# Start a New Project with Keil MDK-ARM Version 5 and ST Micro Nucleo-F446RE

This tutorial is intended for starting a new project to develop software with ST Micro Nucleo-F446RE board (with **STM32F446RE MCU**) using Keil Microcontroller Development Kit for ARM (MDK-ARM) version 5.24a.
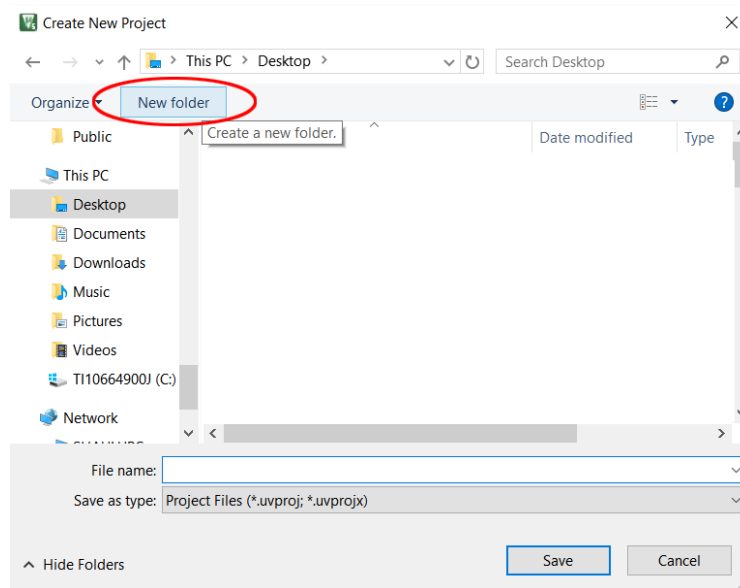
μVision V5.24.2.0
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Create a New Project in Keil MDK v5.24a

1. Launch Keil uVision IDE by double clicking on the icon .

2. From menu, select Project>New uVision Project…
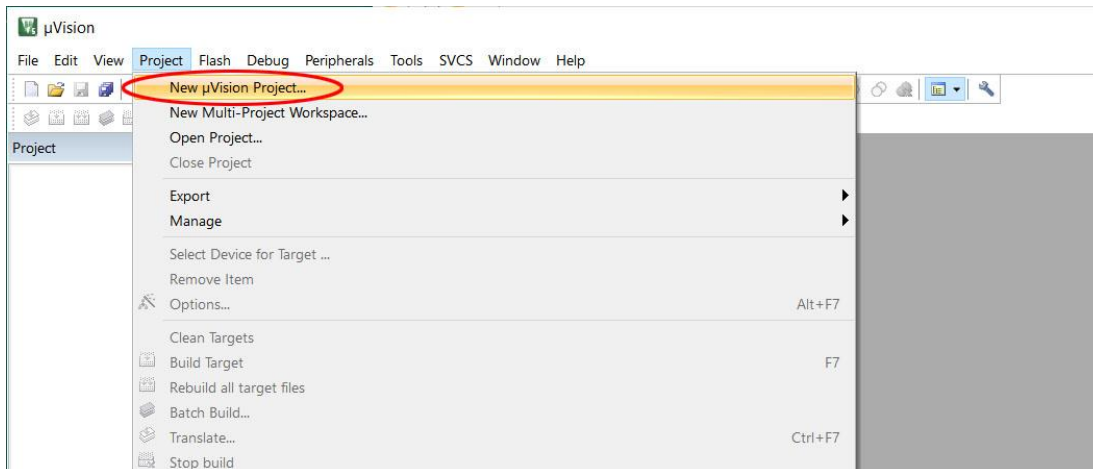
3. In the "Create New Project" dialog box, browse to a folder location where you would like to create your project folder, click "New folder".

4. Type in a folder name, for example, we chose "blinky" for the folder name here, then click the "Open" button. This will create a folder named "blinky" to hold all the files for the new project. It will also take you inside that folder.
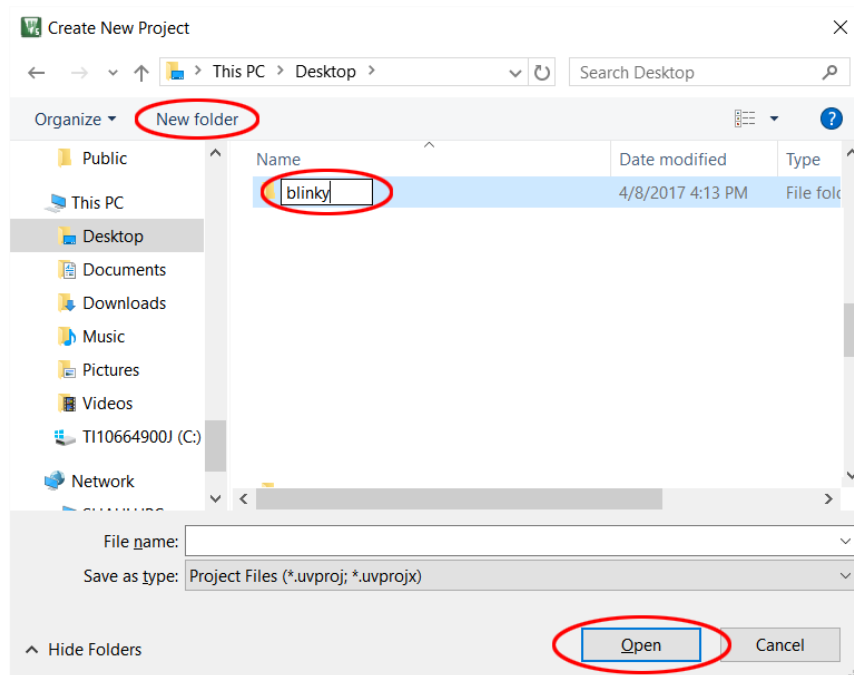

5. While in the project folder, type "blinky" in the File name field and click "Save" button. This creates a project with the project named "blinky". Although we used the same name for the project folder and the project, they do not have to be identical.
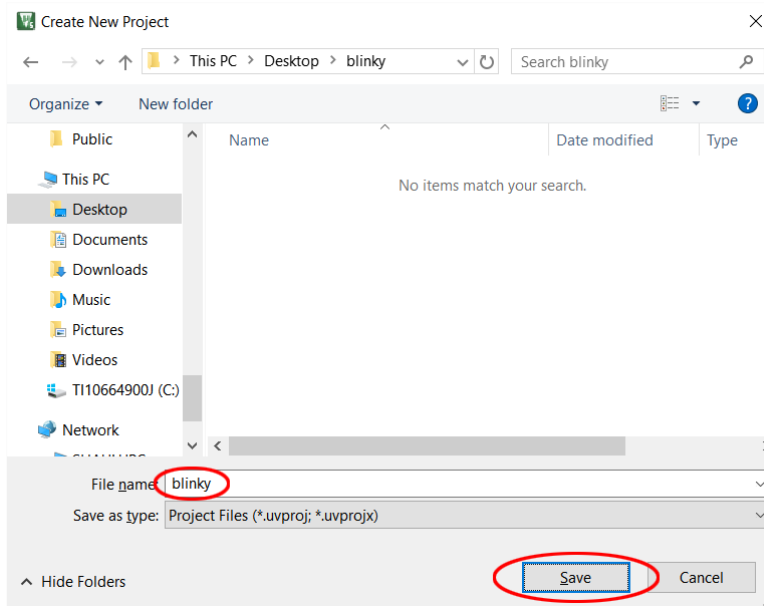
6. The Project Wizard will prompt you to select the device type for the project target device. If you already installed the device software pack for STM32F446, skip to step 10. If you have not installed the device software pack for STM32F446 yet, this will be the time to do so. Click on the Pack Installer button to launch the software pack installation.
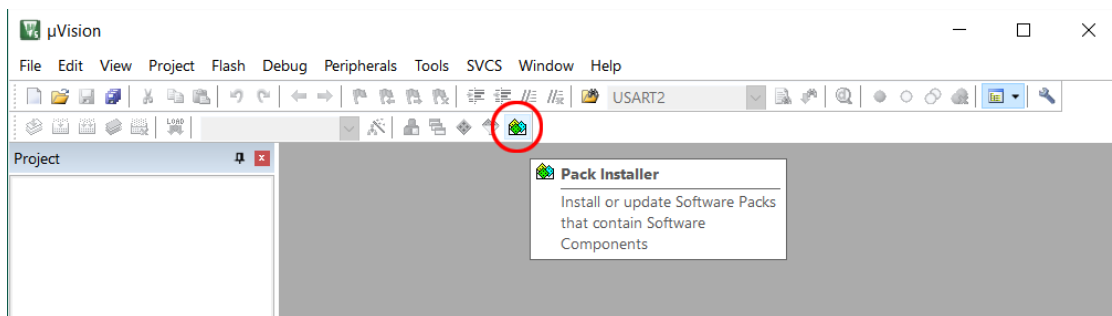

7. Select "Devices" tab and drill down to find "STM32F446", click on that device name and "Keil::STM32F4xx_DFP" will appear on the right panel "Packs" tab. In the "Action" column, click on the "Install" button. The software pack will be downloaded, built, and installed. This may take some time. If ARM::CMSIS and Keil::ARM_Compiler have update available (the Action has a yellow diamond with Update), click them.
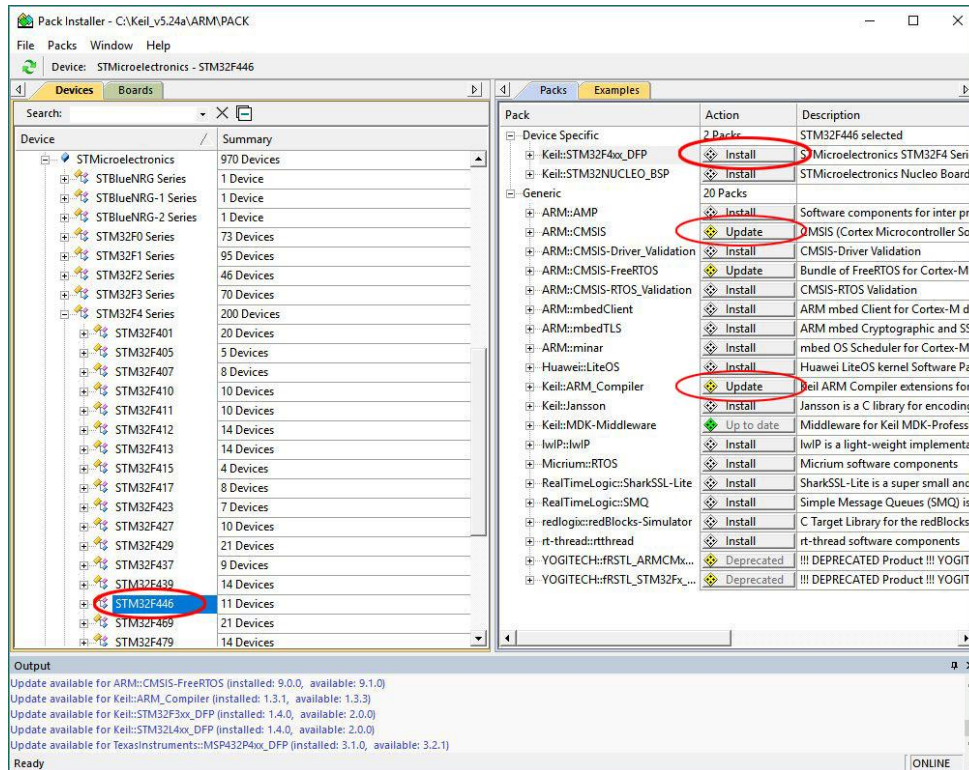
8. When the installation of the software pack is complete, the "Install" button changes to "Up to date" and the icon turns from grey to green.
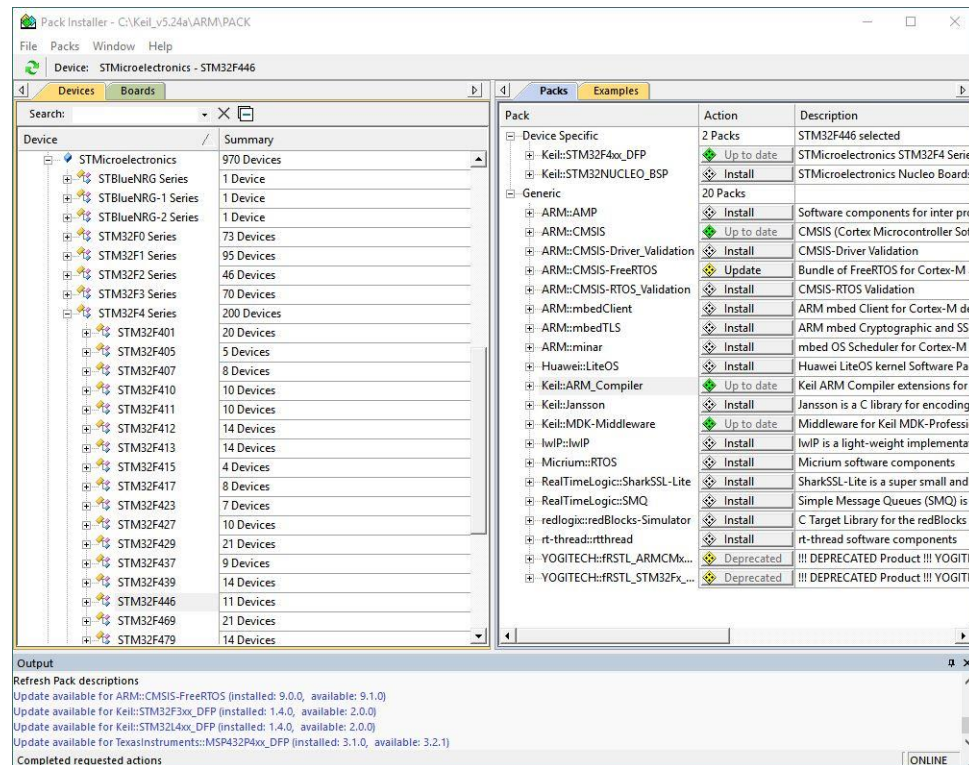
9. Dismiss the "Pack Installer" window. A confirmation dialog box will pop up. Click "Yes" to close it.
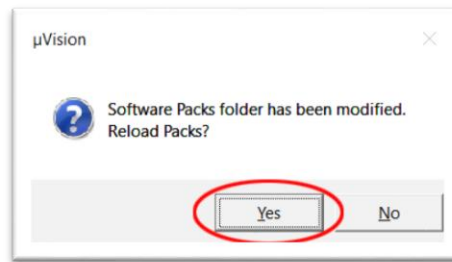
10. You may drill down the device family tree to find "STM32F446RETx". If a large number of devices software packs were installed in your computer, it may take a while to find the device in the family trees. In that case, type in a unique substring of the device name in the "Search" field and the matching devices will appear in the window below. Click select the device type then click "OK" button.
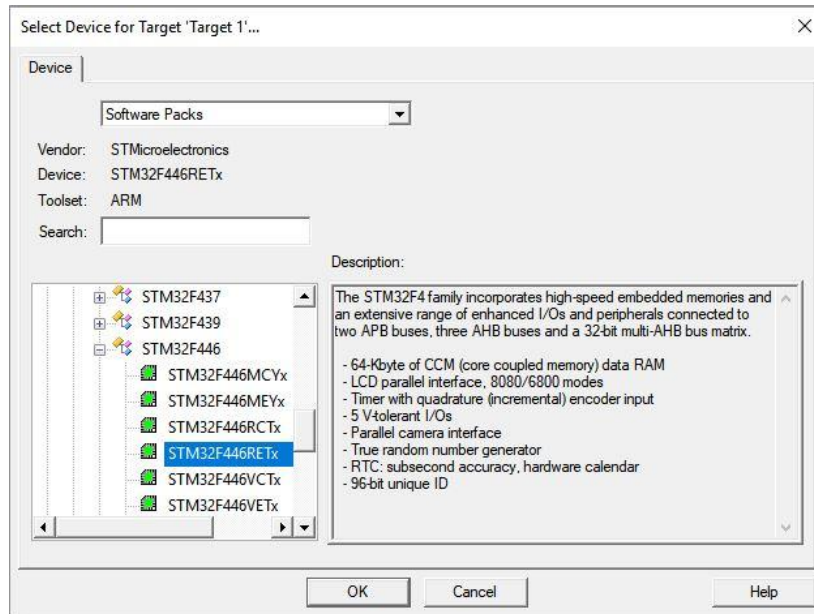

11. Next, the Project Wizard will help you manage the run-time environment. Expand the Software Component selections, check "CMSIS>CORE" and "Device>Startup" then click "OK" button.
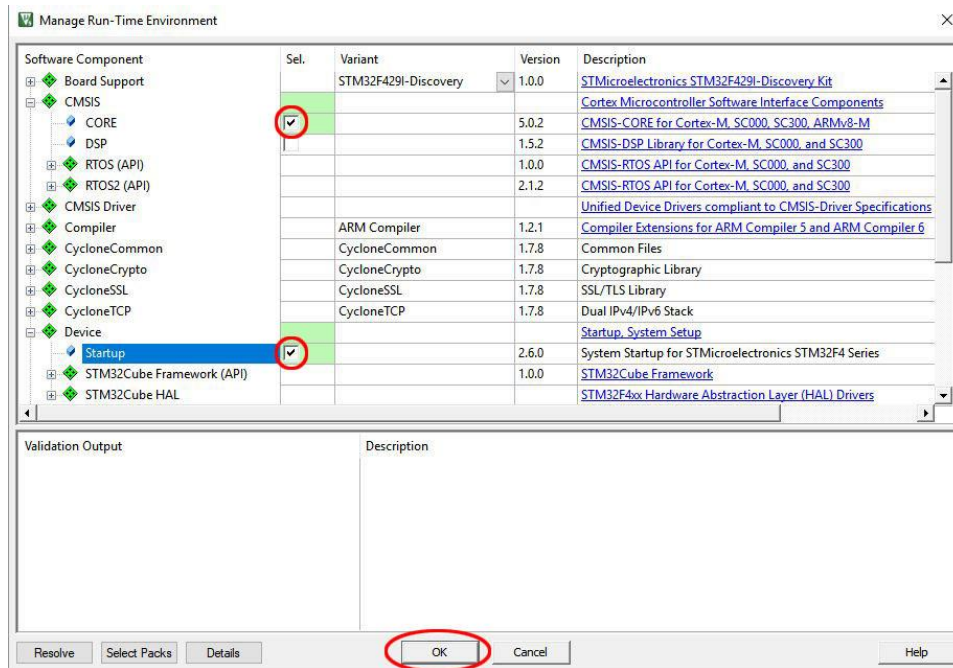
12. You should see a project with a target created in the Project pane. If you click the + signs to open the target, you would see the CMSIS and startup codes for the specific device were created in the project.
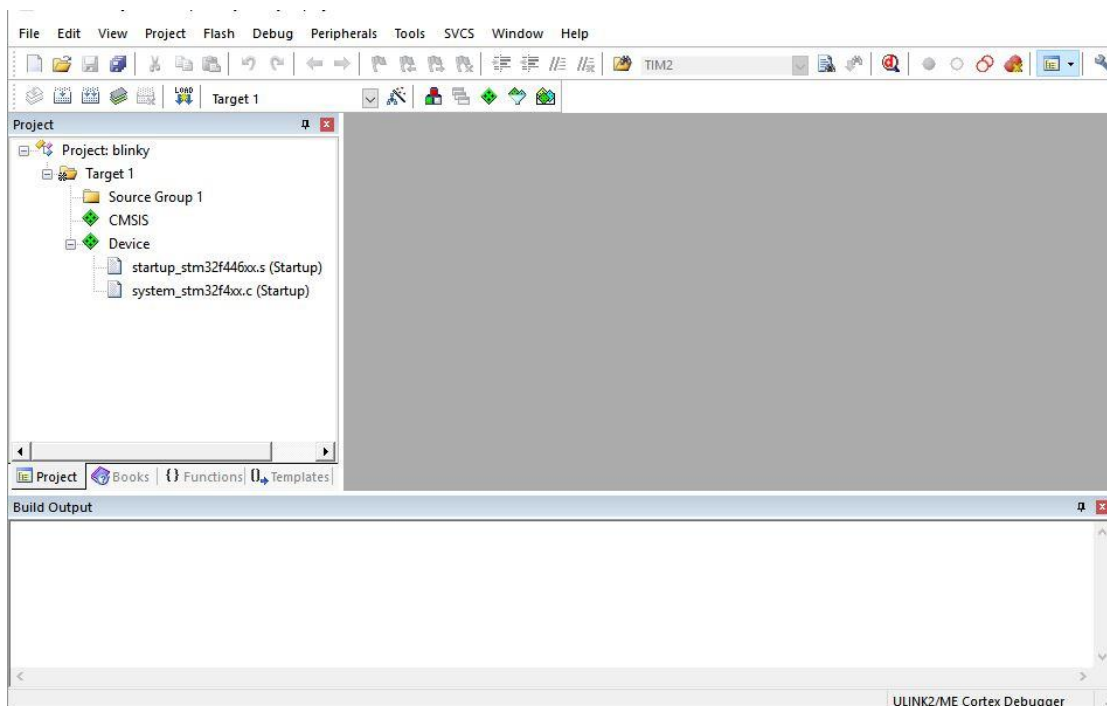
13. Click "New" button for a new text file in the editing window.
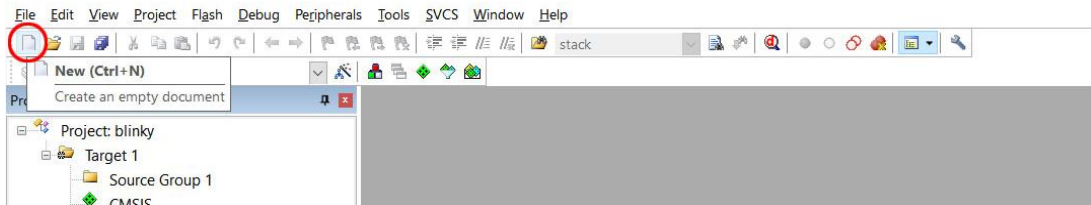
14. Copy the code below into the new text file window. This is a simple program to blink the LD2 (green LED) on the Nucleo-F446RE board.

```c
/* use delay loop, 1 sec on 1 sec off
 * default 16 MHz clock
 * LD2 connects to PA5
 */

#include "stm32f4xx.h"

void delayMs(int n);

int main(void) {
    RCC->AHB1ENR |=  1;                 /* enable GPIOA clock */

    GPIOA->MODER &= ~0x00000C00;    /* clear pin mode */
    GPIOA->MODER |=  0x00000400;    /* set pin to output mode */

    while(1) {
        GPIOA->BSRR = 0x00000020;   /* turn on LED */
        delayMs(500);
        GPIOA->BSRR = 0x00200000;   /* turn off LED */
        delayMs(500);
    }
}

/* 16 MHz SYSCLK */
void delayMs(int n) {
    int i;
    for (; n > 0; n--)
        for (i = 0; i < 3195; i++) ;
}
```
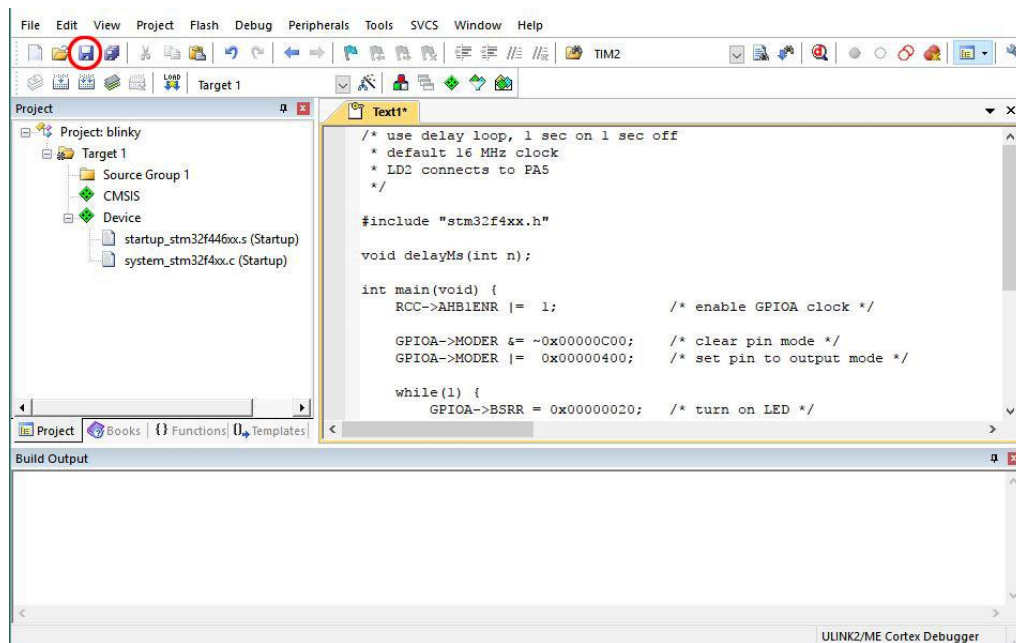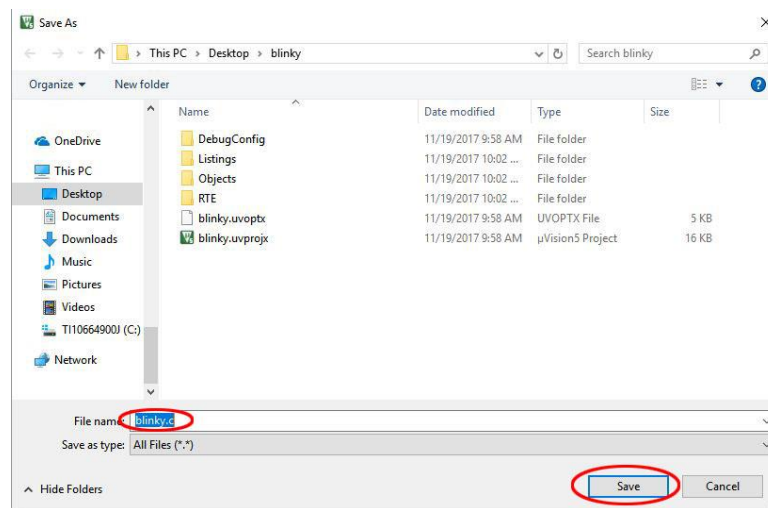
15. Click "Save" button to save the file with the code. By default the file will be saved in the project folder.

16. Give the file name "blinky.c" and click "Save" button. The editor is context sensitive. Once you make it a C source file, the file content will change the color.
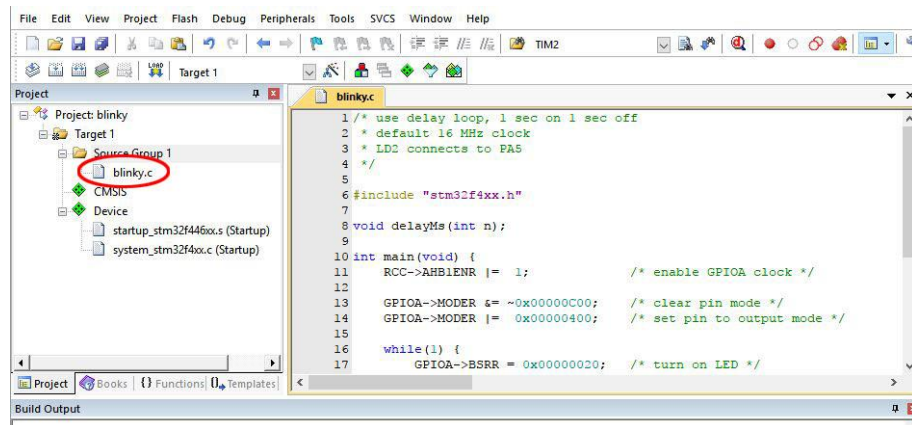

17. Once the source file is saved, it needs to be associated with the project. Right click on "Source Group 1" and select "Add Existing Files to Group 'Source Group 1'…".
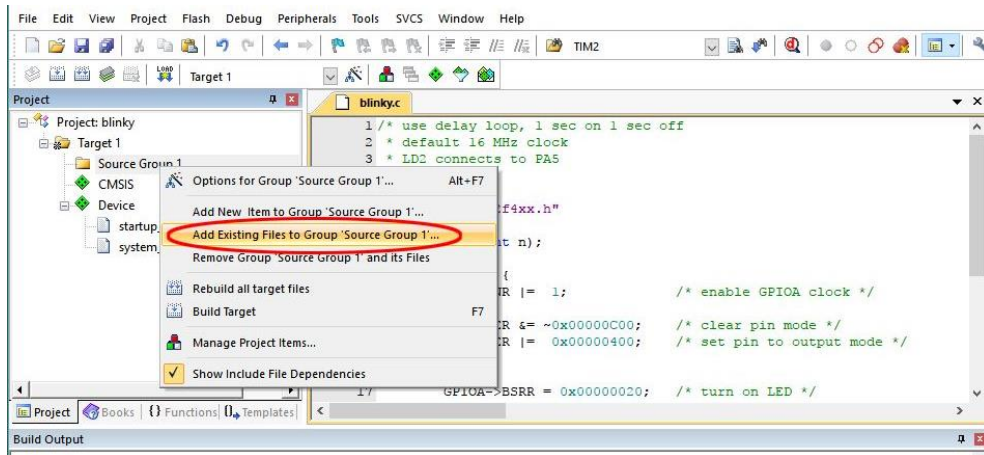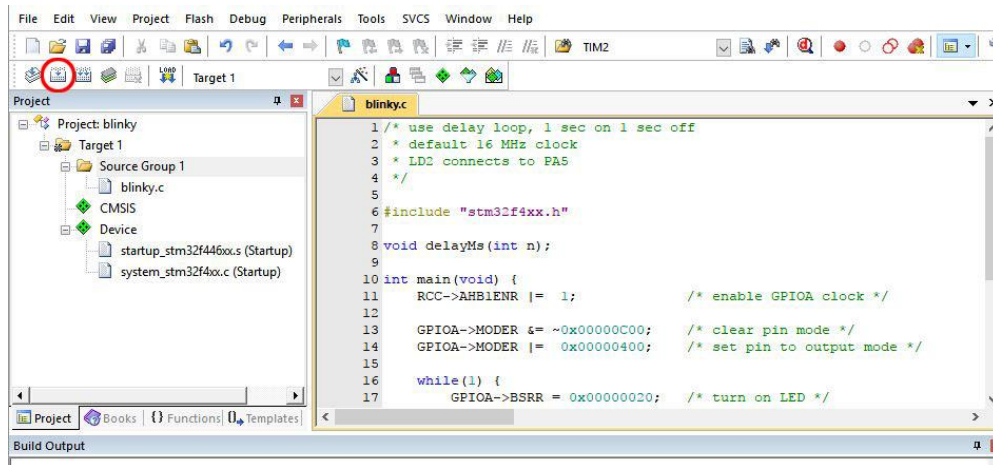
18. Locate the file blinky.c, click select it then click the "Add" button. Click "Close" button to proceed.
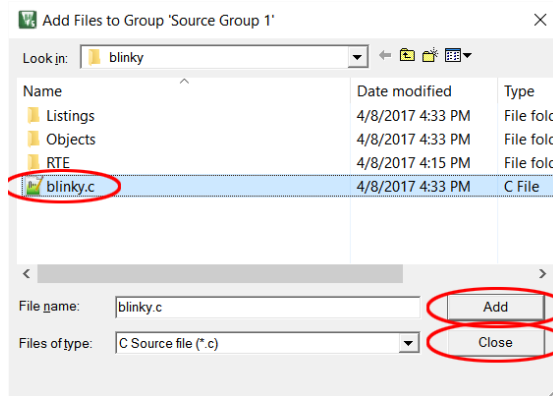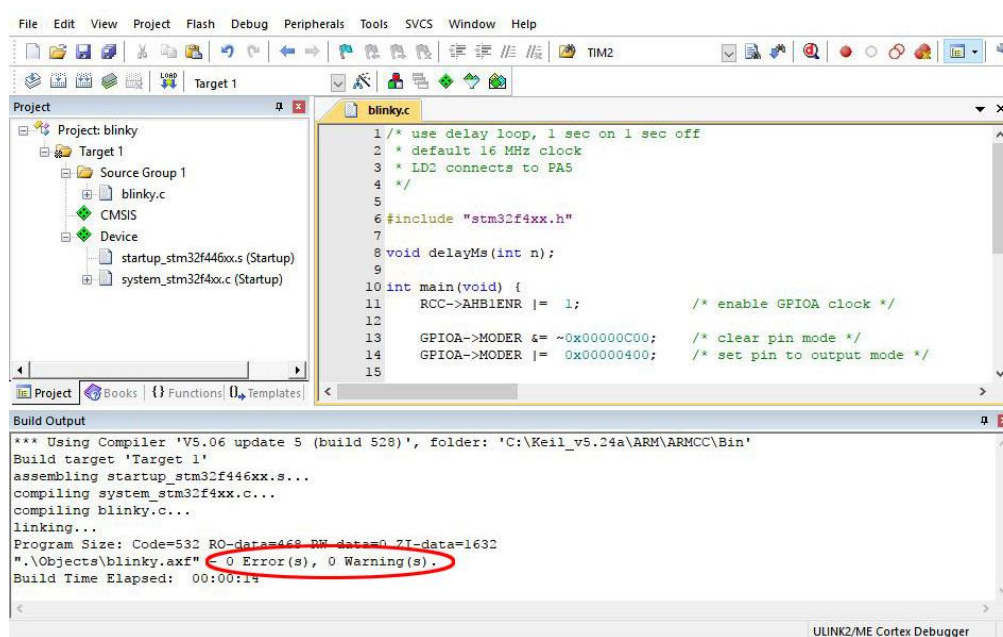

19. Once the file is added to the project, it will appear under "Source Group 1".

20. Click "Build" button to build the project.

21. You should get a clean build with this project with 0 Error and 0 Warning.


22. Once the project is built, we need to configure the debug interface so that the program may be downloaded to the target. Make sure the Nucleo-F446RE board is connected to the computer with the USB cable. It may take a moment for the device driver to load.

23. Click "Options for Target…" button.
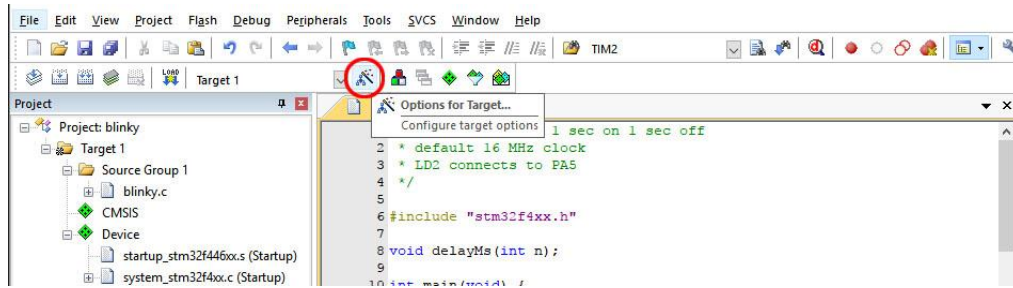
24. Select Debug tab. Click the radio button before "Use:". Click the pull-down menu on the right and select "ST-Link Debugger".
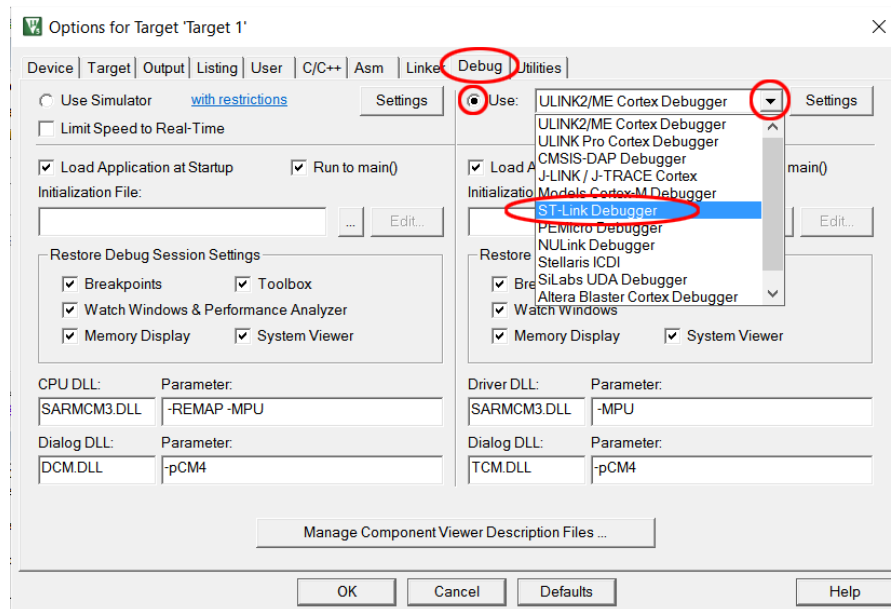

25. Click on **Settings** next to the newly selected ST-Link Debugger. *You must visit the **Settings** dialog box for the debugger to make the proper connection for each new project created.*


26. In the next dialog box, make sure ST-LINK is showing in the Unit of Debug Adapter and there is a Serial Number showing. Pull down the Port: and select "SW" if "SW" is not already selected. If the board is properly connected to the computer, the SW Device information should be filled with an IDCODE. Click "OK" button to close it then click "OK" button to close the Options dialog box.
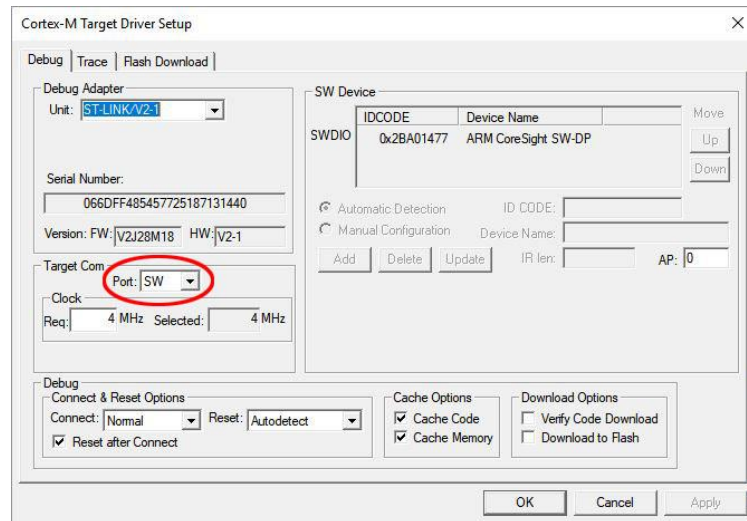
27. The selected debug interface should appear at the lower right corner. Click on the "Start/Stop Debug Session" button to launch the debugger.
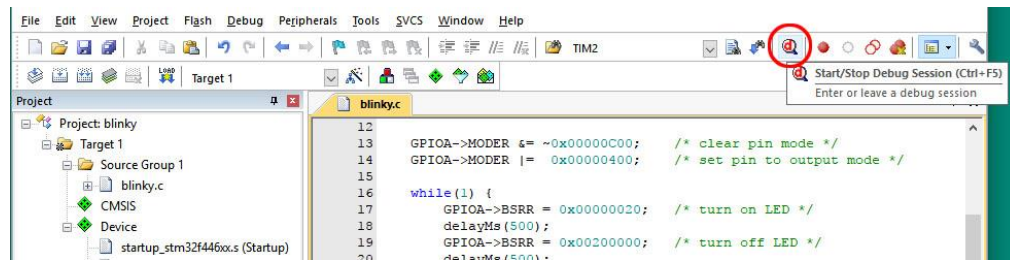

28. It should start to program the target device. The programmer progress bar appears at the bottom of the window. When done, the message should appear in the Build Output pane. If you are using the evaluation version of the Keil uVision, a warning message of the code size limitation will pop up after the target device is programmed. Click "OK" to close the size warning message dialog box.
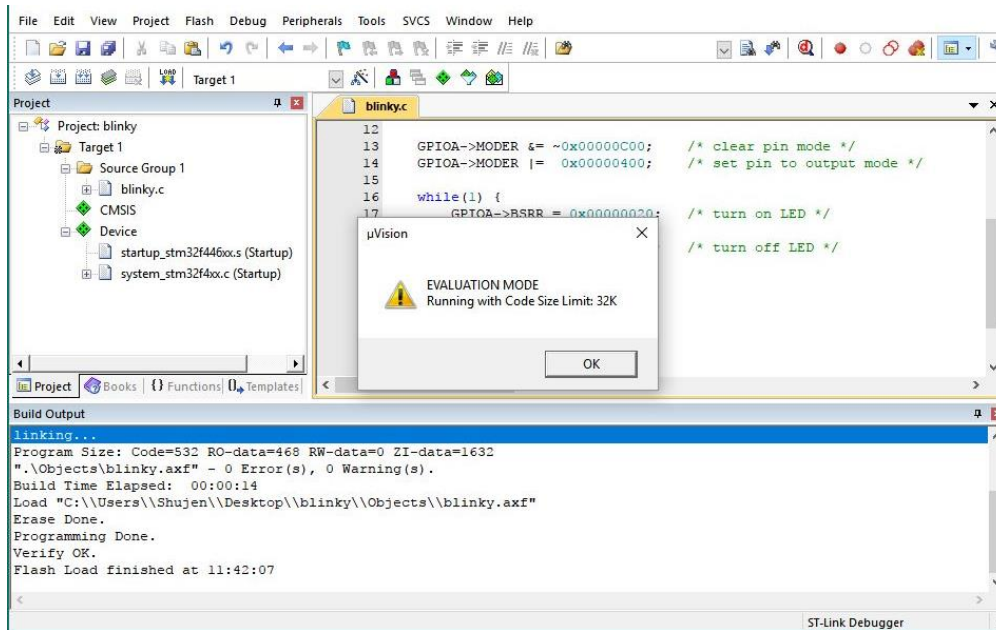
29. The uVision IDE should change to the debug perspective. Click "Run" button and the program will start running and the LD2 blinks.
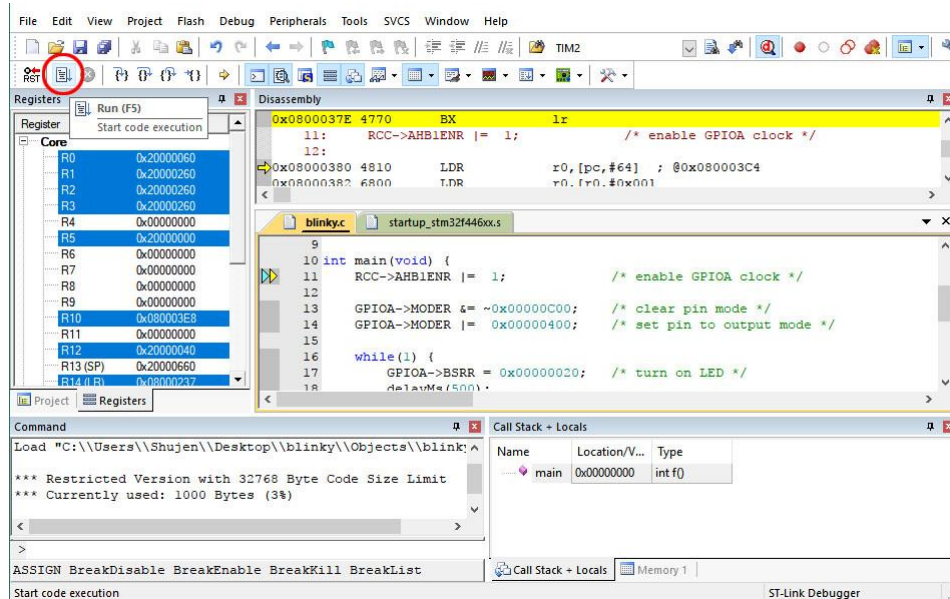
30. To stop the debug session and return to the build project perspective, click on the "Start/Stop Debug Session" button.
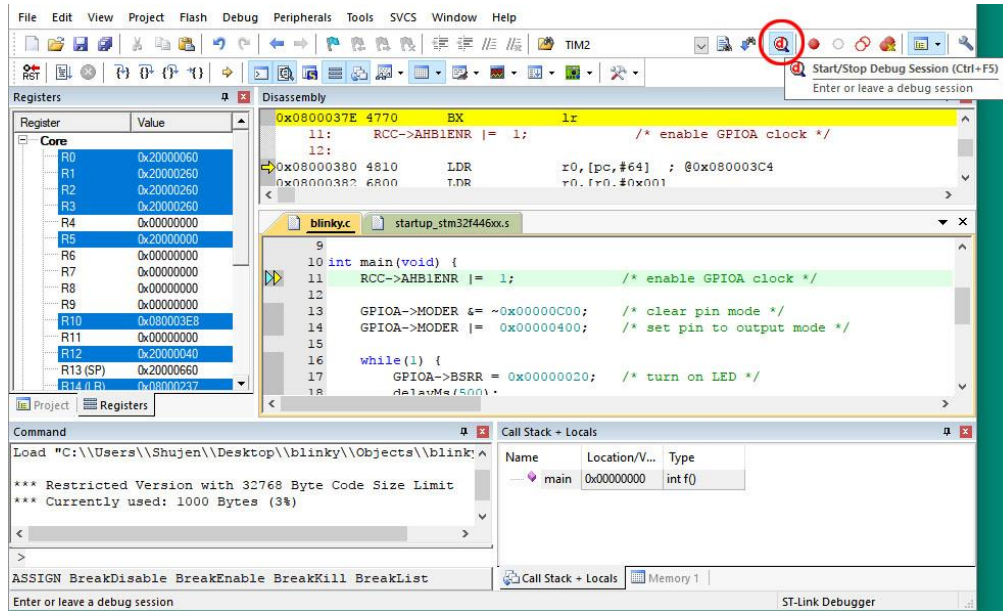
31. Congratulations! You have successfully finished the first programming project for Nucleo-F446RE board using Keil MDK v5 uVision IDE!