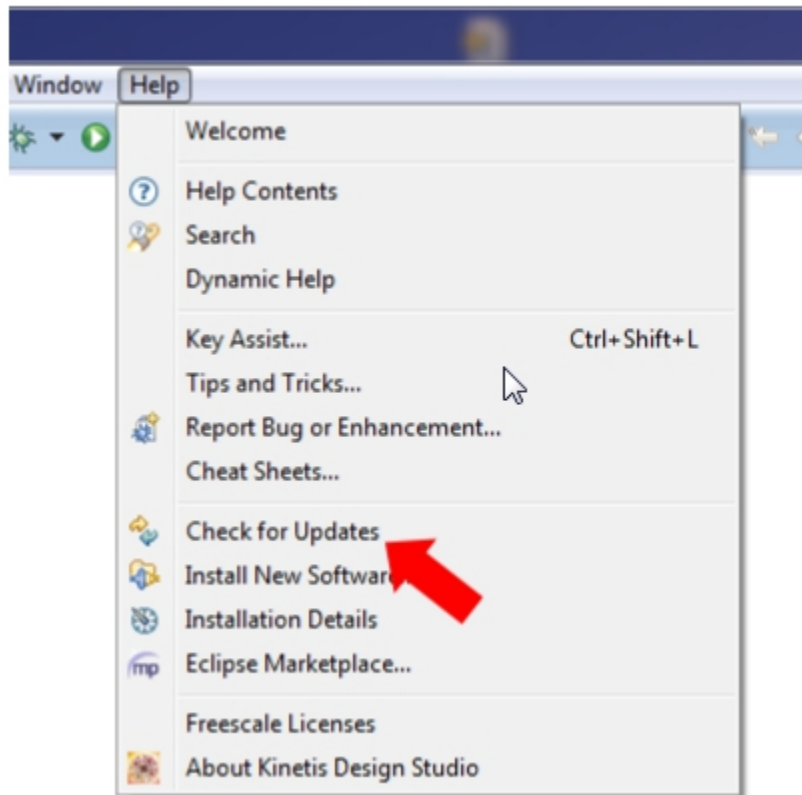


Figure 25. Check for updates

2. Wait until the site content is displayed and select "New Kinetis SDK 2.x Project Wizard". Ensure that no other items are selected.

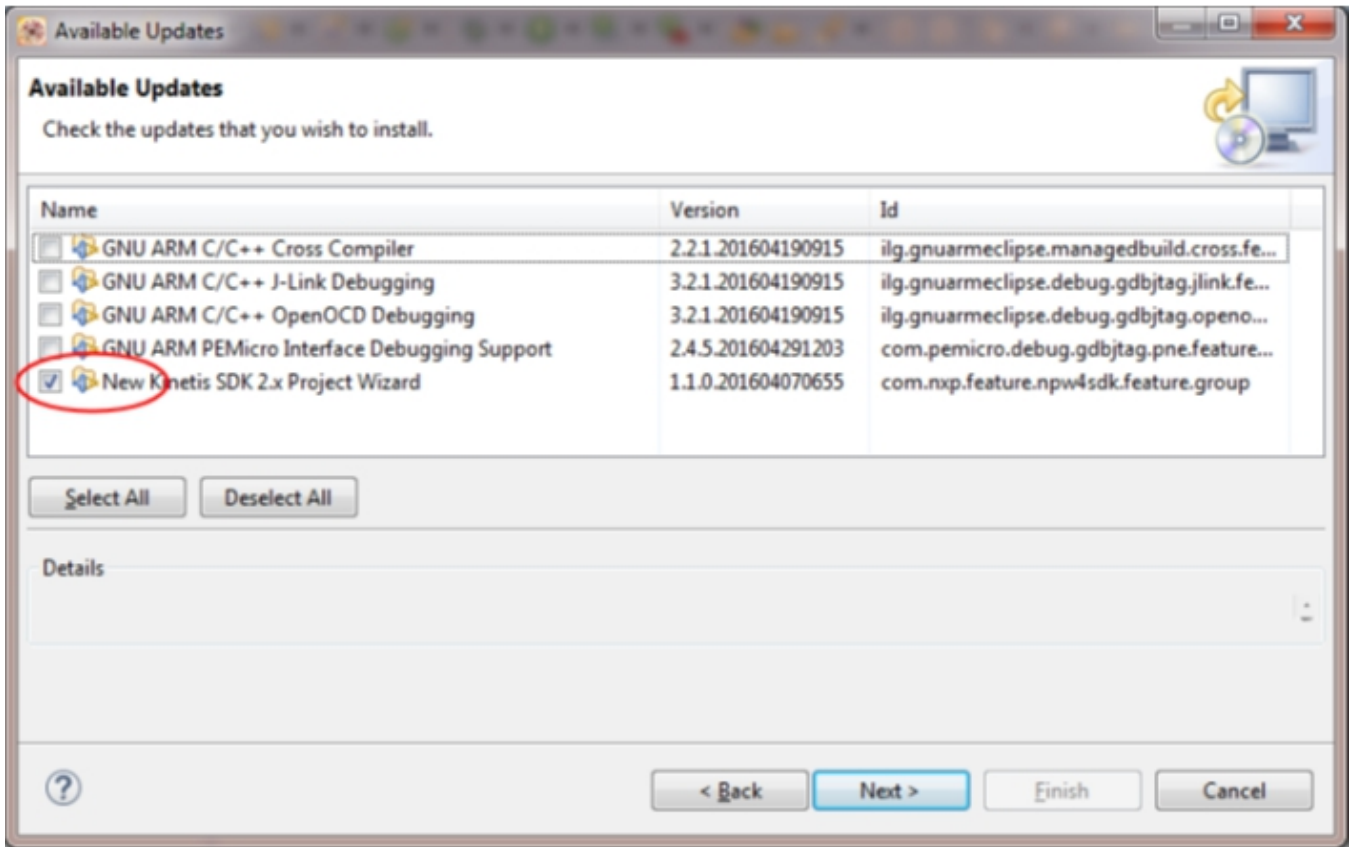


Figure 26. Available updates for KDS IDE

3. Confirm and complete update.
4. Restart the IDE.

5.3 Build an example application

NOTE

The steps required for the Linux® OS and Mac® OS are identical to those for the Windows® operating system. The only difference is that the IDE looks slightly different.

1. Select "File -> Import" from the KDS IDE menu. In the window that appears, expand the "Project of Projects" folder and select "Existing Projects Sets". Then, click the "Next" button.

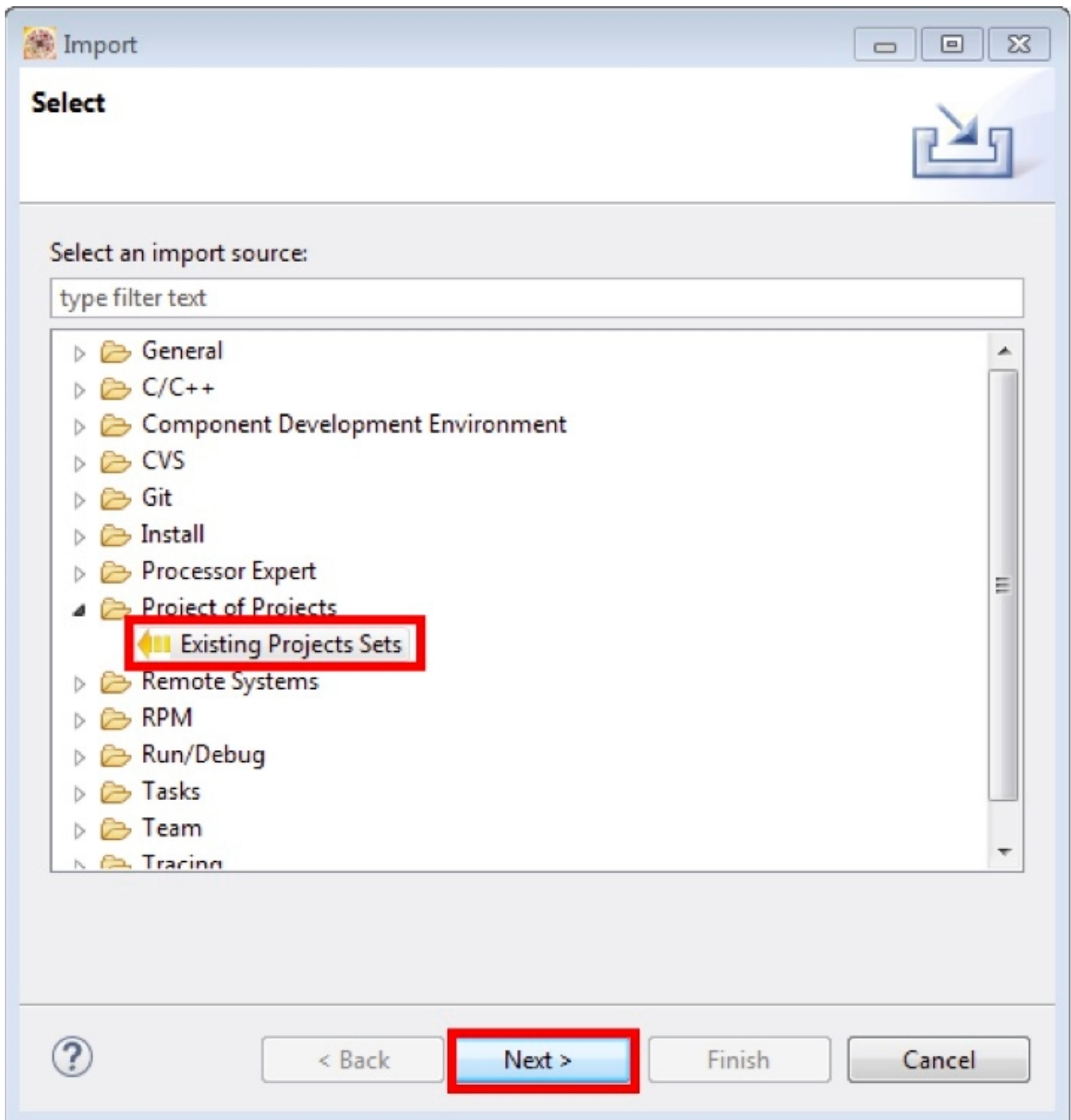


Figure 27. Selection of the correct import type in KDS IDE

2. Click the "Browse" button next to the "Import from file:" option.

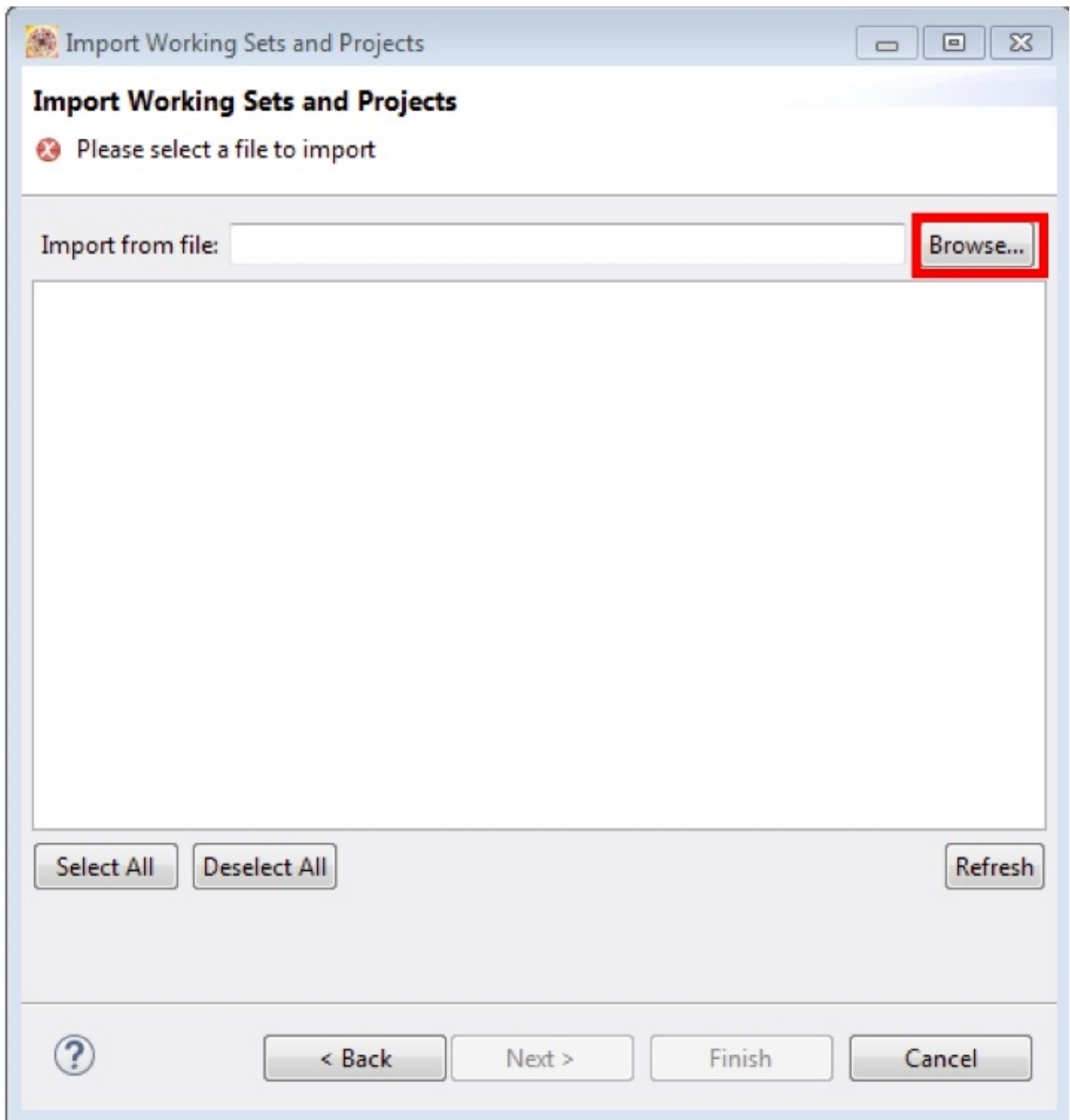


Figure 28. Projects directory selection window

3. Point to the example application project, which can be found using this path:
`<install_dir>/boards/<board_name>/<example_type>/<application_name>/kds`

For this example, the specific location is:

`<install_dir>/boards/frdmk64f/demo_apps/hello_world/kds`

4. After pointing to the correct directory, your "Import Working Sets and Projects" window should look like the figure below. Click the "Finish" button.

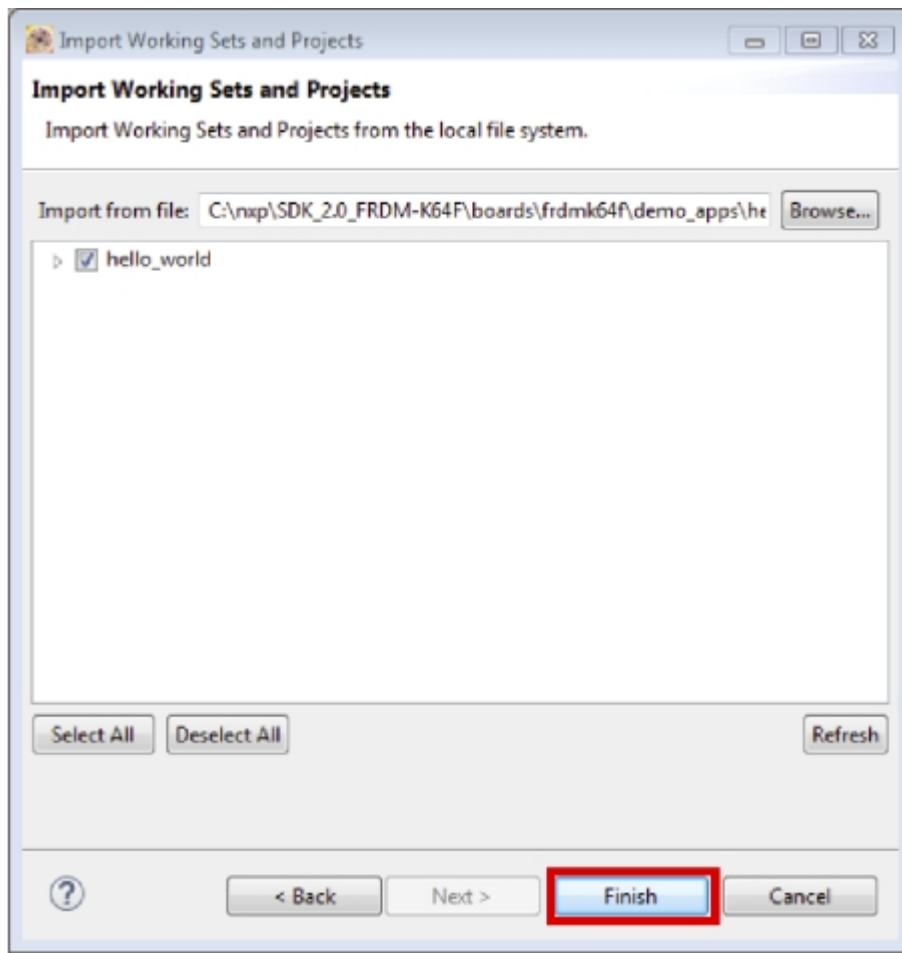


Figure 29. Select K64F12 platform library project

5. There are two project configurations (build targets) supported for each MCUXpresso SDK project:
 - Debug – Compiler optimization is set to low, and debug information is generated for the executable. This target should be selected for development and debug.
 - Release – Compiler optimization is set to high, and debug information is not generated. This target should be selected for final application deployment.
6. Choose the appropriate build target, "debug" or "release", by clicking the downward facing arrow next to the hammer icon, as shown below. For this example, select the "debug" target.

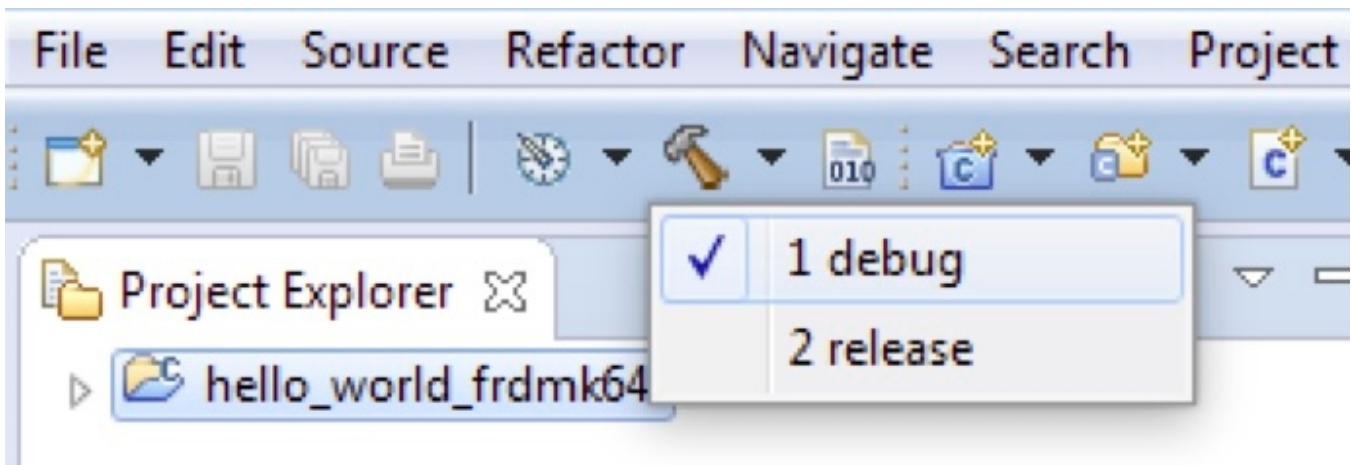


Figure 30. Selection of the build target in KDS IDE

The project starts building after the build target is selected. To rebuild the library in the future, click the hammer icon (assuming the same build target is chosen).

5.4 Run an example application

NOTE

The steps required for the Linux OS and Mac OS are identical to those for the Windows operating system. The only difference is that the IDE looks slightly different. Any platform-specific steps are listed accordingly.

To download and run the application, perform these steps:

1. Reference the table in Appendix B to determine the debug interface that comes loaded on your specific hardware platform.
 - For Windows operating system and Linux OS users, download the driver that corresponds to your debug interface:
 - For boards with the CMSIS-DAP/mbed/DAPLink interface, visit developer.mbed.org/handbook/Windows-serial-configuration and follow the instructions to install the Windows operating system serial driver. If running on Linux OS, this step is not required.
 - For boards with a P&E Micro interface, visit www.pemicro.com/support/downloads_find.cfm and download and install the P&E Micro Hardware Interface Drivers package.
 - For Mac OS users, KDS only supports the J-Link OpenSDA interface.

Follow the instructions in Appendix C to update your board's OpenSDA interface to the J-Link OpenSDA application. Then, see www.segger.com/jlink-software.html to download the necessary software and drivers.
 - For TWR-K80F150M and FRDM-K82F platforms, the J-Link OpenSDA application is required to be loaded because KDS IDE does not support CMSIS-DAP/mbed for those devices. See Appendix C for more information.
2. Connect the development platform to your PC via USB cable between the OpenSDA USB connector (may be named OSJTAG for some boards) and the PC USB connector.
3. In the Windows operating system environment, open the terminal application on the PC, such as PuTTY or TeraTerm, and connect to the debug serial port number (to determine the COM port number, see Appendix A). For Linux OS, open your terminal application and connect to the appropriate device.

Configure the terminal with these settings:

- a. 115200 or 9600 baud rate, depending on your board (reference BOARD_DEBUG_UART_BAUDRATE variable in board.h file)
- b. No parity
- c. 8 data bits
- d. 1 stop bit

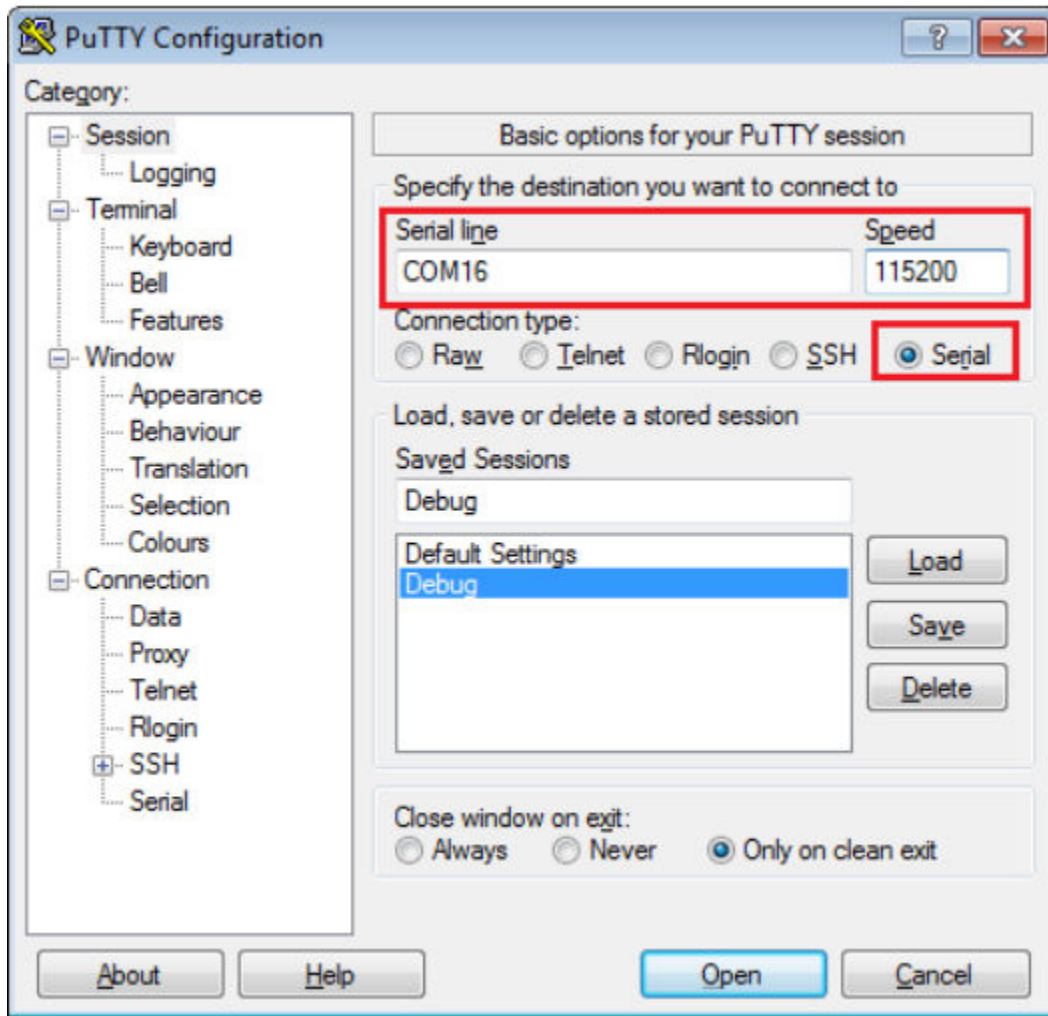


Figure 31. Terminal (PuTTY) configurations

4. For Linux OS users only, run the following commands in your terminal. These install libudev onto your system, which is required by KDS IDE to launch the debugger.

```
user@ubuntu:~$ sudo apt-get install libudev-dev libudev1
```

```
user@ubuntu:~$ sudo ln -s /usr/lib/x86_64-linux-gnu/libudev.so /usr/lib/x86_64-linux-gnu/libudev.so.0
```

5. In KDS IDE, ensure that the debugger configuration is correct for the target you're attempting to connect to.
 - a. To check the available debugger configurations, click the small downward arrow next to the green "Debug" button and select "Debug Configurations".

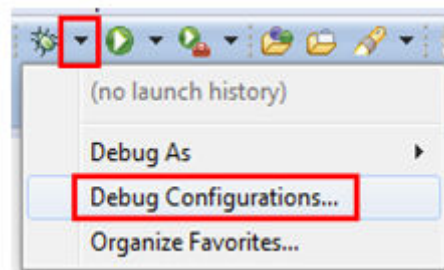


Figure 32. Debug Configurations dialog button

Run a demo using Kinetis Design Studio IDE

- b. In the Debug Configurations dialog box, select the debug configuration that corresponds to the hardware platform you're using. In this example, since the FRDM-K64F is used, select is the CMSIS-DAP/DAPLink option under OpenOCD. To determine the interface to use for other hardware platforms, refer to Appendix B.

After selecting the debugger interface, click the "Debug" button to launch the debugger.

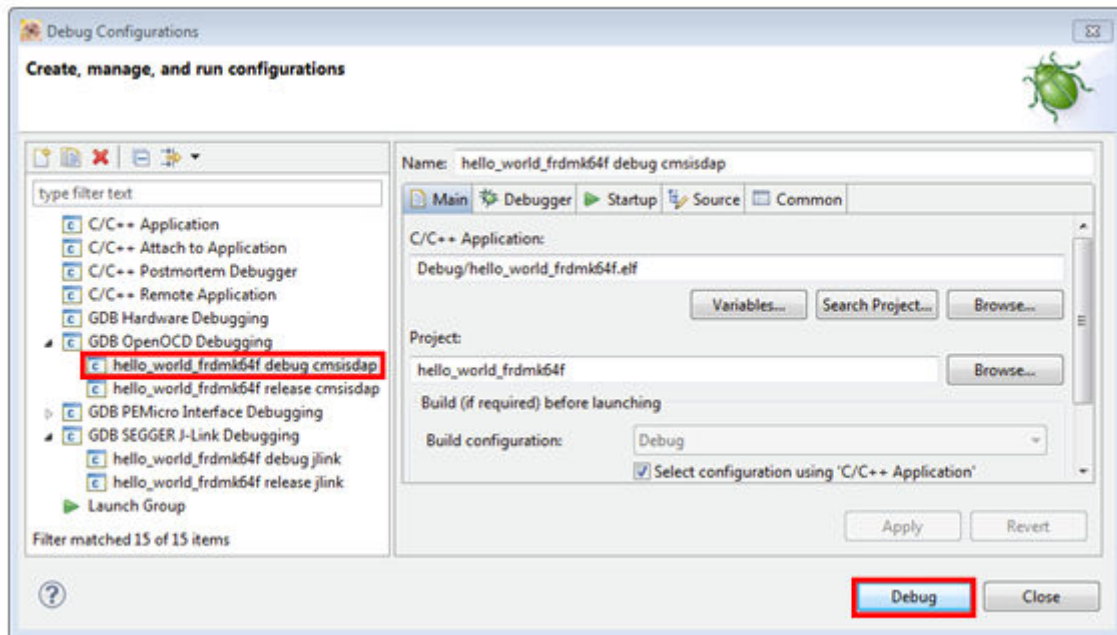


Figure 33. Selection of the debug configuration and debugger launch

6. The application is downloaded to the target and automatically runs to main():

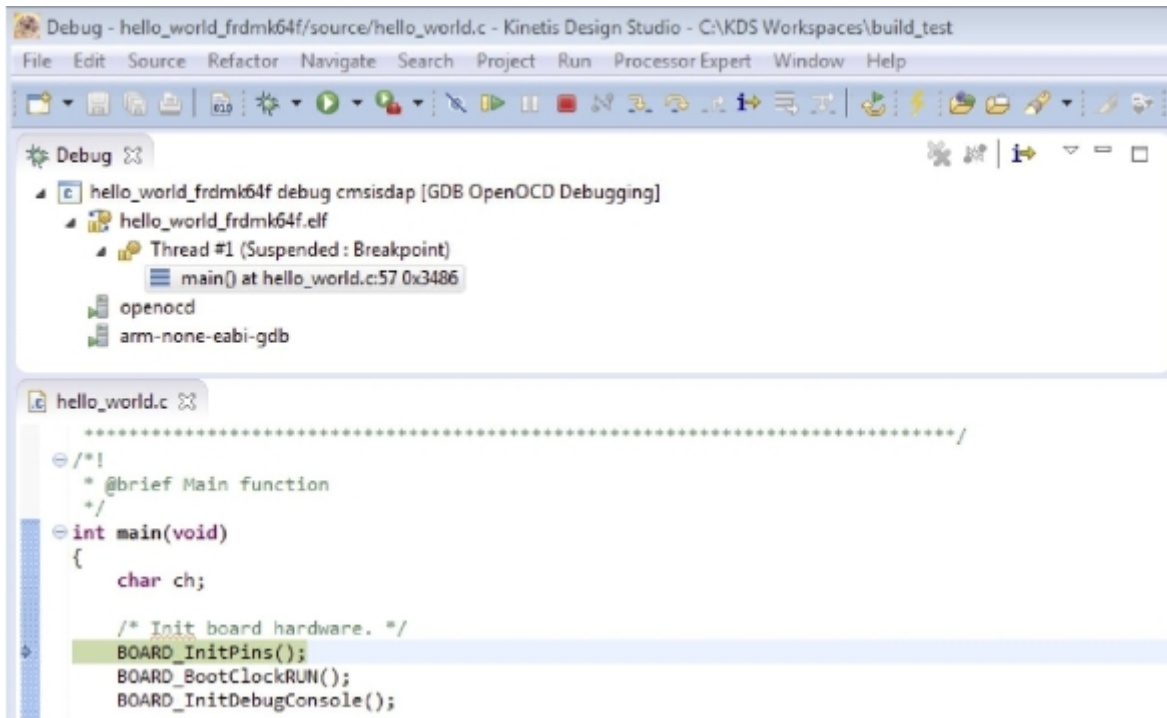


Figure 34. Stop at main() when running debugging

7. Start the application by clicking the "Resume" button:

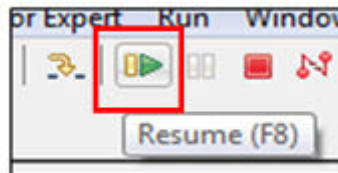


Figure 35. Resume button

The hello_world application is now running and a banner is displayed on the terminal. If this is not true, check your terminal settings and connections.

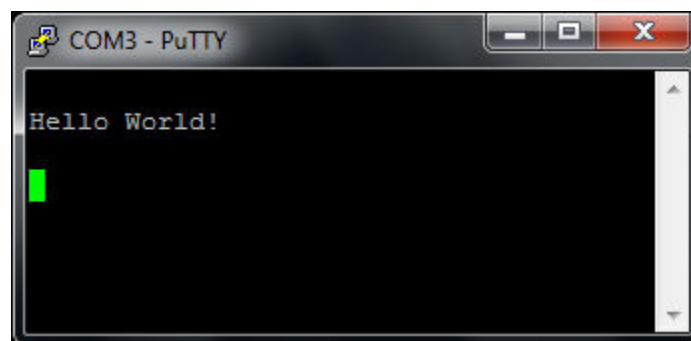


Figure 36. Text display of the hello_world demo

5.5 Create a new project

1. Select the menu File -> New -> MCUXpresso SDK SDK 2.x Project.

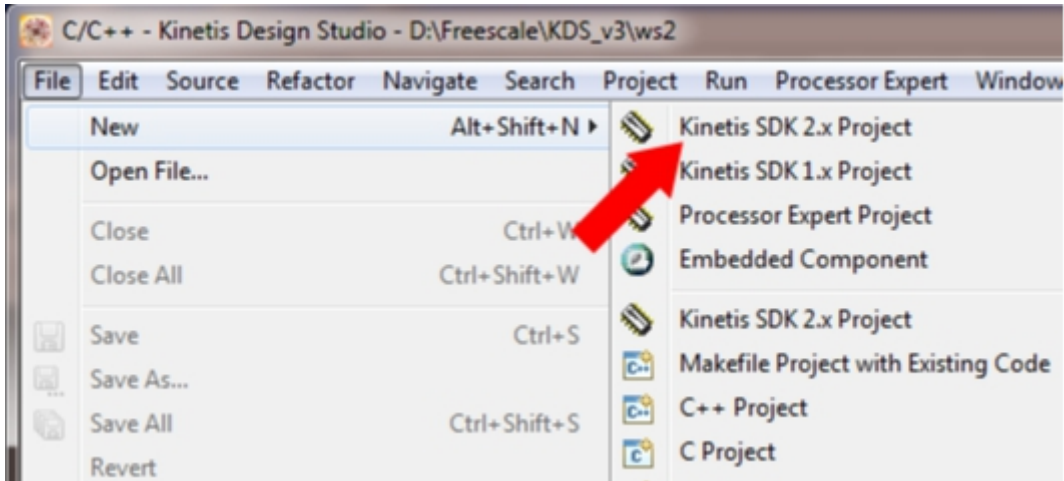


Figure 37. Select the menu File -> New -> MCUXpresso SDK 2.x Project

2. Enter the project name and use the default project location.

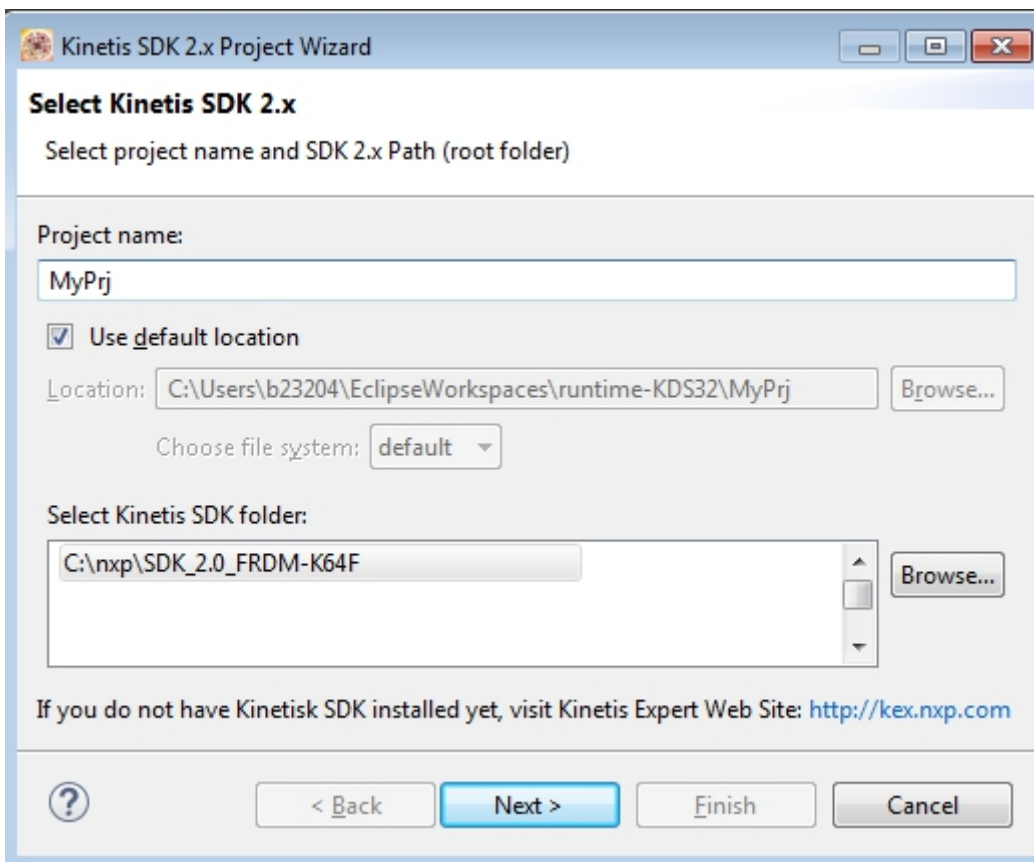


Figure 38. Enter the project name

3. The wizard supports three kinds of projects:
 - Empty project for a board - see Board-><board>->New <board> project

- Example project - see Board -> <board> Examples -> <category> -> <example>

NOTE

This item allows a clone example project from boards/<board>/ folder in the KDS work space. It is available only if the MCUXpresso SDK package contains information about the project cloning.

- Empty project for a processor – see Processor -> <processor> -> New <processor> project

NOTE

An empty project means that there is no significant code in the main function.

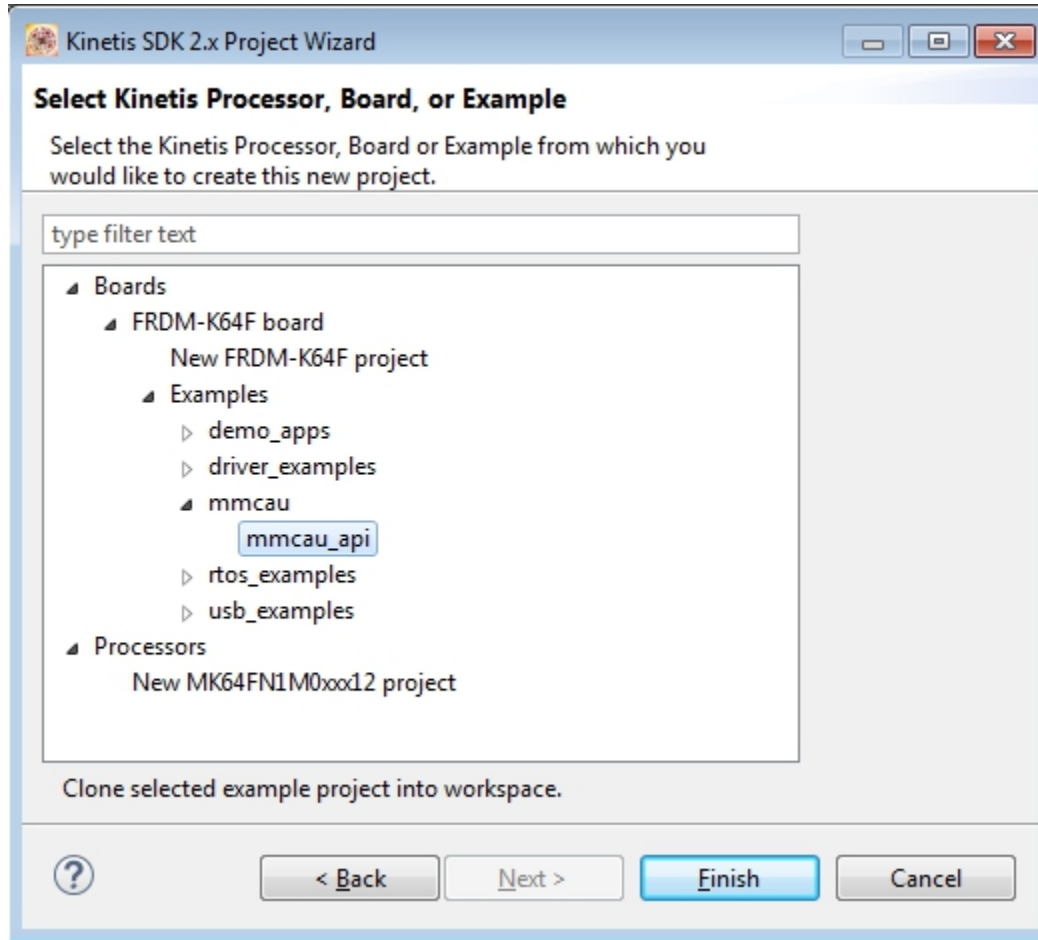


Figure 39. Select board/processor

4. For empty projects, you can select an RTOS and drivers:
 - All drivers – to have all MCUXpresso SDK drivers and utilities copied into the project
 - Minimum set – to have only a basic set of drivers
 - Empty - to create a bare metal project
5. Finish.

You can now build and debug the project.

6 Run a demo using ARM® GCC

This section describes the steps to configure the command line ARM® GCC tools to build, run, and debug demo applications and necessary driver libraries provided in the MCUXpresso SDK. The hello_world demo application targeted for the FRDM-K64F Freedom hardware platform is used as an example, though these steps can be applied to any board, demo or example application in the MCUXpresso SDK.

6.1 Set up toolchain

This section contains the steps to install the necessary components required to build and run an MCUXpresso SDK demo application with the ARM GCC toolchain, as supported by the MCUXpresso SDK. There are many ways to use ARM GCC tools, but this example focuses on a Windows operating system environment. Though not discussed here, ARM GCC tools can also be used with both Linux OS and Mac OSX.

6.1.1 Install GCC ARM Embedded tool chain

Download and run the installer from launchpad.net/gcc-arm-embedded. This is the actual toolset (in other words, compiler, linker, etc.). The GCC toolchain should correspond to the latest supported version, as described in the *MCUXpresso SDK Release Notes*. (document MCUXSDKRN).

6.1.2 Install MinGW

The Minimalist GNU for Windows (MinGW) development tools provide a set of tools that are not dependent on third party C-Runtime DLLs (such as Cygwin). The build environment used by the MCUXpresso SDK does not utilize the MinGW build tools, but does leverage the base install of both MinGW and MSYS. MSYS provides a basic shell with a Unix-like interface and tools.

1. Download the latest MinGW mingw-get-setup installer from sourceforge.net/projects/mingw/files/Installer/.
2. Run the installer. The recommended installation path is C:\MinGW, however, you may install to any location.

NOTE

The installation path cannot contain any spaces.

3. Ensure that the “mingw32-base” and “msys-base” are selected under Basic Setup.

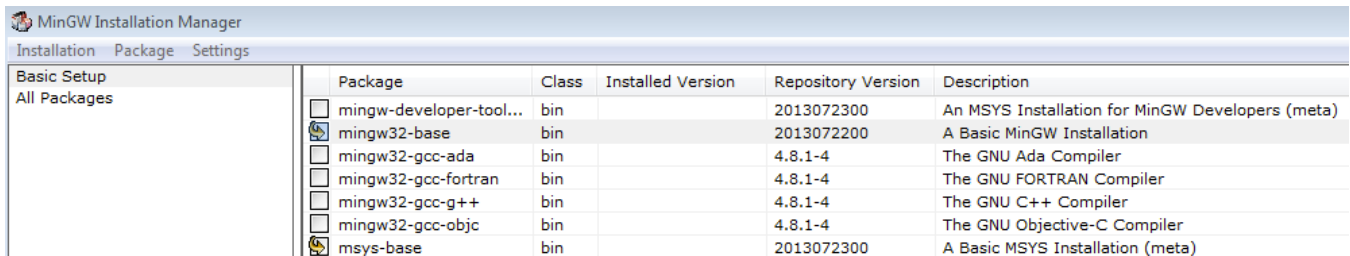


Figure 40. Setup MinGW and MSYS

4. Click “Apply Changes” in the “Installation” menu and follow the remaining instructions to complete the installation.

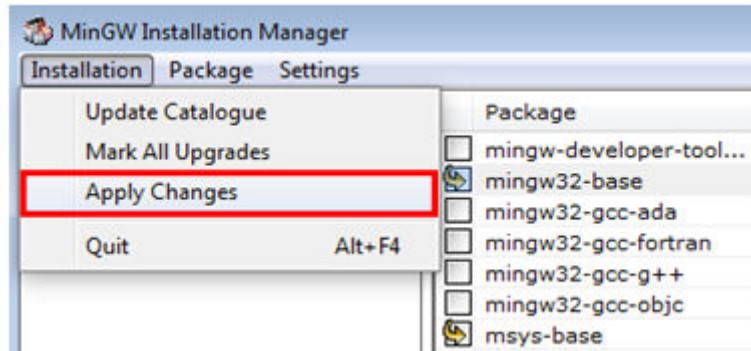


Figure 41. Complete MinGW and MSYS installation

5. Add the appropriate item to the Windows operating system path environment variable. It can be found under *Control Panel -> System and Security -> System -> Advanced System Settings* in the "Environment Variables..." section. The path is:

`<mingw_install_dir>\bin`

Assuming the default installation path, C:\MinGW, an example is shown below. If the path is not set correctly, the toolchain does not work.

NOTE

If you have "C:\MinGW\msys\x.x\bin" in your PATH variable (as required by KSDK 1.0.0), remove it to ensure that the new GCC build system works correctly.

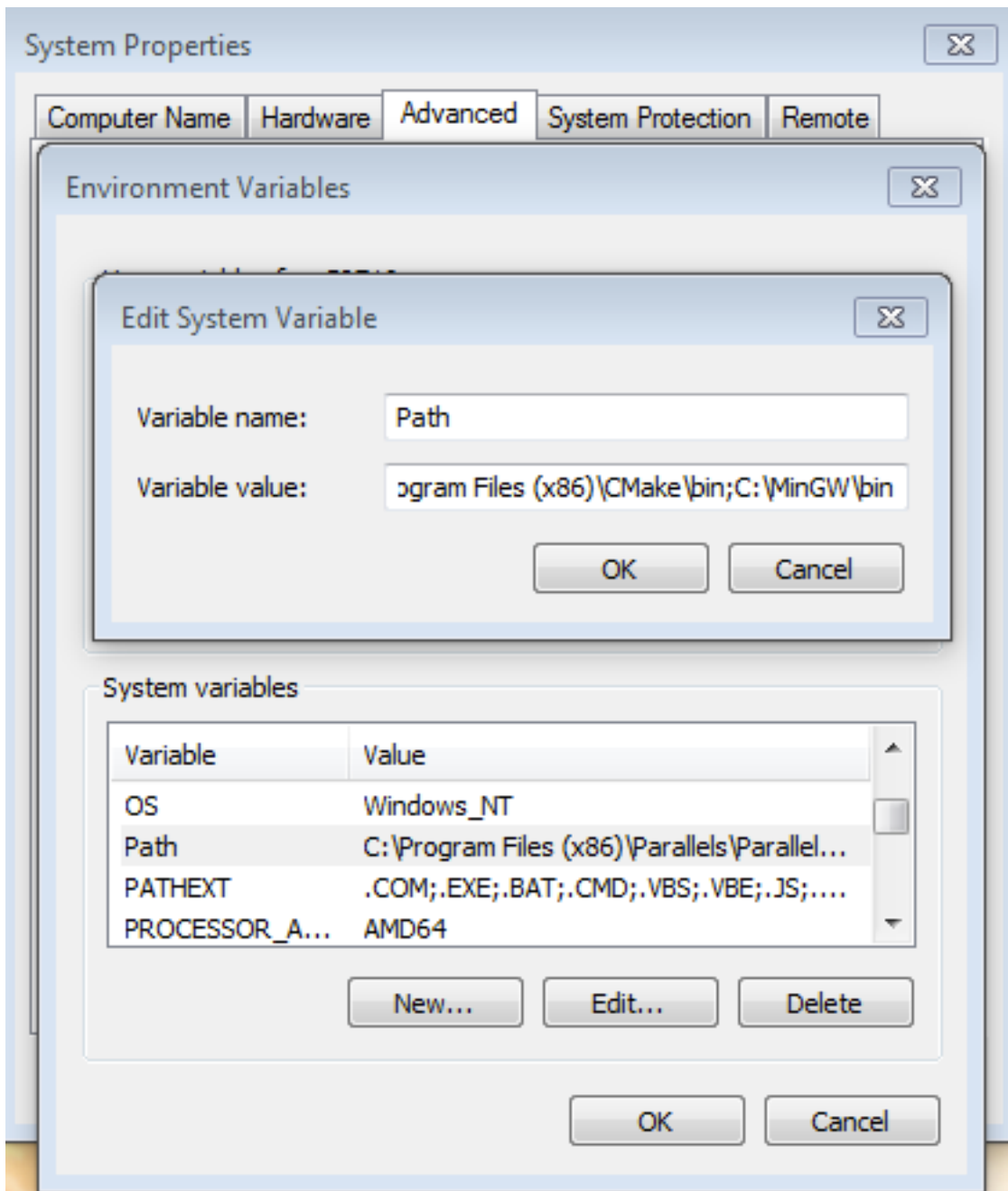


Figure 42. Add Path to systems environment

6.1.3 Add a new system environment variable for ARMGCC_DIR

Create a new *system* environment variable and name it ARMGCC_DIR. The value of this variable should point to the ARM GCC Embedded tool chain installation path, which, for this example, is:

C:\Program Files (x86)\GNU Tools ARM Embedded\5.2 2015q4

Reference the installation folder of the GNU ARM GCC Embedded tools for the exact path name of your installation.

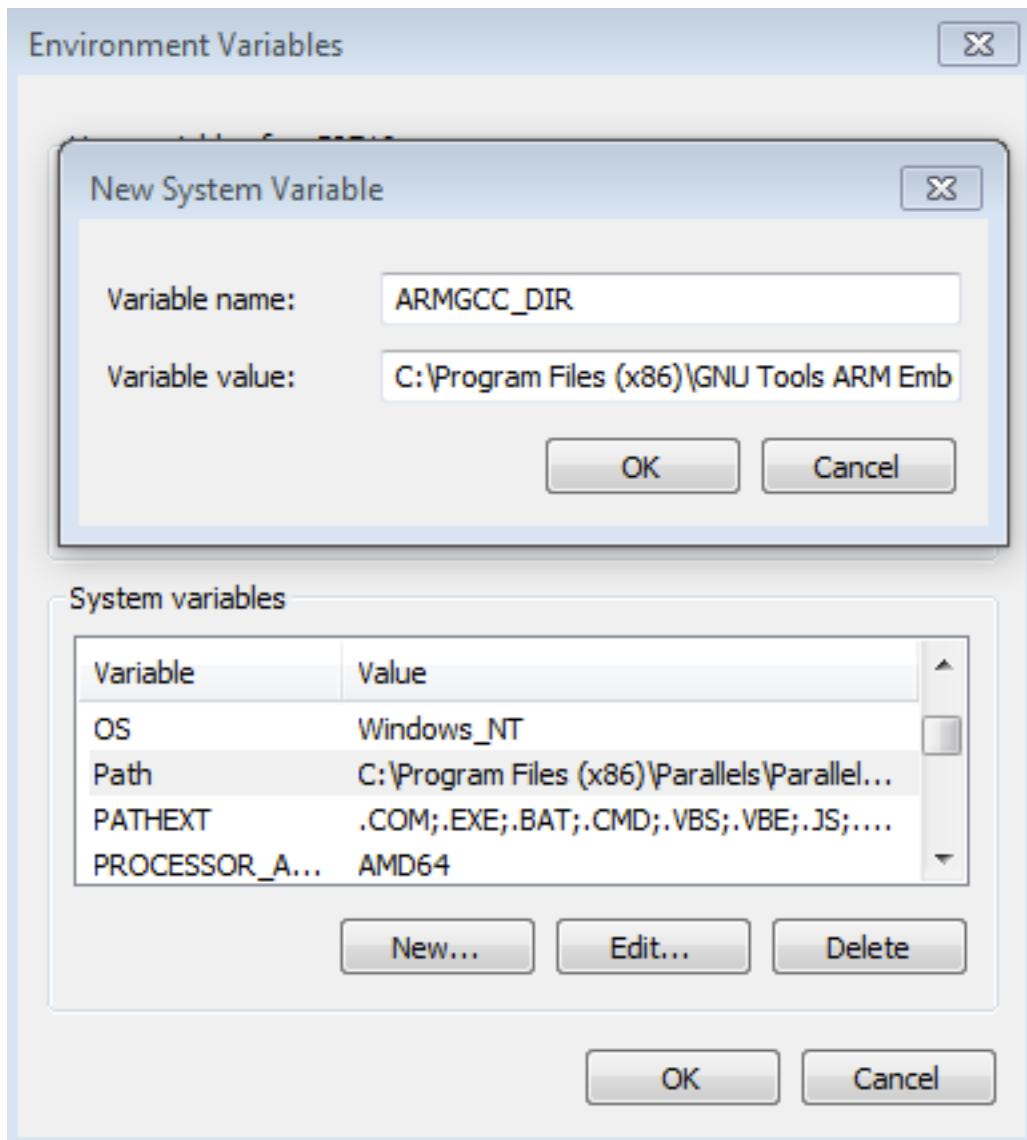


Figure 43. Add ARMGCC_DIR system variable

6.1.4 Install CMake

1. Download CMake 3.0.x from www.cmake.org/cmake/resources/software.html.
2. Install CMake, ensuring that the option "Add CMake to system PATH" is selected when installing. The user chooses to select whether it is installed into the PATH for all users or just the current user. In this example, it is installed for all users.

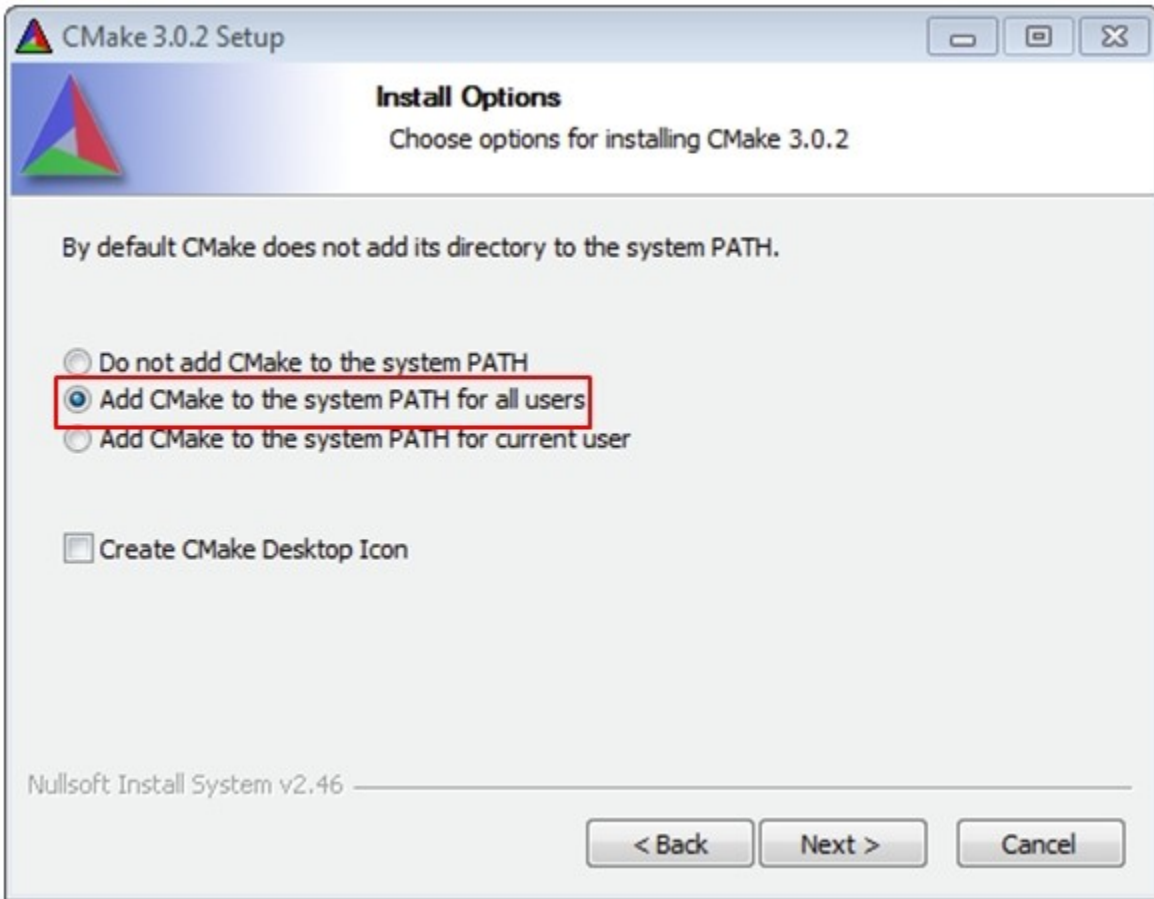


Figure 44. Install CMake

3. Follow the remaining instructions of the installer.
4. You may need to reboot your system for the PATH changes to take effect.

6.2 Build an example application

To build an example application, follow these steps.

1. Open a GCC ARM Embedded tool chain command window. To launch the window, from the Windows operating system Start menu, go to “Programs -> GNU Tools ARM Embedded <version>” and select “GCC Command Prompt”.

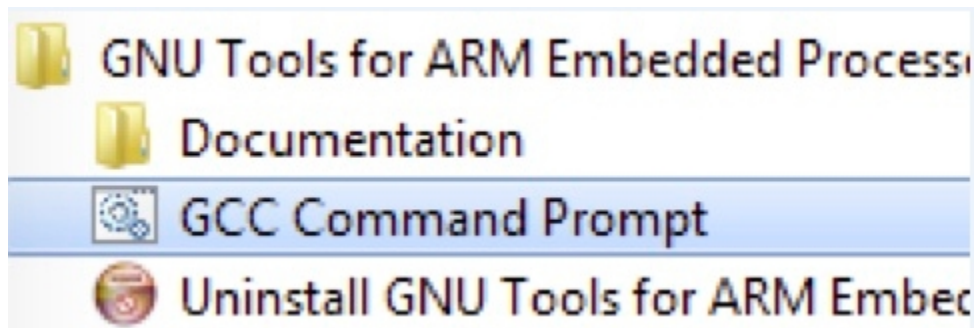


Figure 45. Launch command prompt

2. Change the directory to the example application project directory, which has a path like this:

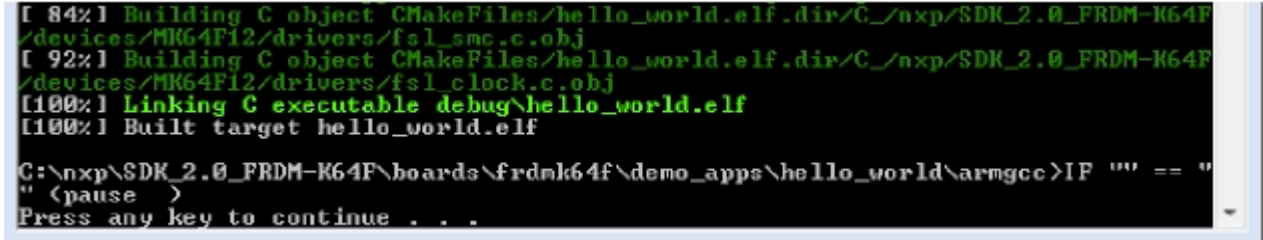
<install_dir>/boards/<board_name>/<example_type>/<application_name>/armgcc

For this example, the exact path is: <install_dir>/examples/frdmk64f/demo_apps/hello_world/armgcc

NOTE

To change directories, use the 'cd' command.

3. Type "build_debug.bat" on the command line or double click on the "build_debug.bat" file in Windows Explorer to perform the build. The output is shown in this figure:



```
[ 84%] Building C object CMakeFiles/hello_world.elf.dir/C:/nxp/SDK_2.0_FRDM-K64F
/devices/MK64F12/drivers/fsl_smc.c.obj
[ 92%] Building C object CMakeFiles/hello_world.elf.dir/C:/nxp/SDK_2.0_FRDM-K64F
/devices/MK64F12/drivers/fsl_clock.c.obj
[100%] Linking C executable debug\hello_world.elf
[100%] Built target hello_world.elf

C:\nxp\SDK_2.0_FRDM-K64F\boards\frdmk64f\demo_apps\hello_world\armgcc>IF "" == ""
" <pause >
Press any key to continue . . .
```

Figure 46. hello_world demo build successful

6.3 Run an example application

This section describes steps to run a demo application using J-Link GDB Server application. To perform this exercise, two things must be done:

- Make sure that either:
 - The OpenSDA interface on your board is programmed with the J-Link OpenSDA firmware. To determine if your board supports OpenSDA, see Appendix B. For instructions on reprogramming the OpenSDA interface, see Appendix C. If your board does not support OpenSDA, then a standalone J-Link pod is required.
 - You have a standalone J-Link pod that is connected to the debug interface of your board. Note that some hardware platforms require hardware modification in order to function correctly with an external debug interface.

After the J-Link interface is configured and connected, follow these steps to download and run the demo application:

1. Connect the development platform to your PC via USB cable between the OpenSDA USB connector (may be named OSJTAG for some boards) and the PC USB connector. If using a standalone J-Link debug pod, also connect it to the SWD/JTAG connector of the board.
2. Open the terminal application on the PC, such as PuTTY or TeraTerm, and connect to the debug serial port number (to determine the COM port number, see Appendix A). Configure the terminal with these settings:
 - a. 115200 or 9600 baud rate, depending on your board (reference BOARD_DEBUG_UART_BAUDRATE variable in board.h file)
 - b. No parity
 - c. 8 data bits
 - d. 1 stop bit

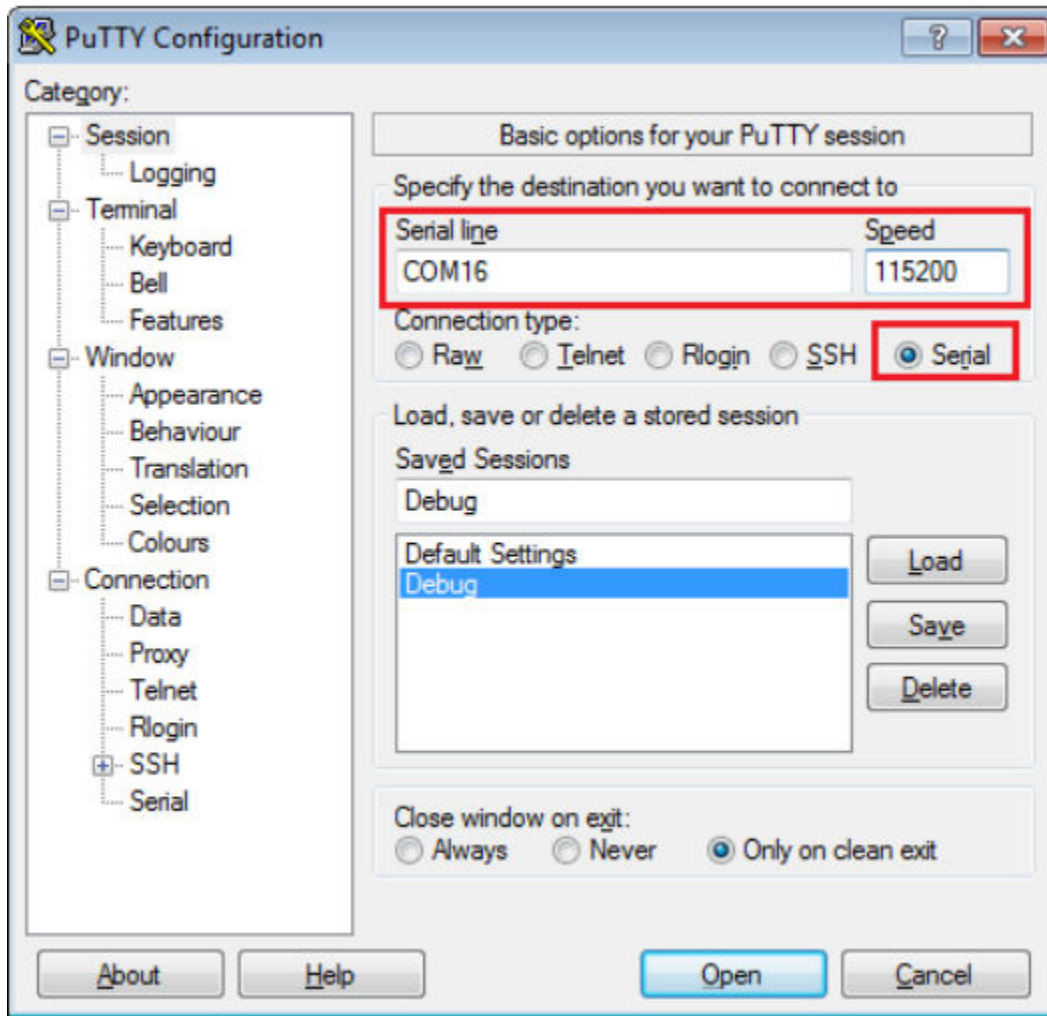


Figure 47. Terminal (PuTTY) configurations

3. Open the J-Link GDB Server application. Assuming the J-Link software is installed, the application can be launched by going to the Windows operating system Start menu and selecting “Programs -> SEGGER -> J-Link <version> J-Link GDB Server”.
4. Modify the settings as shown below. The target device selection chosen for this example is the MK64FN1M0xxx12.
5. After it is connected, the screen should resemble this figure:

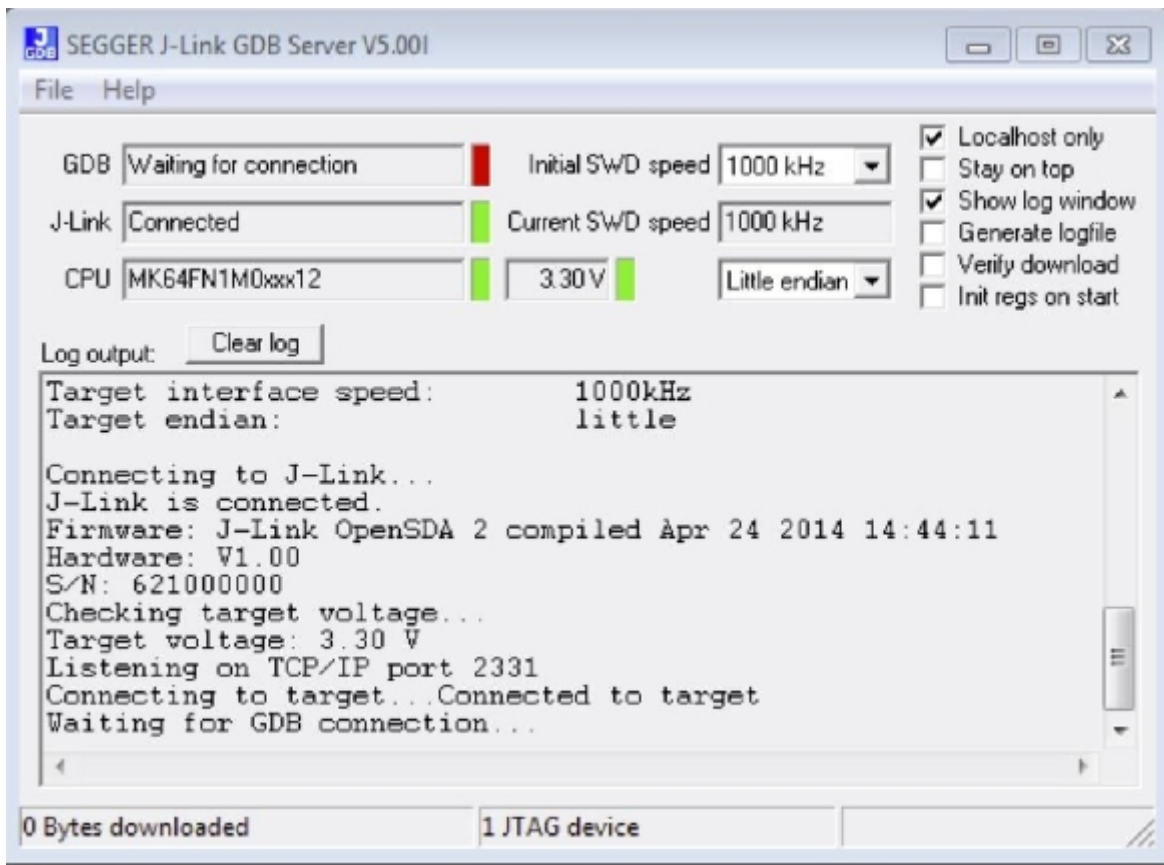


Figure 48. SEGGER J-Link GDB Server screen after successful connection

6. If not already running, open a GCC ARM Embedded tool chain command window. To launch the window, from the Windows operating system Start menu, go to “Programs -> GNU Tools ARM Embedded <version>” and select “GCC Command Prompt”.

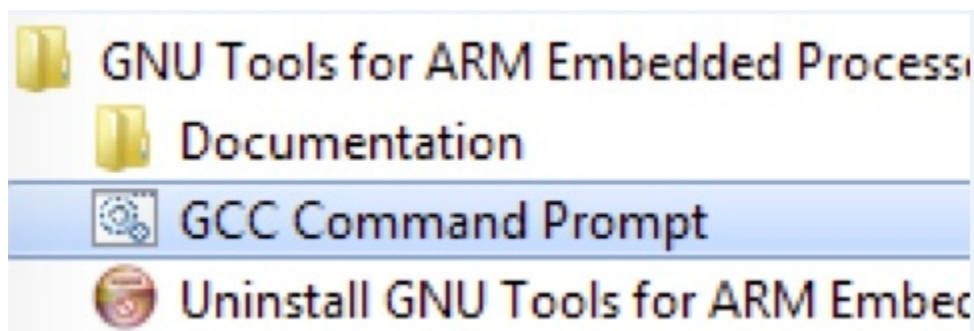


Figure 49. Launch command prompt

7. Change to the directory that contains the example application output. The output can be found in using one of these paths, depending on the build target selected:

`<install_dir>/boards/<board_name>/<example_type>/<application_name>/armgcc/debug`

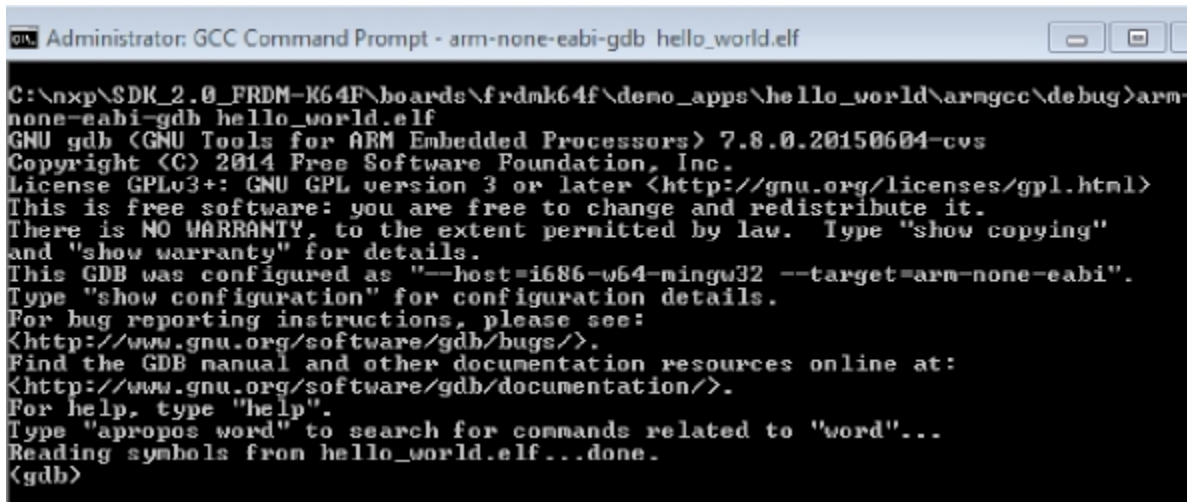
`<install_dir>/boards/<board_name>/<example_type>/<application_name>/armgcc/release`

For this example, the path is:

`<install_dir>/boards/frdmk64f/demo_apps/hello_world/armgcc/debug`

Run a demo using MCUXpresso IDE

- Run the command “arm-none-eabi-gdb.exe <application_name>.elf”. For this example, it is “arm-none-eabi-gdb.exe hello_world.elf”.



```
Administrator: GCC Command Prompt - arm-none-eabi-gdb hello_world.elf
C:\nxp\SDK_2.0_FRDM-K64F\boards\frdmk64f\demo_apps\hello_world\armgcc\debug>arm-
none-eabi-gdb hello_world.elf
GNU gdb (GNU Tools for ARM Embedded Processors) 7.8.0.20150604-cvs
Copyright (C) 2014 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law. Type "show copying"
and "show warranty" for details.
This GDB was configured as "--host=i686-w64-mingw32 --target=arm-none-eabi".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
<http://www.gnu.org/software/gdb/documentation/>.
For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from hello_world.elf...done.
(gdb)
```

Figure 50. Run arm-none-eabi-gdb

- Run these commands:
 - "target remote localhost:2331"
 - "monitor reset"
 - "monitor halt"
 - "load"
 - "monitor reset"
- The application is now downloaded and halted at the reset vector. Execute the “monitor go” command to start the demo application.

The hello_world application is now running and a banner is displayed on the terminal. If this is not true, check your terminal settings and connections.

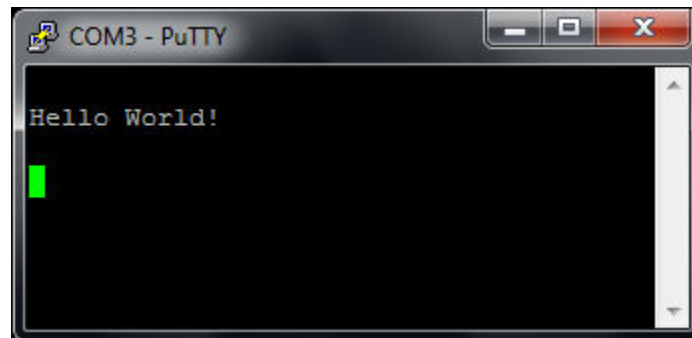


Figure 51. Text display of the hello_world demo

7 Run a demo using MCUXpresso IDE

NOTE

Ensure that the MCUXpresso IDE toolchain is included when generating the MCUXpresso SDK Package.

This section describes the steps required to configure MCUXpresso IDE to build, run, and debug example applications. The `hello_world` demo application targeted for the FRDM-K64F Freedom hardware platform is used as an example, though these steps can be applied to any example application in the MCUXpresso SDK.

7.1 Select the workspace location

The first time MCUXpresso IDE launches, it prompts the user to select a workspace location. MCUXpresso IDE is built on top of Eclipse, which uses workspace to store information about its current configuration, and in some use cases, source files for the projects in the workspace. The location of the workspace can be anywhere, but it is recommended that the workspace be outside of the MCUXpresso SDK tree.

7.2 Build an example application

To build an example application, follow these steps.

1. Drag and drop the SDK zip file into the “Installed SDKs” view to install an SDK. In the window that appears, click the “OK” button and wait until the import has finished.

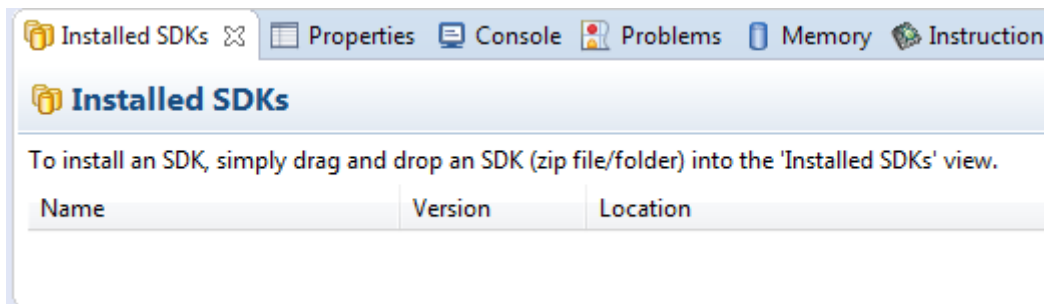


Figure 52. Install an SDK

2. On the *Quickstart Panel*, click “Import SDK example(s)...”.



Figure 53. Import an SDK example

3. In the window that appears, expand the “MKxx” folder and select “MK64FN1M0xxx12”. Then, select “frdmk64f” and click the “Next” button.

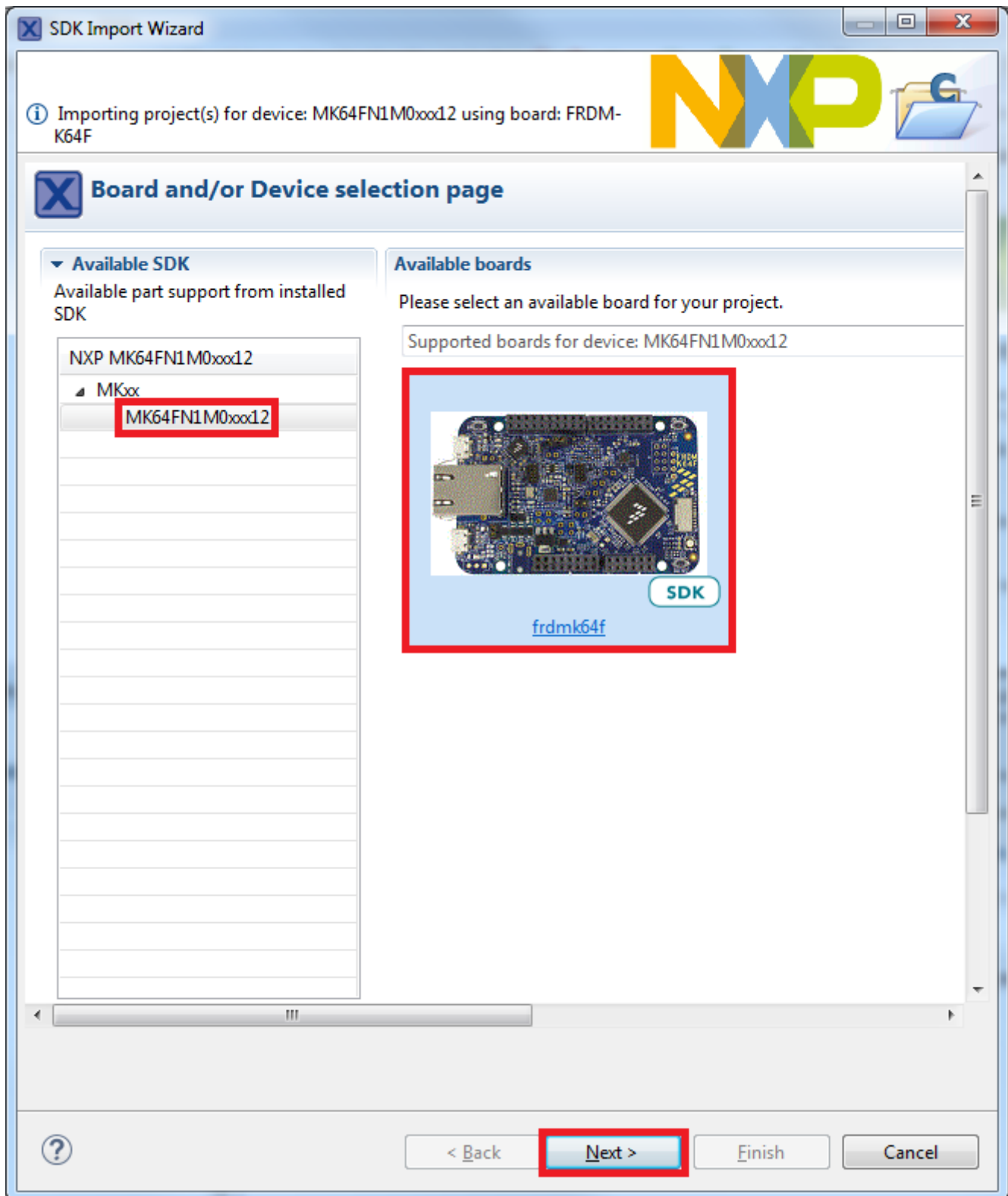


Figure 54. Select FRDM-K64F board

4. Expand the “demo_apps” folder and select “hello_world”. Click the “Finish” button.

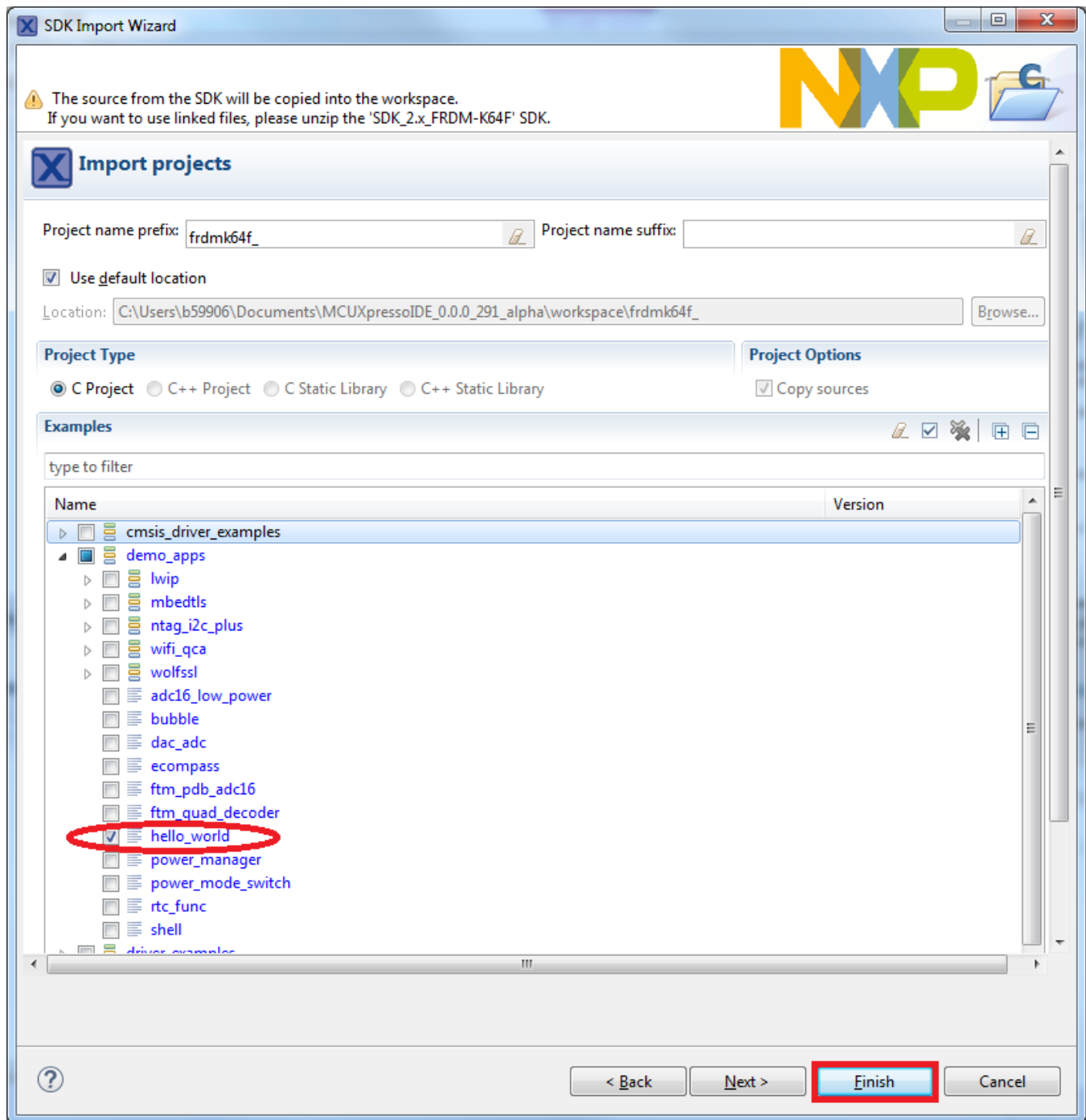


Figure 55. Select "hello_world" case

5. There are two project configurations (build targets) supported for each MCUXpresso SDK project:
 - Debug – Compiler optimization is set to low, and debug information is generated for the executable. This target should be selected for development and debug.
 - Release – Compiler optimization is set to high, and debug information is not generated. This target should be selected for final application deployment.
6. To start building “hello_world” on your target, simply highlight the project in the Project Explorer, then choose the appropriate build target, "Debug" or "Release", by clicking the downward facing arrow next to the hammer icon, as shown below. For this example, select the "Debug" target.

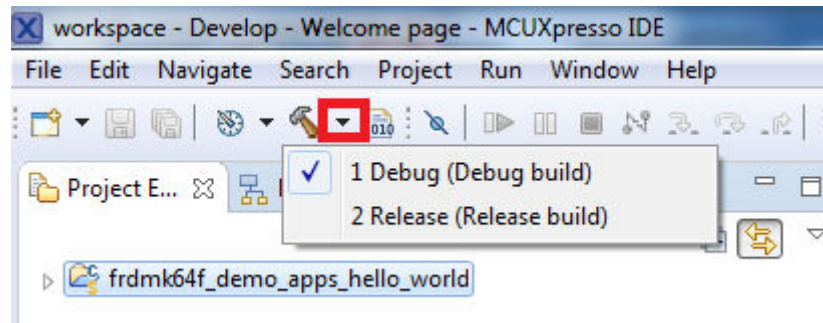


Figure 56. Selection of the build target in MCUXpresso IDE

The project starts building after the build target is selected. To rebuild the library in the future, click the hammer icon (assuming the same build target is chosen).

7.3 Run an example application

For more information on debug probe support in the MCUXpresso IDE, visit community.nxp.com.

To download and run the application, perform these steps:

1. Reference the table in Appendix B to determine the debug interface that comes loaded on your specific hardware platform. For LPCXpresso boards, install the DFU jumper for the debug probe, then connect the debug probe USB connector.
 - For boards with a P&E Micro interface, visit www.pemicro.com/support/downloads_find.cfm and download and install the P&E Micro Hardware Interface Drivers package.
 - For the MRB-KW01 board, visit www.nxp.com/USB2SER to download the serial driver. This board does not support the OpenSDA. Therefore, an external debug probe (such as a J-Link) is required. The steps below referencing the OpenSDA do not apply because there is only a single USB connector for the serial output.
 - If using J-Link with either a standalone debug pod or OpenSDA, install the J-Link software (drivers and utilities) from www.segger.com/jlink-software.html.
 - For boards with the OSJTAG interface, install the driver from www.keil.com/download/docs/408.
2. Connect the development platform to your PC via USB cable.
3. Open the terminal application on the PC, such as PuTTY or TeraTerm, and connect to the debug serial port number (to determine the COM port number, see Appendix A). Configure the terminal with these settings:
 - a. 115200 or 9600 baud rate, depending on your board (reference BOARD_DEBUG_UART_BAUDRATE variable in board.h file)
 - b. No parity
 - c. 8 data bits
 - d. 1 stop bit

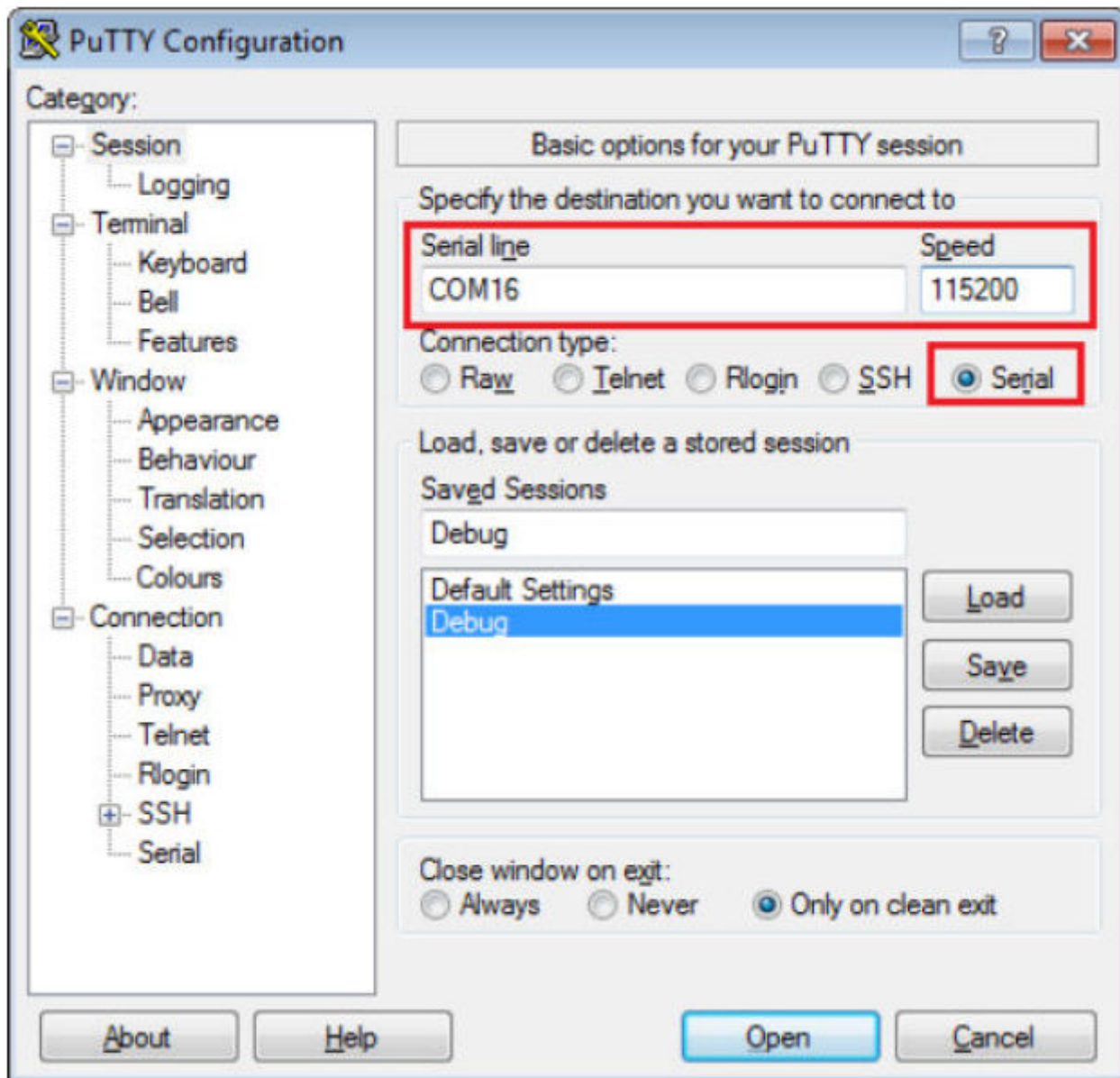


Figure 57. Terminal (PuTTY) configurations

4. On the *Quickstart Panel*, click on "Debug 'frdmk64f_demo_apps_hello_world' [Debug]".



Figure 58. Debug "hello_world" case

5. The first time you debug a project, the Debug Emulator Selection Dialog is displayed, showing all supported probes that are attached to your computer. Select the probe through which you want to debug and click the “OK” button. (For any future debug sessions, the stored probe selection is automatically used, unless the probe cannot be found.)

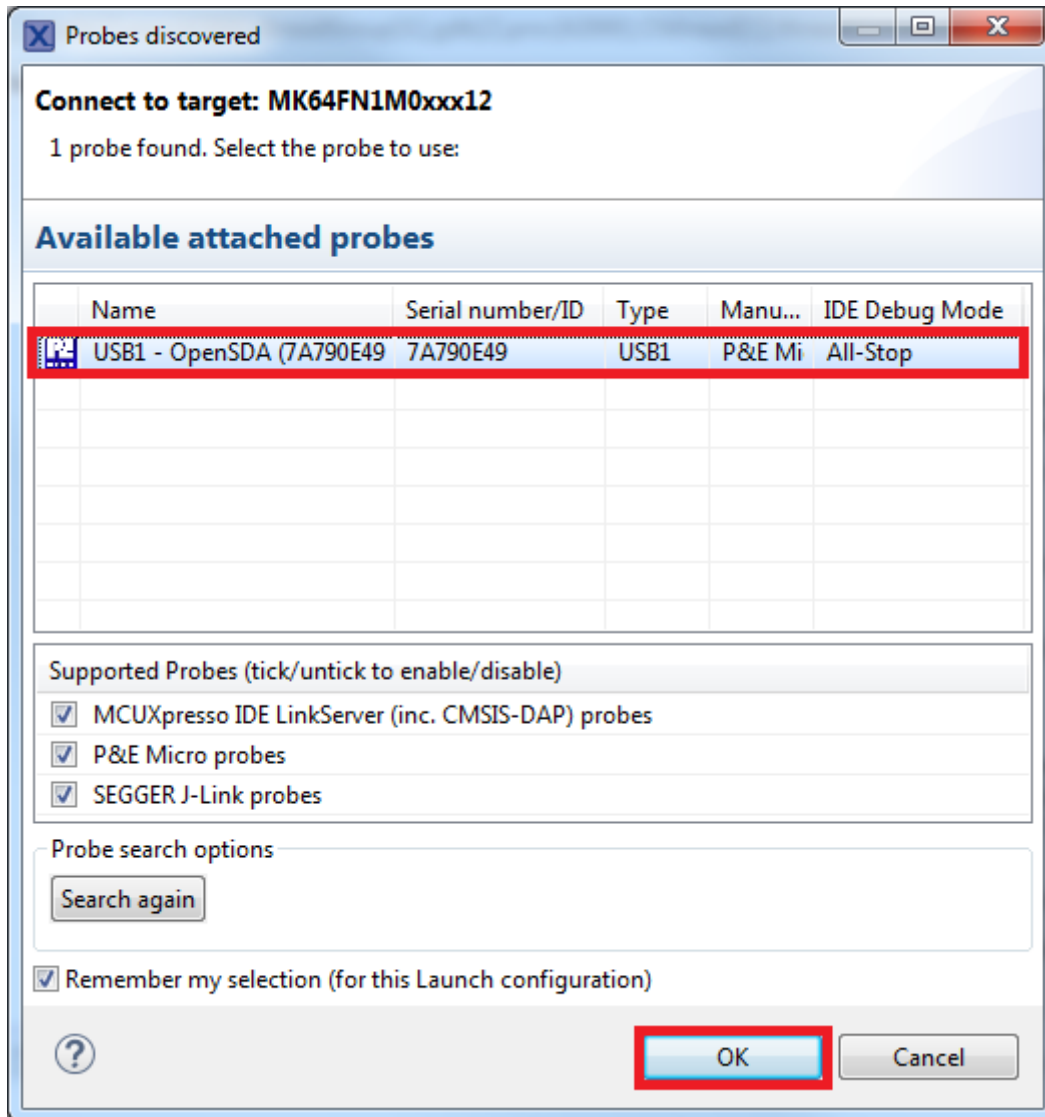


Figure 59. Attached Probes: debug emulator selection

6. The application is downloaded to the target and automatically runs to main():

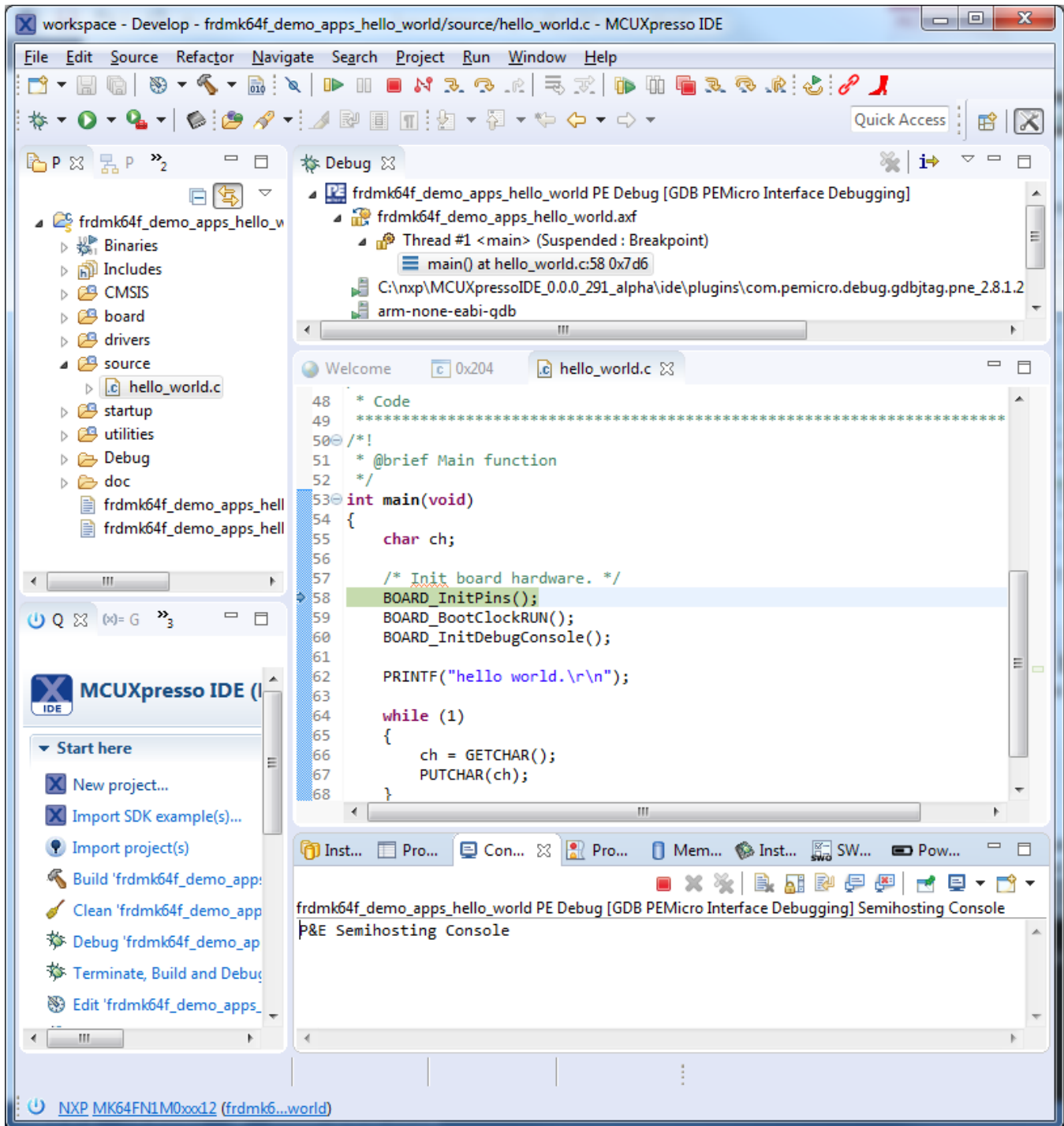


Figure 60. Stop at main() when running debugging

7. Start the application by clicking the "Resume" button.



Figure 61. Resume button

Run a demo using MCUXpresso IDE

The hello_world application is now running and a banner is displayed on the terminal. If this is not the case, check your terminal settings and connections.

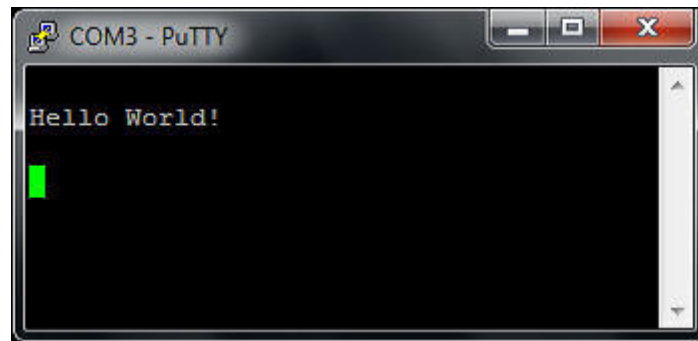


Figure 62. Text display of the hello_world demo

7.4 Build a multicore example application

This section describes the steps required to configure MCUXpresso IDE to build, run, and debug multicore example applications. The dual-core version of hello_world example application targeted for the LPCXpresso54114 hardware platform is used as an example, though these steps can be applied to any multicore example application in the MCUXpresso SDK

1. Multicore examples are imported into the workspace in a similar way as single core applications. When the SDK zip package for LPCXpresso54114 is installed and available in the “Installed SDKs” view, click “Import SDK example(s) ...” on the Quickstart Panel. In the window that appears, expand the “LPCxx” folder and select “LPC54114J256”. Then, select “lpcxpresso54114” and click the “Next” button.

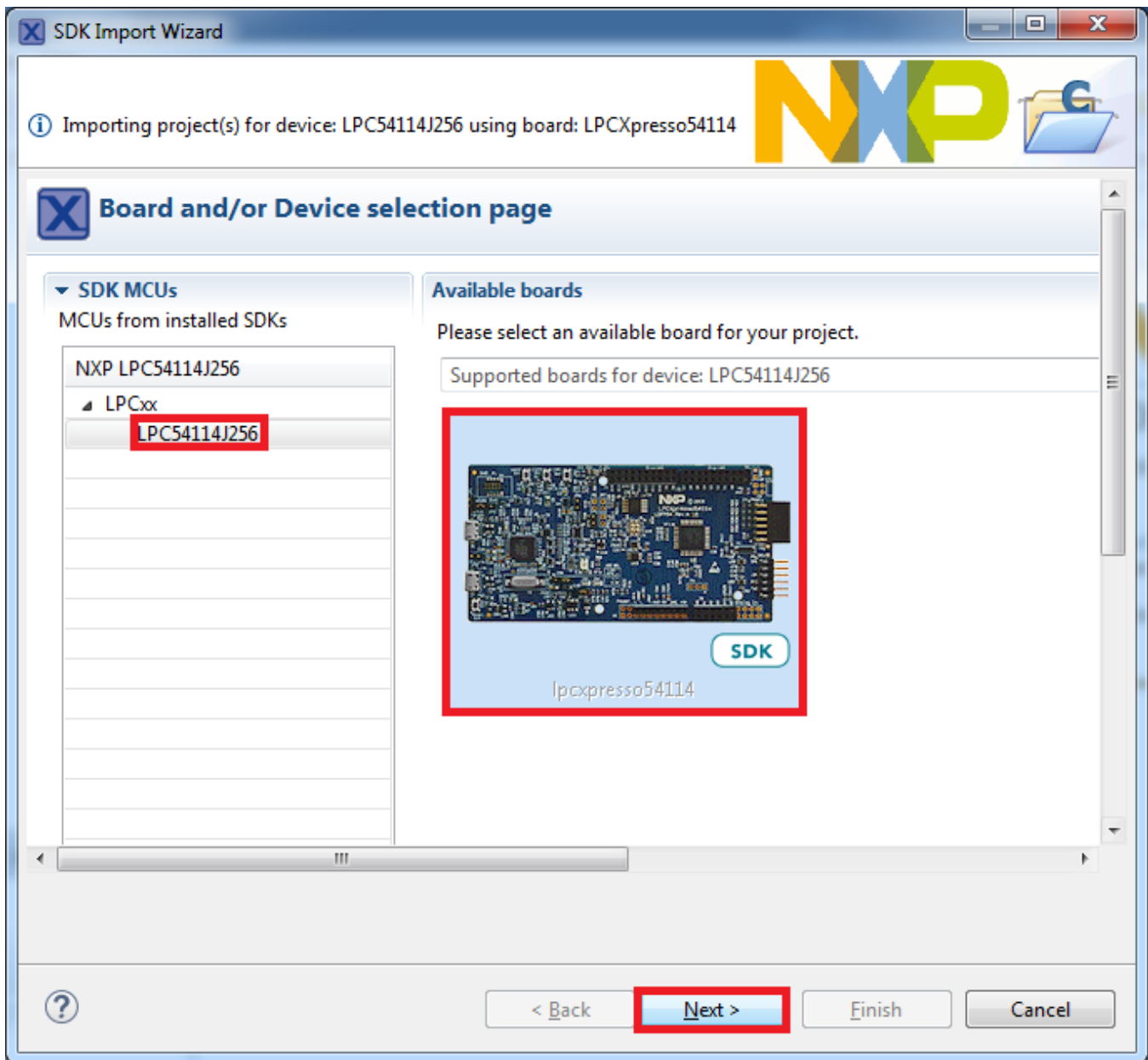


Figure 63. Select the LPCXpresso54114 board

- Expand the “multicore_examples/hello_world” folder and select “cm4”. Because multicore examples are linked together, the cm0plus counterpart project is automatically imported with the cm4 project, and there is no need to select it explicitly. Click the “Finish” button.

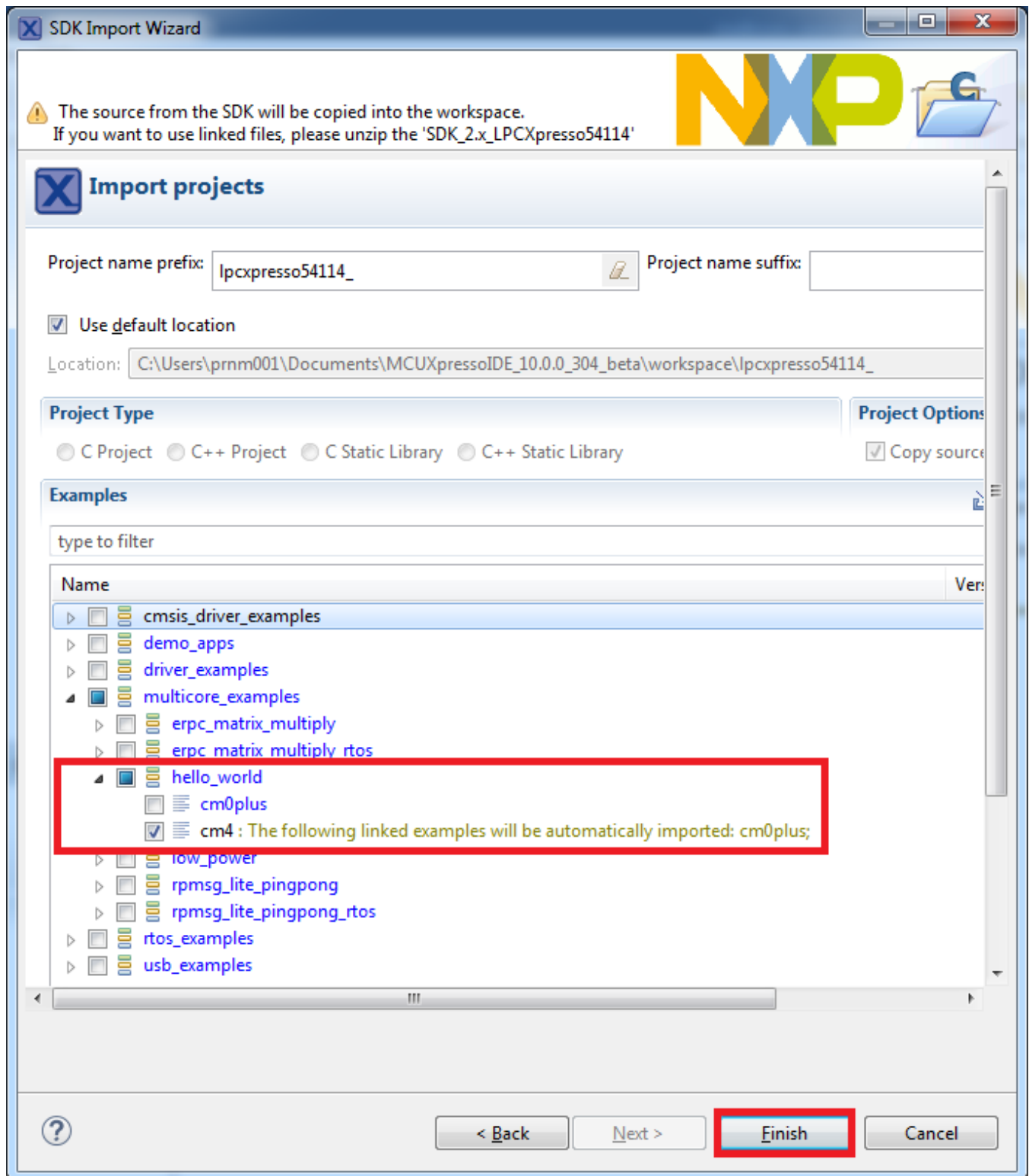


Figure 64. Select the hello_world multicore example

- Now, two projects should be imported into the workspace. To start building the multicore application, highlight the lpcpresso54114_multicore_examples_hello_world_cm4 project (multicore master project) in the Project Explorer, then choose the appropriate build target, "Debug" or "Release", by clicking the downward facing arrow next to the hammer icon, as shown below. For this example, select the "Debug" target.

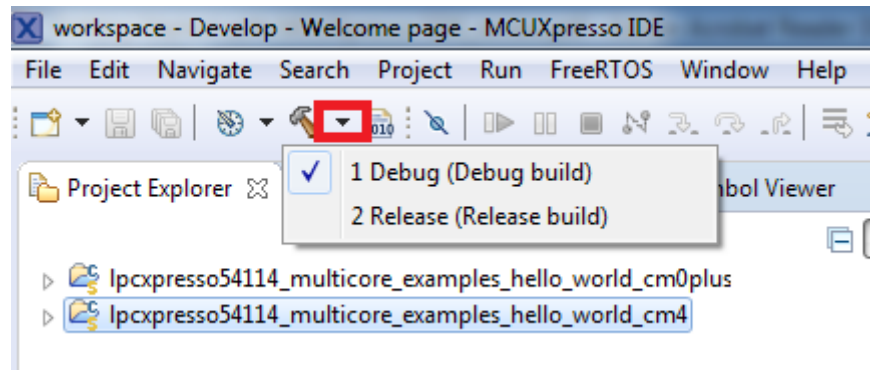


Figure 65. Selection of the build target in MCUXpresso IDE

The project starts building after the build target is selected. Because of the project reference settings in multicore projects, triggering the build of the primary core application (cm4) causes the referenced auxiliary core application (cm0plus) to build as well.

NOTE

When the 'Release' build is requested, it is necessary to change the build configuration of both the primary and auxiliary core application projects first. To do this, select both projects in the Project Explorer view by clicking to select the first project, then using shift-click or control-click to select the second project. Right click in the Project Explorer view to display the context-sensitive menu and select 'Build Configurations->Set Active->Release'. This also possible to do using the menu item 'Project->Build Configuration->Set Active->Release'. After switching to the 'Release' build configuration, the build of the multicore example can be started by triggering the primary core application (cm4) build.

Run a demo using MCUXpresso IDE

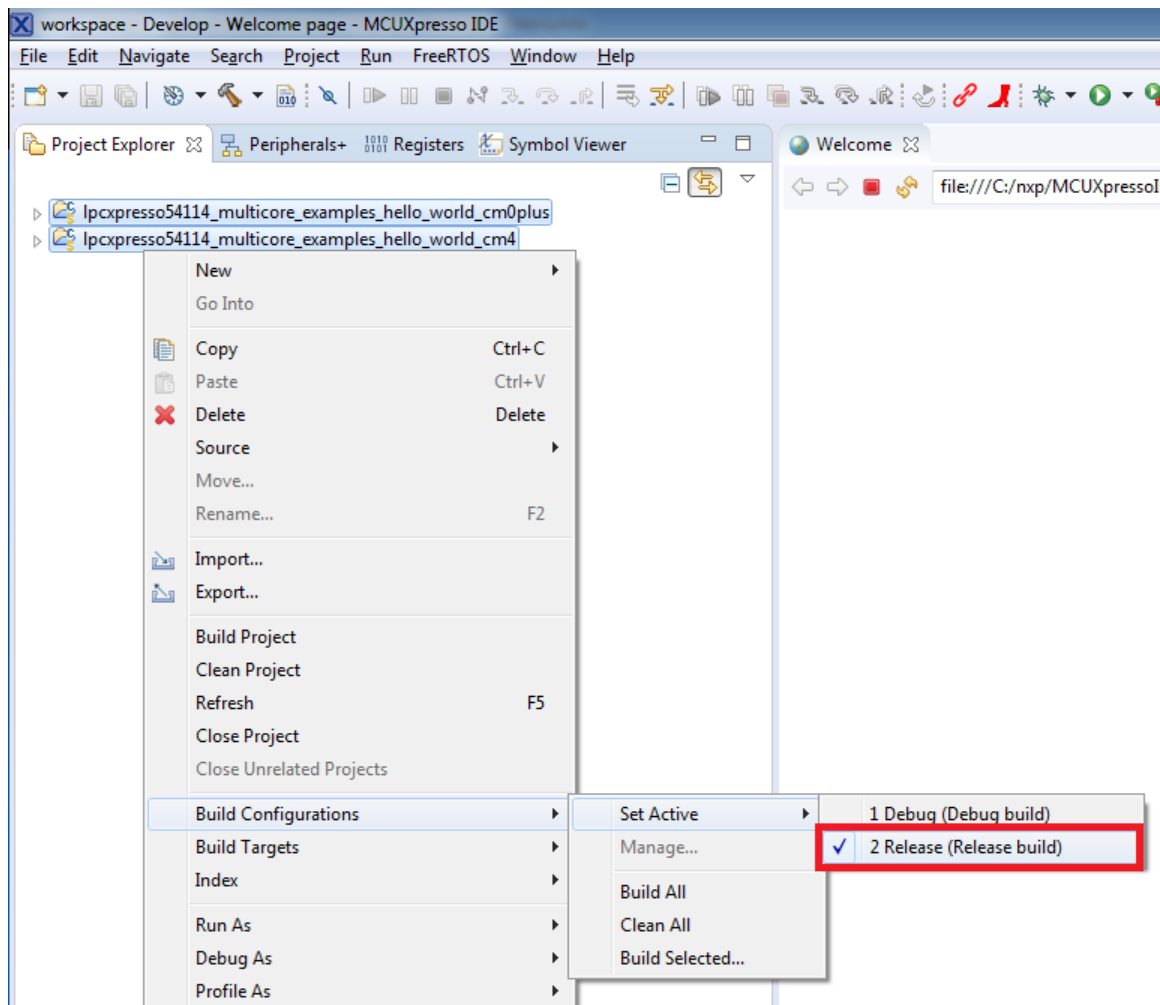


Figure 66. Switching multicore projects into the Release build configuration

7.5 Run a multicore example application

The primary core debugger handles flashing of both the primary and the auxiliary core applications into the SoC flash memory. To download and run the multicore application, switch to the primary core application project and perform all steps as described in Section 7.3, "Run an example application". These steps are common for both single core applications and the primary side of dual-core applications, ensuring both sides of the multicore application are properly loaded and started. However, there is one additional dialogue that is specific to multicore examples, and requires selecting the target core. See the following figures as reference.

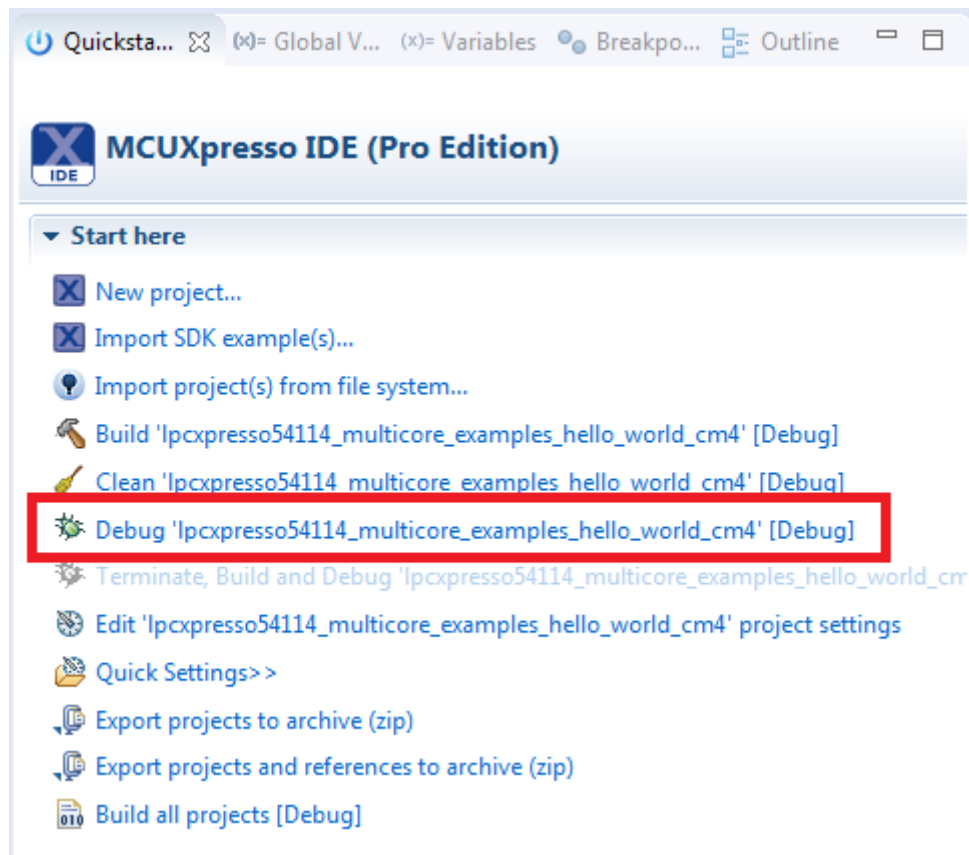


Figure 67. Debug "lpcpresso54114_multicore_examples_hello_world_cm4" case

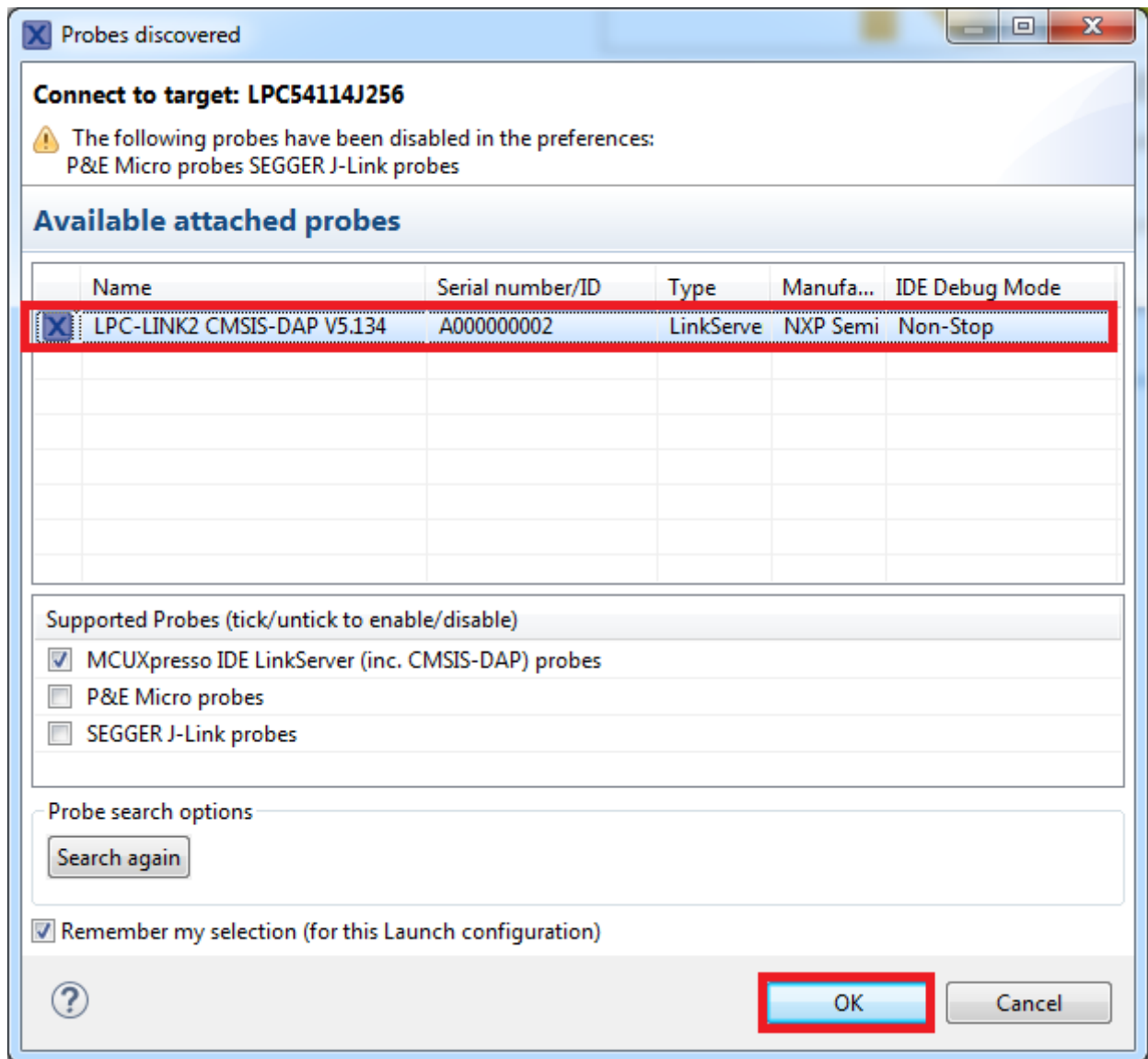


Figure 68. Attached Probes: debug emulator selection

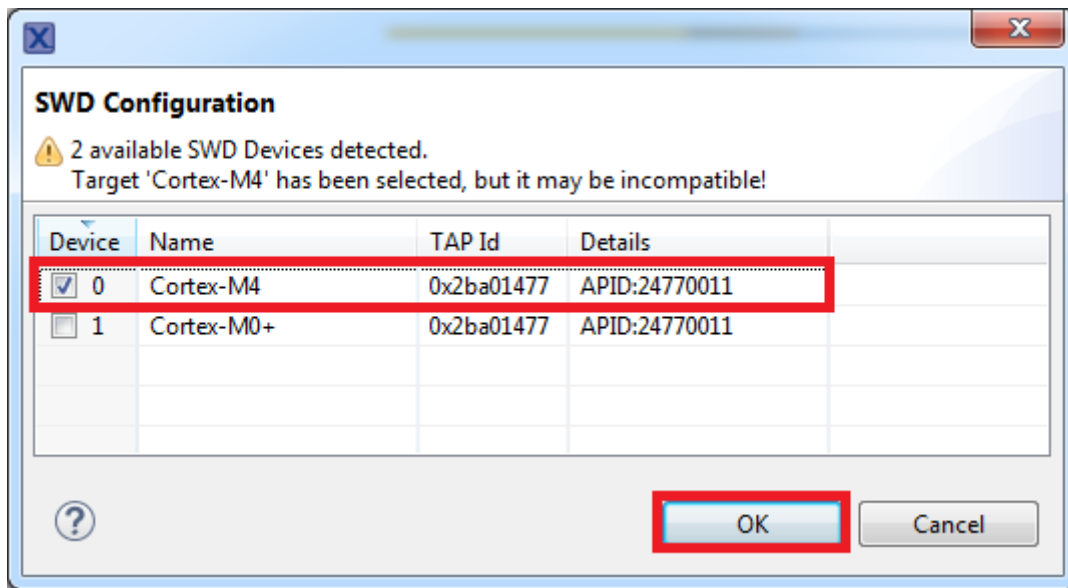


Figure 69. Target core selection dialog

Run a demo using MCUXpresso IDE

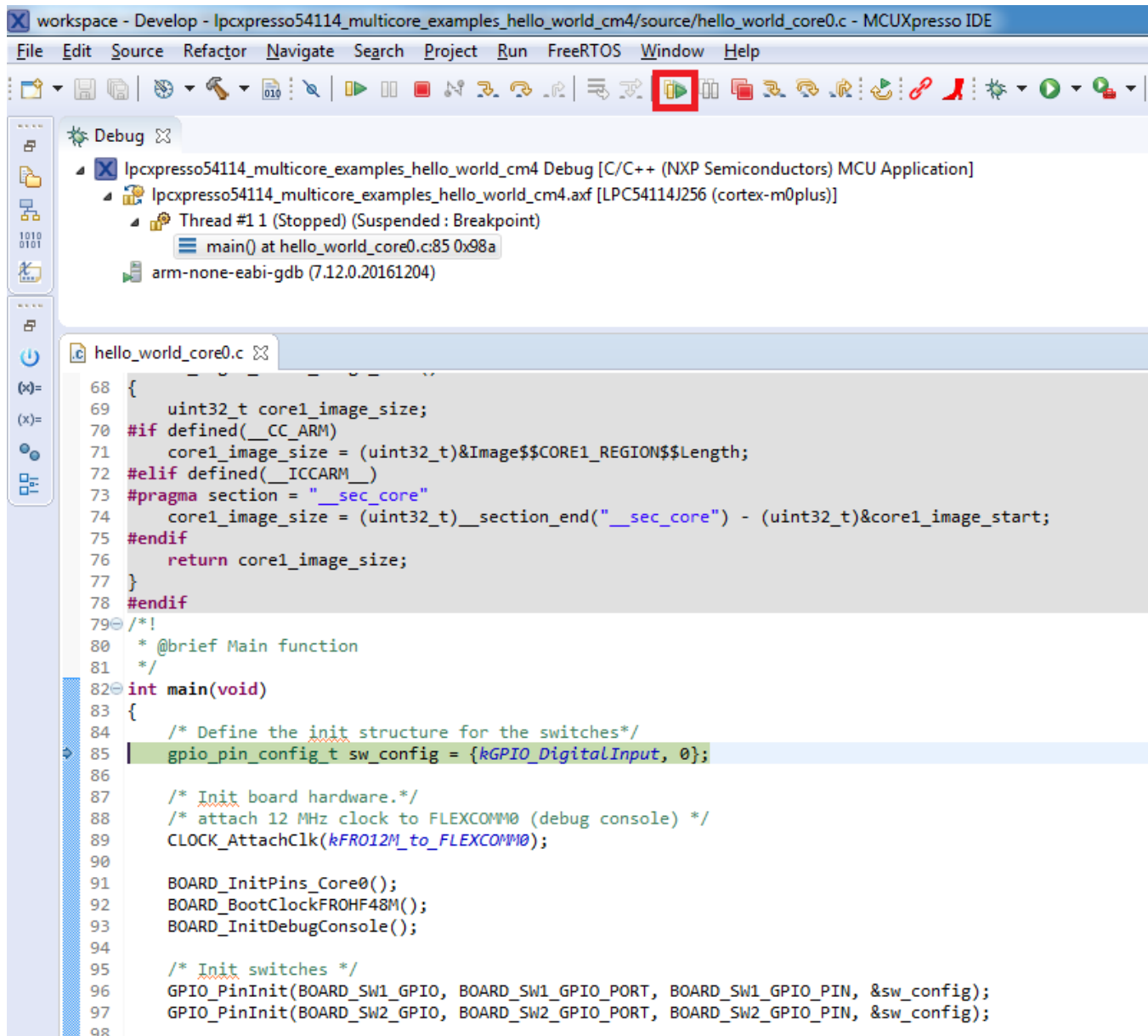


Figure 70. Stop the primary core application at main() when running debugging

After clicking the "Resume All Debug sessions" button, the `hello_world` multicore application runs and a banner is displayed on the terminal. If this is not the case, check your terminal settings and connections.

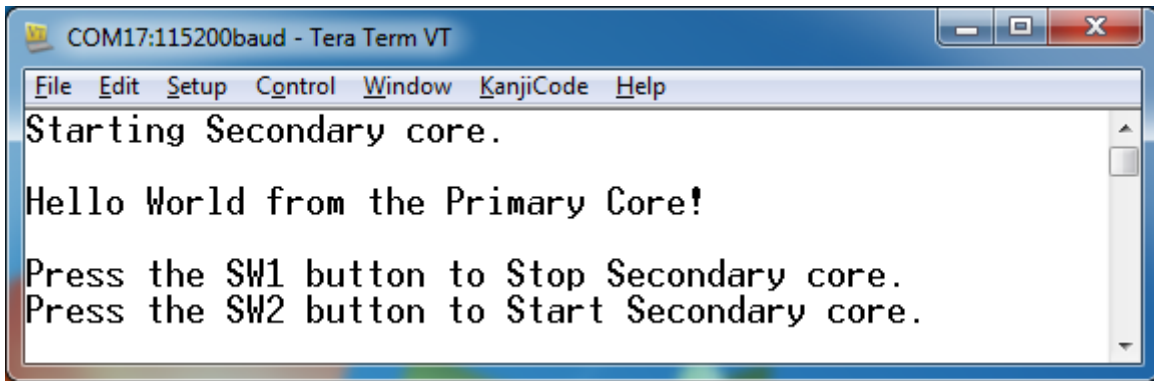


Figure 71. Hello World from the primary core message

An LED controlled by the auxiliary core starts flashing, indicating that the auxiliary core has been released from the reset and running correctly. It is also possible to debug both sides of the multicore application in parallel. After creating the debug session for the primary core, perform same steps also for the auxiliary core application. Highlight the `lpcxpresso54114_multicore_examples_hello_world_cm0plus` project (multicore slave project) in the Project Explorer. On the Quickstart Panel, click “Debug ‘lpcxpresso54114_multicore_examples_hello_world_cm0plus’ [Debug]” to launch the second debug session.

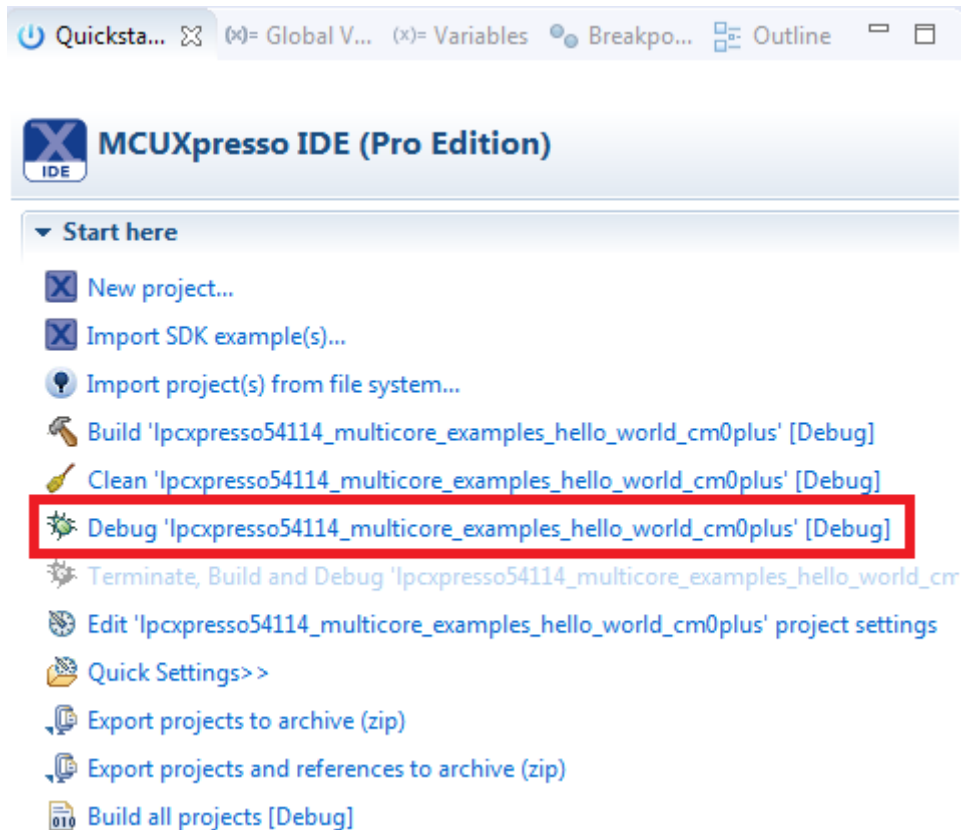


Figure 72. Debug "lpcxpresso54114_multicore_examples_hello_world_cm0plus" case

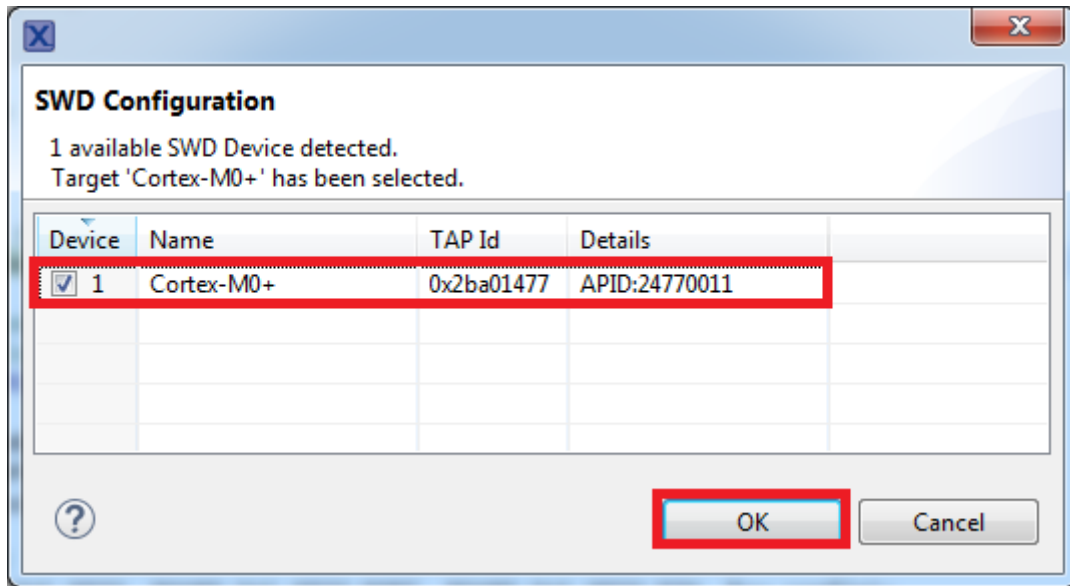


Figure 73. Target core selection dialog

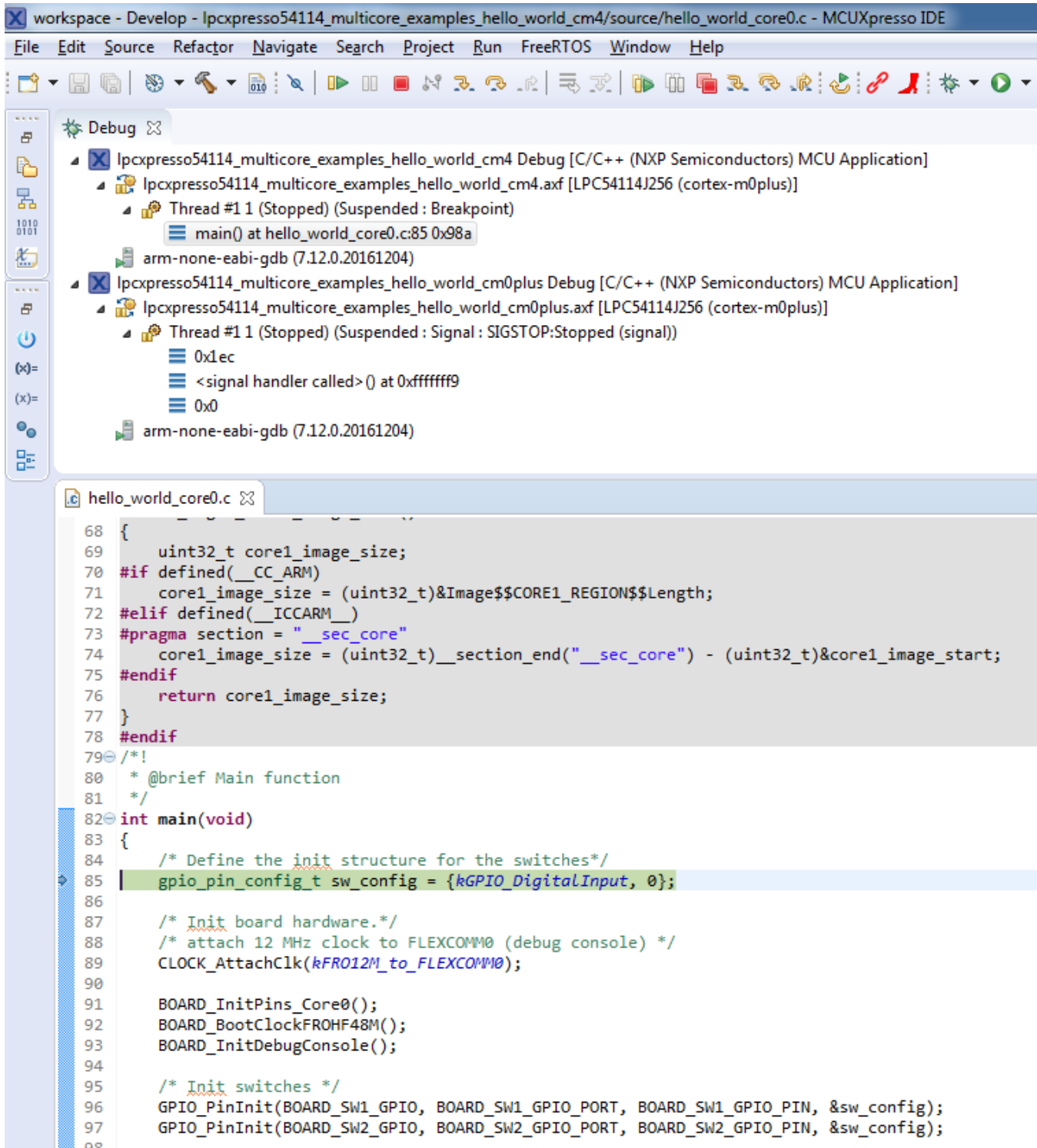


Figure 74. Two opened debug sessions

Now, the two debug sessions should be opened, and the debug controls can be used for both debug sessions depending on the debug session selection. Keep the primary core debug session selected and clicking the "Resume" button. The `hello_world` multicore application then starts running. The primary core application starts the auxiliary core application during runtime, and the auxiliary core application stops at the beginning of the `main()` function. The debug session of the auxiliary core application is highlighted. After clicking the "Resume" button, it is applied to the auxiliary core debug session. Therefore, the auxiliary core application continues its execution.

Run a demo using MCUXpresso IDE

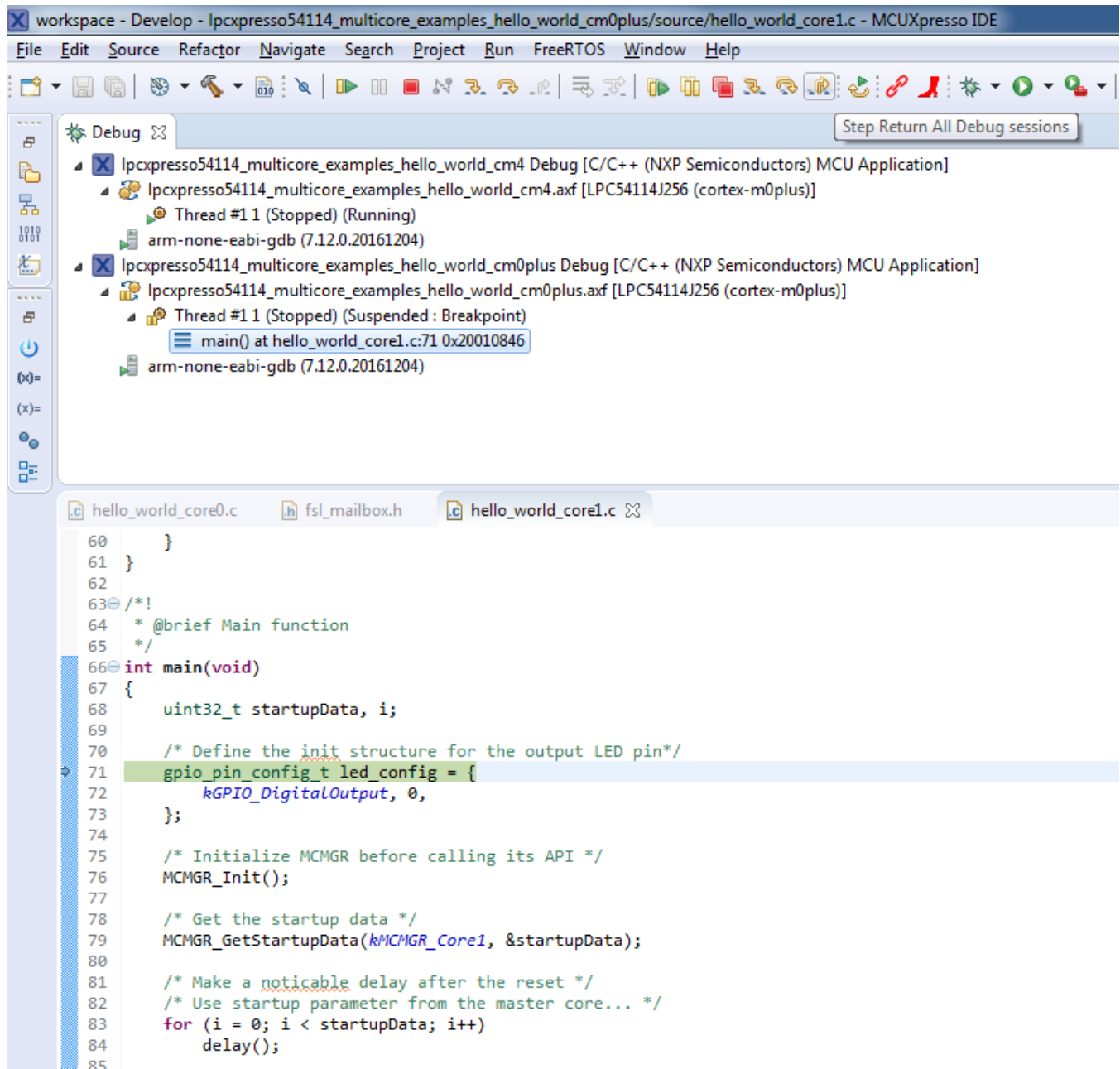


Figure 75. Auxiliary core application stops at the main function

At this point, it is possible to suspend and resume individual cores independently. It is also possible to make synchronous suspension and resumption of both cores. This is done either by selecting both opened debug sessions (multiple selection) and clicking the “Suspend” / “Resume” control button, or just using the “Suspend All Debug sessions” and the “Resume All Debug sessions” buttons.

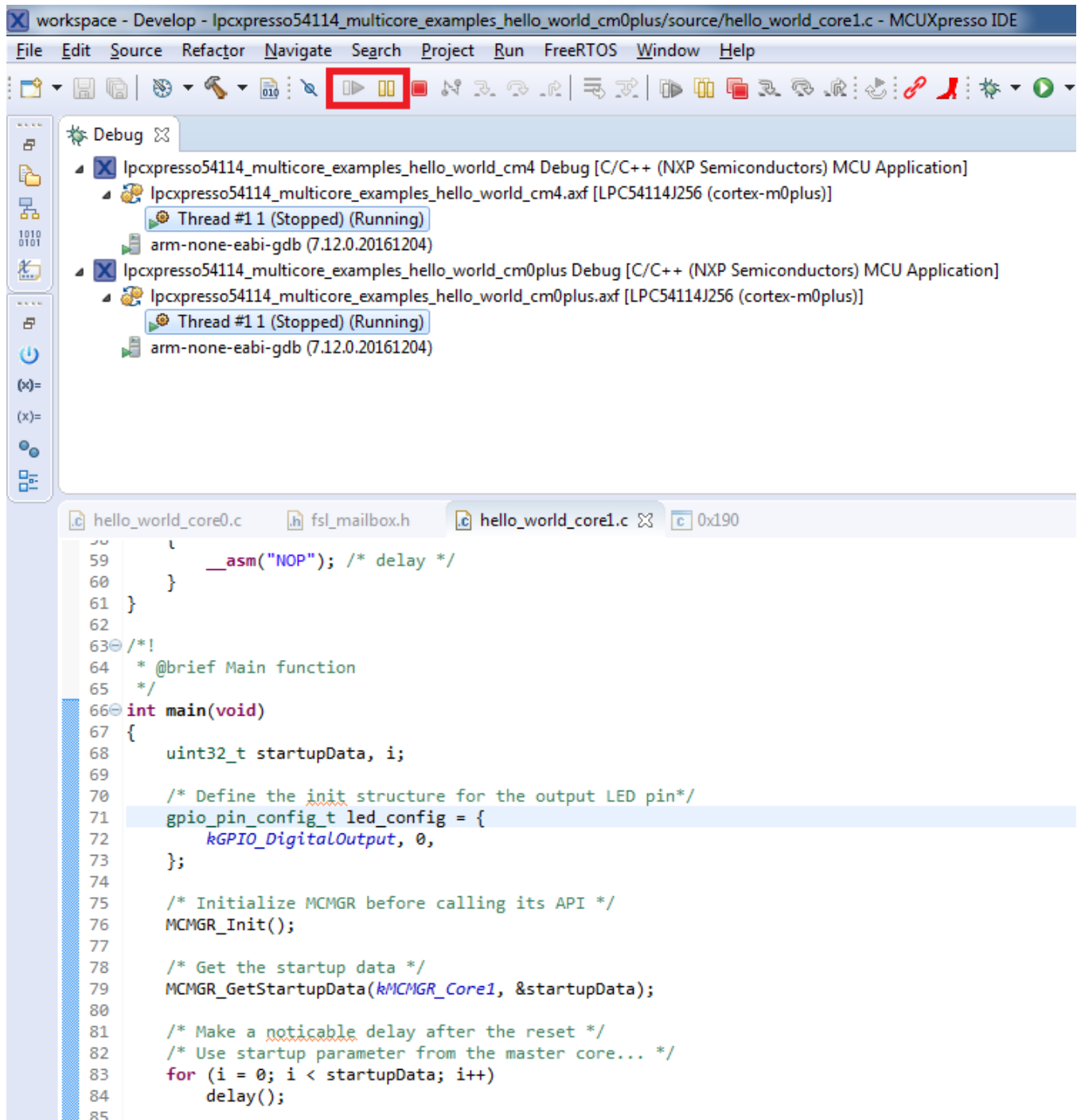


Figure 76. Synchronous suspension/resumption of both cores using the multiple selection of debug sessions and “Suspend”/”Resume” controls

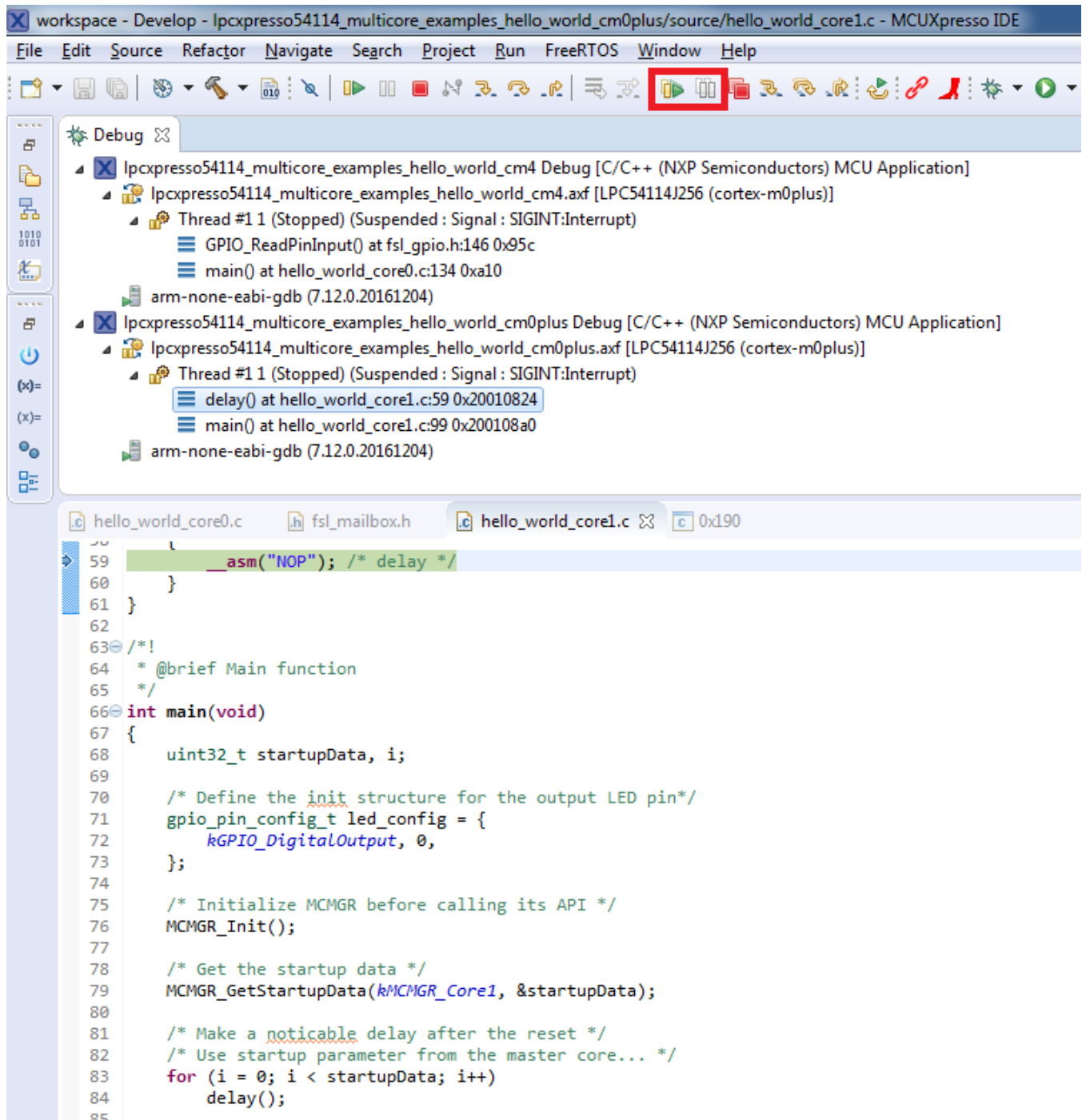


Figure 77. Synchronous suspension/resumption of both cores using the “Suspend All Debug sessions” and the “Resume All Debug sessions” controls

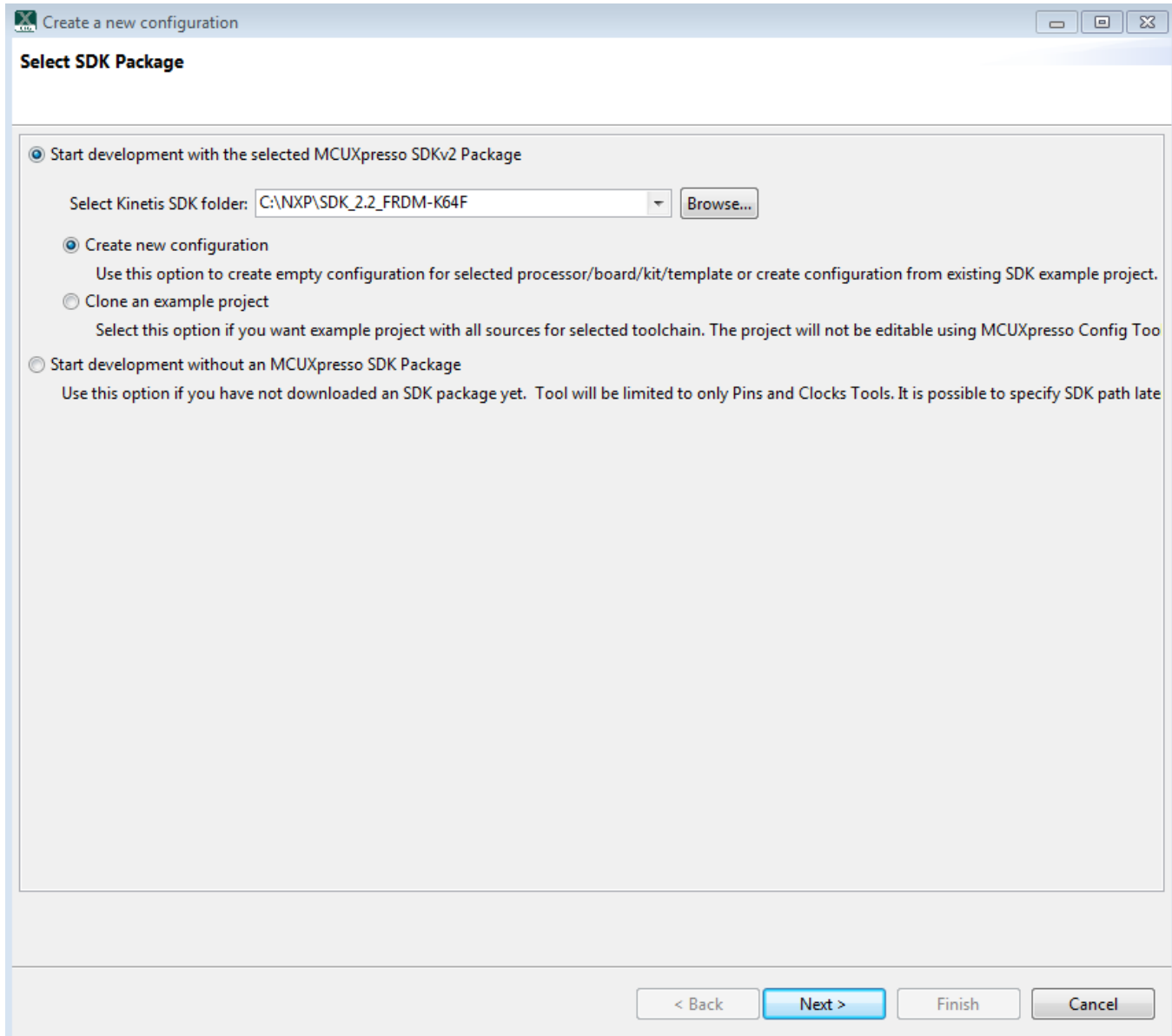
8 MCUXpresso Config Tools Project Generator

The MCUXpresso Config Tools can generate new projects for IAR, Keil MDK, and Kinetis Design Studio, GCC ARM Embedded, SOMNIUM DRT, and MCUXpresso IDE containing all MCUXpresso SDK drivers and utilities which are supported for the selected device, and also generate new standalone projects based on MCUXpresso SDK examples.

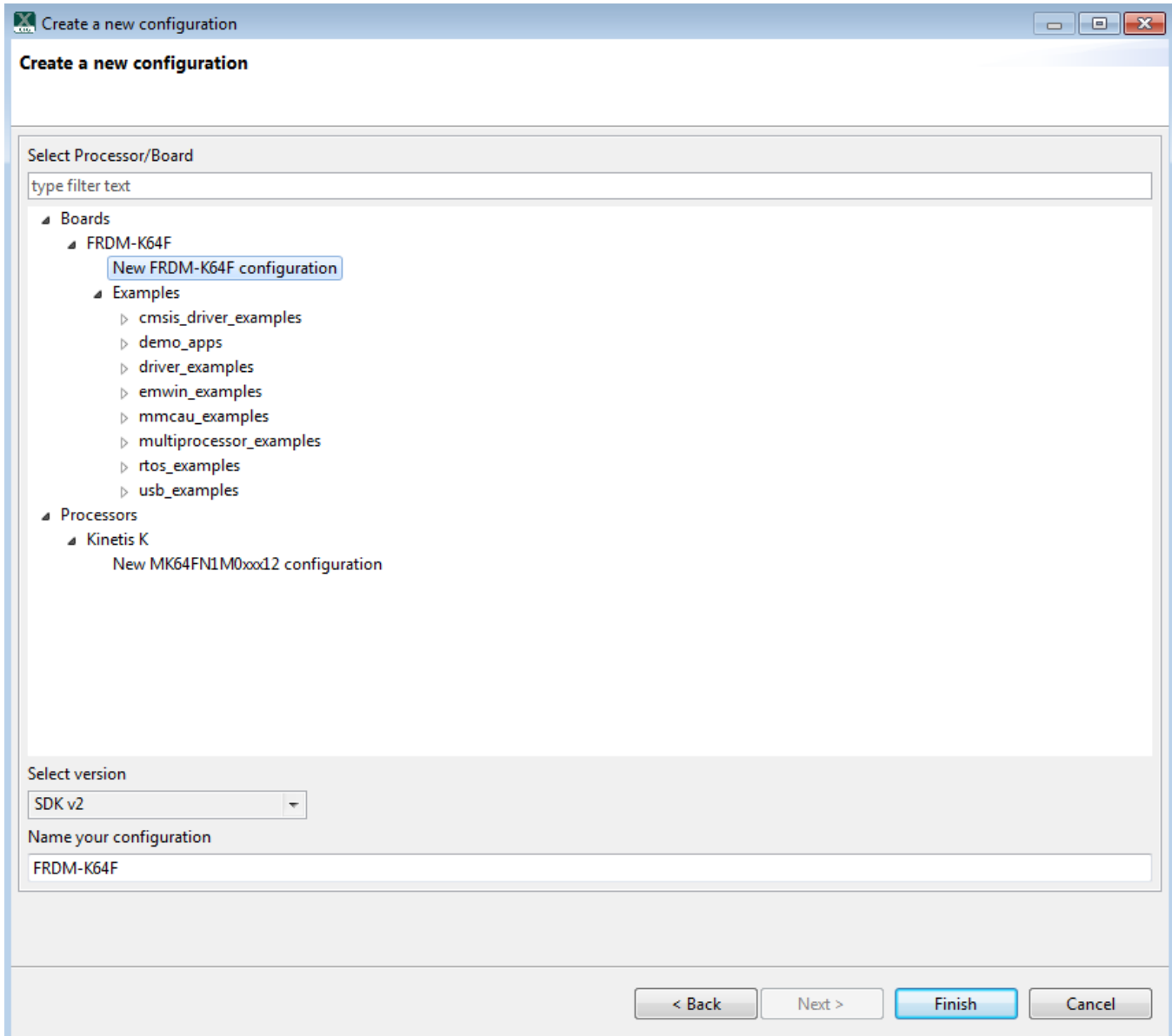
The MCUXpresso Config Tools can be found on www.nxp.com. For more information about the installation process, see the MCUXpresso Config Tools Notes.

8.1 Create new configurations using MCUXpresso Config Tools

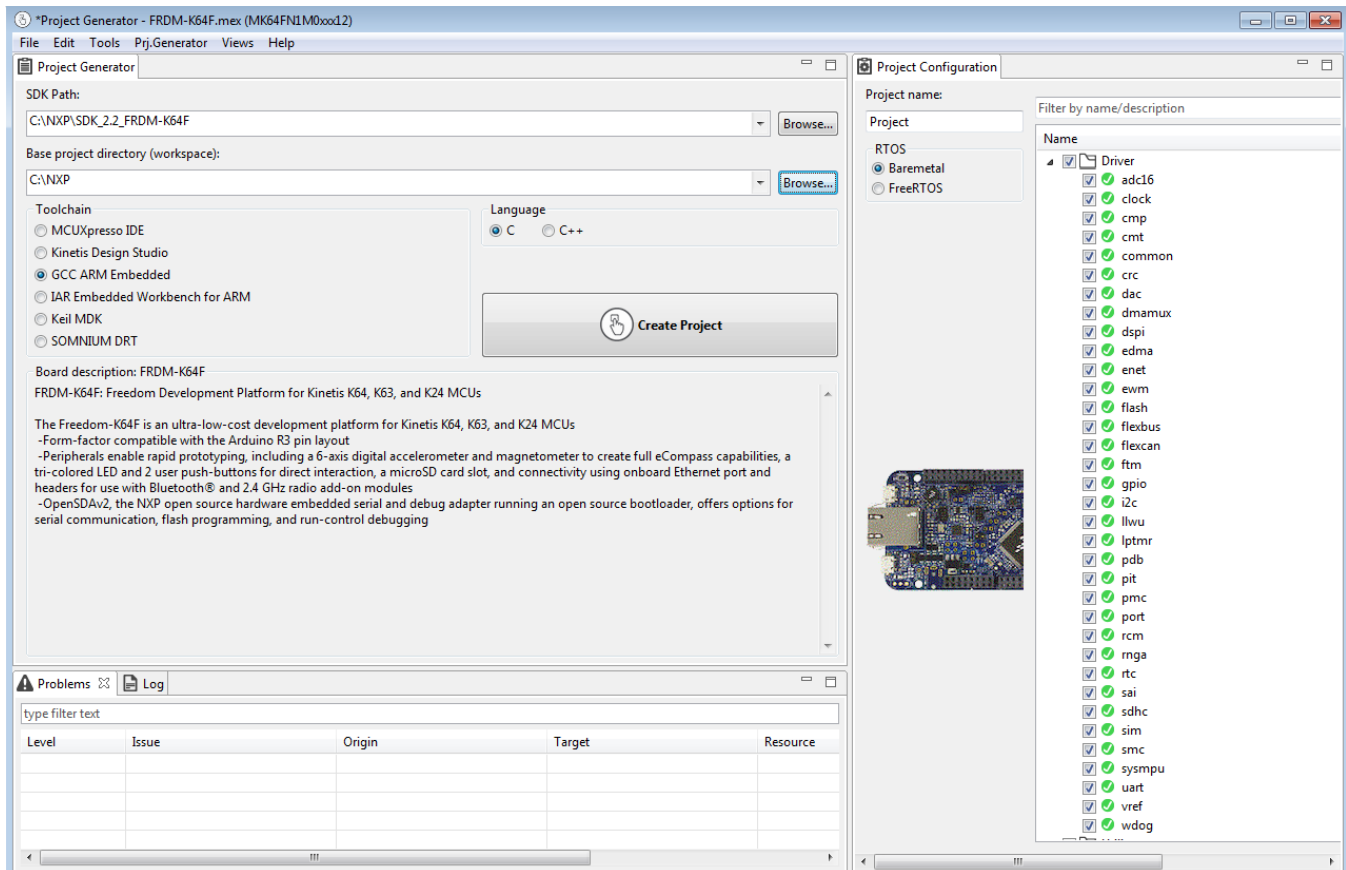
Use this option to create an empty configuration for the selected processor/board/kit/template, or create a configuration from an existing MCUXpresso SDK example project.



1. Run the tool and set the correct MCUXpresso SDK package path using the "Browse" button.
2. Select "Create new configuration".
3. Click the "Next" button.



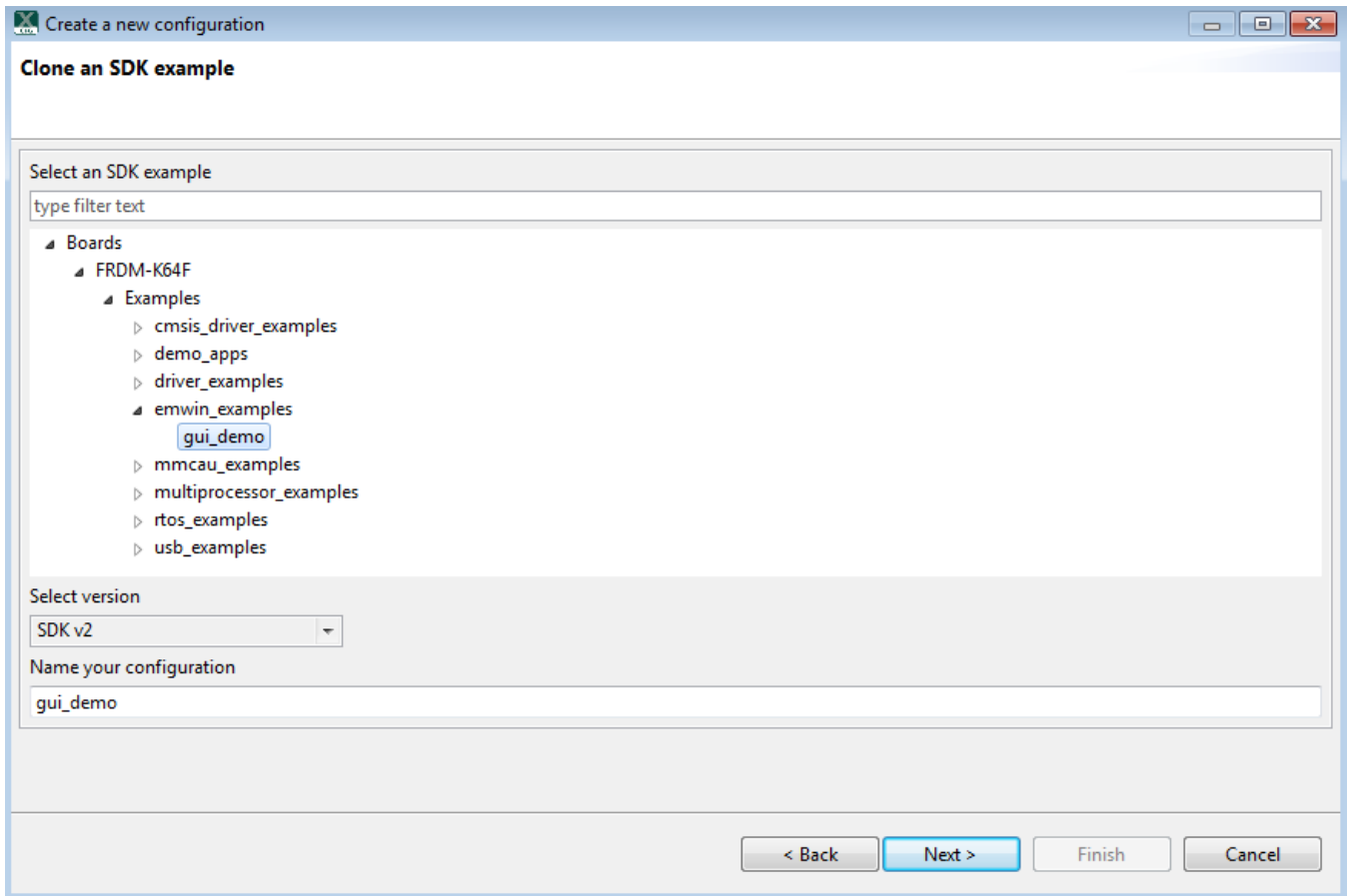
1. Select "New FRDM-K64F configuration" to create the project for the board.
2. Select "New MK64FN1M0xxx12 configuration" to create project for processor.
3. Select "Examples" to create a project for a specific example.
4. Click the "Finish" button.



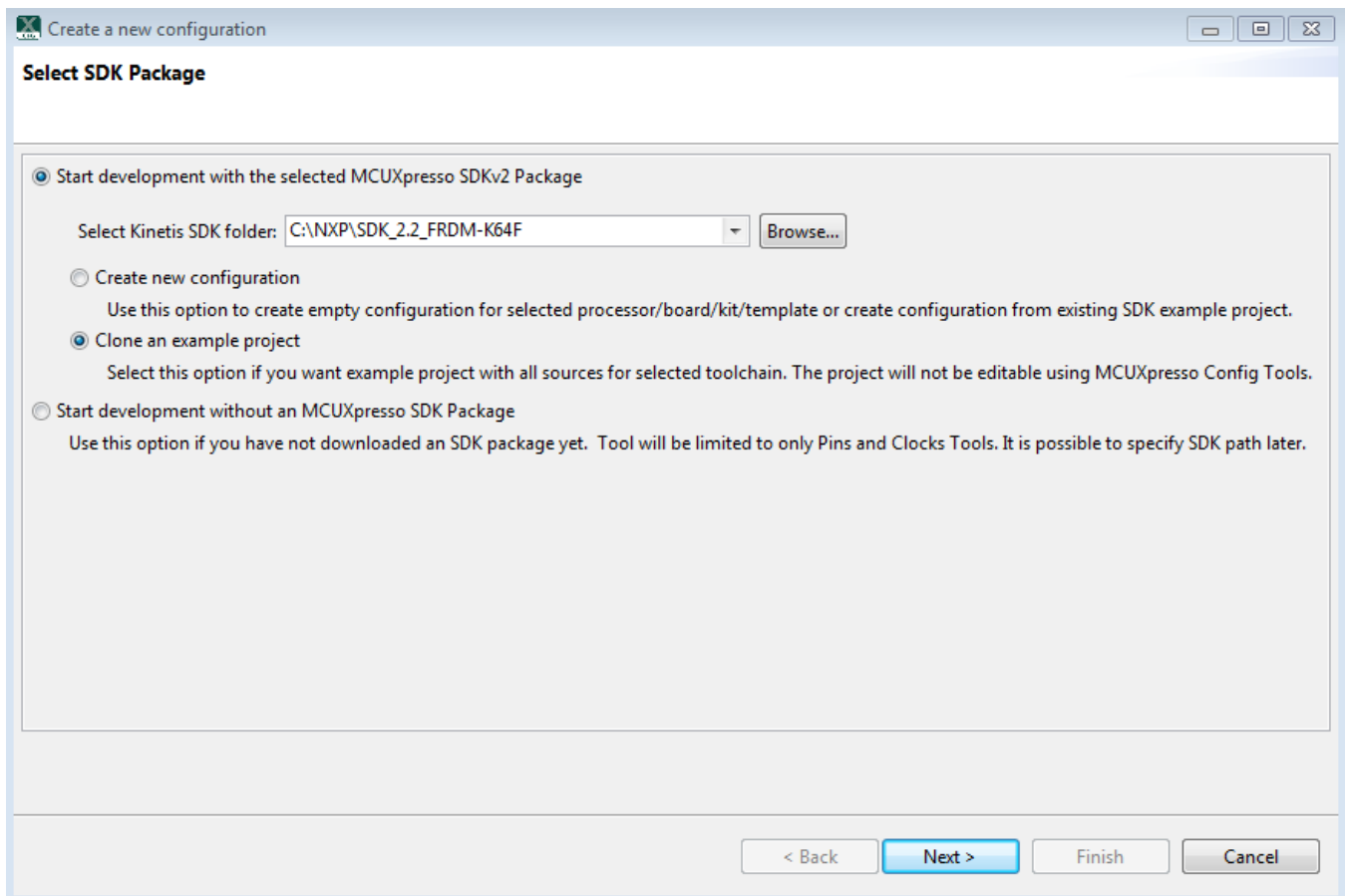
1. Set the Base project directory (workspace) path using the "Browse" button.
2. Type the project name into the corresponding field.
3. In the RTOS section, select the bare metal or FreeRTOS to decide whether to include FreeRTOS code.
4. In the Language, select C language or C++.
5. Select toolchains in the corresponding list.
6. Click the "Create Project" button.
7. A dialog with information about the project location should display.

8.2 Clone an example project using MCUXpresso Config tools

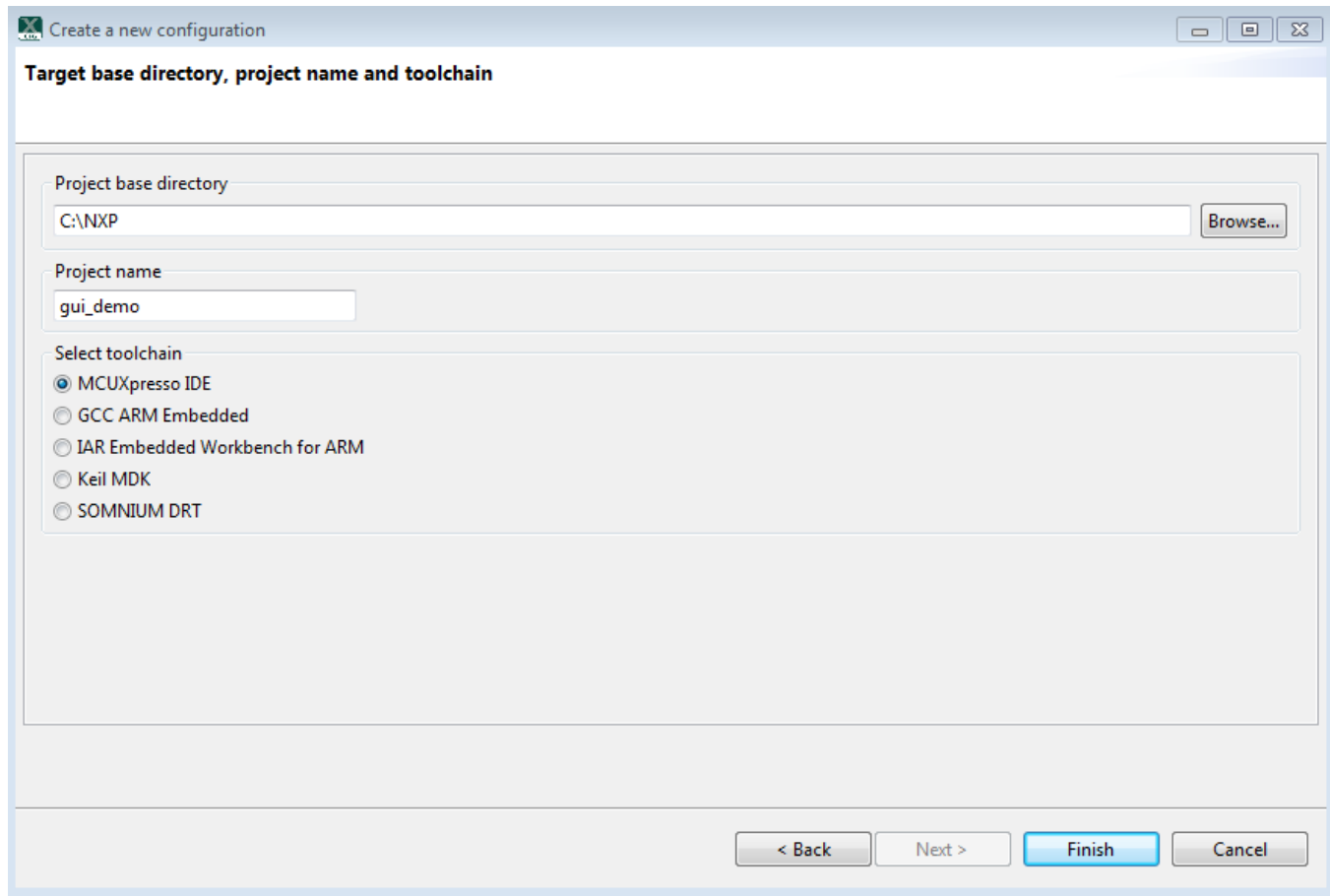
Select this option to create an example project with all sources for the selected toolchain. The project will not be editable using MCUXpresso Config Tools.



1. Run the tool and set the correct MCUXpresso SDK package path using the "Browse" button.
2. Select "Clone an example project".
3. Click the "Next" button.



1. Select "Examples" to create a project for a specific example.
2. Click the "Next" button.



1. Set the Base project directory (workspace) path using the "Browse" button.
2. Type the project name into the corresponding field.
3. Select toolchains in the corresponding list.
4. Click the "Finish" button.
5. A dialog with the information about the project location should display.

9 Appendix A - How to determine COM port

This section describes the steps necessary to determine the debug COM port number of your NXP hardware development platform. All NXP boards ship with a factory programmed, on-board debug interface, whether it's based on OpenSDA or the legacy P&E Micro OSJTAG interface. To determine what your specific board ships with, see Appendix B.

1. To determine the COM port, open the Windows operating system Device Manager. This can be achieved by going to the Windows operating system Start menu and typing "Device Manager" in the search bar, as shown below:

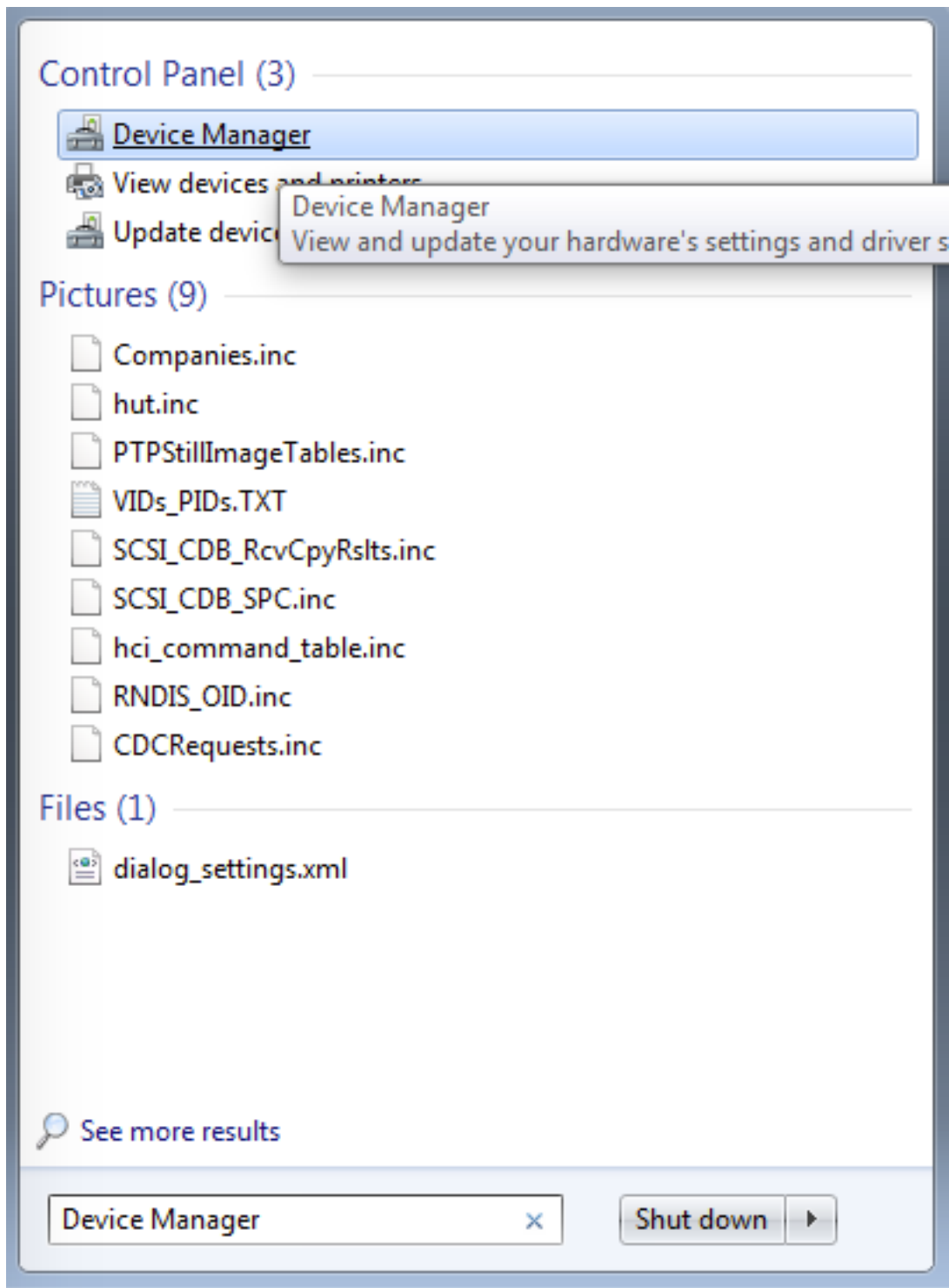


Figure 78. Device manager

2. In the Device Manager, expand the “Ports (COM & LPT)” section to view the available ports. Depending on the NXP board you’re using, the COM port can be named differently:
 - a. OpenSDA – CMSIS-DAP/mbed/DAPLink interface:

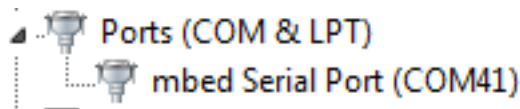


Figure 79. OpenSDA – CMSIS-DAP/mbed/DAPLink interface

b. OpenSDA – P&E Micro:

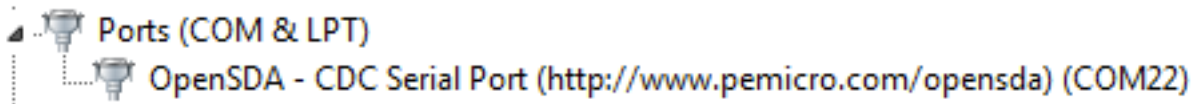


Figure 80. OpenSDA – P&E Micro

c. OpenSDA – J-Link:

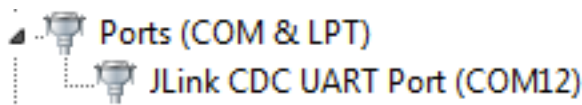


Figure 81. OpenSDA – J-Link

d. P&E Micro OSJTAG:

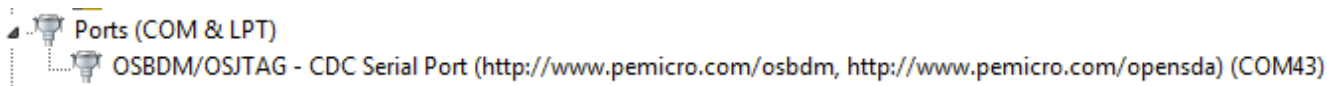


Figure 82. P&E Micro OSJTAG

10 Appendix B - Default debug interfaces

The MCUXpresso SDK supports various hardware platforms that come loaded with a variety of factory programmed debug interface configurations. The following table lists the hardware platforms supported by the MCUXpresso SDK, their default debug interface, and any version information that helps differentiate a specific interface configuration.

All recent and future NXP hardware platforms support the configurable OpenSDA standard.

NOTE

The 'OpenSDA details' row of the following table is not applicable to LPC.

Table 1. Hardware platforms supported by MCUXpresso SDK

Hardware platform	Default interface	OpenSDA details
FRDM-K22F	CMSIS-DAP/mbed/DAPLink	OpenSDA v2.1
FRDM-K28F	DAPLink	OpenSDA v2.1
FRDM-K64F	CMSIS-DAP/mbed/DAPLink	OpenSDA v2.0
FRDM-K66F	J-Link OpenSDA	OpenSDA v2.1
FRDM-K82F	CMSIS-DAP	OpenSDA v2.1
FRDM-KE15Z	DAPLink	OpenSDA v2.1
FRDM-KL02Z	P&E Micro OpenSDA	OpenSDA v1.0
FRDM-KL03Z	P&E Micro OpenSDA	OpenSDA v1.0
FRDM-KL25Z	P&E Micro OpenSDA	OpenSDA v1.0

Table continues on the next page...

Table 1. Hardware platforms supported by MCUXpresso SDK (continued)

FRDM-KL26Z	P&E Micro OpenSDA	OpenSDA v1.0
FRDM-KL27Z	P&E Micro OpenSDA	OpenSDA v1.0
FRDM-KL28Z	P&E Micro OpenSDA	OpenSDA v2.1
FRDM-KL43Z	P&E Micro OpenSDA	OpenSDA v1.0
FRDM-KL46Z	P&E Micro OpenSDA	OpenSDA v1.0
FRDM-KL81Z	CMSIS-DAP	OpenSDA v2.0
FRDM-KL82Z	CMSIS-DAP	OpenSDA v2.0
FRDM-KV10Z	CMSIS-DAP	OpenSDA v2.1
FRDM-KV31F	P&E Micro OpenSDA	OpenSDA v1.0
FRDM-KW24	CMSIS-DAP/mbd/DAPLink	OpenSDA v2.1
FRDM-KW41Z	CMSIS-DAP/DAPLink	OpenSDA v2.1 or greater
FRDM-KW41Z	CMSIS-DAP/DAPLink	OpenSDA v2.1 or greater
Hexiwear	CMSIS-DAP/mbd/DAPLink	OpenSDA v2.0
MAPS-KS22	J-Link OpenSDA	-
TWR-K21D50M	P&E Micro OSJTAG	N/A
TWR-K21F120M	P&E Micro OSJTAG	N/A
TWR-K22F120M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-K24F120M	CMSIS-DAP/mbd	OpenSDA v2.1
TWR-K60D100M	P&E Micro OSJTAG	N/A
TWR-K64D120M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-K65D180M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-K65D180M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-KV10Z32	P&E Micro OpenSDA	OpenSDA v1.0
TWR-K80F150M	CMSIS-DAP	OpenSDA v2.1
TWR-K81F150M	CMSIS-DAP	OpenSDA v2.1
TWR-KE18F	DAPLink	OpenSDA v2.1
TWR-KL28Z72M	P&E Micro OpenSDA	OpenSDA v2.1
TWR-KL43Z48M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-KL81Z72M	CMSIS-DAP	OpenSDA v2.0
TWR-KL82Z72M	CMSIS-DAP	OpenSDA v2.0
TWR-KM34Z75M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-KV10Z32	P&E Micro OpenSDA	OpenSDA v1.0
TWR-KV11Z75M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-KV31F120M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-KV46F150M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-KV58F220M	CMSIS-DAP	OpenSDA v2.1
TWR-KW24D512	P&E Micro OpenSDA	OpenSDA v1.0
USB-KW24D512	N/A External probe	N/A
USB-KW41Z	CMSIS-DAP/DAPLink	OpenSDA v2.1 or greater
USB-KW41Z	CMSIS-DAP/DAPLink	OpenSDA v2.1 or greater

Table continues on the next page...

Table 1. Hardware platforms supported by MCUXpresso SDK (continued)

USB-KW41Z	CMSIS-DAP/DAPLink	OpenSDA v2.1 or greater
LPCXpresso54114	CMSIS-DAP	N/A
LPCXpresso54608	-	N/A
LPCXpresso54S618	-	N/A

11 Appendix C - Updating OpenSDA firmware

Any NXP hardware platform that comes with an OpenSDA-compatible debug interface has the ability to update the OpenSDA firmware. This typically means switching from the default application (either CMSIS-DAP/mbed/DAPLink or P&E Micro) to a SEGGER J-Link. This section contains the steps to switch the OpenSDA firmware to a J-Link interface. However, the steps can be applied to also restoring the original image.

For reference, OpenSDA firmware files can be found at the links below:

- **J-Link:** Download appropriate image from www.segger.com/opensda.html. Chose the appropriate J-Link binary based on the table in Appendix B. Any OpenSDA v1.0 interface should use the standard OpenSDA download (in other words, the one with no version). For OpenSDA 2.0 or 2.1, select the corresponding binary.
- **CMSIS-DAP/mbed/DAPLink:** This interface is provided to support the ARM mbed initiative. Navigate to developer.mbed.org/platforms and select your hardware platform. On the specific platform/board page, there is a link to the firmware image and instructions on how to load it, though the instructions are the same as below.
- **P&E Micro:** Downloading P&E Micro OpenSDA firmware images requires registration with P&E Micro (www.pemicro.com).

These steps show how to update the OpenSDA firmware on your board for Windows operating system and Linux OS users:

1. Unplug the board's USB cable.
2. Press the board's "Reset" button. While still holding the button, plug the board back in to the USB cable.
3. When the board re-enumerates, it shows up as a disk drive called "BOOTLOADER".

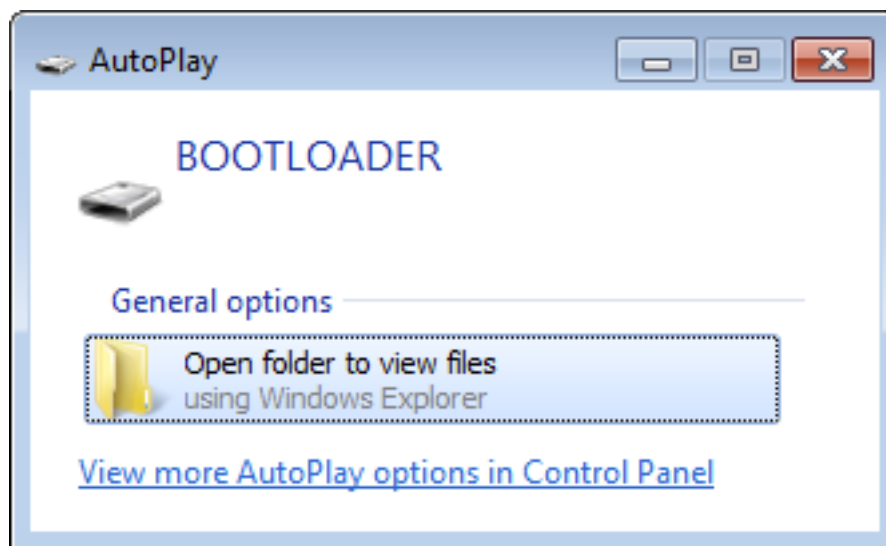


Figure 83. BOOTLOADER drive

4. Drag the new firmware image onto the BOOTLOADER drive in Windows operating system Explorer, similar to how you would drag and drop a file onto a normal USB flash drive.

NOTE

If for any reason the firmware update fails, the board can always re-enter bootloader mode by holding down the "Reset" button and power cycling.

These steps show how to update the OpenSDA firmware on your board for Mac OS users.

1. Unplug the board's USB cable.
2. Press the board's "Reset" button. While still holding the button, plug the board back in to the USB cable.
3. For boards with OpenSDA v2.0 or v2.1, it shows up as a disk drive called "BOOTLOADER" in Finder. Boards with OpenSDA v1.0 may or may not show up depending on the bootloader version. If you see the drive in Finder, proceed to the next step. If you do not see the drive in Finder, use a PC with Windows® OS 7 or an earlier version to either update the OpenSDA firmware, or update the OpenSDA bootloader to version 1.11 or later. The bootloader update instructions and image can be obtained from P&E Microcomputer website.
4. For OpenSDA v2.1 and OpenSDA v1.0 (with bootloader 1.11 or later) users, drag the new firmware image onto the BOOTLOADER drive in Finder, similar to how you would drag and drop the file onto a normal USB Flash drive.
5. For OpenSDA v2.0 users, type these commands in a Terminal window:

```
> sudo mount -u -w -o sync /Volumes/BOOTLOADER
> cp -X <path to update file> /Volumes/BOOTLOADER
```

NOTE

If for any reason the firmware update fails, the board can always re-enter bootloader mode by holding down the "Reset" button and power cycling.

11.1 Updating OpenSDA firmware

Any NXP hardware platform that comes with an OpenSDA-compatible debug interface has the ability to update the OpenSDA firmware. This typically means switching from the default application (either CMSIS-DAP/mbed/DAPLink or P&E Micro) to a SEGGER J-Link. This section contains the steps to switch the OpenSDA firmware to a J-Link interface. However, the steps can be applied to also restoring the original image.

For reference, OpenSDA firmware files can be found at the links below:

- **J-Link**: Download appropriate image from www.segger.com/opensda.html. Chose the appropriate J-Link binary based on the table in Appendix B. Any OpenSDA v1.0 interface should use the standard OpenSDA download (in other words, the one with no version). For OpenSDA 2.0 or 2.1, select the corresponding binary.
- **CMSIS-DAP/mbed/DAPLink**: This interface is provided to support the ARM mbed initiative. Navigate to developer.mbed.org/platforms and select your hardware platform. On the specific platform/board page, there is a link to the firmware image and instructions on how to load it, though the instructions are the same as below.
- **P&E Micro**: Downloading P&E Micro OpenSDA firmware images requires registration with P&E Micro (www.pemicro.com).

These steps show how to update the OpenSDA firmware on your board for Windows operating system and Linux OS users:

1. Unplug the board's USB cable.
2. Press the board's "Reset" button. While still holding the button, plug the board back in to the USB cable.
3. When the board re-enumerates, it shows up as a disk drive called "BOOTLOADER".

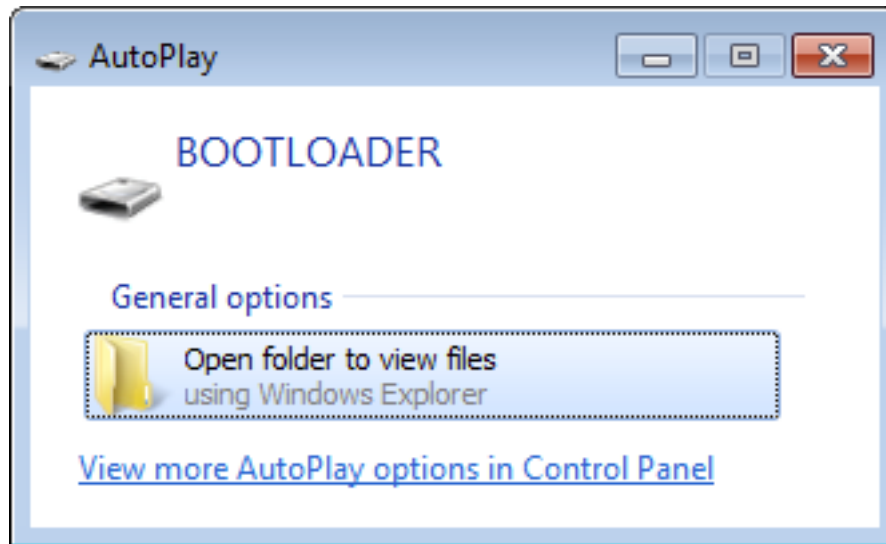


Figure 84. BOOTLOADER drive

4. Drag the new firmware image onto the BOOTLOADER drive in Windows operating system Explorer, similar to how you would drag and drop a file onto a normal USB flash drive.

NOTE

If for any reason the firmware update fails, the board can always re-enter bootloader mode by holding down the "Reset" button and power cycling.

These steps show how to update the OpenSDA firmware on your board for Mac OS users.

1. Unplug the board's USB cable.
2. Press the board's "Reset" button. While still holding the button, plug the board back in to the USB cable.
3. For boards with OpenSDA v2.0 or v2.1, it shows up as a disk drive called "BOOTLOADER" in Finder. Boards with OpenSDA v1.0 may or may not show up depending on the bootloader version. If you see the drive in Finder, proceed to the next step. If you do not see the drive in Finder, use a PC with Windows® OS 7 or an earlier version to either update the OpenSDA firmware, or update the OpenSDA bootloader to version 1.11 or later. The bootloader update instructions and image can be obtained from P&E Microcomputer website.
4. For OpenSDA v2.1 and OpenSDA v1.0 (with bootloader 1.11 or later) users, drag the new firmware image onto the BOOTLOADER drive in Finder, similar to how you would drag and drop the file onto a normal USB Flash drive.
5. For OpenSDA v2.0 users, type these commands in a Terminal window:

```
> sudo mount -u -w -o sync /Volumes/BOOTLOADER
> cp -X <path to update file> /Volumes/BOOTLOADER
```

NOTE

If for any reason the firmware update fails, the board can always re-enter bootloader mode by holding down the "Reset" button and power cycling.

11.2 Updating LPCXpresso board firmware

The LPCXpresso hardware platform comes with a CMSIS-DAP-compatible debug interface that has the ability to update the debugger firmware. This typically means switching from the default application (CMSIS-DAP) to a SEGGER J-Link. This section contains the steps to switch the CMSIS-DAP firmware to a J-Link interface. However, the steps can also be applied to restoring the original image.

NOTE

If LPCXpresso IDE is used and the jumper making DFUlink is installed on the board (JP5 on some boards, but consult the board user manual or schematic for specific jumper number), Link2 debug probe boots to DFU mode, and LPCXpresso IDE automatically downloads the CMSIS-DAP firmware to the probe before flash memory programming (after clicking the "Debug" button). Using DFU mode ensures most up-to-date/compatible firmware is used with LPCXpresso IDE.

NXP provides the LPCScript utility, which is the recommended tool for programming the latest versions of CMSIS-DAP and J-Link firmware onto LPC-Link2 or LPCXpresso boards. The utility can be downloaded from www.nxp.com/lpcutilities.

These steps show how to update the debugger firmware on your board for Windows operating system. For Linux OS, follow the instructions described in LPCScript user guide (www.nxp.com/lpcutilities, select LPCScript, then select documentation tab).

1. Install the LPCScript utility.
2. Unplug the board's USB cable.
3. For LPCXpresso board: make DFU link (install the jumper labelled DFUlink).
4. Connect the probe to the host via USB (use Link USB connector).
5. Open a command shell and call the appropriate script located in the LPCScript installation directory (<LPCScript install dir>).
 - a. To program CMSIS-DAP debug firmware: <LPCScript install dir>/scripts/program_CMSIS
 - b. To program J-Link debug firmware: <LPCScript install dir>/scripts/program_JLINK
6. Remove DFU link (remove the jumper installed in step 3).
7. Re-power the board by removing the USB cable and plugging it again.

12 Revision history

This table summarizes revisions to this document.

Table 2. Revision history

Revision number	Date	Substantive changes
3	03/2017	MCUXpresso SDK
2	08/2016	Added Chapter 8 and updated Section 5.5
1	06/2016	Added Section 5.5 related to the New Project Wizard for KSDK 2.0.0
0	01/2016	Initial release

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