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Klein Embedded

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April 27, 2022

C++ and STM32CubeMX code generation

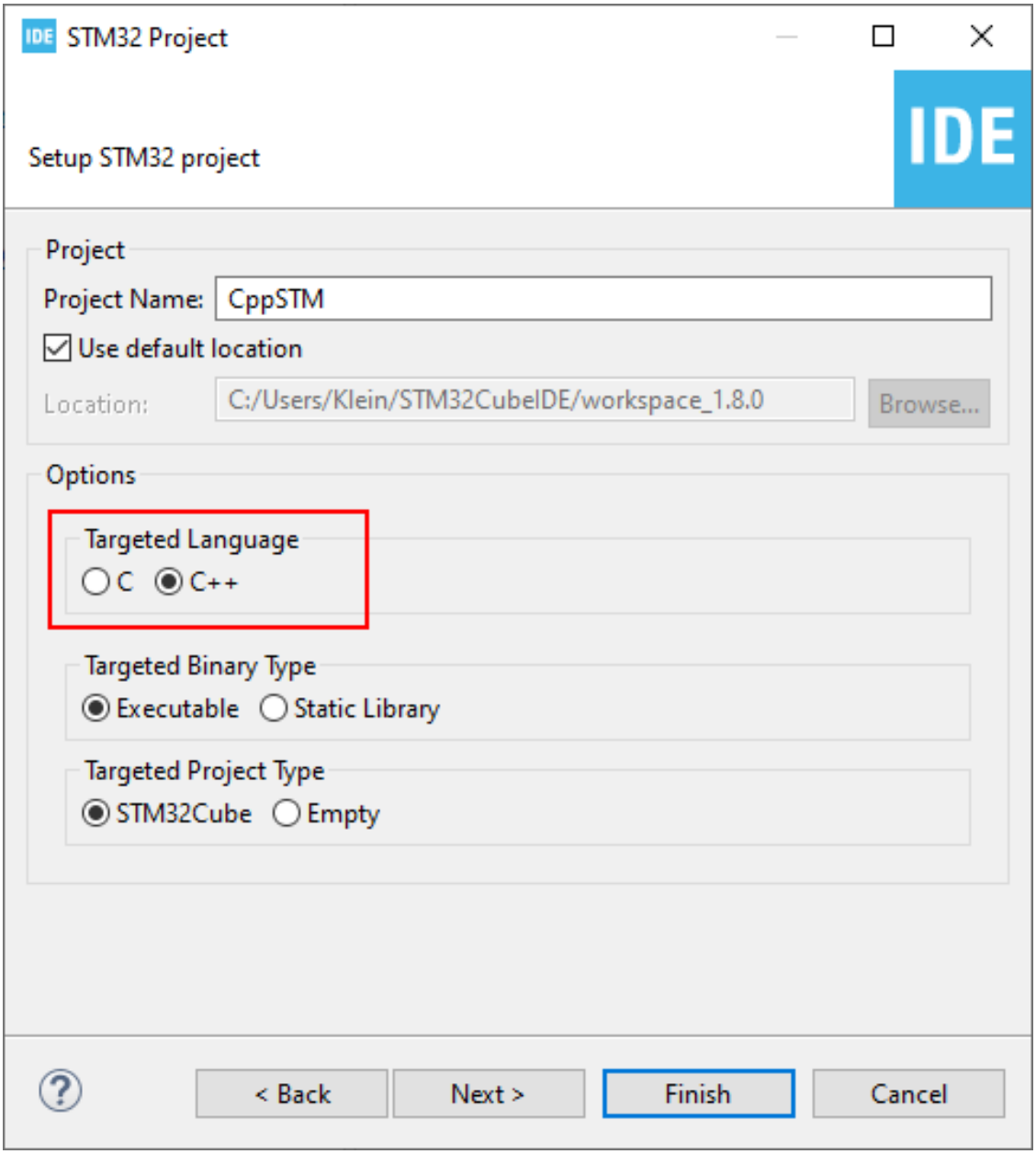
I spend most of my time writing C code for STM32 microcontrollers. I have recently considered writing more code in C++, mainly for easier implementation of various design patterns and especially for using abstract classes for dependency injection when writing testable modules/classes.

However, when using STM32CubeMX to generate hardware initialization code, there is no option to use C++ instead of C. Mostly this is not a concern, since nearly all C code is also valid C++ code, so there is no problem including the generated C code in your C++ application code. However, CubeMX also generates a `main.c` file where all the hardware initialization functions are called. Since we might want to add some additional initialization code in C++, we would rather have a `main.cpp` file. You can try simply renaming the file, but the next time you make any changes in CubeMX and run the code generator, a new `main.c` file will be generated and `main.cpp` will remain untouched.

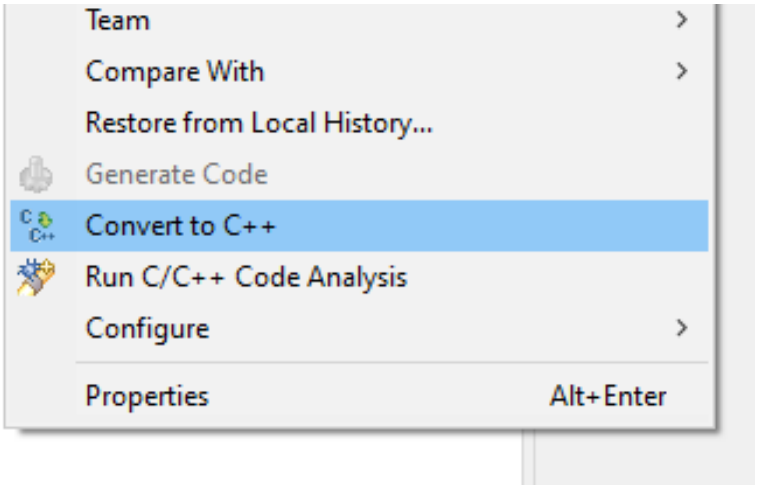
I have seen people suggest renaming `main.cpp` to `main.c` before generating code and then renaming it back to `main.cpp` afterwards, which doesn't seem like a sustainable solution. Below I'll present a simple workaround.

Create a C++ project or convert an existing C project in STM32CubeIDE

Create a new STM32 project by navigating to **File > New > STM32 Project**. Select your desired MCU or development board. When you get to the following screen, make sure to select C++ as the targeted language:

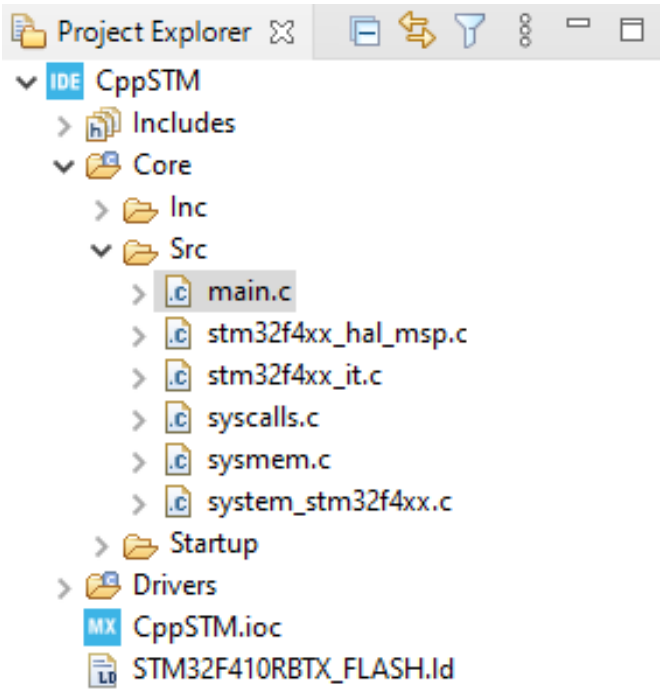


If you have an existing C project that you want to convert to C++, right click your project in the Project Explorer and select “Convert to C++”:



As far as I can tell, this simply adds the g++ compiler to your project toolchain.

After creating the project you will notice that a `main.c` file has been generated instead of `main.cpp`:



Instead of the silly renaming before and after running CubeMX, a simple workaround is to create an alternate main function in C++ but with C calling convention. Let's name it alt_main(). We can then call this function from `main.c` inside a `USER CODE BLOCK`. This way CubeMX can still generate code in `main.c`, but you can use the `alt_main()` function as the entry point for your C++ application.

An alternate main() function

First we will create the header file for our alternate main function:

alt_main.h

```
#ifndef ALT_MAIN_H_
#define ALT_MAIN_H_

#ifdef __cplusplus
extern "C"
{
#endif

int alt_main();

#ifdef __cplusplus
}
#endif

#endif
```

If we include the header from a C++ file, we see that the function declaration gets wrapped in an `extern "C"` block, ensuring that the function is called using C calling convention. If we include it from a C file, it just looks like a regular C function.

Next we will create the source file:

alt_main.cpp

```
#include "alt_main.h"

int alt_main()
{
    /* Initialization */

    while (1)
    {
        /* Super loop */
```

```
    }
}
```

Notice that this is a `.cpp` file, so we can write all the C++ code we want in here.

Next, we will call `alt_main()` from within a `USER CODE BLOCK` in `main()` *before* the super loop:

```
int main(void)
{
  /* USER CODE BEGIN 1 */

  /* USER CODE END 1 */

  /* MCU Configuration--------------------------------------

  /* Reset of all peripherals, Initializes the Flash interfa
  HAL_Init();

  /* USER CODE BEGIN Init */

  /* USER CODE END Init */

  /* Configure the system clock */
  SystemClock_Config();

  /* USER CODE BEGIN SysInit */

  /* USER CODE END SysInit */

  /* Initialize all configured peripherals */
  MX_GPIO_Init();
  MX_USART2_UART_Init();
  /* USER CODE BEGIN 2 */

  /* USER CODE END 2 */

  /* Infinite loop */
```

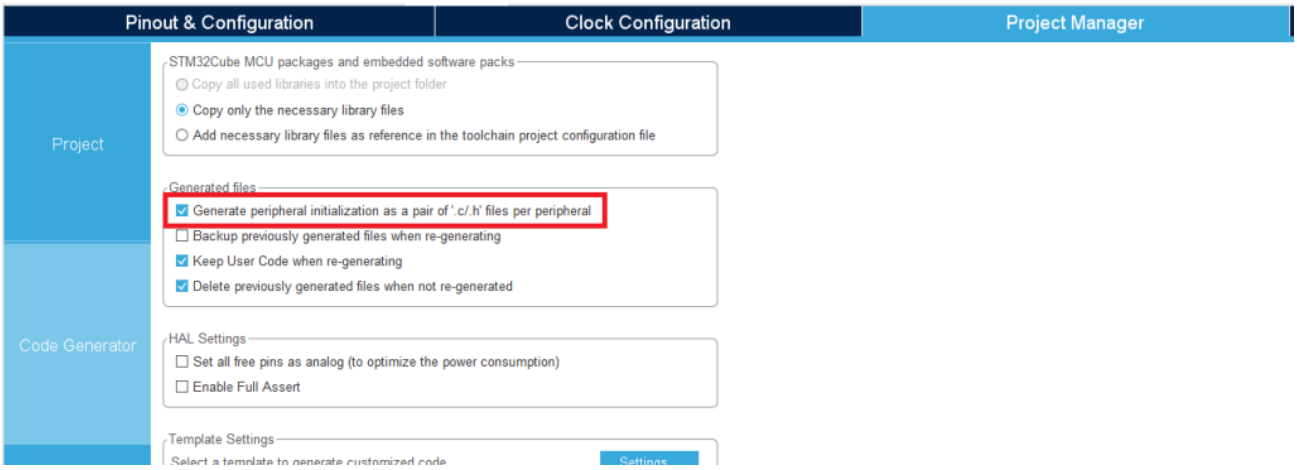
```
  /* USER CODE BEGIN WHILE */
  alt_main(); // Contains our super loop, so the while loop

  while (1)
  {
    /* USER CODE END WHILE */

    /* USER CODE BEGIN 3 */
  }
  /* USER CODE END 3 */
}
```

That's it! Now you can just let CubeMX handle `main.c` and you can add your own code in `alt_main.cpp`.

Using the global peripheral handles

Lastly, if you are using the default CubeMX settings, all handles for the initialized peripherals will be defined globally in `main.c`. For example, if you initialize SPI1 in CubeMX, `SPI_HandleTypeDef hspi1` will appear in the "Private variables" section in `main.c`. If you want to use this handle in `alt_main.cpp`, you'll have to declare it `extern` in that file. This gets a bit messy if you have a lot of peripherals.

Instead, you can configure CubeMX to generate a separate header and source file for each type of peripheral. In CubeMX go to **Project Manager > Code Generator** and check the box "**Generate peripheral initialization as a pair of '.c/.h' files per peripheral**":



Now you can simply `#include "spi.h"` where all SPI handles are declared.

4 thoughts on “C++ and STM32CubeMX code generation”

Ran. says:
November 21, 2022 at 12:55

> Thank you very much, it helped.
> Especially the “Convert to C++” and the idea to run my alternate main().
>
> Reply

Kristian Klein-Wengel says:
November 21, 2022 at 20:11

> I’m glad to hear you found it useful.
>
> Reply

Alex says:
December 29, 2022 at 17:35

Hi! Every .cpp file is compiled using g++. There is a way to switch compiler to main.c file so it will be treated as .cpp file.
Right click on main.c -> Properties -> C/C++ Build -> Settings-> Command. Instead of gcc use g++

Reply

PlagueMen says:
February 20, 2023 at 19:01

Check last comment https://shawnhymel.com/1941/how-to-use-c-with-stm32cubeide/

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