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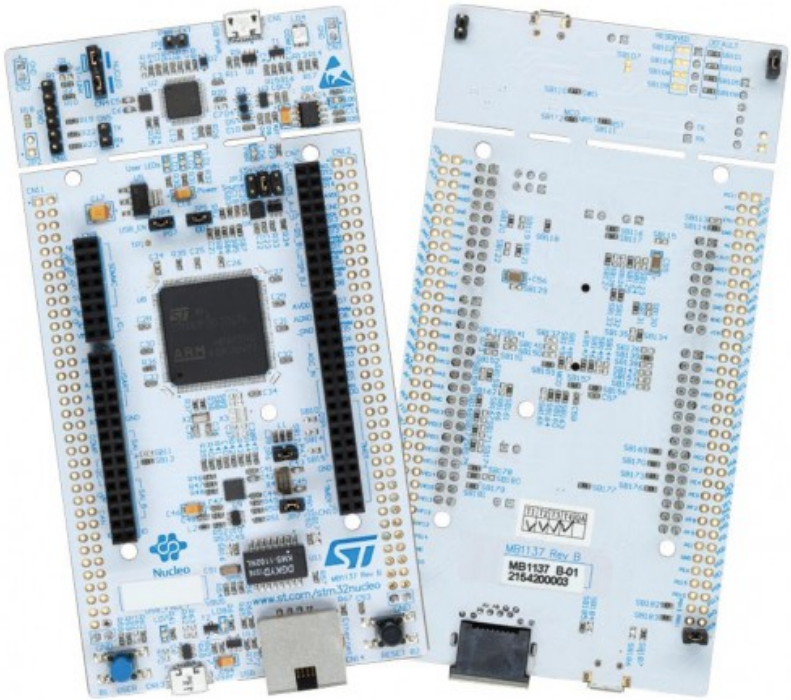
núcleo de estudantes de engenharia eletrónica industrial e computadores da universidade do minho

ESRG
EMBEDDED SYSTEMS RESEARCH GROUP

# STM 32 F767ZI

## TOOLS SET UP AND BASIC CONCEPTS



ÁLVARO CASTRO LEITE
DEC 2021

# Requirements

Computer with Windows OS

Internet connection

10 Gb of free space on disk

Micro-USB cable

STM32 development board

Java Runtime Environment (JRE)

# Agenda

Skill level: Beginner

Why STM32?

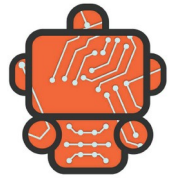
Choosing the IDE

What tools are needed?

ST-LINK/V2

Keil MDK-ARM

STM32CubeMX



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# Agenda

Skill level: Beginner

Create the first Project

Compile the program and Flash the board

Terminal

File Tree

Resources

Conclusion

# Why STM32?

- 32 bits professional development board
- Cheap to buy and develop with
- Same toolchain and API through all ranges of products
- Cross compatibility
- Lots of documentation
- And much much more…

# Choosing the IDE

During the course we will use the Keil ARM IDE as our main IDE. However there are other alternatives that you may consider using in the future.

The decision to use the Keil ARM IDE was made based in your past experiences, and in the well known performance achieved by those IDE.

A recent alternative for non Windows OS, is the STM32CubeIDE, if you want use that IDE, you must assume all responsibility about that. You can find a installation guide at this link: https://bit.ly/330GSHS

If you want to install the Keil continue to the next slide, if you want to install STM32CubeIDE jump to slide 26.

# What tools are needed?

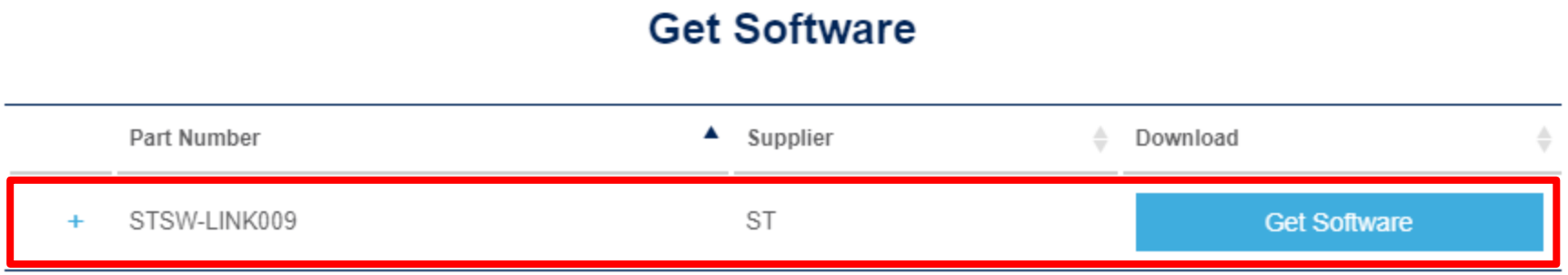
- ST-LINK/V2: It's a ST tool that provides capabilities to load code to the board and on-chip debug functionalities.
- STM32CubeMX: It has a graphical software configuration tool that allows the generation of C initialization code using graphical wizards. And it makes developers' lives easier by reducing development effort, time and cost.
- Keil ARM: It's an IDE that combines project management, run-time environment, build facilities, source code editing and program debugging in a single powerful environment.

# ST-LINK/V2

The ST-LINK/V2 is an in-circuit debugger and programmer for the STM8 and STM32 microcontroller families. The single wire interface module (SWIM) and JTAG/serial wire debugging (SWD) interfaces are used to communicate with any STM8 or STM32 microcontroller located on an application board.

https://bit.ly/2MCx4zl

# ST-LINK/V2


Get Software
Part Number
Supplier
Download
STSW-LINK009
ST
Get Software

# ST-LINK/V2

Install it after download

If your computer has a 32 bits system use “dpint_x86.exe”

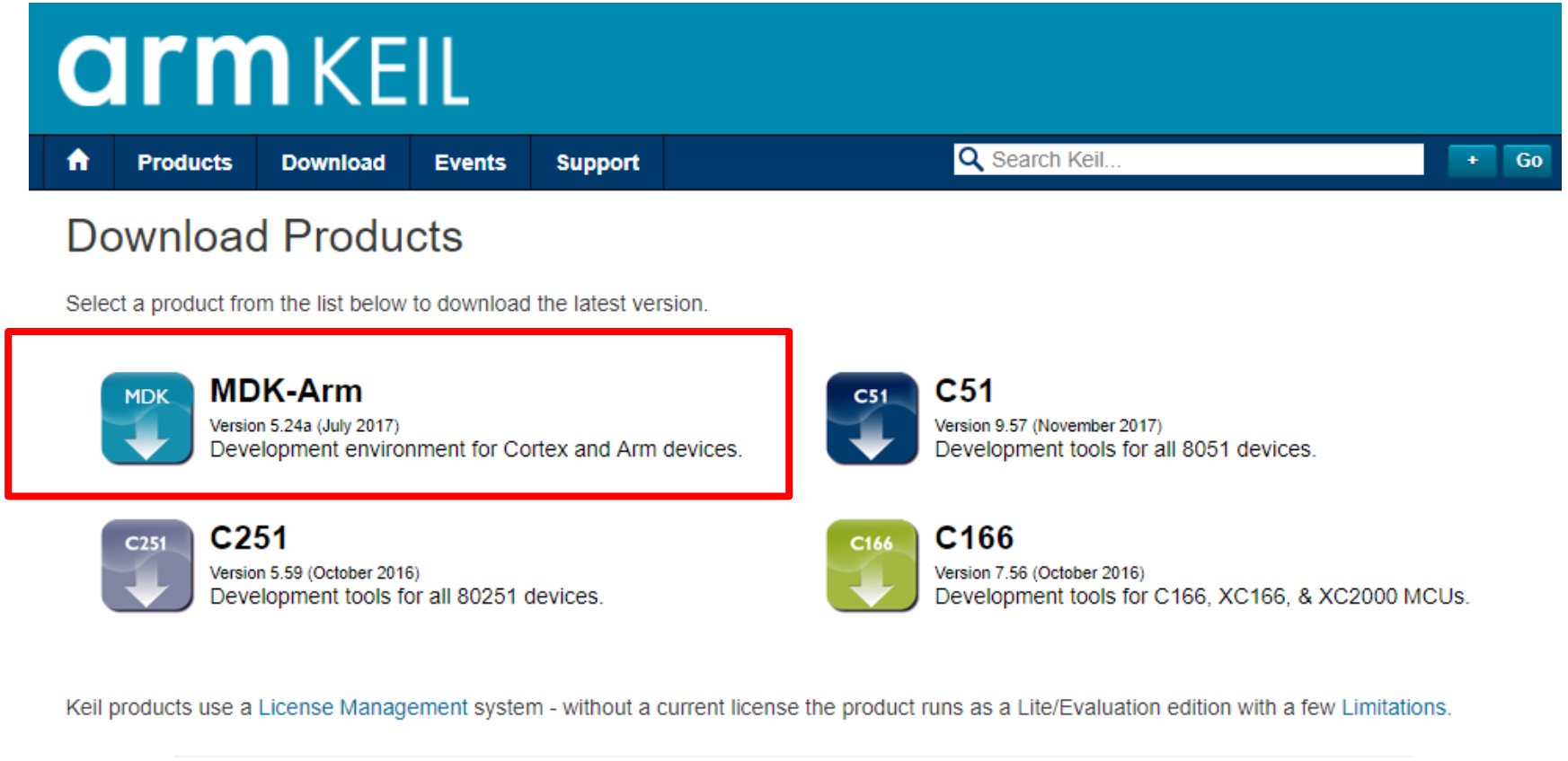
If your computer has a 64 bits system use “dpint_amd64.exe”

# Keil MDK-ARM

The MDK-ARM is a complete software development environment for Cortex™-M, Cortex-R4, ARM7™ and ARM9™ processor-based devices. MDK-ARM is specifically designed for microcontroller applications, it is easy to learn and use, yet powerful enough to deal with demanding embedded applications.

https://www.keil.com/download/product/

# Keil MDK-ARM


arm KEIL
Products
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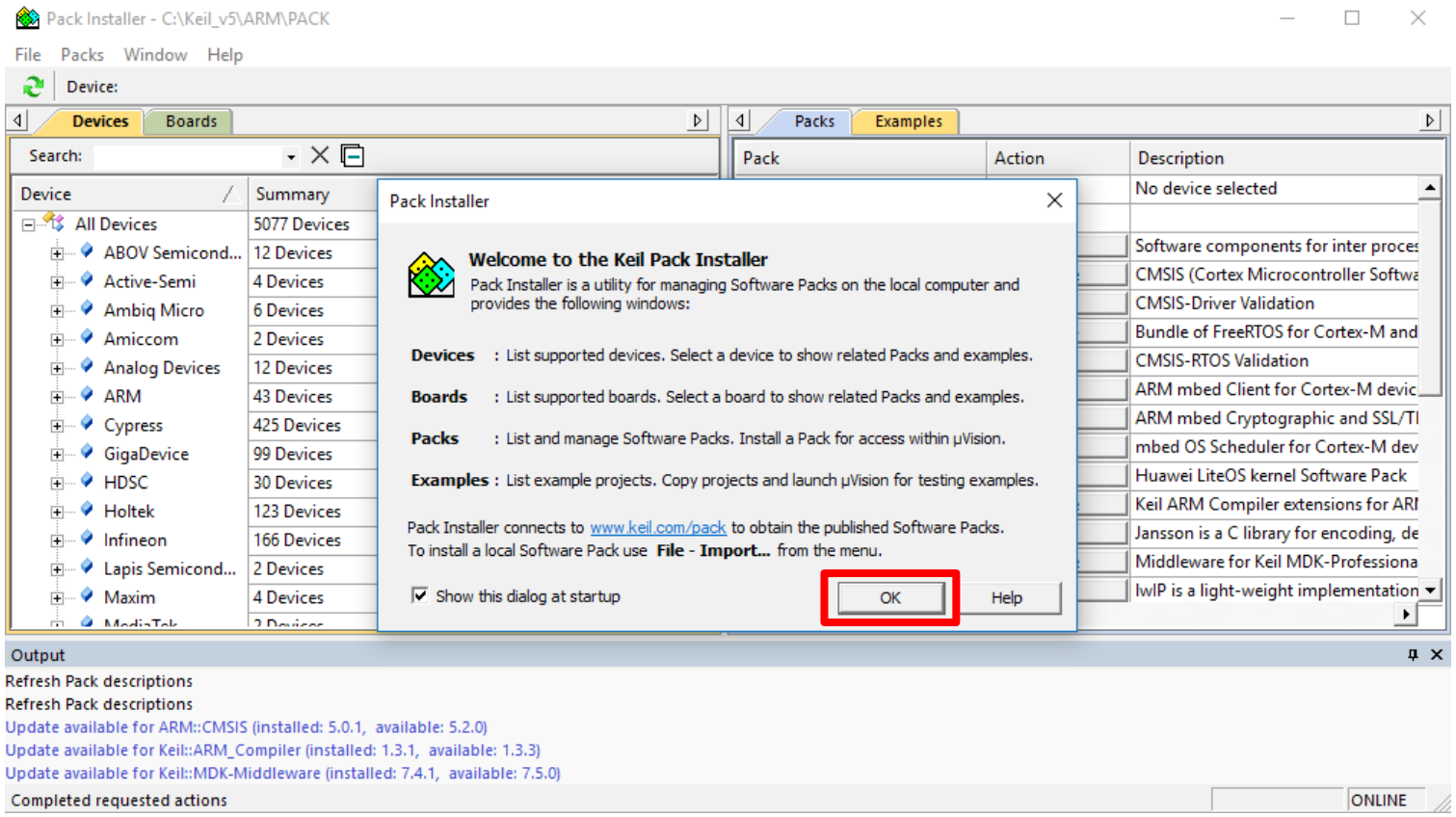
Go
Download Products
Select a product from the list below to download the latest version.
MDK
MDK-Arm
Version 5.24a (July 2017)
Development environment for Cortex and Arm devices.
C51
C51
Version 9.57 (November 2017)
Development tools for all 8051 devices.
C251
C251
Version 5.59 (October 2016)
Development tools for all 80251 devices.
C166
C166
Version 7.56 (October 2016)
Development tools for C166, XC166, & XC2000 MCUs.
Keil products use a License Management system - without a current license the product runs as a Lite/Evaluation edition with a few Limitations.

# Keil MDK-ARM

After download install it

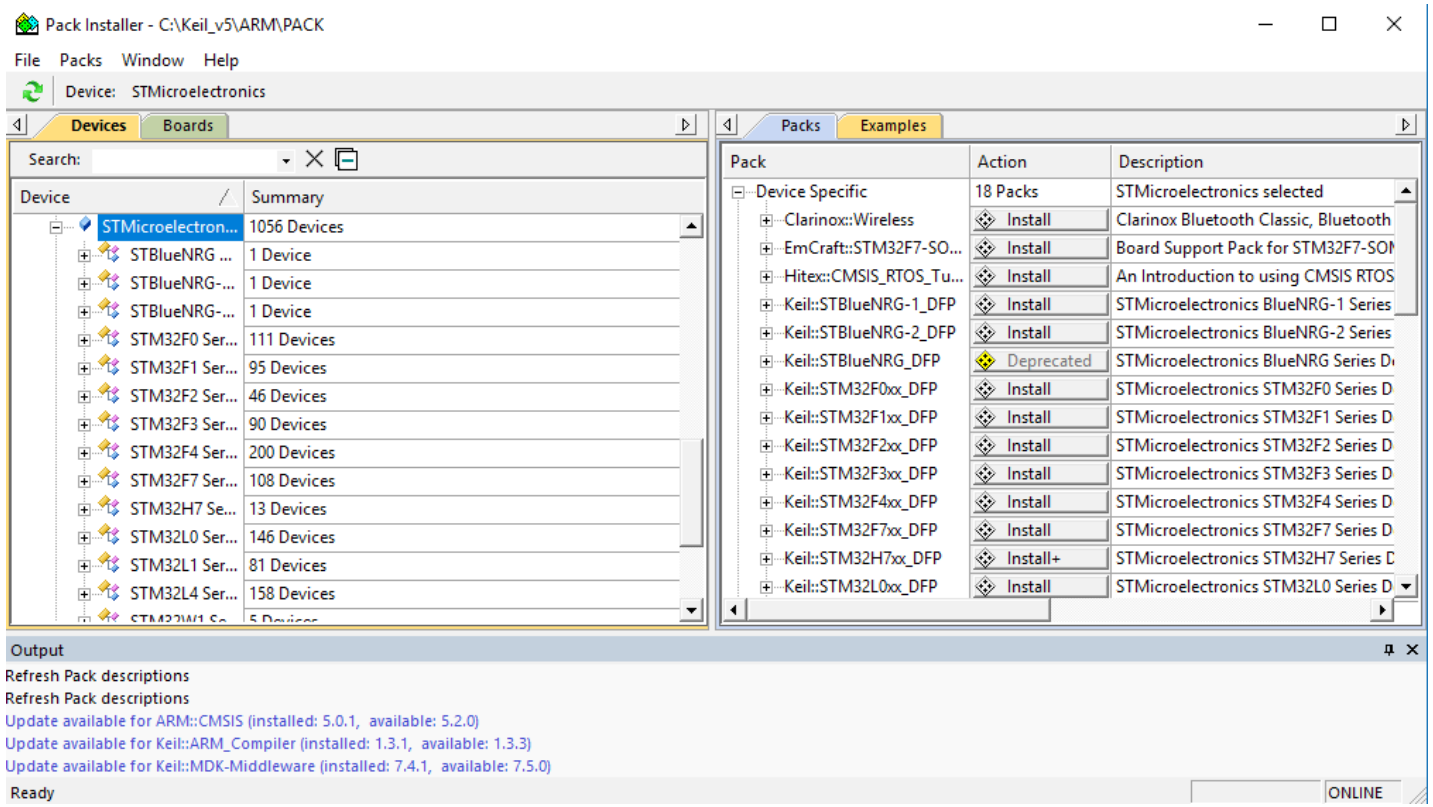
And open Keil for the first time

# Keil MDK-ARM


Pack Installer - C:\Keil_v5\ARM\PACK
File Packs Window Help
Device:
Devices Boards
Search:
Device Summary
All Devices 5077 Devices
ABOV Semicond... 12 Devices
Active-Semi 4 Devices
Ambiq Micro 6 Devices
Amiccom 2 Devices
Analog Devices 12 Devices
ARM 43 Devices
Cypress 425 Devices
GigaDevice 99 Devices
HDSC 30 Devices
Holtek 123 Devices
Infineon 166 Devices
Lapis Semicond... 2 Devices
Maxim 4 Devices
Packs Examples
Pack Action Description
No device selected
Software components for inter proces
CMSIS (Cortex Microcontroller Softwa
CMSIS-Driver Validation
Bundle of FreeRTOS for Cortex-M and
CMSIS-RTOS Validation
ARM mbed Client for Cortex-M devic
ARM mbed Cryptographic and SSL/TI
mbed OS Scheduler for Cortex-M dev
Huawei LiteOS kernel Software Pack
Keil ARM Compiler extensions for ARI
Jansson is a C library for encoding, de
Middleware for Keil MDK-Professiona
lwIP is a light-weight implementation
Pack Installer
Welcome to the Keil Pack Installer
Pack Installer is a utility for managing Software Packs on the local computer and provides the following windows:
Devices : List supported devices. Select a device to show related Packs and examples.
Boards : List supported boards. Select a board to show related Packs and examples.
Packs : List and manage Software Packs. Install a Pack for access within µVision.
Examples : List example projects. Copy projects and launch µVision for testing examples.
Pack Installer connects to www.keil.com/pack to obtain the published Software Packs.
To install a local Software Pack use File - Import... from the menu.
Show this dialog at startup
OK
Help
Output
Refresh Pack descriptions
Refresh Pack descriptions
Update available for ARM::CMSIS (installed: 5.0.1, available: 5.2.0)
Update available for Keil::ARM_Compiler (installed: 1.3.1, available: 1.3.3)
Update available for Keil::MDK-Middleware (installed: 7.4.1, available: 7.5.0)
Completed requested actions
ONLINE

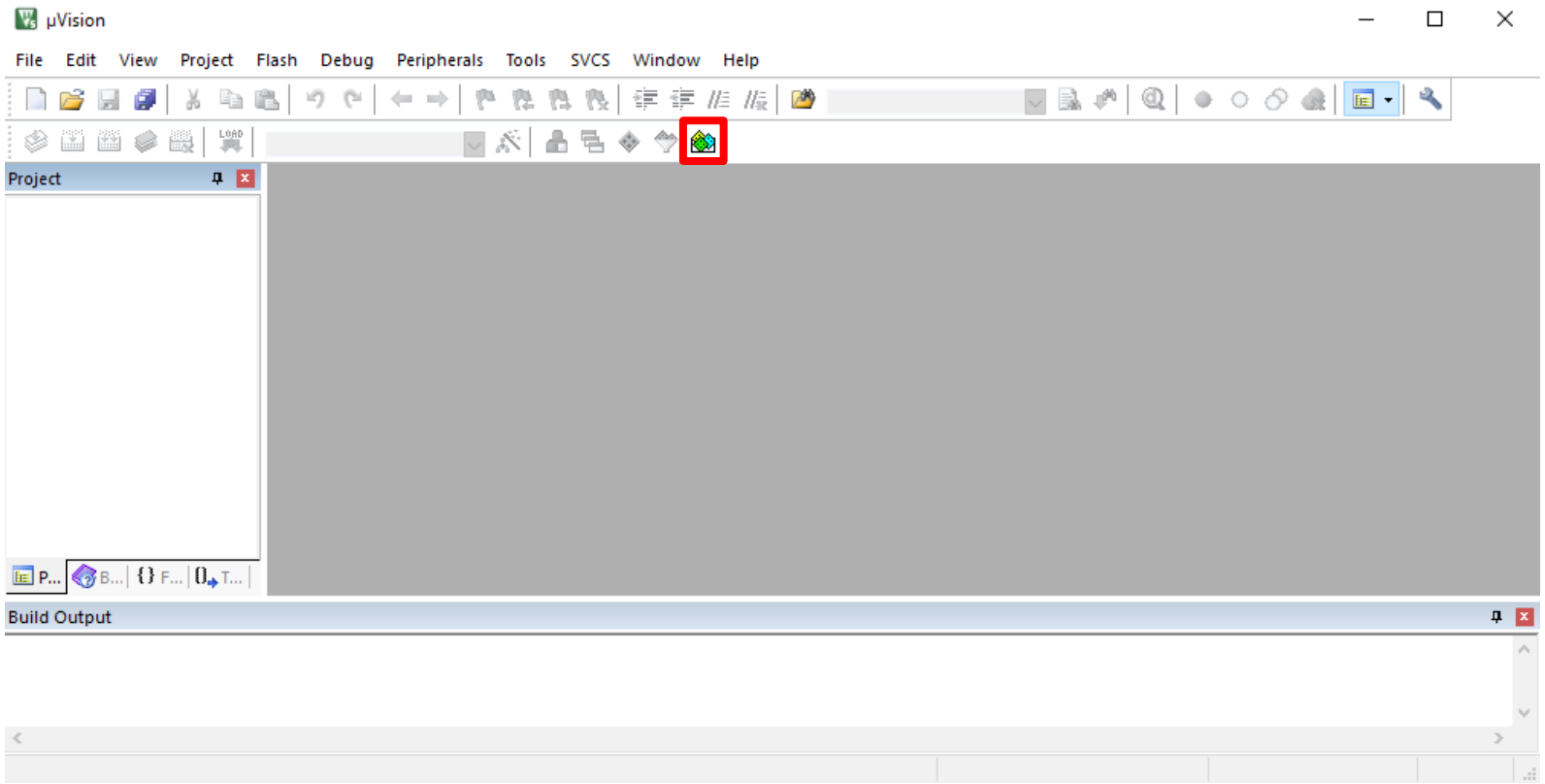
# Keil MDK-ARM

If you don’t see this menu…



# Keil MDK-ARM

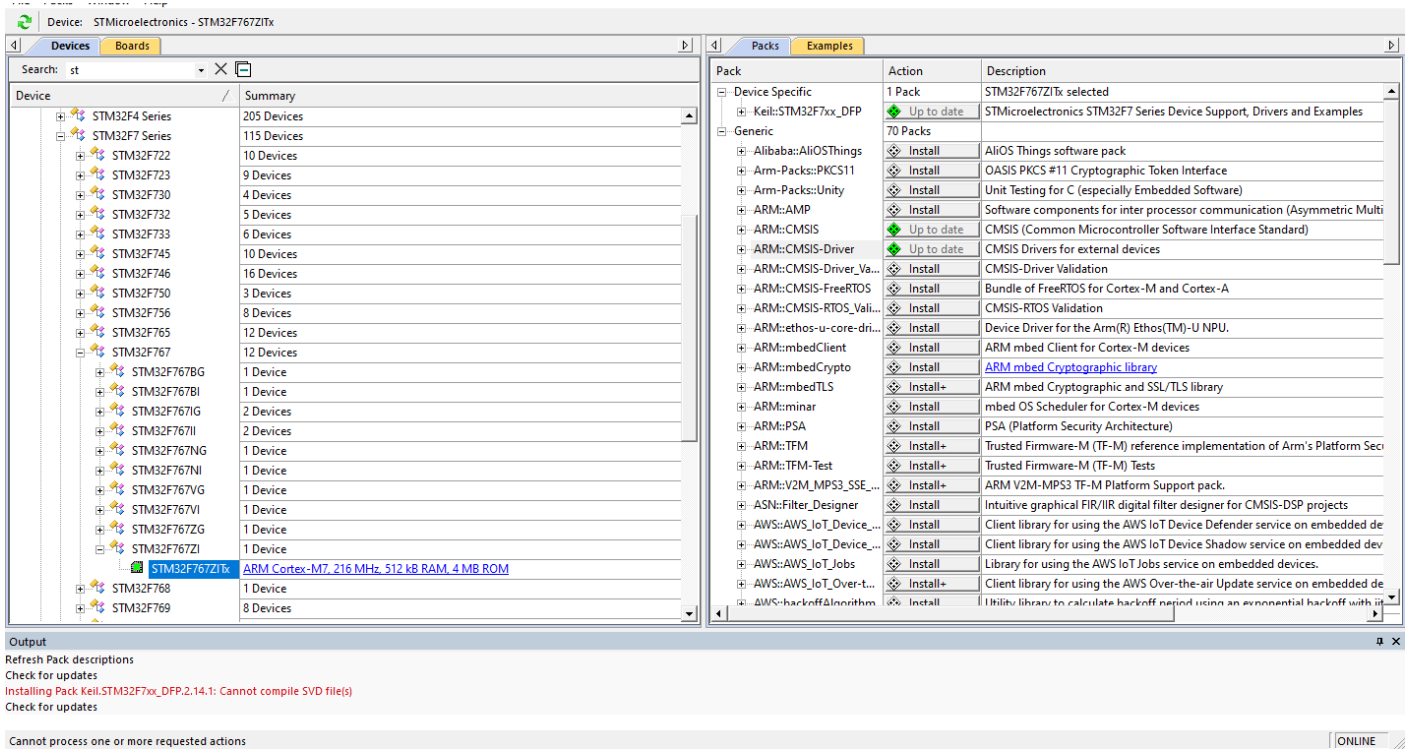
Click here…



# Keil MDK-ARM

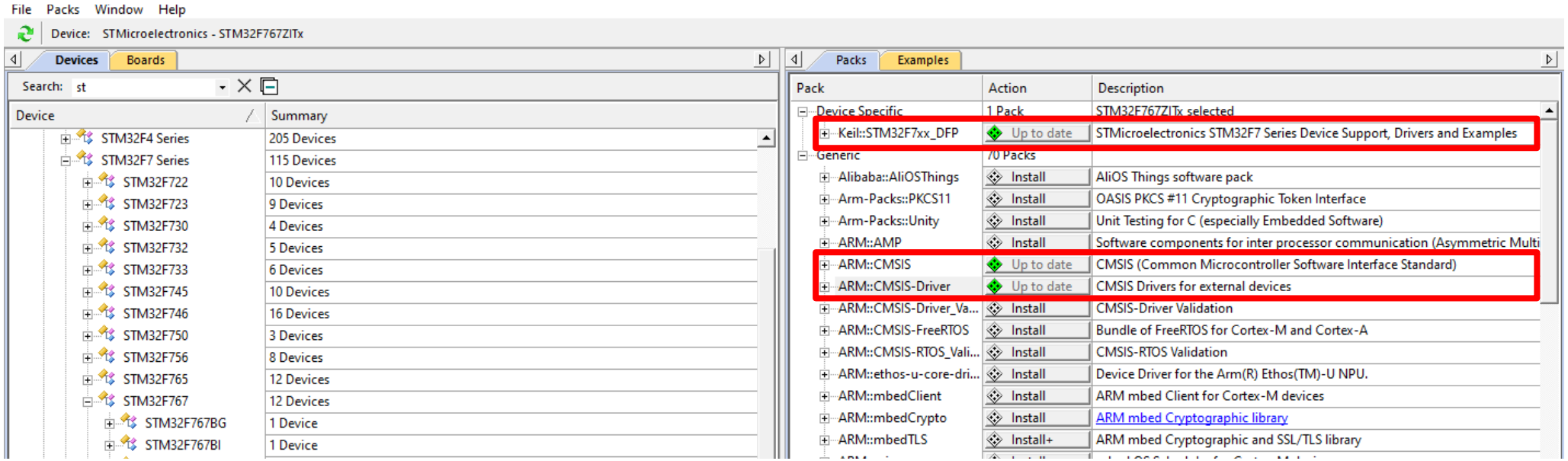
In “Device” tab select: STMicroelectronics -> STM32F7 Series -> STM32F767 -> STM32F767ZI

If you still don’t see this menu wait until the update finishes



# Keil MDK-ARM

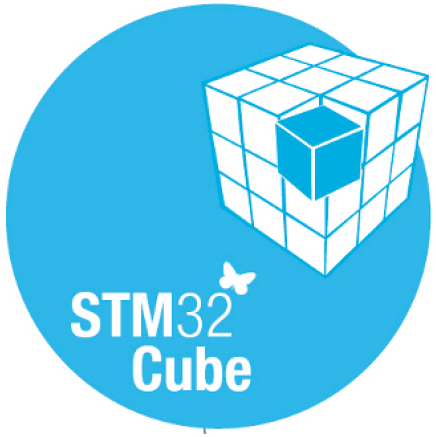
## Install the following 3 packs



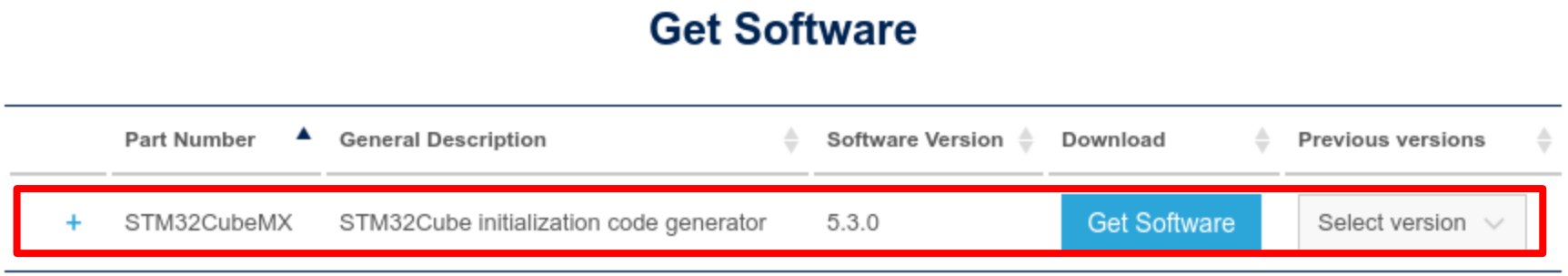
# STM32CubeMX

STM32Cube includes STM32CubeMX, a graphical software configuration tool that allows the generation of C initialization code, for STM32 microcontrollers very easily, using graphical wizards.

http://www.st.com/en/development-tools/stm32cubemx.html



# STM32CubeMX



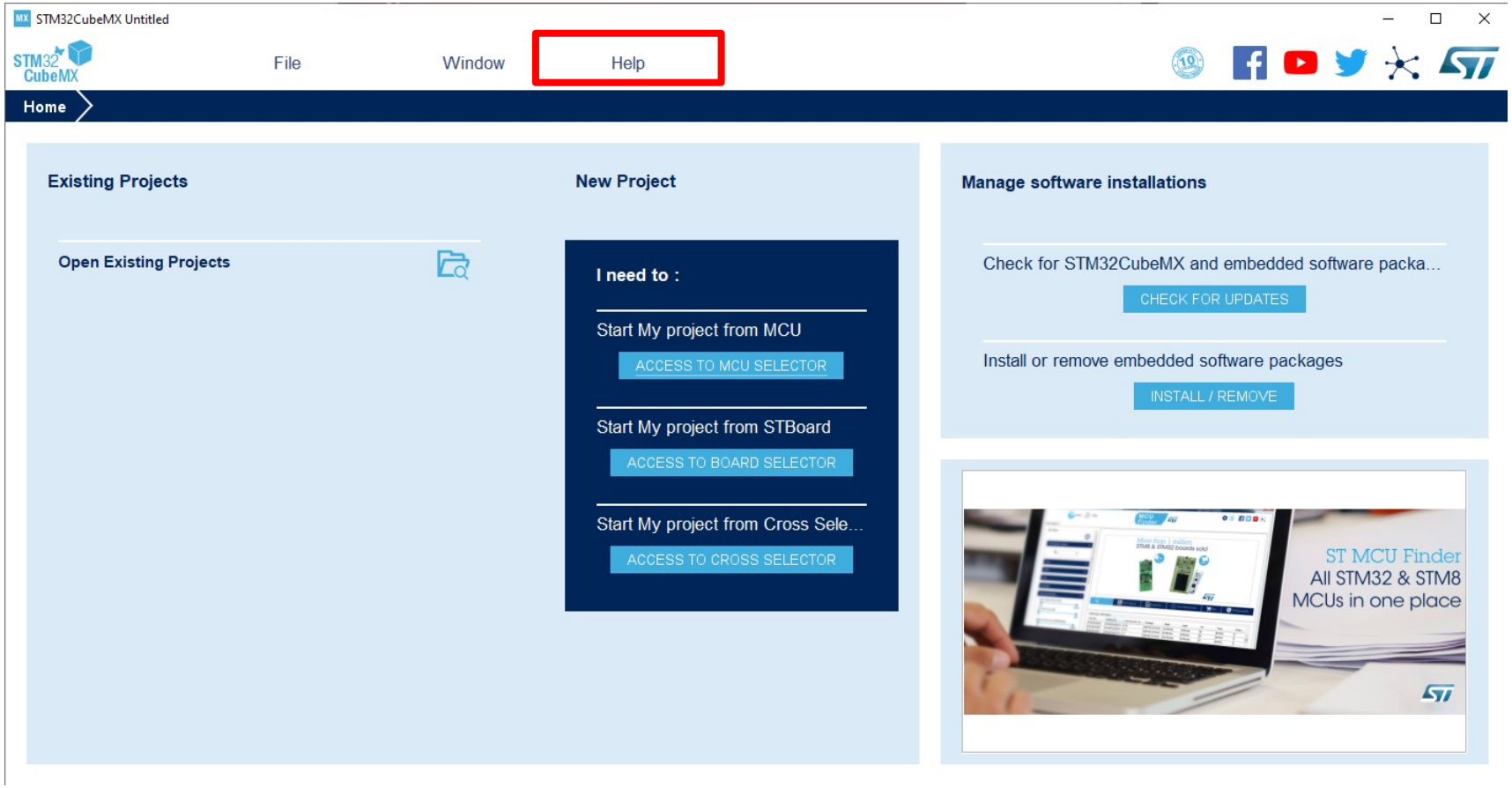
# STM32CubeMX

Install Cube after download

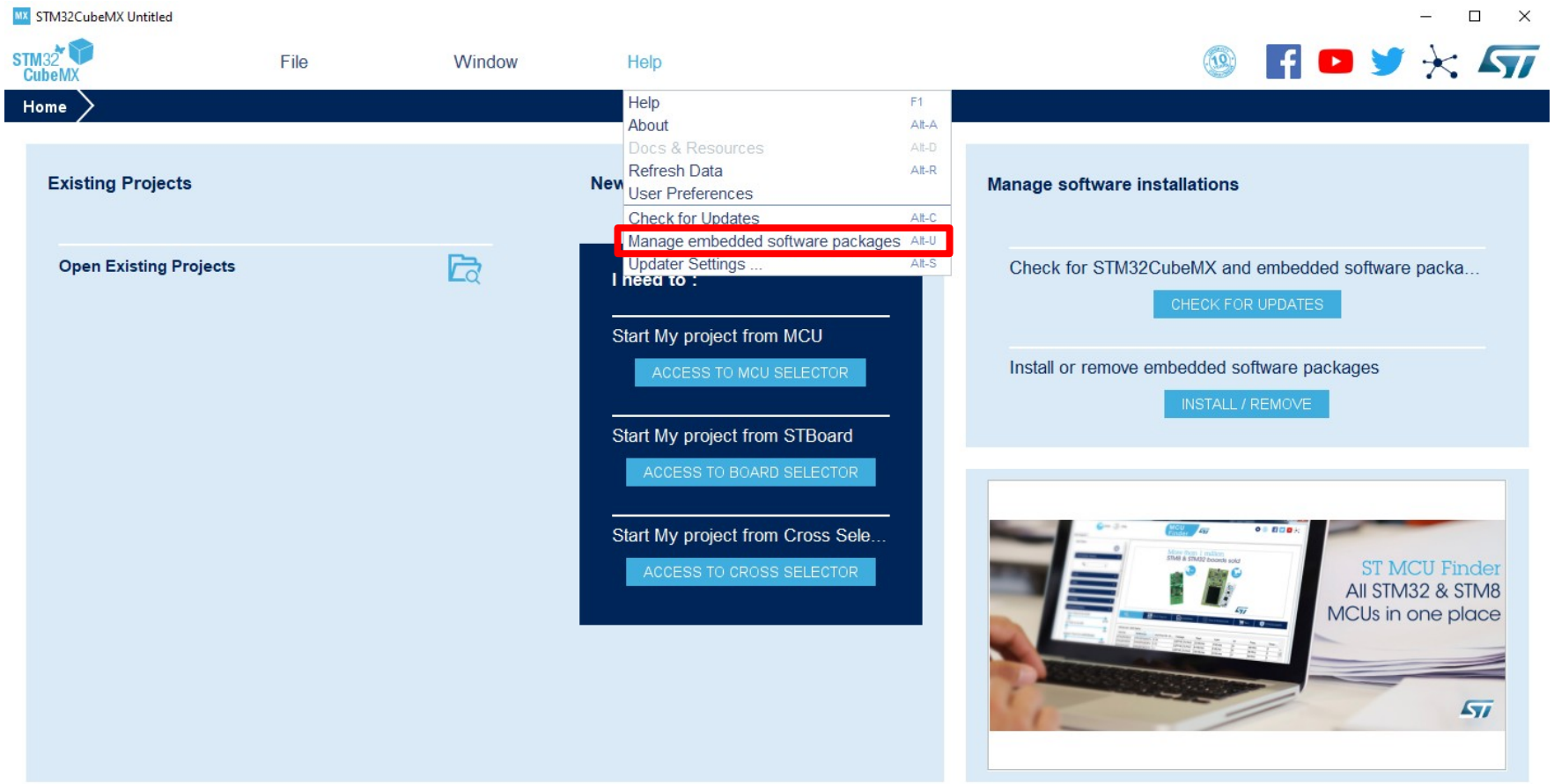
It requires Java Runtime Environment

Open STM32CubeMX when installation is finished

# STM32CubeMX

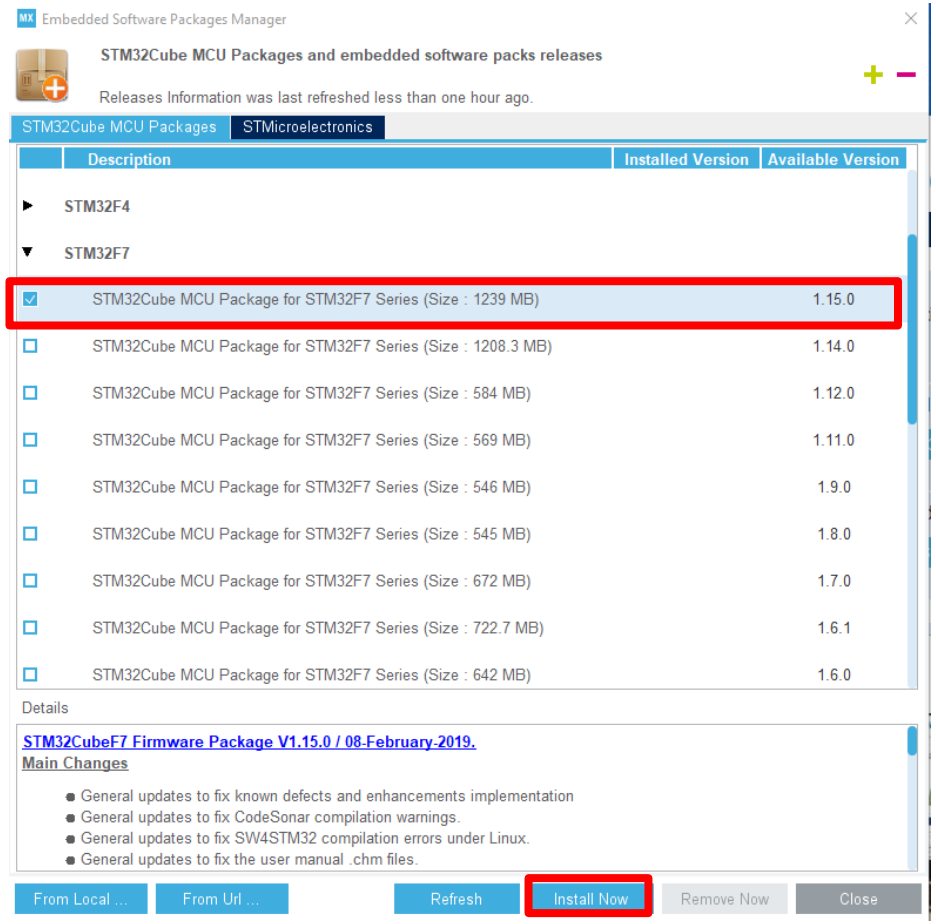


# STM32CubeMX



# STM32CubeMX

Install the latest:



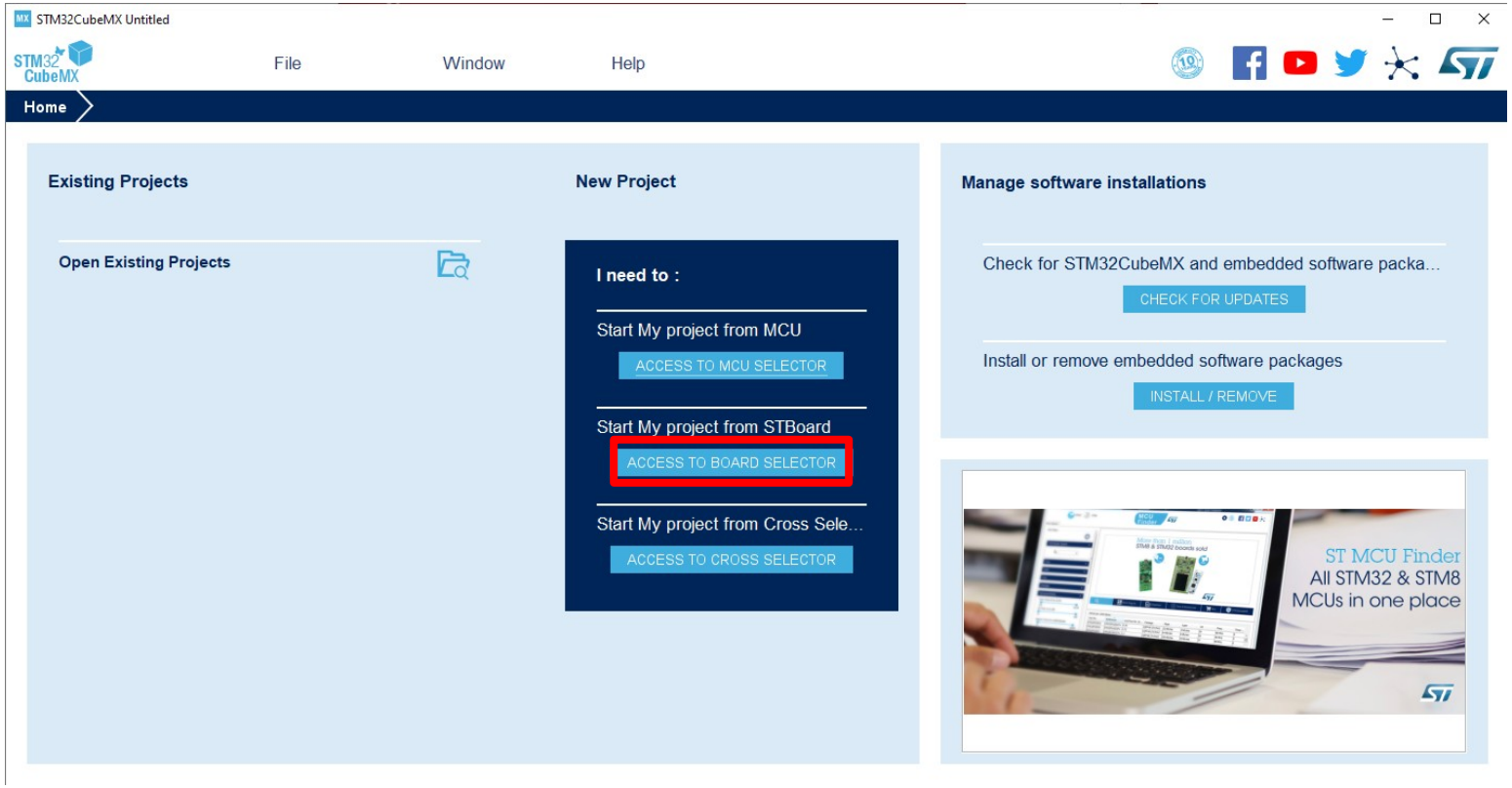

Click “Install”

# STM32CubeMX

And… that’s it. Installation complete.

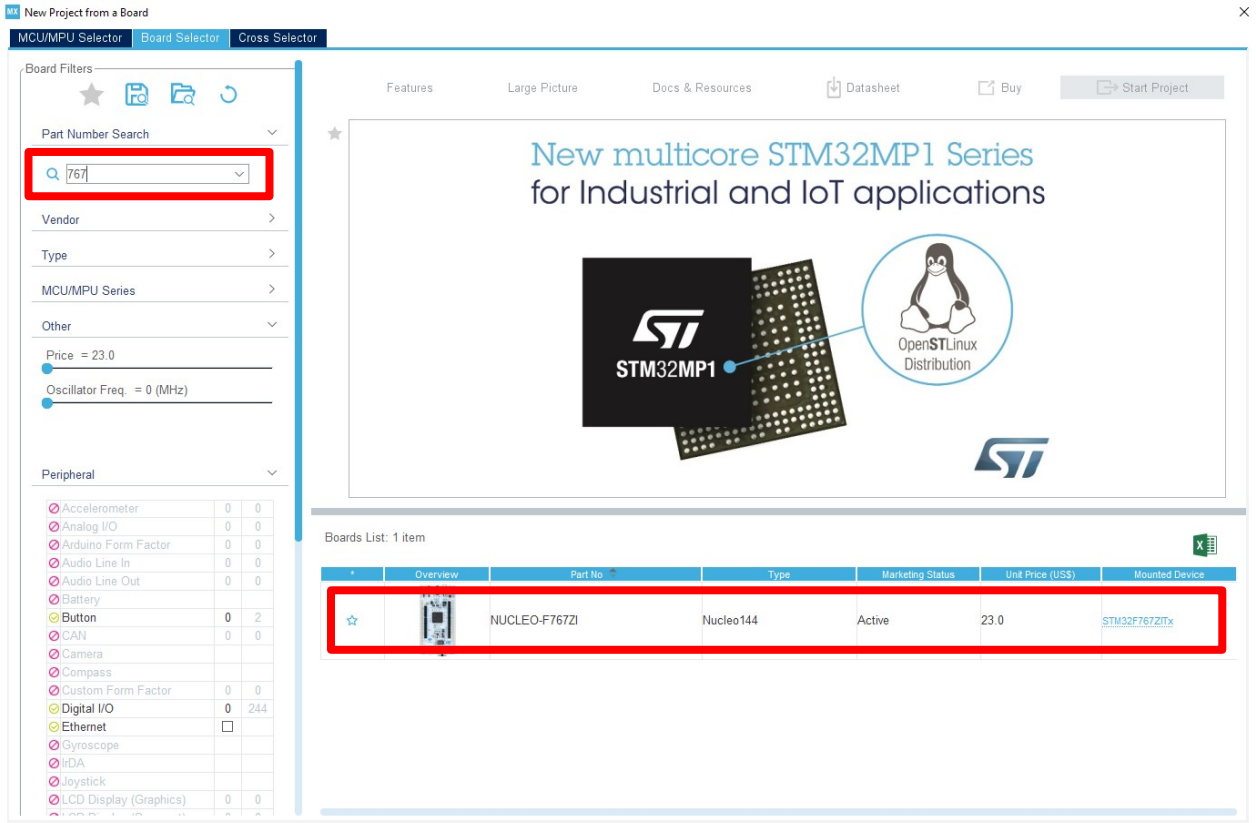
# Create the first Project

Open STM32CubeMX. Select “Access to Board Selector”.



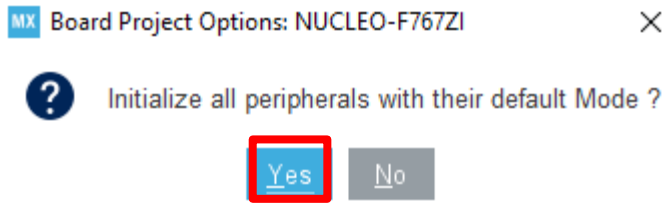
# Create the first Project

Search for “767”, and double click in “Nucleo-F767ZI”.



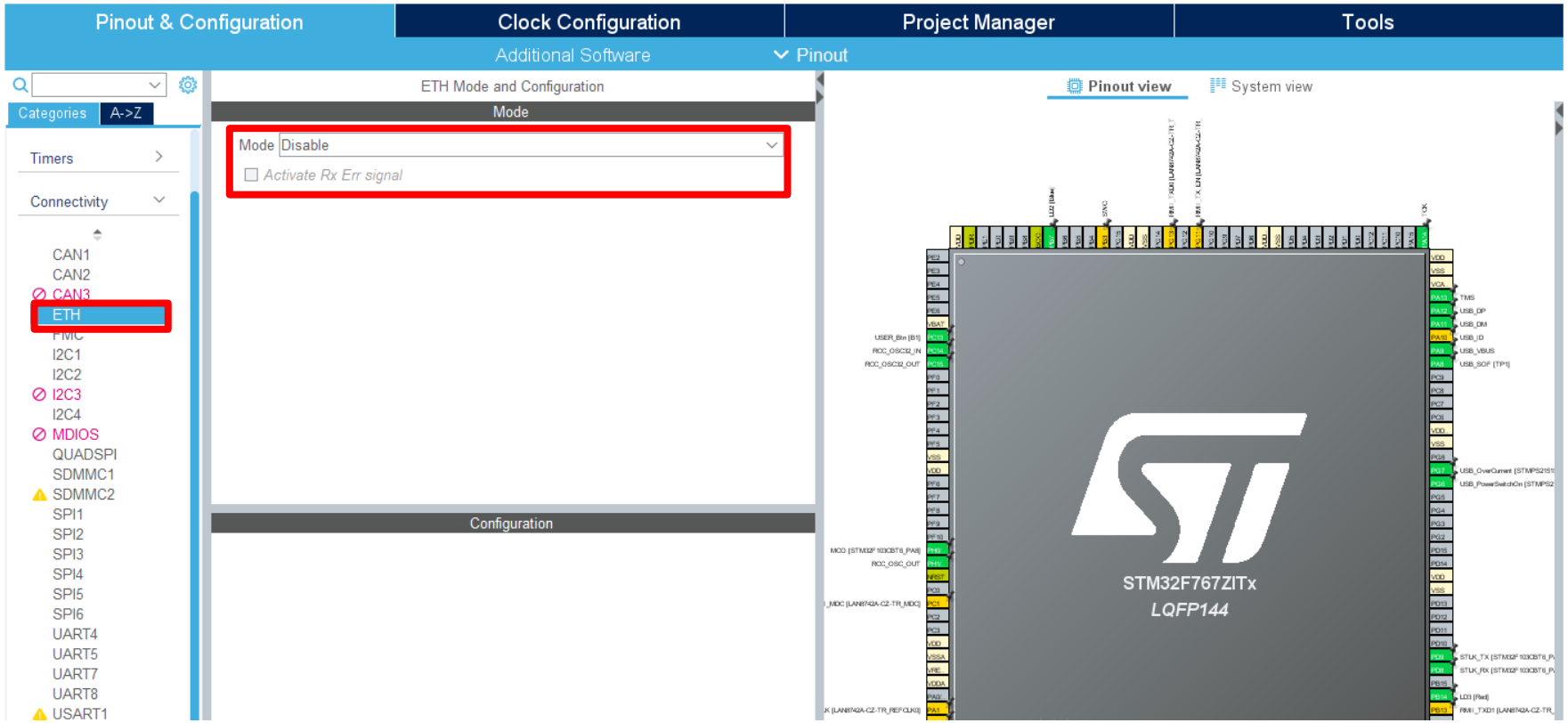
# Create the first Project

Initialize all peripherals in default mode.



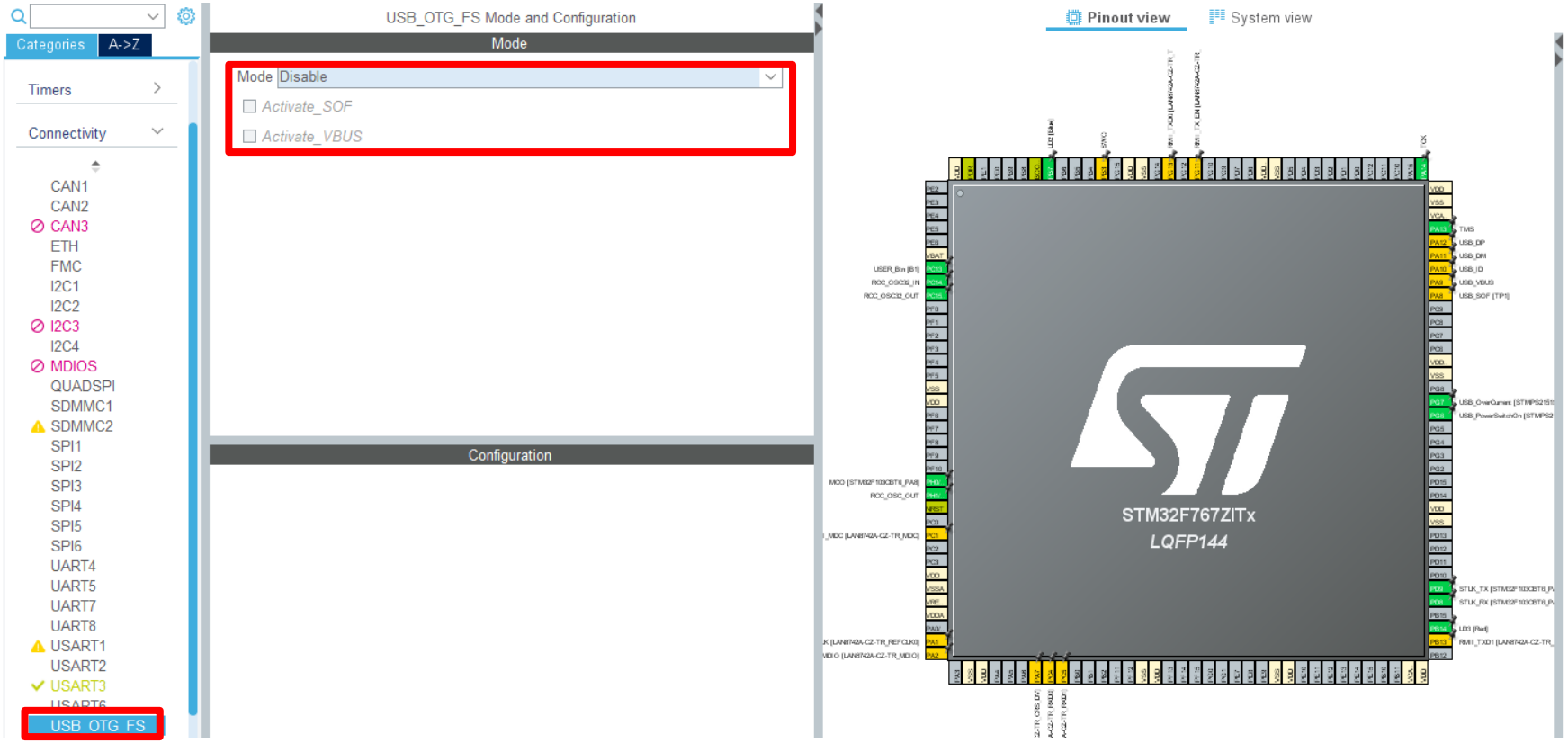
# Create the first Project

## Disable the Ethernet peripheral.



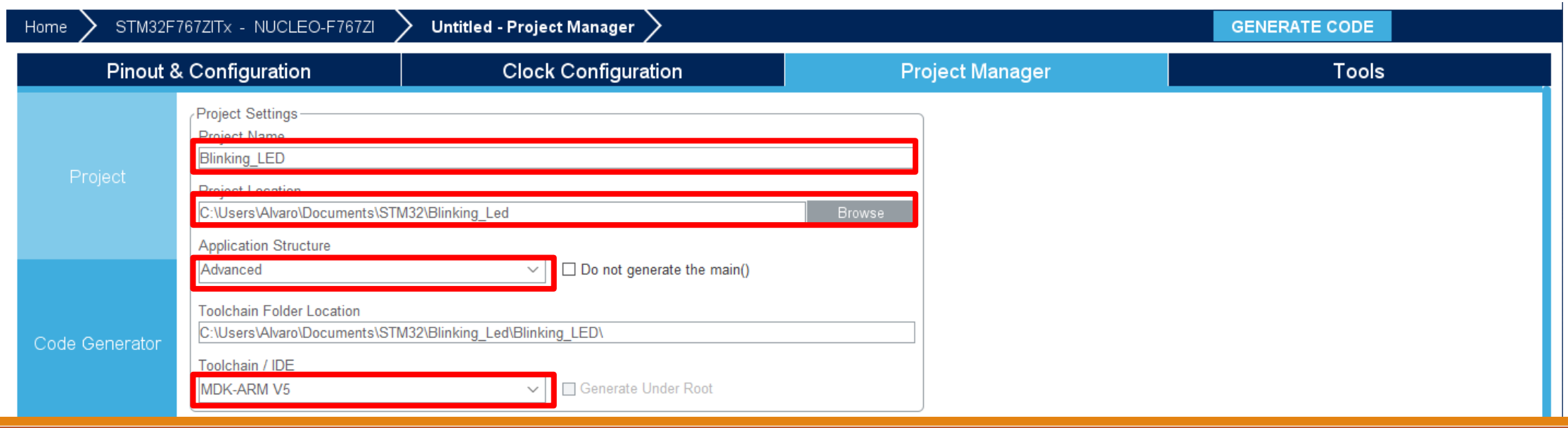
# Create the first Project

## Disable the USB peripheral.



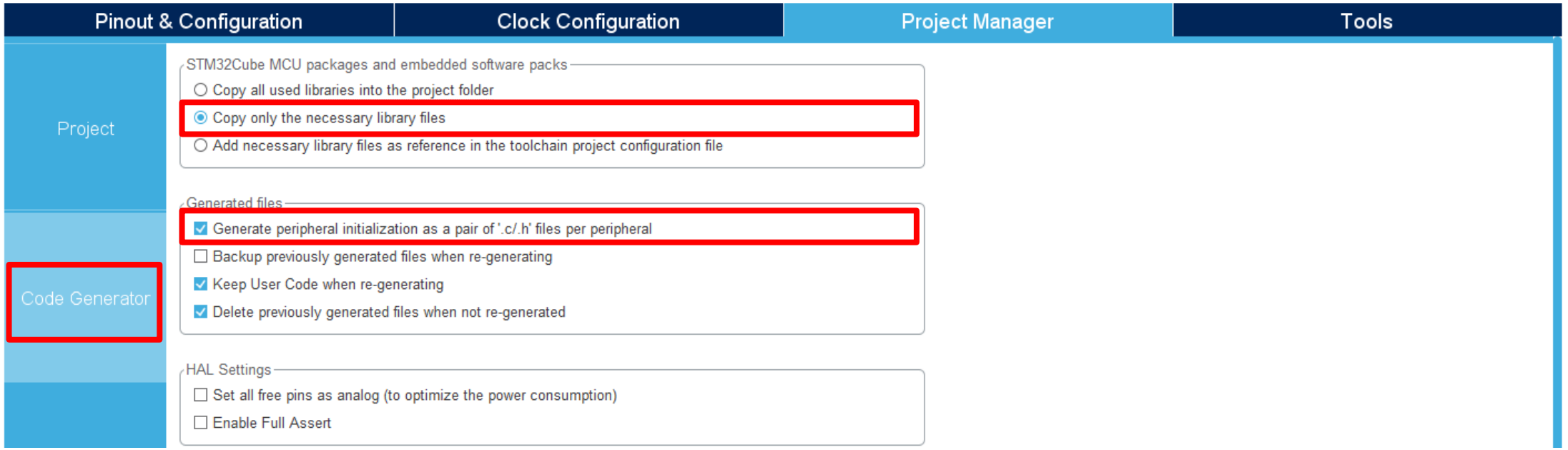
# Create the first Project

Go to “Project Manager”, give a name to the project, choose the location of the project, set the structure to advanced, and set the Tollchain to “MDK-ARM V5”. To avoid complications the save path mustn’t have spaces or other special characters.



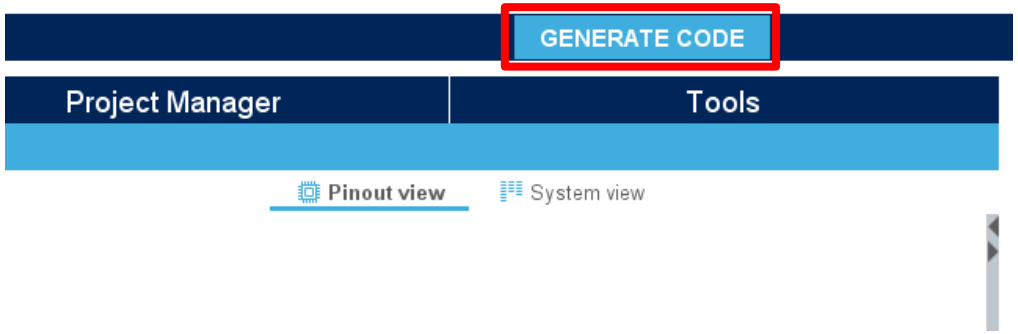
# Create the first Project

Under “Code Generator” select “Copy only the necessary library files”, and “Generate peripheral initialization as a pair of ‘.c/.h’ files per peripheral.

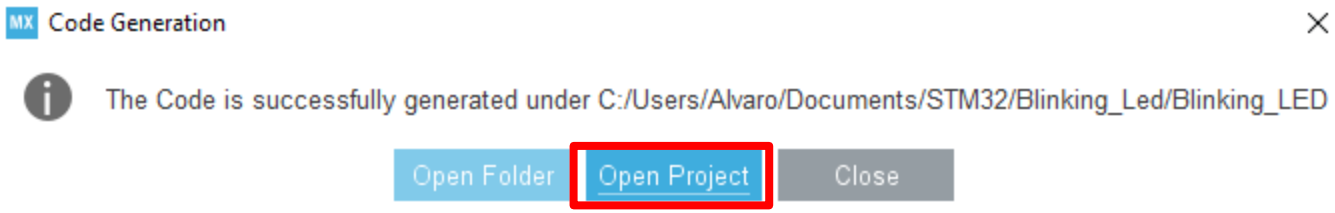


# Create the first Project

Generate the code.

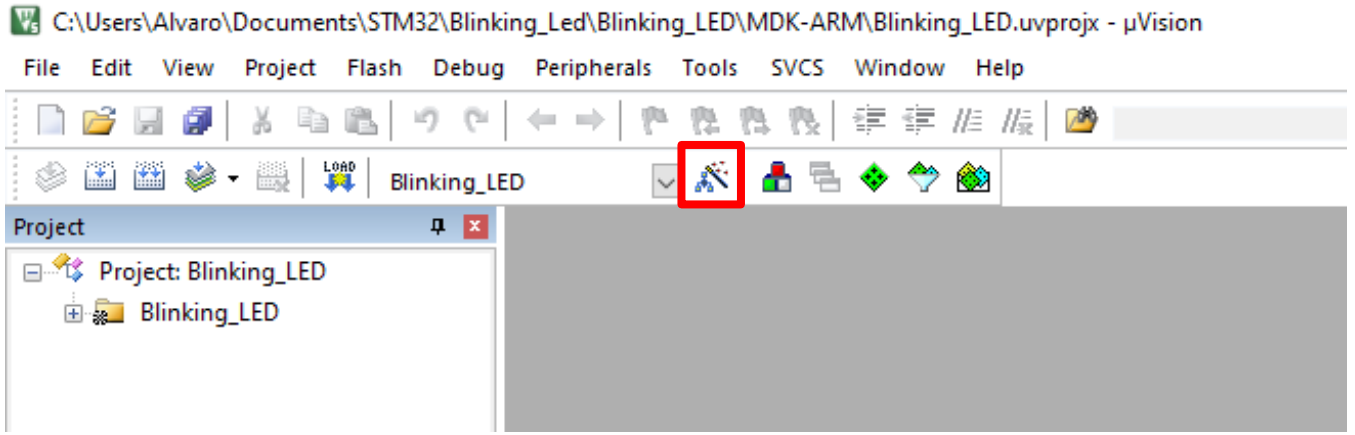



And Open the Project



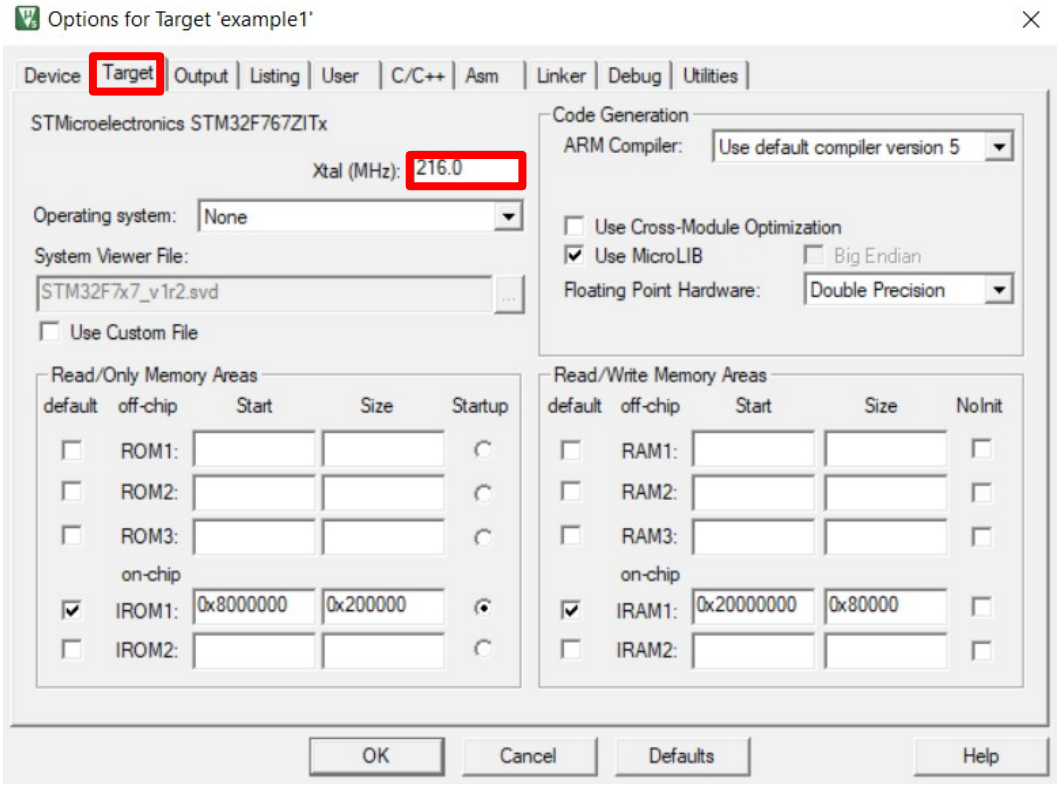
# Create the first Project

Open the settings menu.



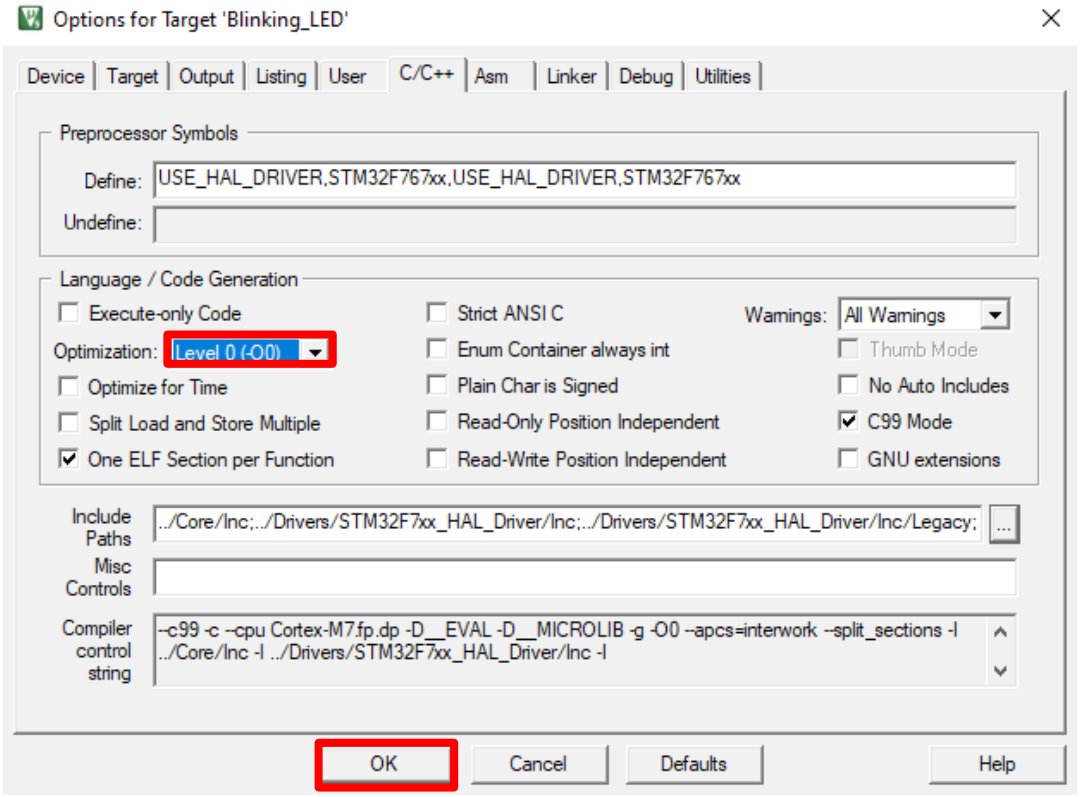
# Create the first Project

Under Outup tab, set Xtal to 216.



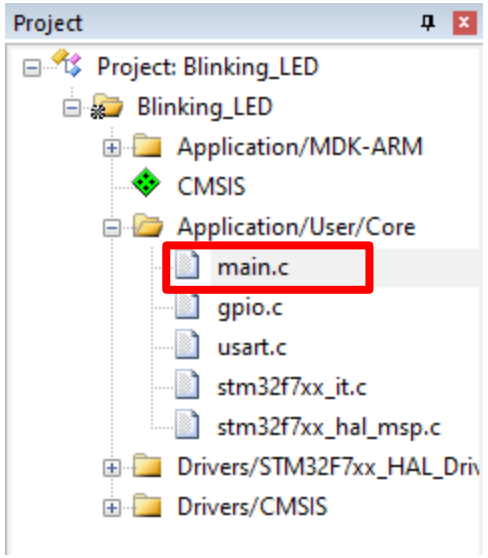
# Create the first Project

Under C/C++ tab, set the optimization level to 0.



# Create the first Project

Open the main.c file



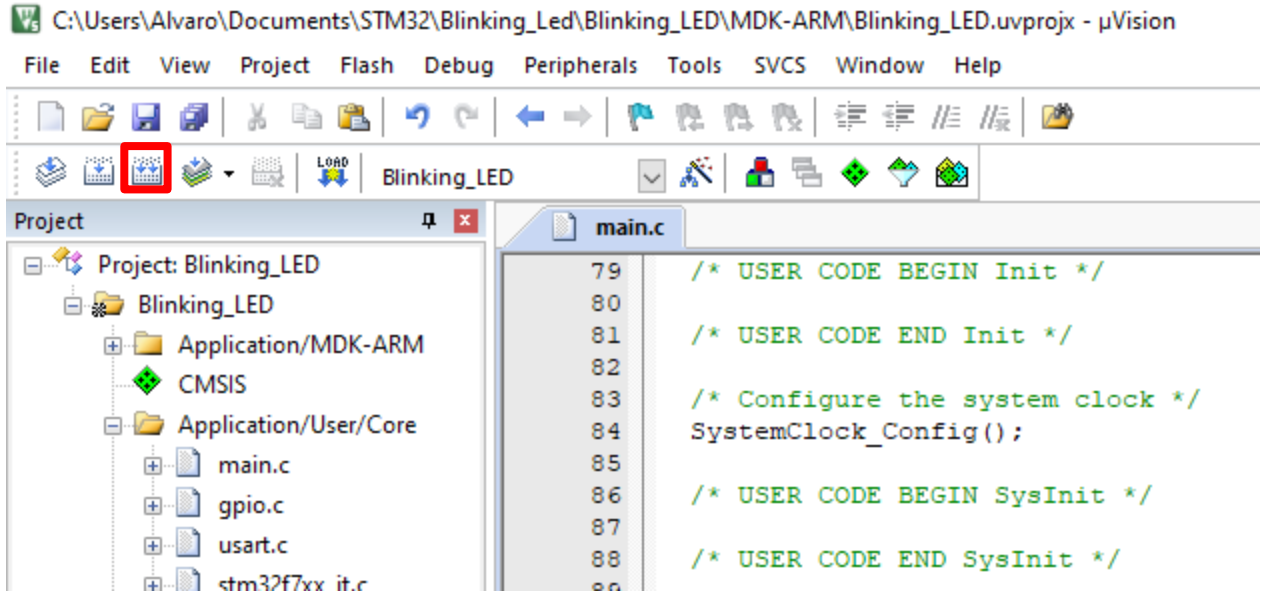
# Create the first Project

Add those two lines of code at lines 101 and 102.

```
 97    /* Infinite loop */
 98    /* USER CODE BEGIN WHILE */
 99    while (1)
100    {
101      HAL_GPIO_TogglePin(GPIOB, GPIO_PIN_7);
102      HAL_Delay(1000);
103      /* USER CODE END WHILE */
```

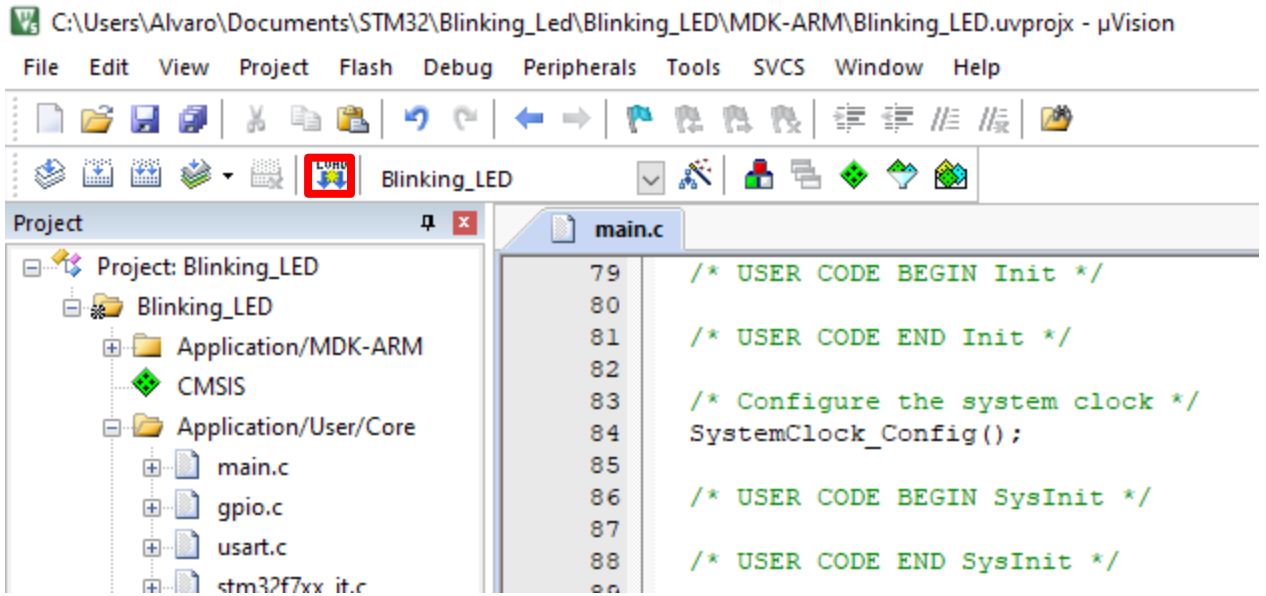
# Compile a program

To compile all target files (this is going to take a while)



# Flash the board

Connect the development board to your pc through a micro USB cable (don’t use the connection next to the ethernet port)



# Flash the board

When the flash is finished press the reset button on the board (black button)

The blue LED should blink at a frequency of 0,5Hz.

# Terminal

A good terminal is very convenient if you want work with serial port. You can use termite or this terminal:
https://sites.google.com/site/terminalbpp/

# File tree

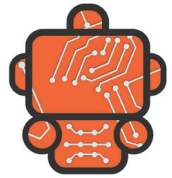
Inside the project Directory, there are many sub directories and files, some of the most important are:

- ***Drives***: where the CubeMX puts the drivers, you don't need to touch here
- ***Inc***: where the user header files are, and where you should put all the header files you will create

(continues on the next page)

# File tree

- ***MDK-ARM***: where all the files for the Keil configurations and the output files of the compilation are, at this moment you only should touch the file with the extension ***.uvprojx*** (this file open the keil project)
- ***Src***: where the user source files are, and where you should put all the source files you will create
- ***.ioc***: STM32CubeMX file, contains all the Cube info for the project
- ***.gitignore***: to specify intentionally untracked files to be ignore by git



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# Resources

The following slides have some documentation that you should have with you every time you are working with the development board, in order to consult some information in case of doubts.

# Resources

STM32F76xxx and STM32F77xxx advanced Arm®-based
https://bit.ly/2SrZbQS

Description of STM32F7 HAL and Low-layer drivers
https://bit.ly/2JsqPcE

STM32CubeMX for STM32 configuration and initialization C code generation
https://bit.ly/2OXkEmM

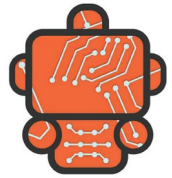
# Resources

STM32F7 Series and STM32H7 Series Cortex®-M7 processor programming manual
https://bit.ly/2qiOYJC

STM32 Nucleo-144 boards
https://bit.ly/2Df5i6S

Getting started with STM32F7 Series MCU hardware development
https://bit.ly/2StPQIj

General-purpose timer cookbook
https://bit.ly/2ITtSKB



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# Conclusion

Now you should have all tools installed and configured.

You should know how to create a project, compile and flash the board

Good work