

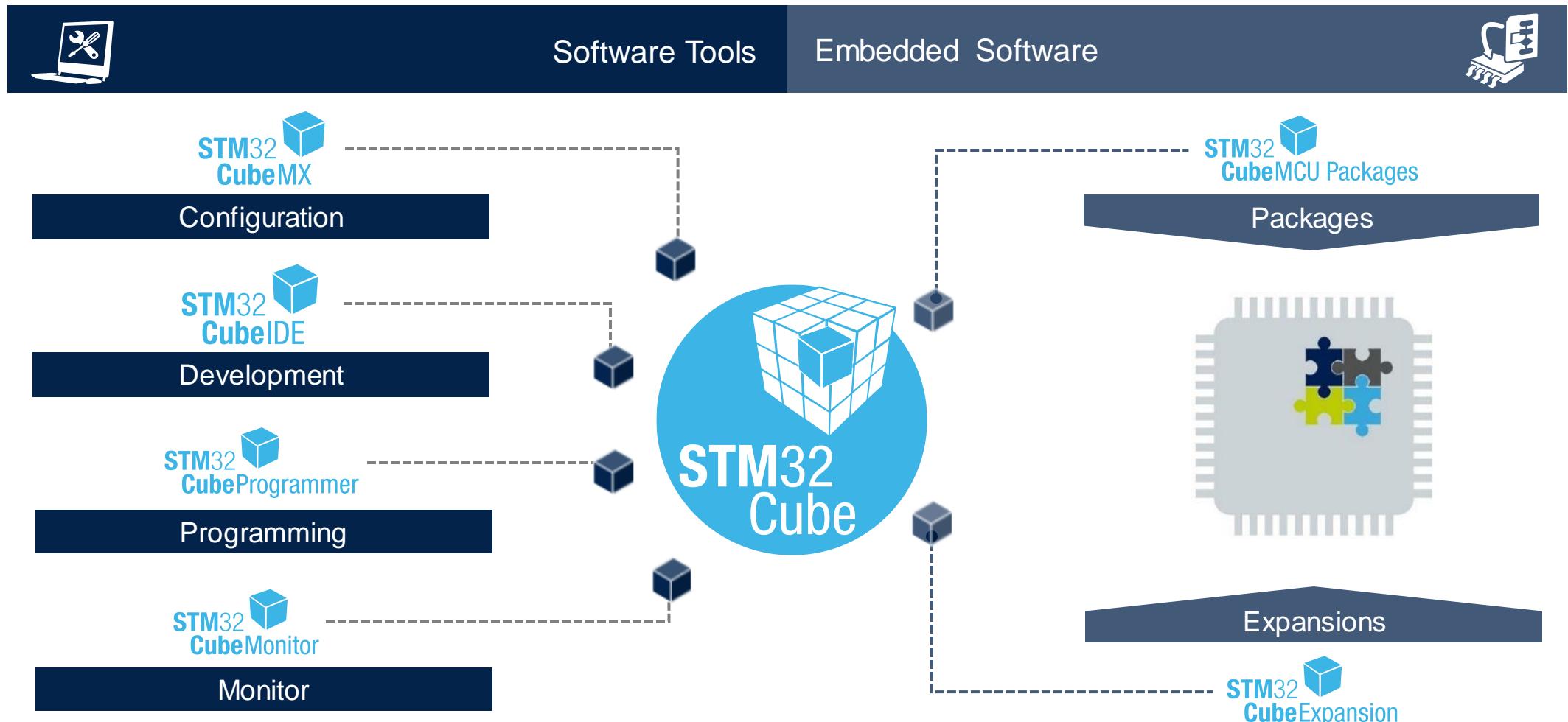


# STM32Cube ecosystem overview

## Making STM32 development easier

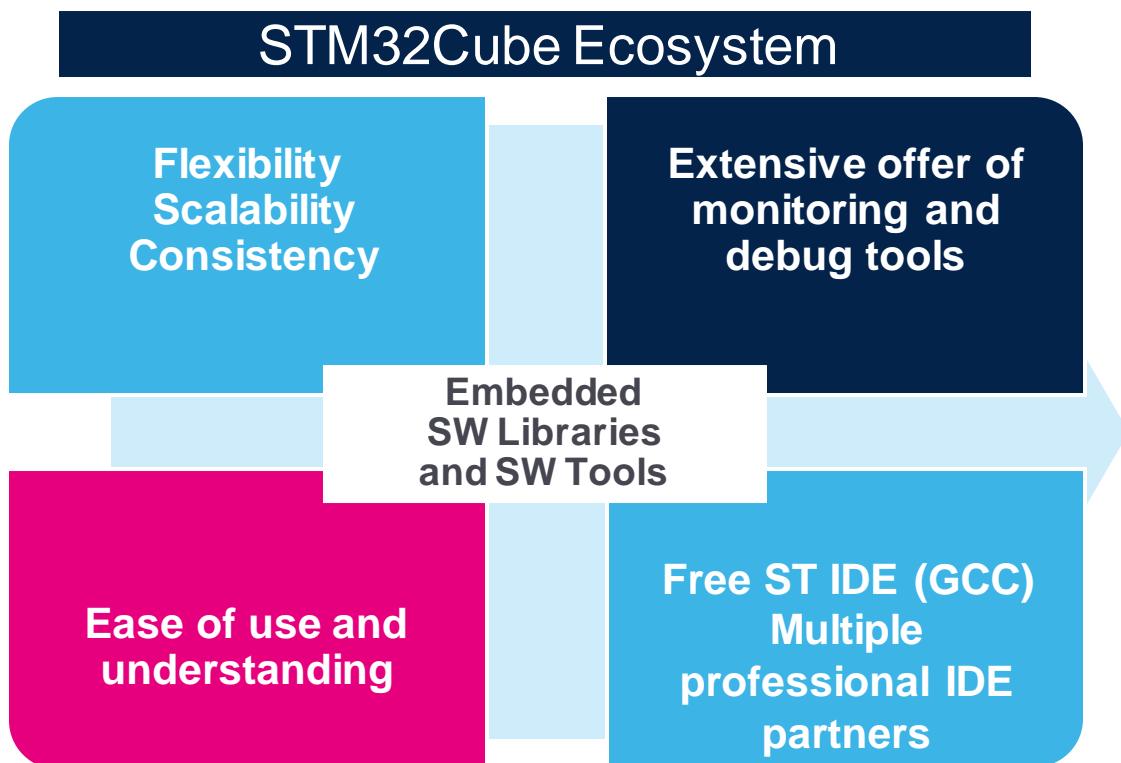


# Inside the STM32Cube ecosystem



# STM32Cube ecosystem: benefits

Comprehensive, consistent, scalable,  
easy to use SW development framework



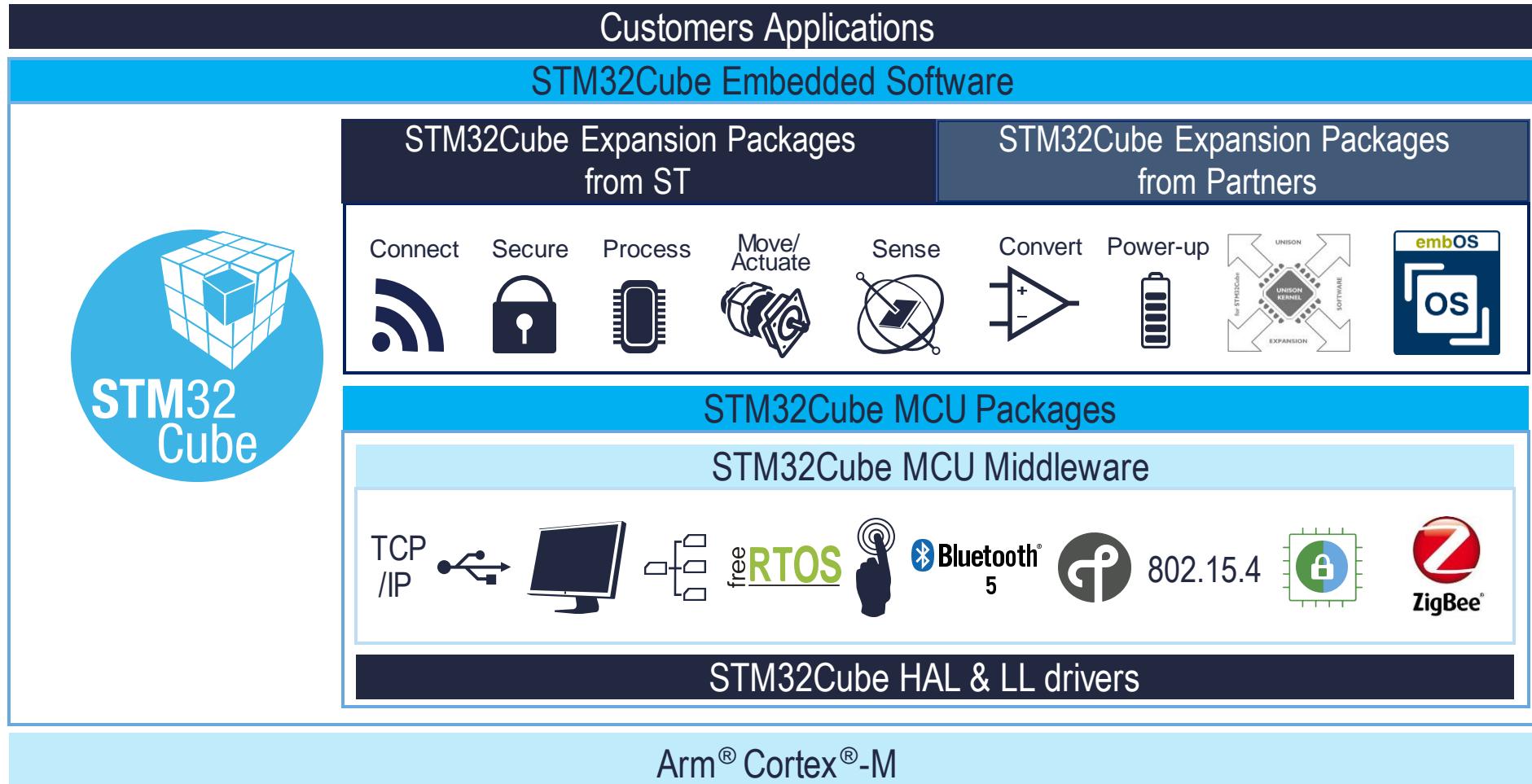
## Developer benefits

- Addressing all the needs of a complete development cycle
- Reduced learning curve
- Fits most developer profiles needs from beginners to experts
- Reduced time-to-market leading to a competitive advantage

# STM32Cube embedded software



# A flexible, scalable and consistent offer



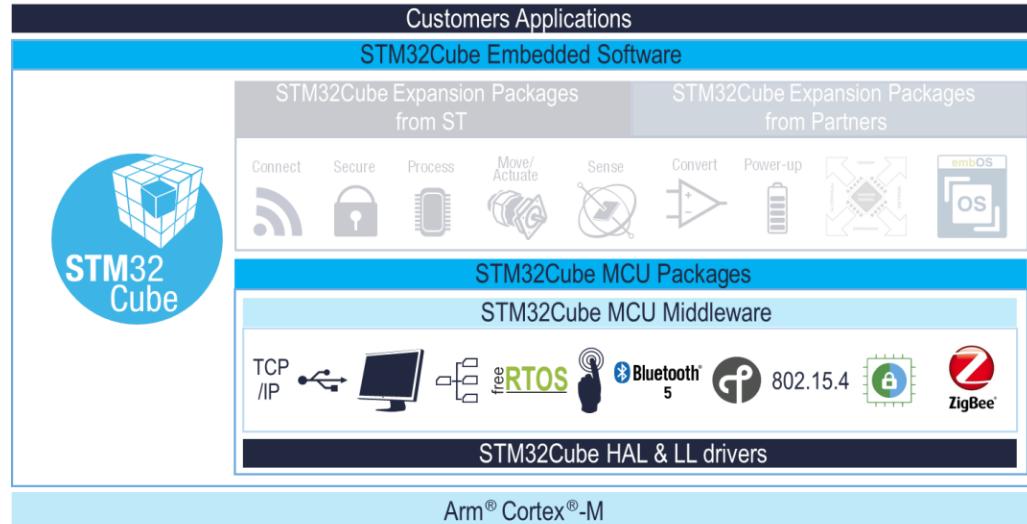
# STM32Cube MCU packages

STM32  
CubeMCU Packages

# Dedicated to each STM32 Series

Mainstream	High Performance	MPU	Ultra-Low Power	Wireless
<b>STM32 CubeG4</b>	<b>STM32 CubeH7</b>	<b>STM32 CubeMP1</b>	<b>STM32 CubeL0</b>	<b>STM32 CubeWB</b>
<b>STM32 CubeF3</b>	<b>STM32 CubeF7</b>		<b>STM32 CubeL1</b>	
<b>STM32 CubeF1</b>	<b>STM32 CubeF4</b>		<b>STM32 CubeL4</b>	
<b>STM32 CubeG0</b>	<b>STM32 CubeF2</b>		<b>STM32 CubeL5</b>	
<b>STM32 CubeF0</b>				

# One-stop-shop SW packages



## Peripheral drivers

### HAL API

Hardware Abstraction Layer, highly portable and easy to use

### LL APIs

Low-Layer APIs, light weight and highly optimized for runtime efficiency

## STM32Cube Middleware

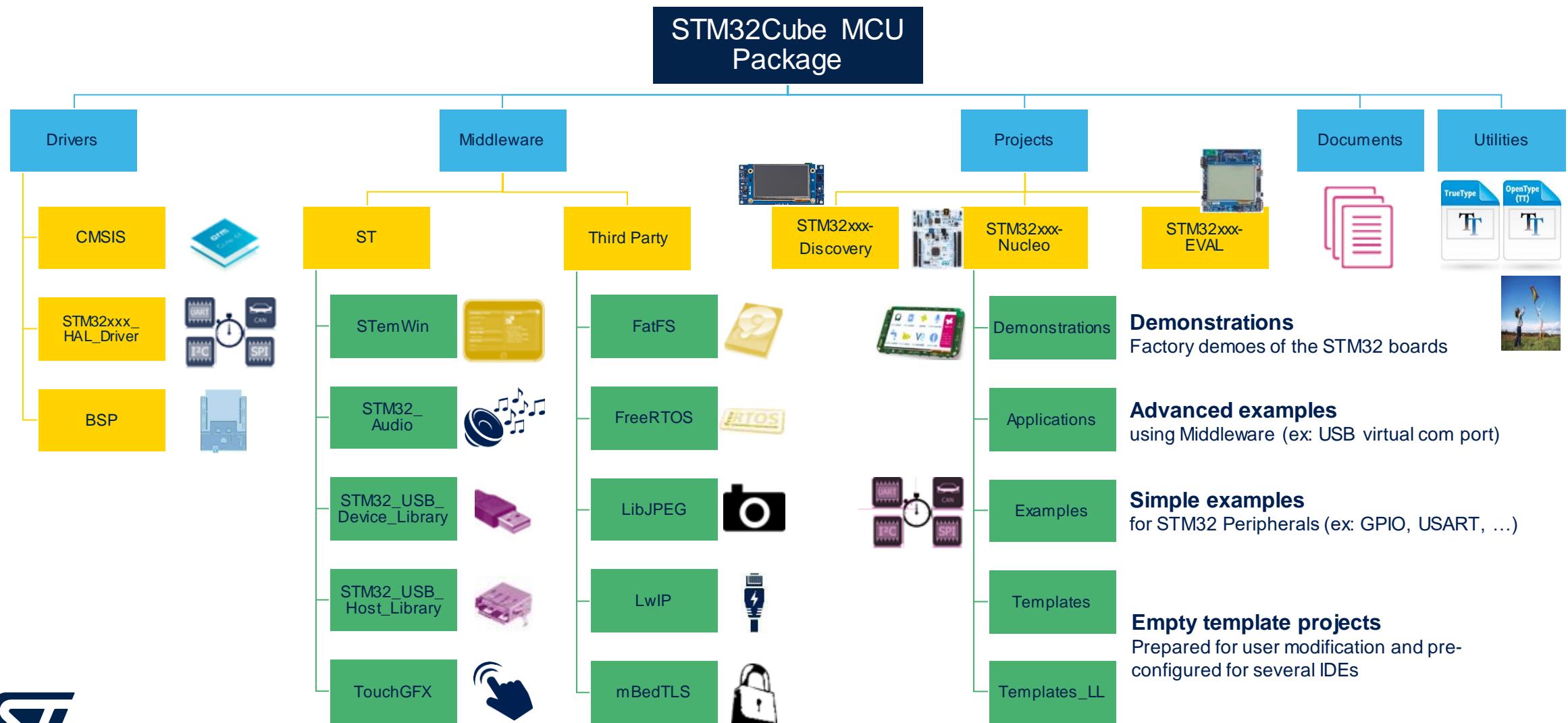
### Generic MW

- FreeRTOS
- FatFS file system
- LwIP TCP/IP stack
- mbedTLS and mbedCrypto
- Open Bootloader

### Dedicated MW

- ST Bluetooth 5 stack
- OpenThread stack
- ST 802.15.4 MAC
- Zigbee 3 stack
- STM32 WPAN
- ST Key Management Services (KMS)
- TF-M
- ST USB Host & Device stacks
- STM32 Touch Sensing library
- STemWin graphics stack

# Detailed content and organization



# Middleware tailored for each series

Family	LL API	HAL API	FreeRTOS	FatFS	STemWin	USB Host	USB Device	LwIP mBedTLS	Touch Sense	USBPD	OpenAMP	BLE Stack	OpenThread Stack	Zigbee 3	TF-M
<a href="#">STM32CubeF0</a>	✓	✓	✓	✓	✓		✓		✓						
<a href="#">STM32CubeF1</a>	✓	✓	✓	✓	✓	✓	✓	✓	✓						
<a href="#">STM32CubeF2</a>	✓	✓	✓	✓	✓	✓	✓	✓	✓						
<a href="#">STM32CubeF3</a>	✓	✓	✓	✓	✓	✓		✓	✓						
<a href="#">STM32CubeF4</a>	✓	✓	✓	✓	✓	✓	✓	✓	✓						
<a href="#">STM32CubeF7</a>	✓	✓	✓	✓	✓	✓	✓	✓	✓						
<a href="#">STM32CubeH7</a>	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓		
<a href="#">STM32CubeG0</a>	✓	✓	✓	✓							✓				
<a href="#">STM32CubeL0</a>	✓	✓	✓	✓				✓							
<a href="#">STM32CubeL1</a>	✓	✓	✓	✓	✓	✓	✓	✓							
<a href="#">STM32CubeL4</a>	✓	✓	✓	✓	✓	✓	✓	✓							
<a href="#">STM32CubeL5</a>	✓	✓	✓	✓				✓		✓	✓				✓
<a href="#">STM32CubeWB</a>	✓	✓	✓	✓				✓				✓		✓	✓
<a href="#">STM32CubeMP1</a>	✓	✓	✓								✓				

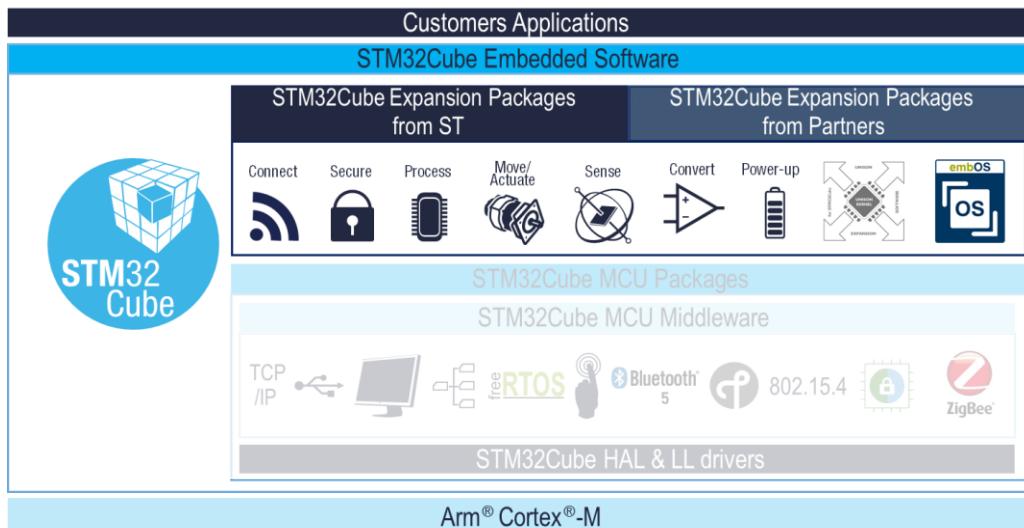
# STM32Cube expansion packages

STM32  
CubeExpansion

# X-CUBE / I-CUBE / Function Pack (FP)

## Function Pack (FP)

Advanced applicative projects and libraries



## X-CUBE packages

### From ST

Ex: X-CUBE-SBSFU, X-CUBE-BLE,  
X-CUBE-CRYPTO, ...

## I-CUBE packages

### From 3<sup>rd</sup> parties

Ex: I-CUBE-EMBOS, I-CUBE-UNISON,  
I-CUBE-NETX...

Complementing and expanding the STM32Cube MCU Packages with straightforward implementations of real applicative use cases

# Expansions for various applications

**Audio**

X-CUBE

- X-CUBE-AUDIO
- X-CUBE-VS4A
- X-CUBE-USB-AUDIO



**Bootloader/Secure Boot**

X-CUBE

- X-CUBE-IAP-USART
- X-CUBE-IAP-SD
- X-CUBE-SBSFU



**Safety**

X-CUBE

- X-CUBE-CLASSB
- X-CUBE-STL



**Crypto**

X-CUBE

- X-CUBE-CRYPTOLIB



**USB**

X-CUBE

- X-CUBE-USB-PD



**SigFox**

X-CUBE

- X-CUBE-SFOX



**LoRa**

I-CUBE

- I-CUBE-LRWAN



**Sub-1G**

X-CUBE

- X-CUBE-SUBG1



**BLE**

X-CUBE

- X-CUBE-BLE1
- X-CUBE-BLE2

Enhanced for STM32 Toolset

Enhanced for STM32 Toolset



**NFC**

X-CUBE

- X-CUBE-NFC1
- X-CUBE-NFC2
- X-CUBE-NFC3
- X-CUBE-NFC4
- X-CUBE-NFC5

Enhanced for STM32 Toolset



# Expansions with Function Packs

**Cloud**



**X-CUBE**

- X-CUBE-CLD-GEN1**
- X-CUBE-AWS**
- X-CUBE-AZURE**
- X-CUBE-WATSON**
- X-CUBE-GCP**

**FP**

- FP-CLD-AWS1**
- FP-CLD-AZURE1**
- FP-CLD-WASTON1**

**Motion**



**X-CUBE**

- X-CUBE-6180XA1**
- X-CUBE-IKA02A1**
- X-CUBE-MEMS-XT1**
- X-CUBE-MEMS1** Enhanced for STM32 Toolset
- X-CUBE-MEMS1-V4**

**FP**

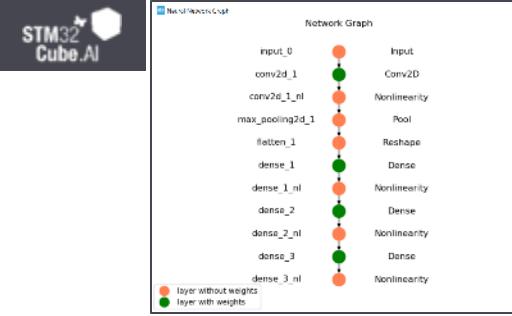
- FP-SNS-6LPNODE1**
- FP-SNS-ALLMEMS1**
- FP-SNS-FLIGHT1**
- FP-SNS-MOTENV1**

**AI**



**X-CUBE**

**X-CUBE-AI** Enhanced for STM32 toolset



**FP**

- FP-AI-SENSING1**
- FP-AI-VISION1**

# Expansions for motor control

## Motor - PMSM

### X-CUBE

### X-CUBE-MCSDK

STM32 Motor Control SDK (MCSDK)



### X-CUBE-MCSDK-FUL

STM32 Motor Control SDK (MCSDK) –  
FULL source code –  
Registration/approval needed for  
download

### X-CUBE-SPN7

Three-phase brushless DC motor driver

## Motor - Stepper



### X-CUBE

### X-CUBE-SPN1

Stepper bipolar motor driver software expansion for STM32Cube

### X-CUBE-SPN2

Two axes stepper motor driver software expansion for STM32Cube

### X-CUBE-SPN3

High-power stepper motor driver software expansion for STM32Cube

### X-CUBE-SPN4

Dual-brush DC motor driver software expansion for STM32Cube

### X-CUBE-SPN5

Stepper bipolar motor driver software expansion for STM32Cube

# Expansions enhanced for STM32 Toolset

MX Embedded Software Packages Manager

STM32Cube MCU Packages and embedded software packs releases

Releases Information was last refreshed less than one hour ago.

STM32Cube MCU Packages | STMicroelectronics

Description	Available Version
► X-CUBE-AI	
► X-CUBE-BLE1	
► X-CUBE-GNSS1	
► X-CUBE-MEMS1	
► X-CUBE-NFC4	

**BLE**

X-CUBE

X-CUBE-BLE1 Enhanced for STM32 Toolset

X-CUBE-BLE2 Enhanced for STM32 Toolset



**NFC**

X-CUBE

X-CUBE-NFC1

X-CUBE-NFC2

X-CUBE-NFC3

X-CUBE-NFC4 Enhanced for STM32 Toolset

X-CUBE-NFC5



**AI**

X-CUBE

X-CUBE-AI Enhanced for STM32 toolset

FP

FP-AI-SENSING1



**Motion**

X-CUBE

X-CUBE-6180XA1

X-CUBE-IKA02A1

X-CUBE-MEMS-XT1

X-CUBE-MEMS1 Enhanced for STM32 Toolset

X-CUBE-MEMS1-V4

FP

FP-SNS-6LPNODE1

FP-SNS-ALLMEMS1

FP-SNS-FLIGHT1

FP-SNS-MOTENV1





# STM32Cube expansions on ST website

The figure consists of three side-by-side screenshots. The left screenshot shows a Google search results page for 'stm32cubeexpansion'. The middle screenshot shows the 'STM32Cube Expansion Packages' page on the official ST website. The right screenshot shows a detailed product listing for expansion packages.

**Google Search Results:**

- Search term: stm32cubeexpansion
- Page 1 of 830 results
- Results include:
  - STM32Cube Expansion Packages - STMicroelectronics (<https://www.st.com/embedded-software/stm32cube-expansion-packages>)
  - STM32Cube Expansion Software - STMicroelectronics (<https://www.st.com/ecosystems/stm32cube-expansion-software>)
  - Development guidelines for STM32Cube Expansion Packages ([https://www.st.com/resource/user\\_manual](https://www.st.com/resource/user_manual))
  - STM32Cube Expansion Packages - STMicroelectronics ([www.stmicroelectronics.com.cn.../STM32\\_EMBEDDED\\_SOFTWARE](http://www.stmicroelectronics.com.cn.../STM32_EMBEDDED_SOFTWARE))

**STM32Cube Expansion Packages Page:**

- Page title: STM32Cube Expansion Packages
- Breadcrumbs: Embedded Software > MCU & MPU Embedded Software > STM32 Embedded Software > STM32Cube Expansion Packages
- Content:
  - Overview: STM32Cube embedded software is a basic set of software components like HAL, LL APIs, middleware and application examples ... These expansion packages build upon, are compatible with the STM32Cube embedded software libraries and tools and enable rapid application development based on ...
  - Product selector: A table listing expansion packages, including:
    - FP-AI-VISION1 (ACTIVE)
    - FP-CLD-AWS1 (ACTIVE)
    - FP-CLD-AZURE1 (ACTIVE)
    - I-CUBE-UNISON (ACTIVE)
    - X-CUBE-CRYPTO1\_B (ACTIVE)
  - Resources: Development guidelines for STM32Cube Expansion Packages, Development checklist for STM32Cube Expansion Packages.

**Detailed Product Listing:**

- Page title: STM32Cube Expansion Packages
- Breadcrumbs: Embedded Software > MCU & MPU Embedded Software > STM32 Embedded Software > STM32Cube Expansion Packages
- Table:

Part Number	General Description	Supplier	Supported Devices	STM32CubeMX Compatible	Deliverable	License
FP-AI-VISION1 (ACTIVE)	STM32Cube function pack for high performance STM32 with artificial intelligence (AI) application for Computer Vision	ST	-	-	-	-
FP-CLD-AWS1 (ACTIVE)	STM32Cube function pack for IoT sensor node with telemetry and device control applications for Amazon AWS Cloud	ST	-	-	Source	Free
FP-CLD-AZURE1 (ACTIVE)	STM32Cube function pack for IoT sensor node with telemetry and device management applications for Microsoft Azure cloud	ST	-	-	Source	Free
I-CUBE-UNISON (ACTIVE)	UNISON software expansion for STM32cubs	RoweBots	-	-	Source	Free
X-CUBE-CRYPTO1_B (ACTIVE)	STM32 cryptographic firmware library software expansion for STM32Cube (LIM1924)	ST	STM32	-	Source	Support & Feedback

# **STM32Cube software**

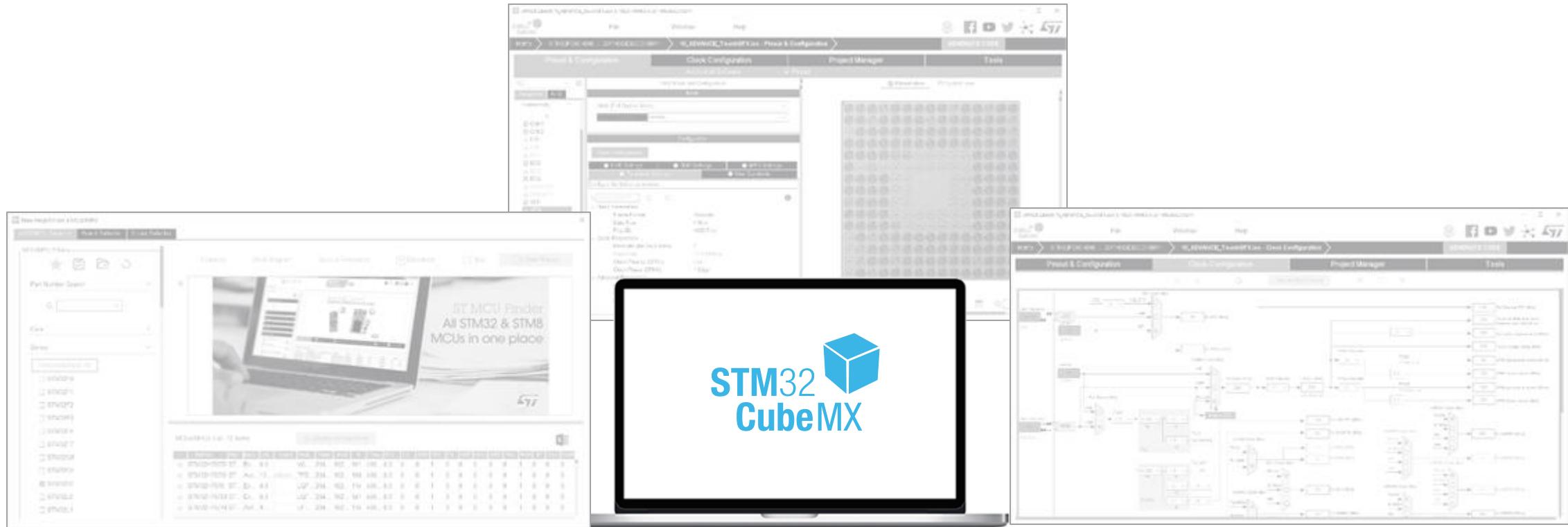
## **Development tools**



# STM32CubeMX

STM32  
CubeMX

# What's STM32CubeMX?

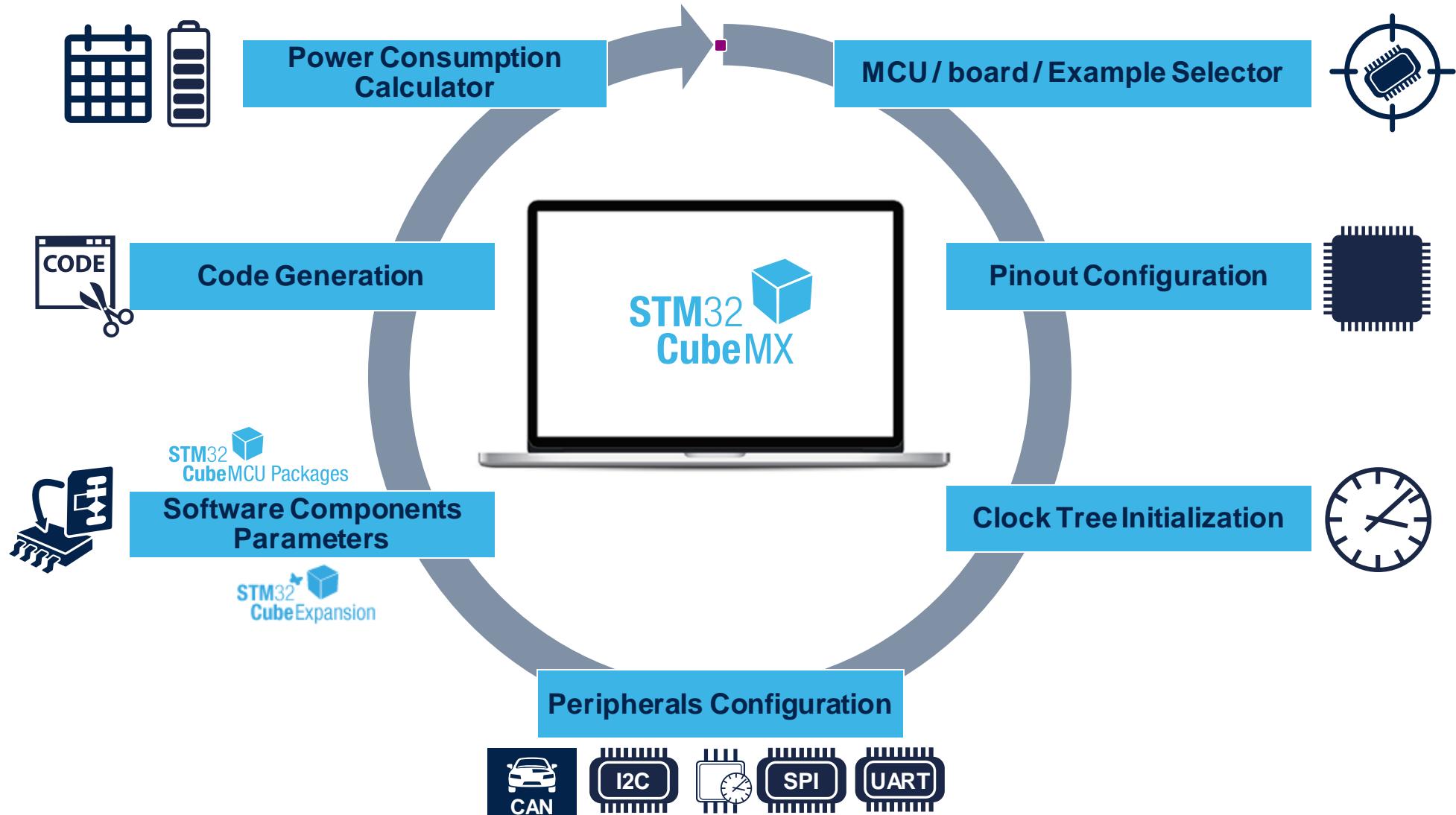


**Graphical Configuration**  
(Pinout/Peripherals/Middleware/Clock-Tree)

**IDE Project Generation**  
(IAR™, Keil™ and GCC compilers)

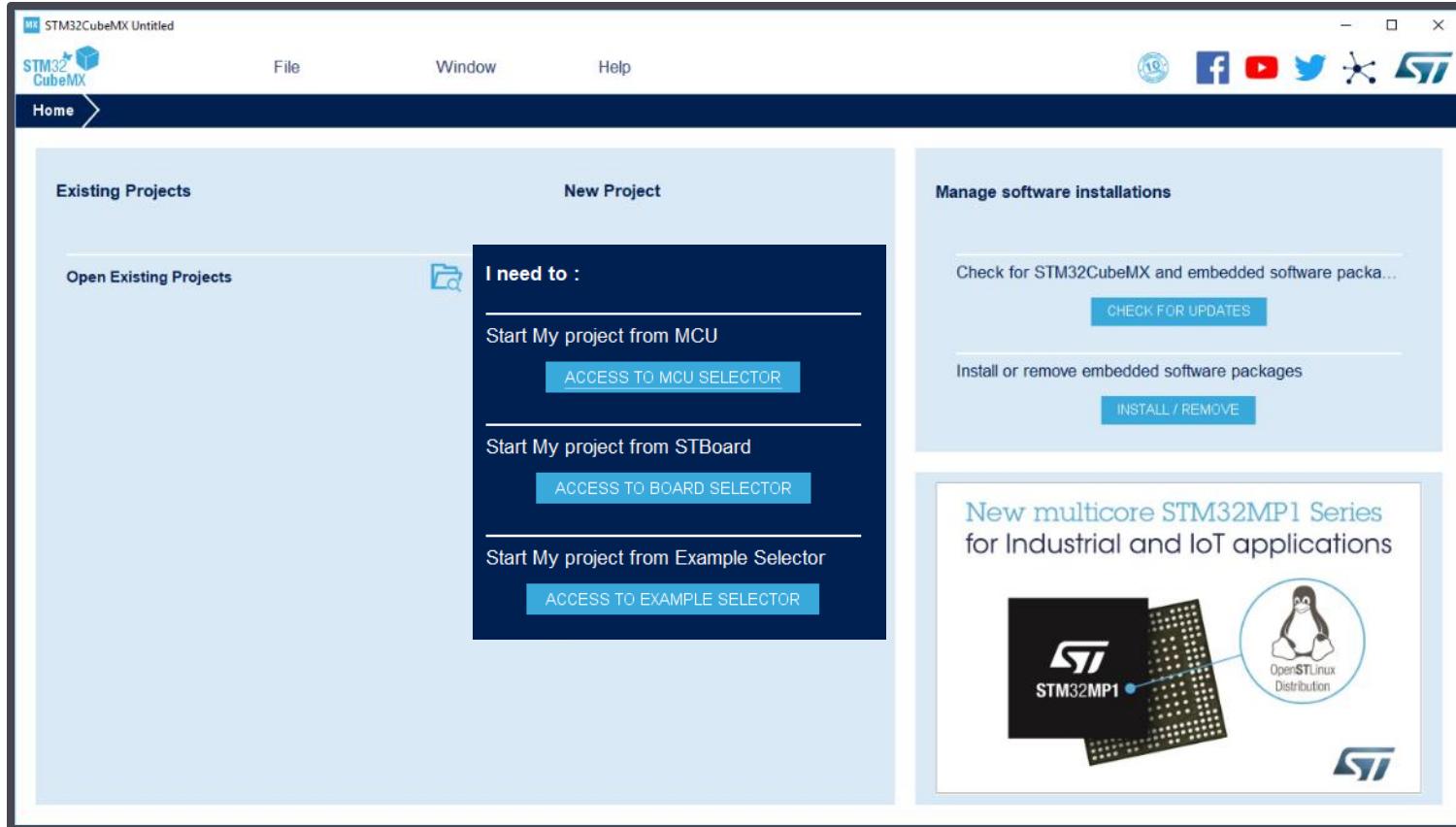
**Multi-platform**  
(Windows, Linux, macOS)

# STM32CubeMX key steps





# MCU / MPU selection



MCU / MPU  
SELECTOR

BOARD  
SELECTOR

EXAMPLE  
SELECTOR



# MCU/MPU selector

MX New Project from a MCU/MPU

MCU/MPU Selector Board Selector Cross Selector

MCU/MPU Filters

Part Number Search

Core >

Series >

Check/Uncheck All

- STM32F0
- STM32F1
- STM32F2
- STM32F3
- STM32F4
- STM32F7
- STM32G0
- STM32G4
- STM32H7
- STM32L0
- STM32L1

Features Block Diagram Docs & Resources Datasheet Buy Start Project

More than 1 million STM8 & STM32 boards sold

ST MCU Finder All STM32 & STM8 MCUs in one place

MCUs/MPUs List: 72 items

+ Display similar items

*	Part No	Ref...	Mark...	Unit...	Board	Pack...	Flash	RAM	IO	Freq.	GFX...	CO...	DDR	DEB...	FM...	HDP	HMAC	MDS	PKA	PWR	RF	SHA	TAMP
★	STM32H757ZI	ST...	Ev...	0.0	WL...	204...	102...	101	480...	0.0	0	0	0	1	0	0	0	0	0	1	0	0	0
★	STM32H757XI	ST...	Act...	10...	STM32H...	TFB...	204...	102...	168	480...	0.0	0	0	0	1	0	0	0	0	0	1	0	0
★	STM32H757II	ST...	Ev...	0.0	LQF...	204...	102...	114	480...	0.0	0	0	0	1	0	0	0	0	0	1	0	0	0
★	STM32H757BI	ST...	Ev...	0.0	LQF...	204...	102...	141	480...	0.0	0	0	0	1	0	0	0	0	0	1	0	0	0
★	STM32H757AI	ST...	Act...	9....	UF...	204...	102...	114	480...	0.0	0	0	0	1	0	0	0	0	0	1	0	0	0



# Board selector

MX New Project from a MCU/MPU

MCU/MPU Selector Board Selector Cross Selector

Vendor >

Type >

Discovery  Evaluation Board  Nucleo144

MCU/MPU Series >

STM32F2  STM32F3  STM32F4  STM32F7  STM32H7  STM32L4  STM32L4+  Other >  Peripheral

Features Large Picture Docs & Resources

★  ST MCU Finder  
All STM32 & STM8 MCUs in one place

Boards List: 5 items

*	Overview	Part No	Type	Marketing Status	Unit Price (US\$)	Mounted Device	MCU/MPU	Kit Contents	Included in ...
★		NUCLEO-H743ZI	Nucleo144	Active	23.0	<a href="#">STM32H743ZITx</a>	STM32H7		
★		NUCLEO-H743ZI2	Nucleo144		0.0	<a href="#">STM32H743ZITx</a>	STM32H7		
★		NUCLEO-H745ZI-Q	Nucleo144	Active	29.0	<a href="#">STM32H745ZITx</a>	STM32H7		



# Example selector

New Project from Example

MCU/MPU Selector | Board Selector | Example Selector | Cross Selector

Example Filters

Name:

Keyword:  Flash

Vendor: Flash memory, NOR flash, external flash

STMicroelectronics

Board

MCU / MPU

Name:

Series:

STM32F4  
 STM32F7  
 STM32G0  
 STM32G4  
 STM32H7  
 STM32L5  
 STM32WB

Project

Toolchain / IDE

EWARM  
 MDK-ARM  
 STM32CubeIDE

Features

Start Project

SIL Ready, ASIL Ready, ClassB Ready, Partner Program

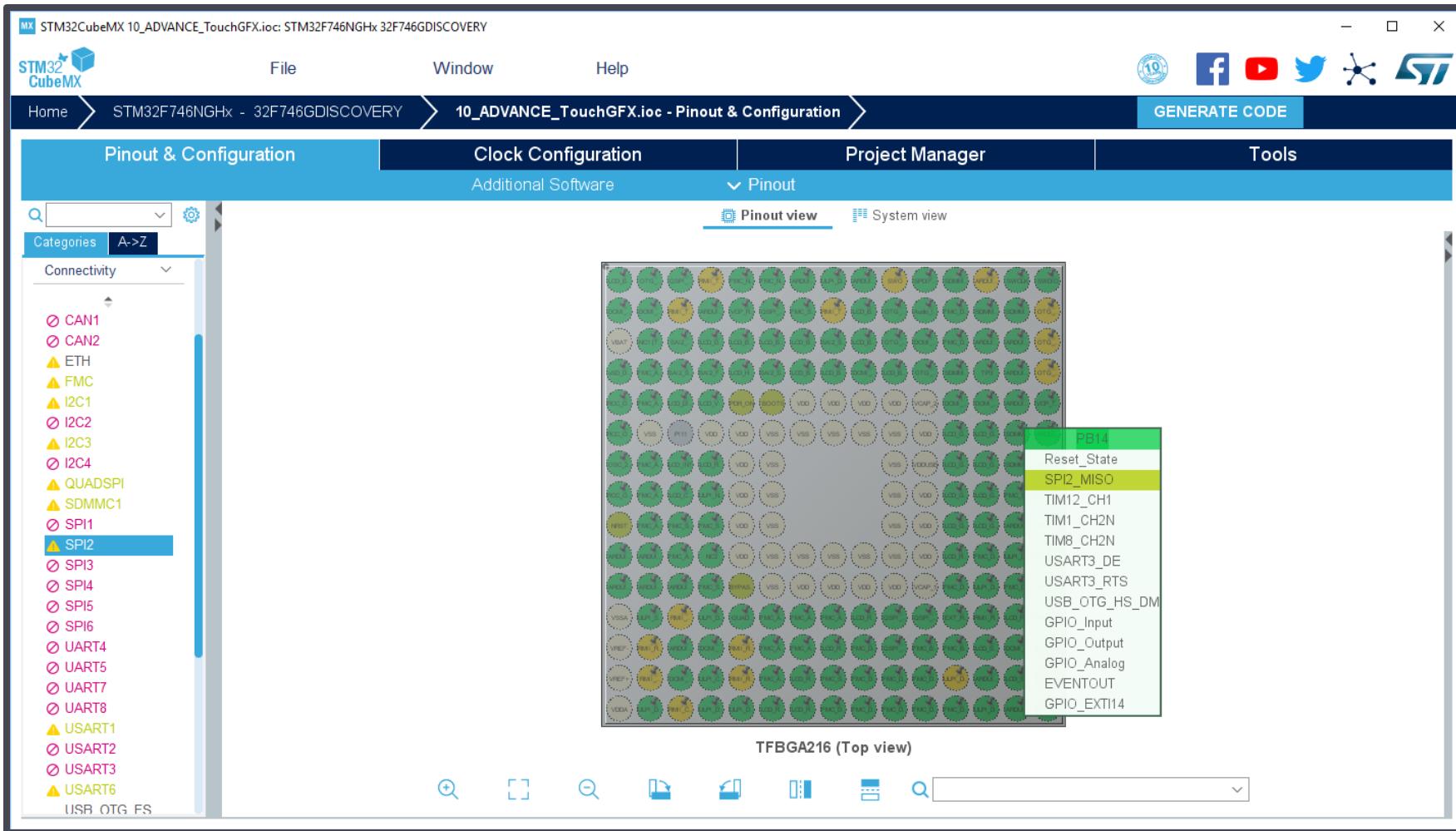
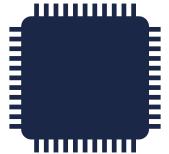
Build your certified safety system with STM32 and STM8

STM logo

Examples List: 59 items

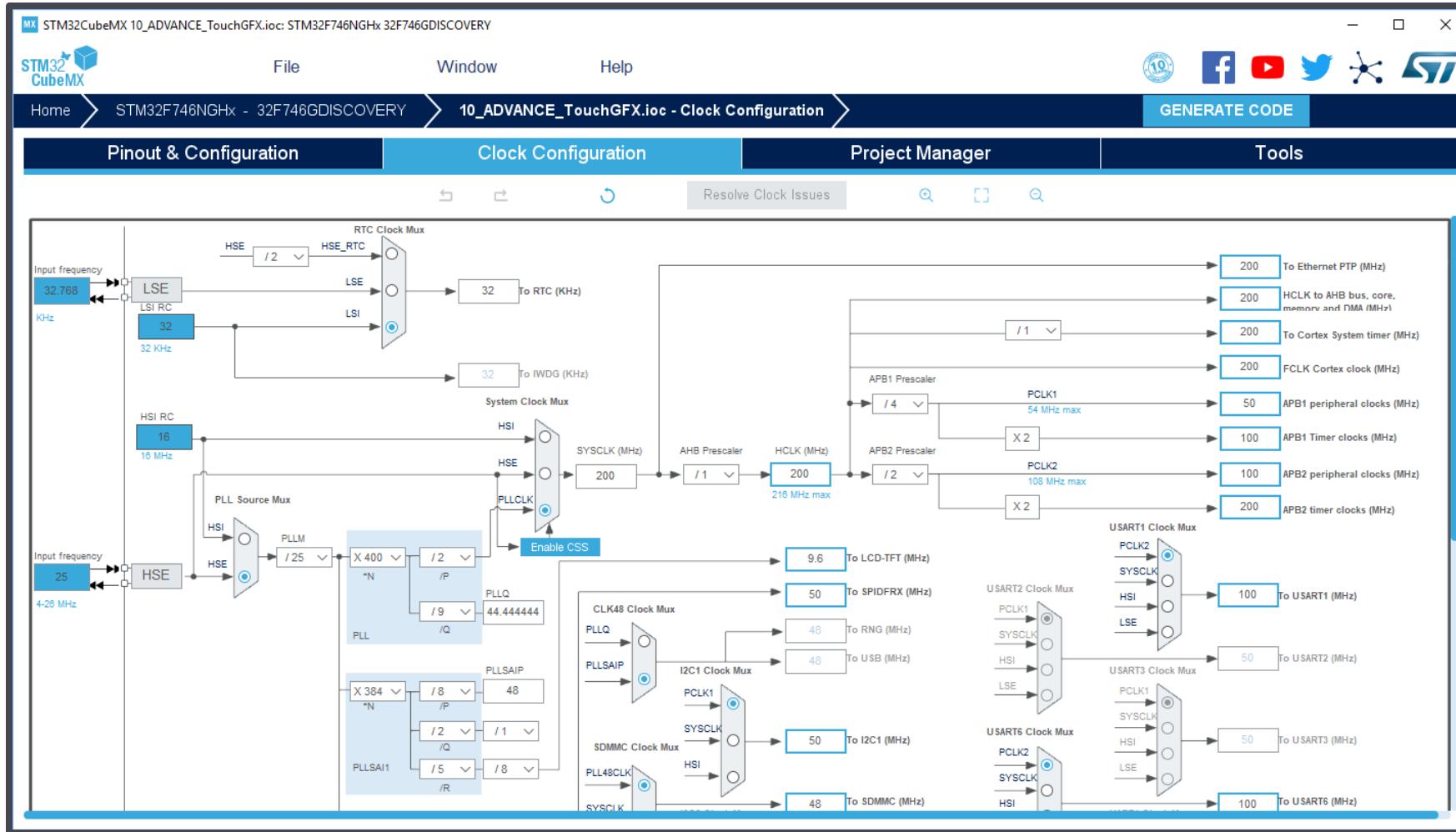
Name	Board	Board Type	Series	Project Type	Driver
DMA_CopyFromFlashToMemory	NUCLEO-H723ZD	Nucleo-144	STM32H7	Example	LL
DMA_CopyFromFlashToMemory	NUCLEO-H7A3ZI-Q	Nucleo-144	STM32H7	Example	LL
DMA_CopyFromFlashToMemory_Init	NUCLEO-H723ZD	Nucleo-144	STM32H7	Example	LL
DMA_FLASHToRAM	NUCLEO-H723ZG	Nucleo-144	STM32H7	Example	MIX
DMA_FLASHToRAM	NUCLEO-H7A3ZD-Q	Nucleo-144	STM32H7	Example	MIX
DMA_FLASHToRAM	STM32H743H-EVAL	Evaluation Board	STM32H7	Example	HAL
DMA_FLASHToRAM	STM32H7B9-EVAL	Evaluation Board	STM32H7	Example	HAL
EEPROM_Emulation	NUCLEO-H743ZD	Nucleo-144	STM32H7	Application	HAL
EEPROM_Emulation	NUCLEO-H7A3ZD-Q	Nucleo-144	STM32H7	Application	HAL
EEPROM_Emulation	STM32H743H-EVAL	Evaluation Board	STM32H7	Application	HAL
FLASH_CoreConfiguration	STM32H745L0I8Q	Discovery Kit	STM32H7	Example	HAL
FLASH_EraseProgram	NUCLEO-H723ZG	Nucleo-144	STM32H7	Example	HAL
FLASH_EraseProgram	STM32H735Q-DK	Discovery Kit	STM32H7	Example	HAL
FLASH_EraseProgram	NUCLEO-H743ZD	Nucleo-144	STM32H7	Example	HAL
FLASH_EraseProgram	NUCLEO-H7A3ZD-Q	Nucleo-144	STM32H7	Example	HAL

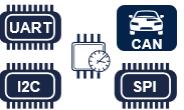
# Pinout configuration





# Clock-tree configuration





# Peripheral parameters

The screenshot shows the STM32CubeMX software interface. The title bar indicates the project is "STM32CubeMX 10\_ADVANCE\_TouchGFX.ioc: STM32F746NGHx 32F746GDISCOVERY". The main menu includes File, Window, Help, and several social media and ST logos. The navigation bar shows the path: Home > STM32F746NGHx - 32F746GDISCOVERY > 10\_ADVANCE\_TouchGFX.ioc - Pinout & Configuration.

The central panel displays the "Clock Configuration" tab, which is part of the "Pinout & Configuration" section. It shows the "SPI2 Mode and Configuration" settings. The "Mode" dropdown is set to "Full-Duplex Master" and the "Hardware NSS Signal" dropdown is set to "Disable". Below these, there are tabs for "Reset Configuration" and "Parameter Settings" (which is selected). The configuration parameters listed include:

- Basic Parameters:
  - Frame Format: Motorola
  - Data Size: 4 Bits
  - First Bit: MSB First
- Clock Parameters:
  - Prescaler (for Baud Rate): 2
  - Baud Rate: 25.0 Mbits/s
  - Clock Polarity (CPOL): Low
  - Clock Phase (CPHA): 1 Edge
- Advanced Parameters:
  - CRC Calculation: Disabled
  - NSSP Mode: Enabled
  - NSS Signal Type: Software

To the right of the configuration panel is a "Pinout view" showing a grid of pins for a TFBGA216 package, labeled "TFBGA216 (Top view)". The pinout grid contains numerous green and yellow circular icons representing different pin functions.



# Middleware and software components parameters

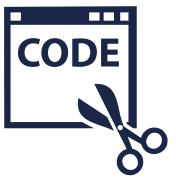
The screenshot shows the STM32CubeMX software interface. The title bar indicates the project is "STM32CubeMX 10\_ADVANCE\_TouchGFX.ioc: STM32F746NGHx 32F746GDISCOVERY". The main menu includes File, Window, Help, and various icons for social media and tools. The navigation bar shows the path: Home > STM32F746NGHx - 32F746GDISCOVERY > 10\_ADVANCE\_TouchGFX.ioc - Pinout & Configuration.

The left sidebar lists categories: System Core, Analog, Timers, Connectivity, Multimedia, Security, Computing, Middleware, FATFS, FREERTOS, GRAPHICS, LIBJPEG, LWIP, MBEDTLS, PDM2PCM, USB\_DEVICE, and USB\_HOST. The "FREERTOS" option is selected.

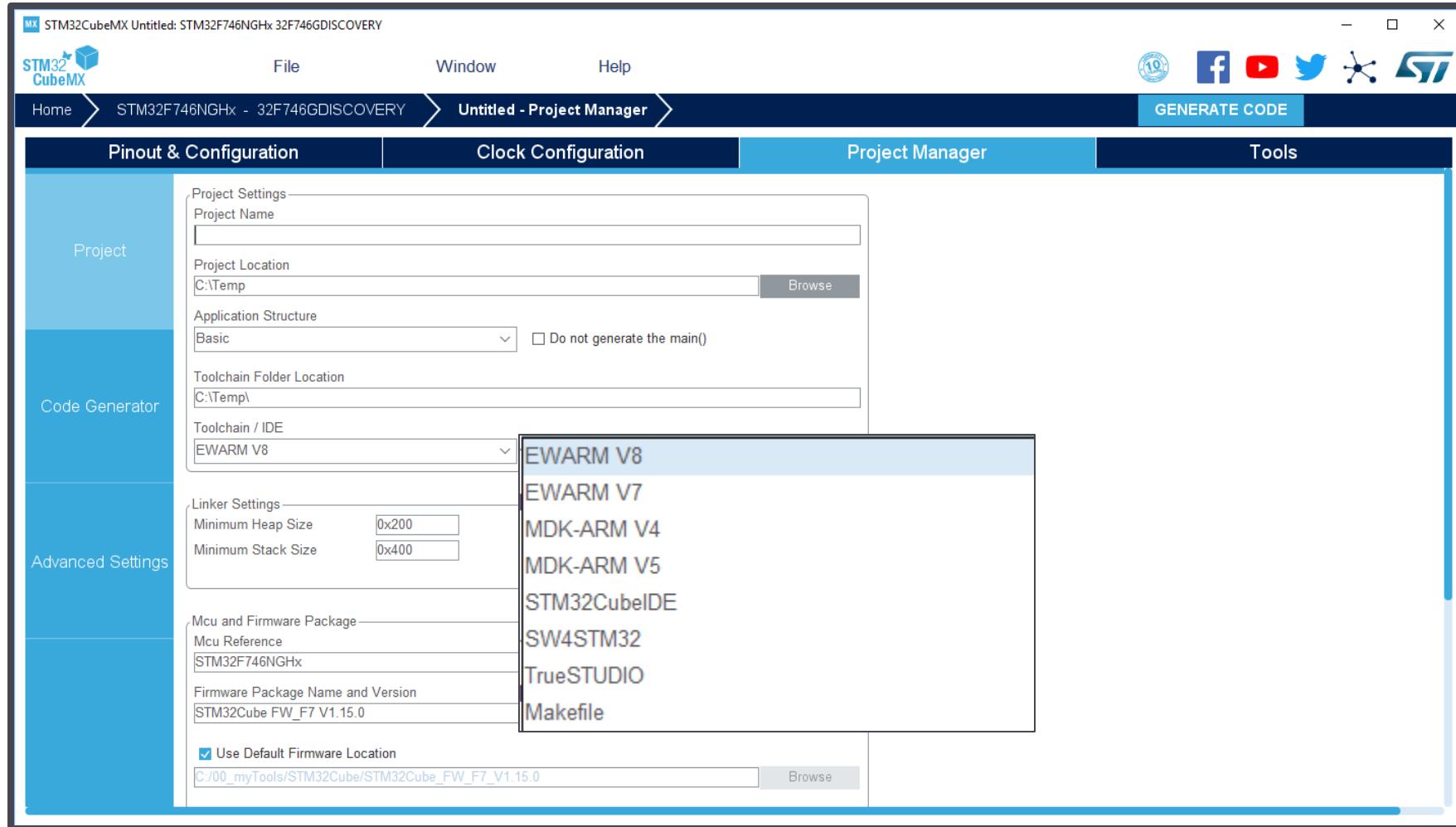
The central area has tabs for Pinout & Configuration, Clock Configuration, Additional Software, Project Manager, and Tools. The Pinout & Configuration tab is active, showing the "FREERTOS Mode and Configuration" section. It includes fields for "Interface" (set to CMSIS\_V1) and sections for "Mode" and "Configuration". Under "Configuration", there are checkboxes for Mutexes, Tasks and Queues, Config parameters, FreeRTOS Heap Usage, Timers and Semaphores, Include parameters, and User Constants. Below this, a list of kernel settings is provided:

Setting	Value
USE_PREEMPTION	Enabled
CPU_CLOCK_HZ	SystemCoreClock
TICK_RATE_HZ	1000
MAX_PRIORITIES	7
MINIMAL_STACK_SIZE	128 Words
MAX_TASK_NAME_LEN	16
USE_16_BIT_TICKS	Disabled
IDLE_SHOULD_YIELD	Enabled
USE_MUTEXES	Enabled
USE_RECURSIVE_MUTEXES	Enabled
USE_COUNTING_SEMAPHORES	Enabled
QUEUE_REGISTRY_SIZE	8
USE_APPLICATION_TASK_TAG	Enabled

To the right, a large grid diagram titled "TFBGA216 (Top view)" shows the pinout layout for the TFBGA216 package. The pins are color-coded and labeled with their functions. Navigation icons at the bottom include magnifying glasses, arrows, and a search bar.



# Code generation





# Power consumption calculator

STM32CubeMX 10\_ADVANCE\_TouchGFX.ioc\*: STM32F746NGHx 32F746GDISCOVERY

File Window Help

STM32CubeMX Home STM32F746NGHx - 32F746GDISCOVERY 10\_ADVANCE\_TouchGFX.ioc - Tools GENERATE CODE

Pinout & Configuration Clock Configuration Project Manager Tools

Power

STM32F746NGHx  
T<sub>A</sub> 25°C / V<sub>DD</sub> 3.3V  
Alkaline(C LR14) (1x1)

PCC Change Reset

New Step Step Sequence

Sequence Table

Step	Mode	Vdd	Range/Scale	Memory	CPU/Bus Freq	Clock Config	Peripherals	Step Current	Duration
1	RUN	3.3	Scale1-High	SRAM/FLAS...	216 MHz	HSE PLL	ADC3 CRC D...	163.5 mA	1 ms
2	STOP_NM (N...)	3.3	No Scale	n/a	0 Hz	Regulator_LP ...	IWDG	270.25 µA	1 ms

Edit Step

Reset Step Settings Enable All IPs Disable All IPs Enable IPs from Pinout

Power/Memory

Power Mode RUN

Power Scale Scale1-High

Memory Fetch Type SRAM/LASH-ART/L1Cache/REGON

V<sub>DD</sub> 3.3

Voltage Source Battery

Clocks

CPU Frequency 216 MHz

Interpolation Ranges

User Choice (Hz)

Clock Configuration HSE PLL

Clock Source Frequency 4 MHz

Optional Settings

Step Duration 1 ms

Additional Consumption 0 mA

Results

Step Consumption 163.5 mA

Without Peripherals 108 mA

Peripherals Part 65.5 mA (A: 1.75 mA - D: 53.77 mA)

Ta Max (°C) 89.35

Warnings

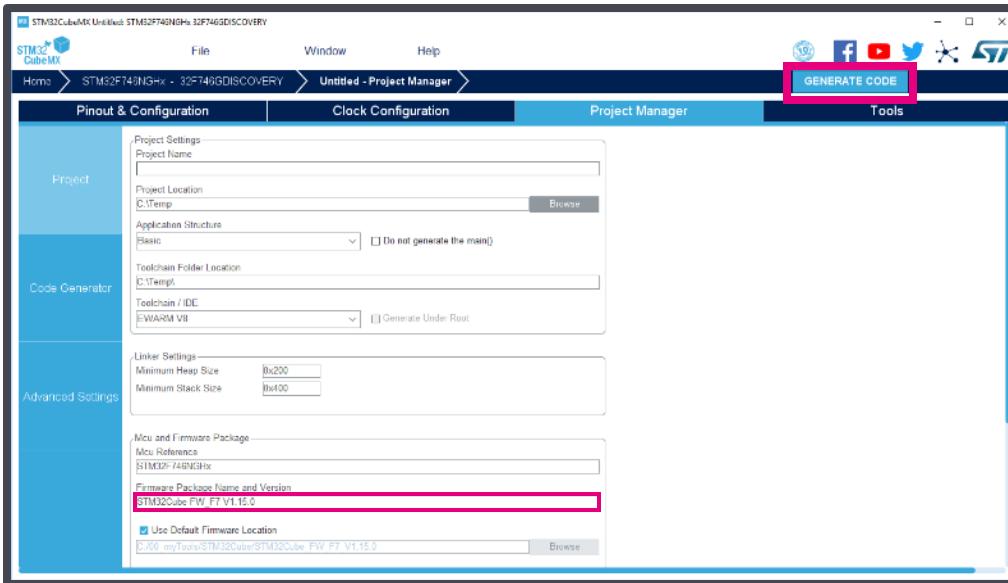
Peripherals Selection

Enabled Peripherals

- ADC1
- ADC2
- ADC3
- DAC
- BKPSRAM
- BusMatrix
- CAN1
- CAN2
- CEC
- CRC
- CRYP
- DCMI
- DMA1
- DMA2
- GPIOA
- GPIOB
- GPIOC
- GPIOE
- GPIOF
- GPIOH
- GPIOJ
- GPIOK
- RTC
- LTC
- QUADSPI
- RTC
- SPI1
- SPI2
- SPI3
- SPI4
- TIM1
- TIM2
- TIM3
- TIM6
- TIM12
- USART1
- USART2
- USART3
- USART6
- USART7
- USART8
- USART9
- USART10
- USART11
- USART12
- USART13
- USART14
- USART15
- USART16
- USART17
- USART18
- USART19
- USART20
- USART21
- USART22
- USART23
- USART24
- USART25
- USART26
- USART27
- USART28
- USART29
- USART30
- USART31
- USART32
- USART33
- USART34
- USART35
- USART36
- USART37
- USART38
- USART39
- USART40
- USART41
- USART42
- USART43
- USART44
- USART45
- USART46
- USART47
- USART48
- USART49
- USART50
- USART51
- USART52
- USART53
- USART54
- USART55
- USART56
- USART57
- USART58
- USART59
- USART60
- USART61
- USART62
- USART63
- USART64
- USART65
- USART66
- USART67
- USART68
- USART69
- USART70
- USART71
- USART72
- USART73
- USART74
- USART75
- USART76
- USART77
- USART78
- USART79
- USART80
- USART81
- USART82
- USART83
- USART84
- USART85
- USART86
- USART87
- USART88
- USART89
- USART90
- USART91
- USART92
- USART93
- USART94
- USART95
- USART96
- USART97
- USART98
- USART99
- USART100
- USART101
- USART102
- USART103
- USART104
- USART105
- USART106
- USART107
- USART108
- USART109
- USART110
- USART111
- USART112
- USART113
- USART114
- USART115
- USART116
- USART117
- USART118
- USART119
- USART120
- USART121
- USART122
- USART123
- USART124
- USART125
- USART126
- USART127
- USART128
- USART129
- USART130
- USART131
- USART132
- USART133
- USART134
- USART135
- USART136
- USART137
- USART138
- USART139
- USART140
- USART141
- USART142
- USART143
- USART144
- USART145
- USART146
- USART147
- USART148
- USART149
- USART150
- USART151
- USART152
- USART153
- USART154
- USART155
- USART156
- USART157
- USART158
- USART159
- USART160
- USART161
- USART162
- USART163
- USART164
- USART165
- USART166
- USART167
- USART168
- USART169
- USART170
- USART171
- USART172
- USART173
- USART174
- USART175
- USART176
- USART177
- USART178
- USART179
- USART180
- USART181
- USART182
- USART183
- USART184
- USART185
- USART186
- USART187
- USART188
- USART189
- USART190
- USART191
- USART192
- USART193
- USART194
- USART195
- USART196
- USART197
- USART198
- USART199
- USART200
- USART201
- USART202
- USART203
- USART204
- USART205
- USART206
- USART207
- USART208
- USART209
- USART210
- USART211
- USART212
- USART213
- USART214
- USART215
- USART216
- USART217
- USART218
- USART219
- USART220
- USART221
- USART222
- USART223
- USART224
- USART225
- USART226
- USART227
- USART228
- USART229
- USART230
- USART231
- USART232
- USART233
- USART234
- USART235
- USART236
- USART237
- USART238
- USART239
- USART240
- USART241
- USART242
- USART243
- USART244
- USART245
- USART246
- USART247
- USART248
- USART249
- USART250
- USART251
- USART252
- USART253
- USART254
- USART255
- USART256
- USART257
- USART258
- USART259
- USART260
- USART261
- USART262
- USART263
- USART264
- USART265
- USART266
- USART267
- USART268
- USART269
- USART270
- USART271
- USART272
- USART273
- USART274
- USART275
- USART276
- USART277
- USART278
- USART279
- USART280
- USART281
- USART282
- USART283
- USART284
- USART285
- USART286
- USART287
- USART288
- USART289
- USART290
- USART291
- USART292
- USART293
- USART294
- USART295
- USART296
- USART297
- USART298
- USART299
- USART300
- USART301
- USART302
- USART303
- USART304
- USART305
- USART306
- USART307
- USART308
- USART309
- USART310
- USART311
- USART312
- USART313
- USART314
- USART315
- USART316
- USART317
- USART318
- USART319
- USART320
- USART321
- USART322
- USART323
- USART324
- USART325
- USART326
- USART327
- USART328
- USART329
- USART330
- USART331
- USART332
- USART333
- USART334
- USART335
- USART336
- USART337
- USART338
- USART339
- USART340
- USART341
- USART342
- USART343
- USART344
- USART345
- USART346
- USART347
- USART348
- USART349
- USART350
- USART351
- USART352
- USART353
- USART354
- USART355
- USART356
- USART357
- USART358
- USART359
- USART360
- USART361
- USART362
- USART363
- USART364
- USART365
- USART366
- USART367
- USART368
- USART369
- USART370
- USART371
- USART372
- USART373
- USART374
- USART375
- USART376
- USART377
- USART378
- USART379
- USART380
- USART381
- USART382
- USART383
- USART384
- USART385
- USART386
- USART387
- USART388
- USART389
- USART390
- USART391
- USART392
- USART393
- USART394
- USART395
- USART396
- USART397
- USART398
- USART399
- USART400
- USART401
- USART402
- USART403
- USART404
- USART405
- USART406
- USART407
- USART408
- USART409
- USART410
- USART411
- USART412
- USART413
- USART414
- USART415
- USART416
- USART417
- USART418
- USART419
- USART420
- USART421
- USART422
- USART423
- USART424
- USART425
- USART426
- USART427
- USART428
- USART429
- USART430
- USART431
- USART432
- USART433
- USART434
- USART435
- USART436
- USART437
- USART438
- USART439
- USART440
- USART441
- USART442
- USART443
- USART444
- USART445
- USART446
- USART447
- USART448
- USART449
- USART450
- USART451
- USART452
- USART453
- USART454
- USART455
- USART456
- USART457
- USART458
- USART459
- USART460
- USART461
- USART462
- USART463
- USART464
- USART465
- USART466
- USART467
- USART468
- USART469
- USART470
- USART471
- USART472
- USART473
- USART474
- USART475
- USART476
- USART477
- USART478
- USART479
- USART480
- USART481
- USART482
- USART483
- USART484
- USART485
- USART486
- USART487
- USART488
- USART489
- USART490
- USART491
- USART492
- USART493
- USART494
- USART495
- USART496
- USART497
- USART498
- USART499
- USART500
- USART501
- USART502
- USART503
- USART504
- USART505
- USART506
- USART507
- USART508
- USART509
- USART510
- USART511
- USART512
- USART513
- USART514
- USART515
- USART516
- USART517
- USART518
- USART519
- USART520
- USART521
- USART522
- USART523
- USART524
- USART525
- USART526
- USART527
- USART528
- USART529
- USART530
- USART531
- USART532
- USART533
- USART534
- USART535
- USART536
- USART537
- USART538
- USART539
- USART540
- USART541
- USART542
- USART543
- USART544
- USART545
- USART546
- USART547
- USART548
- USART549
- USART550
- USART551
- USART552
- USART553
- USART554
- USART555
- USART556
- USART557
- USART558
- USART559
- USART560
- USART561
- USART562
- USART563
- USART564
- USART565
- USART566
- USART567
- USART568
- USART569
- USART570
- USART571
- USART572
- USART573
- USART574
- USART575
- USART576
- USART577
- USART578
- USART579
- USART580
- USART581
- USART582
- USART583
- USART584
- USART585
- USART586
- USART587
- USART588
- USART589
- USART590
- USART591
- USART592
- USART593
- USART594
- USART595
- USART596
- USART597
- USART598
- USART599
- USART600
- USART601
- USART602
- USART603
- USART604
- USART605
- USART606
- USART607
- USART608
- USART609
- USART610
- USART611
- USART612
- USART613
- USART614
- USART615
- USART616
- USART617
- USART618
- USART619
- USART620
- USART621
- USART622
- USART623
- USART624
- USART625
- USART626
- USART627
- USART628
- USART629
- USART630
- USART631
- USART632
- USART633
- USART634
- USART635
- USART636
- USART637
- USART638
- USART639
- USART640
- USART641
- USART642
- USART643
- USART644
- USART645
- USART646
- USART647
- USART648
- USART649
- USART650
- USART651
- USART652
- USART653
- USART654
- USART655
- USART656
- USART657
- USART658
- USART659
- USART660
- USART661
- USART662
- USART663
- USART664
- USART665
- USART666
- USART667
- USART668
- USART669
- USART670
- USART671
- USART672
- USART673
- USART674
- USART675
- USART676
- USART677
- USART678
- USART679
- USART680
- USART681
- USART682
- USART683
- USART684
- USART685
- USART686
- USART687
- USART688
- USART689
- USART690
- USART691
- USART692
- USART693
- USART694
- USART695
- USART696
- USART697
- USART698
- USART699
- USART700
- USART701
- USART702
- USART703
- USART704
- USART705
- USART706
- USART707
- USART708
- USART709
- USART710
- USART711
- USART712
- USART713
- USART714
- USART715
- USART716
- USART717
- USART718
- USART719
- USART720
- USART721
- USART722
- USART723
- USART724
- USART725
- USART726
- USART727
- USART728
- USART729
- USART730
- USART731
- USART732
- USART733
- USART734
- USART735
- USART736
- USART737
- USART738
- USART739
- USART740
- USART741
- USART742
- USART743
- USART744
- USART745
- USART746
- USART747
- USART748
- USART749
- USART750
- USART751
- USART752
- USART753
- USART754
- USART755
- USART756
- USART757
- USART758
- USART759
- USART760
- USART761
- USART762
- USART763
- USART764
- USART765
- USART766
- USART767
- USART768
- USART769
- USART770
- USART771
- USART772
- USART773
- USART774
- USART775
- USART776
- USART777
- USART778
- USART779
- USART780
- USART781
- USART782
- USART783
- USART784
- USART785
- USART786
- USART787
- USART788
- USART789
- USART790
- USART791
- USART792
- USART793
- USART794
- USART795
- USART796
- USART797
- USART798
- USART799
- USART800
- USART801
- USART802
- USART803
- USART804
- USART805
- USART806
- USART807
- USART808
- USART809
- USART810
- USART811
- USART812
- USART813
- USART814
- USART815
- USART816
- USART817
- USART818
- USART819
- USART820
- USART821
- USART822
- USART823
- USART824
- USART825
- USART826
- USART827
- USART828
- USART829
- USART830
- USART831
- USART832
- USART833
- USART834
- USART835
- USART836
- USART837
- USART838
- USART839
- USART840
- USART841
- USART842
- USART843
- USART844
- USART845
- USART846
- USART847
- USART848
- USART849
- USART850
- USART851
- USART852
- USART853
- USART854
- USART855
- USART856
- USART857
- USART858
- USART859
- USART860
- USART861
- USART862
- USART863
- USART864
- USART865
- USART866
- USART867
- USART868
- USART869
- USART870
- USART871
- USART872
- USART873
- USART874
- USART875
- USART876
- USART877
- USART878
- USART879
- USART880
- USART881
- USART882
- USART883
- USART884
- USART885
- USART886
- USART887
- USART888
- USART889
- USART890
- USART891
- USART892
- USART893
- USART894
- USART895
- USART896
- USART897
- USART898
- USART899
- USART900
- USART901
- USART902
- USART903
- USART904
- USART905
- USART906
- USART907
- USART908
- USART909
- USART910
- USART911
- USART912
- USART913
- USART914
- USART915
- USART916
- USART917
- USART918
- USART919
- USART920
- USART921
- USART922
- USART923
- USART924
- USART925
- USART926
- USART927
- USART928
- USART929
- USART930
- USART931
- USART932
- USART933
- USART934
- USART935
- USART936
- USART937
- USART938
- USART939
- USART940
- USART941
- USART942
- USART943
- USART944
- USART945
- USART946
- USART947
- USART948
- USART949
- USART950
- USART951
- USART952
- USART953
- USART954
- USART955
- USART956
- USART957
- USART958
- USART959
- USART960
- USART961
- USART962
- USART963
- USART964
- USART965
- USART966
- USART967
- USART968
- USART969
- USART970
- USART971
- USART972
- USART973
- USART974
- USART975
- USART976
- USART977
- USART978
- USART979
- USART980
- USART981
- USART982
- USART983
- USART984
- USART985
- USART986
- USART987
- USART988
- USART989
- USART990
- USART991
- USART992
- USART993
- USART994
- USART995
- USART996
- USART997
- USART998
- USART999
- USART1000
- USART1001
- USART1002
- USART1003
- USART1004
- USART1005
- USART1006
- USART1007
- USART1008
- USART1009
- USART1010
- USART1011
- USART1012
- USART1013
- USART1014
- USART1015
- USART1016
- USART1017
- USART1018
- USART1019
- USART1020
- USART1021
- USART1022
- USART1023
- USART1024
- USART1025
- USART1026
- USART1027
- USART1028
- USART1029
- USART1030
- USART1031
- USART1032
- USART1033
- USART1034
- USART1035
- USART1036
- USART1037
- USART1038
- USART1039
- USART1040
- USART1041
- USART1042
- USART1043
- USART1044
- USART1045
- USART1046
- USART1047
- USART1048
- USART1049
- USART1050
- USART1051
- USART1052
- USART1053
- USART1054
- USART1055
- USART1056
- USART1057
- USART1058
- USART1059
- USART1060
- USART1061
- USART1062
- USART1063
- USART1064
- USART1065
- USART1066
- USART1067
- USART1068
- USART1069
- USART1070
- USART1071
- USART1072
- USART1073
- USART1074
- USART1075
- USART1076
- USART1077
- USART1078
- USART1079
- USART1080
- USART1081
- USART1082
- USART1083
- USART1084
- USART1085
- USART1086
- USART1087
- USART1088
- USART1089
- USART1090
- USART1091
- USART1092
- USART1093
- USART1094
- USART1095
- USART1096
- USART1097
- USART1098
- USART1099
- USART1100
- USART1101
- USART1102
- USART1103
- USART1104
- USART1105
- USART1106
- USART1107
- USART1108
- USART1109
- USART1110
- USART1111
- USART1112
- USART1113
-

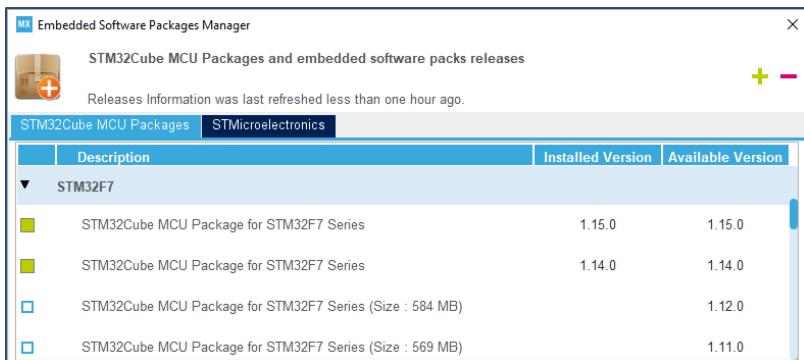


# STM32CubeMX repository

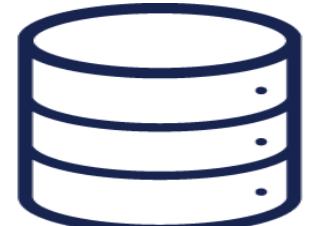


After pressing “GENERATE CODE”:

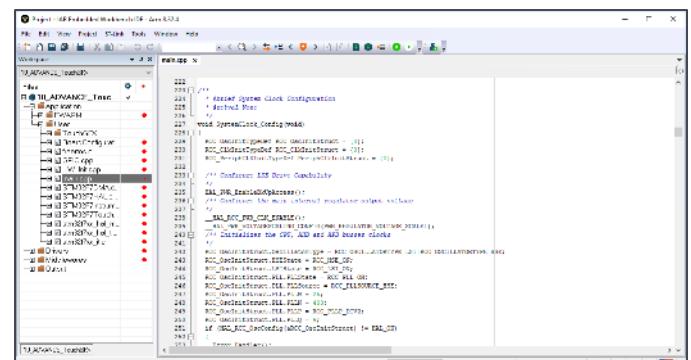
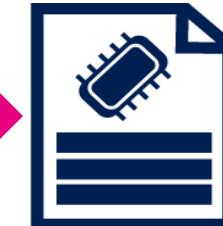
1. STM32CubeMX grabs necessary peripheral drivers based on your pinout/peripheral configuration from STM32Cube MCU Package in STM32CubeMX Repository
  2. STM32CubeMX grabs necessary middleware based on your middleware configuration from STM32Cube MCU Package in STM32CubeMX repository
  3. Generate IDE project



# STM32CubeMX Repository



# IDE Project





# MCU/MPU selection for graphic application

MX New Project

MCU/MPU Selector | Board Selector | Cross Selector

Advanced Graphic

Enable

Display Resolution : 480x272

Height: 272 Pixels  
1 768

Width: 480 Pixels  
1 1280

Display Interface : RGB Parallel 16-bit - RGB565

Frame Buffer Format : 24bpp - RGB888

GFX RAM : Internal RAM

GFX Flash : Internal Flash

Artificial Intelligence >

Peripheral >

Features Block Diagram Docs & Resources Datasheet Buy Start Project

New multicore STM32MP1 Series for Industrial and IoT applications

STM32MP1 OpenLinux Distribution

Graphic Summary AI Summary

Required Pixel Clock (MHz): 9.4

Required Graphic RAM (kBytes): 765.0

Maximum System Pixel Clock (MHz): 89.51 352.62

Graphic Performance Score (GFXMark): 241.89 112.5

MCUs/MPUs List: 153 items

Display similar items

*	Part No	Ref...	Mark...	Unit...	Board	Pack...	Flash	RAM	IO	Freq.	GFX...	CO...	DDR	DEB...	FM...	HDP	HMAC	MDS	PKA	PWR	RF	SHA	TAMP
☆	STM32F429...	ST...	Act...	6....	UF...	102...	256...	130	180...	306...	0	0	0	0	0	0	0	0	0	0	0	0	0
☆	STM32F429AI	ST...	Act...	7....	UF...	204...	256...	130	180...	306...	0	0	0	0	0	0	0	0	0	0	0	0	0
☆	STM32F429...	ST...	Act...	6....	LQF...	512...	256...	168	180...	306...	0	0	0	0	0	0	0	0	0	0	0	0	0
☆	STM32F429...	ST...	Act...	7....	LQF...	102...	256...	168	180...	306...	0	0	0	0	0	0	0	0	0	0	0	0	0
☆	STM32F429BI	ST...	Act...	8....	LQF...	204...	256...	168	180...	306...	0	0	0	0	0	0	0	0	0	0	0	0	0



# MCU/MPU selection for AI application

MX New Project from a MCU/MPU

MCU/MPU Selector | Board Selector | Cross Selector

Core >  
Series >  
Line >  
Package >  
Other >  
Advanced Graphic >  
Artificial Intelligence >

Enable

Model: Keras (highlighted)  
Type: Saved model  
Model: HAR-CNN-Kera....h5  
Compression: 4  
Peripheral: >

Graphic Summary | AI Summary

New multicore STM32MP1 Series for Industrial and IoT applications

STM32MP1 (STM32MP1) - OpenLinux Distribution

K Keras  
Minimum Ram: 44.50 KBytes  
Minimum Flash: 775.52 KBytes  
C:\100\_myProjects\AI\_DL\Trials\HAR-CNN-Keras\_model.h5

Keras  
Lasagne  
Caffe  
Convnetjs  
List: 338 items  
Display similar items

Ref...	Mark...	Unit...	Board	Pack...	Flash	RAM	IO	Freq.	GFX...	CO...	DDR	DEB...	FM...	HDP	HMAC	MDS	PKA	PWR	RF	SHA	TAMP
★	STM32F405...	ST...	Act...4....	WL...	102...	192...	72	168...	0.0	0	0	0	0	0	0	0	0	0	0	0	0
★	STM32F405...	ST...	Act...4....	LQF...	102...	192...	51	168...	0.0	0	0	0	0	0	0	0	0	0	0	0	0
★	STM32F405...	ST...	Act...5....	LQF...	102...	192...	82	168...	0.0	0	0	0	0	0	0	0	0	0	0	0	0
★	STM32F405...	ST...	Act...5....	LQF...	102...	192...	114	168...	0.0	0	0	0	0	0	0	0	0	0	0	0	0
★	STM32F407IG	ST...	Act...6....	STM324...	UF...	102...	192...	140	168...	0.0	0	0	0	0	0	0	0	0	0	0	0

# STM32CubeIDE

STM32  
CubeIDE

# Background of STM32CubeIDE

## History

a atollic  
TrueSTUDIO®

ST a atollic  
TrueSTUDIO® for STM32

STM32  
CubeMX

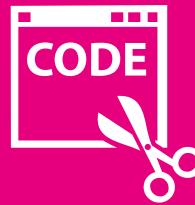


# One tool for all your STM32 development

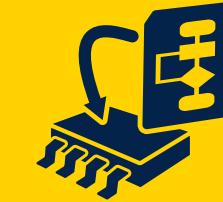
Chipset / Board Configuration



Code Development

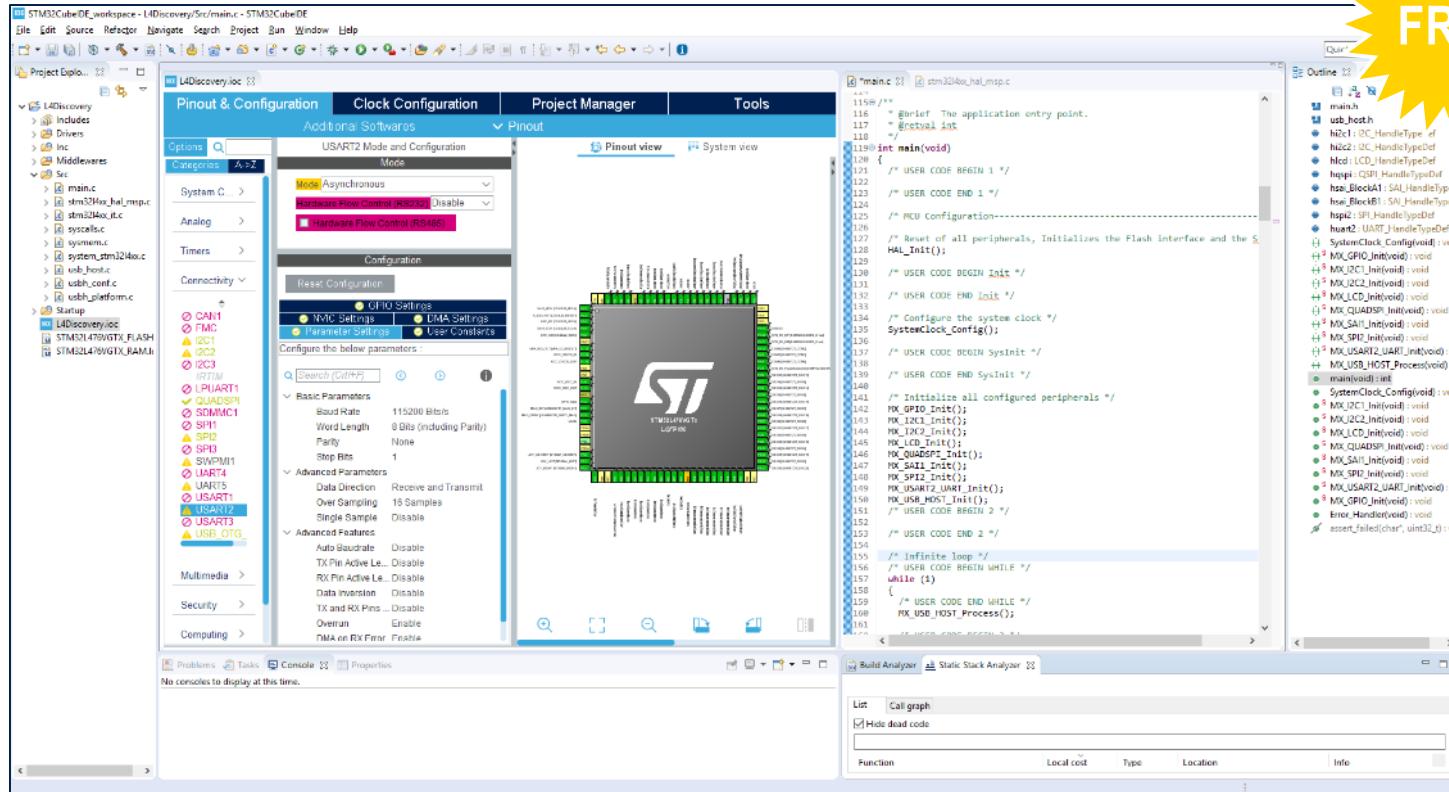


Validation Debug



# Free multi-platform development tool

eclipse



FREE

Windows



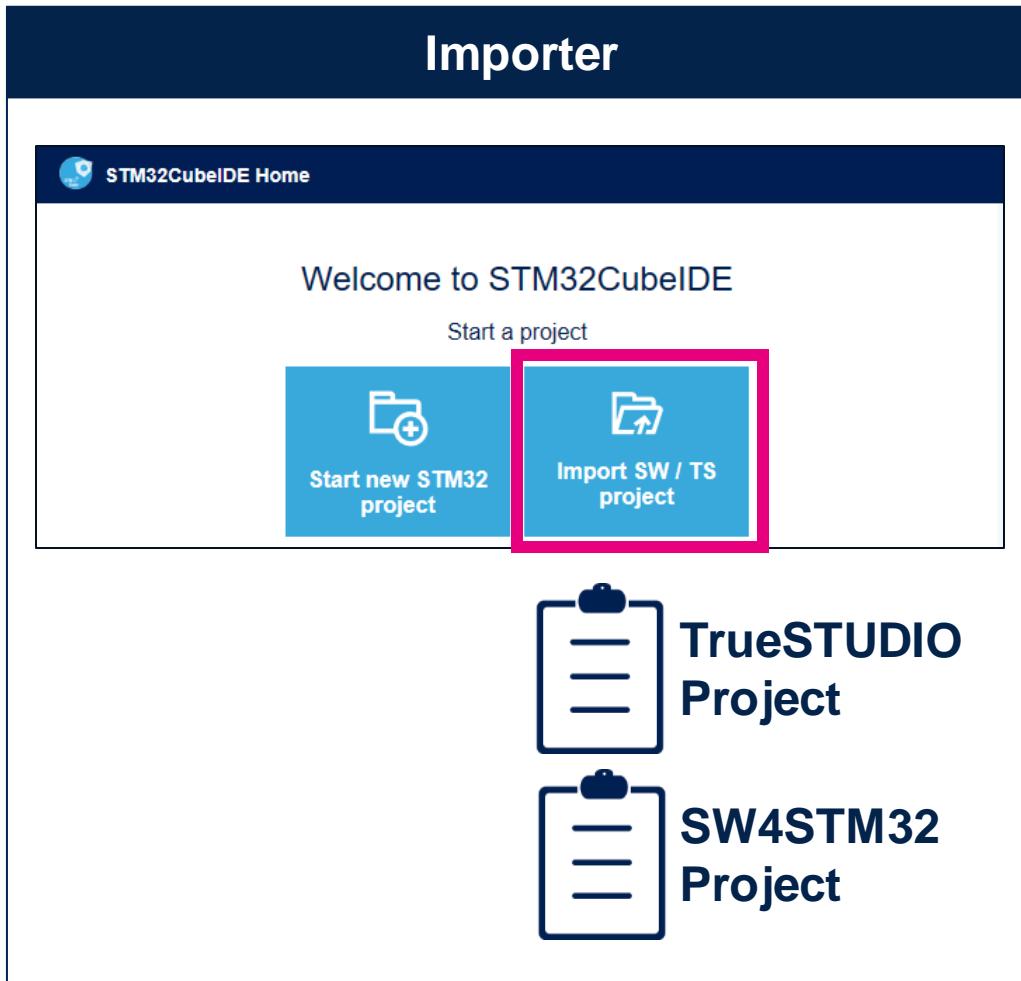
macOS

Eclipse/GCC Based

Free for Commercial Development

Multi-OS Support

# Project management





# Code editor – navigation

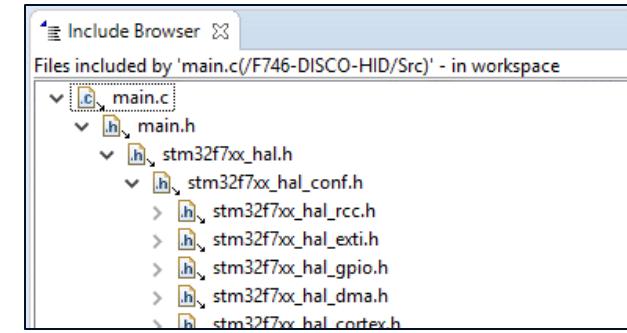
## Symbol Hyperlink

```
BSP_LED_Init(LED1);
BSP_LED_Init(LED2);
BSP_LED_Init(LED3);
BSP_LED_Init(LED4);

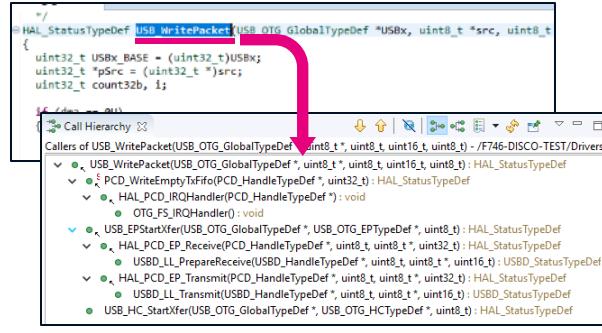
void BSP_LED_Init(Led_TypeDef Led)
{
    GPIO_InitTypeDef gpio_init_structure;

    if (Led <= LED4)
    {
        /* Configure the GPIO_LED pin */
        gpio_init_structure.Pin = GPIO_PIN[Led];
        gpio_init_structure.Mode = GPIO_MODE_OUTPUT_PP;
        gpio_init_structure.Pull = GPIO_PULLUP;
        gpio_init_structure.Speed = GPIO_SPEED_HIGH;
    }
}
```

## Include Browser



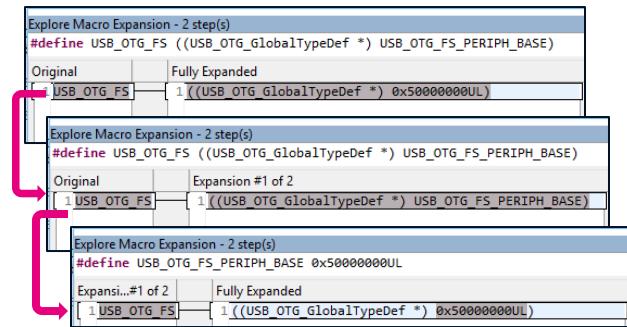
## Call Hierarchy



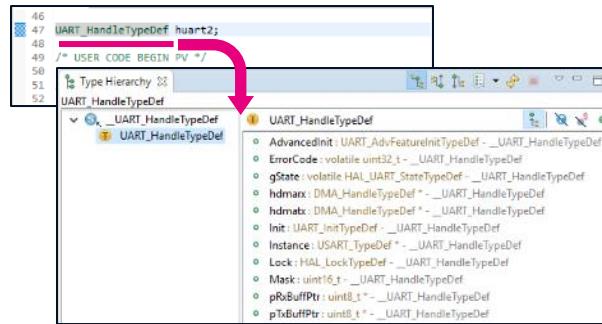
## Brace Navigation

```
294     /* Check the parameters */
295     assert_param(IS_OPTIONBYTE(pOBInit->OptionType));
296
297     /* Write protection configuration */
298     if((pOBInit->OptionType & OPTIONBYTE_WRP) == OPTIONBYTE_WRP)
299     {
300         assert_param(IS_WRPSTATE(pOBInit->WRPState));
301         if(pOBInit->WRPState == OB_WRPSTATE_ENABLE)
302         {
303             /*Enable of Write protection on the selected Sector*/
304             status = FLASH_OB_EnableWRP(pOBInit->WRPSector);
305         }
306         else
307         {
308             /*Disable of Write protection on the selected Sector*/
309             status = FLASH_OB_DisableWRP(pOBInit->WRPSector);
310         }
311     }
312 }
```

## Macro Expansion Browser



## Type Hierarchy





# Code editor – navigation (2/2)

# Outline View

# Powerful Search

The screenshot shows the STM32CubeMX interface with the C/C++ Search dialog open. The search string is set to "NVIC". The search results pane displays 12 matches in the workspace, all related to the STM32F7xx HAL Driver. The results are as follows:

- 1: STM32F7xx\_HAL.h
- 2: STM32F7xx\_HAL\_Driver
- 3: nvic.h
- 4: NVIC\_SetPriority(NVIC\_PRIO\_BITS)
- 5: NVIC\_SetPriority(NVIC\_PRIO\_BITS)
- 6: NVIC\_SetPriority(NVIC\_PRIO\_BITS)
- 7: NVIC\_SetPriority(NVIC\_PRIO\_BITS)
- 8: NVIC\_SetPriority(NVIC\_PRIO\_BITS)
- 9: NVIC\_SetPriority(NVIC\_PRIO\_BITS)
- 10: NVIC\_SetPriority(NVIC\_PRIO\_BITS)
- 11: NVIC\_SetPriority(NVIC\_PRIO\_BITS)
- 12: NVIC\_SetPriority(NVIC\_PRIO\_BITS)

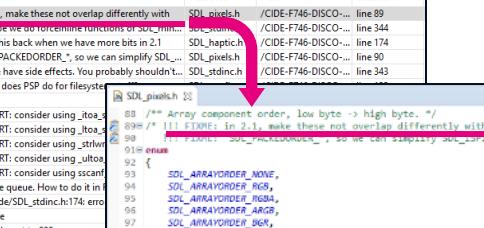
The results are color-coded by file: blue for nvic.h and red for the other 11 entries.

# Open Resource

The screenshot shows a software interface titled "Open Resource". In the search bar at the top, the text "hal\_uart" is entered. Below the search bar, the text "Enter resource name prefix, path prefix or pattern (? \* or camel case):" is displayed. A dropdown arrow is located to the right of the search bar. The main area contains a table with four columns: "Matching items:" (header), followed by four rows of results:

Matching items:
stm32f7xx_hal_uart.c - F746-DISCO-TEST/Drivers/STM32F7xx_HAL_Driver/Src
stm32f7xx_hal_uart.h - F746-DISCO-TEST/Drivers/STM32F7xx_HAL_Driver/Inc
stm32f7xx_hal_uart_ex.c - F746-DISCO-TEST/Drivers/STM32F7xx_HAL_Driver/Src
stm32f7xx_hal_uart_ex.h - F746-DISCO-TEST/Drivers/STM32F7xx_HAL_Driver/Inc

# Task Tags

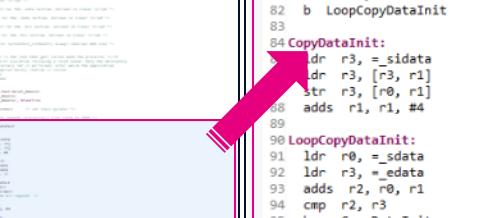


SDL\_pixels.h

```
/* Array component order, low byte -> high byte. */
/* 00 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 01 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 02 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 03 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 04 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 05 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 06 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 07 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 08 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 09 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 10 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 11 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 12 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 13 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 14 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 15 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 16 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 17 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 18 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 19 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
/* 20 */ #if !defined(_MSC_VER) & !defined(_WIN32_WCE)
```

# Bookmark

# Minimap



The screenshot shows two windows side-by-side. The left window is titled 'Minimap' and displays a memory dump of the STM32F746's RAM, showing various memory regions and their addresses. The right window is titled 'startup\_stm32f746nhxs' and displays the assembly code for the startup file. A pink arrow points from the left margin of the 'Minimap' window towards the assembly code in the right window.

```
81    movs r1, #0
82    b  LoopCopyDataInit
83
84 CopyDataInit:
85    ldr r3, =_sidata
86    ldr r3, [r3, r1]
87    str r3, [r0, r1]
88    adds r1, r1, #4
89
90 LoopCopyDataInit:
91    ldr r0, =_data
92    ldr r3, =_edata
93    adds r2, r0, r1
94    cmp r2, r3
95    bcc CopyDataInit
96    ldr r2, =_ssbs
97    b  LoopFillZeroBss
98 /* _main = fill_main comment= */
```



# Code editor – writing

## Highlight Inactive Code

```
usbd_desc.c
157 #if defined (_ICCARM_) /* IAR Compiler */
158 #pragma data_alignment=4
159 #endif /* defined (_ICCARM_) */
160 /* defined ( _ICCARM_ ) */
161 /* standard device descriptor. */
162 __ALIGN_BEGIN uint8_t USBD_F5_DeviceDesc[USB_LEN_DEV_DESC] __ALIGN_END =
163 {
164     0x12,           /*bLength */
165     USB_DESC_TYPE_DEVICE,
166     #if (USBD_LPM_ENABLED == 1)
167     0xd0,           /*bcdUSB */ // changed to USB version 2.01
168     0x00,           /*in order to support LPM L1 suspend
169     resume test of USBCV3.0*/
170     #else
171     0x00,           /*bcdUSB */
172     #endif /* (USBD_LPM_ENABLED == 1) */
173     0x02,
174     0x00,           /*bDeviceClass*/
175     0x00,           /*bDeviceSubClass*/
176     0x00,           /*bDeviceProtocol*/
177     USB_MAX_EP0_SIZE,
178     0x00,           /*bMaxPacketSize*/
179     LOBYTE(USB_VID),
180     HIBYTE(USB_VID),
181     /*idVendor*/
182 }
```

## Auto-Complete

```
main.c
97 /* USER CODE BEGIN 2 */
98 HAL_GPIO
99     /* USER CO
100     HAL_GPIO_Delinit(GPIO_TypeDef * GPIOx, uint32_t GPIO_Pin) : void
101     HAL_GPIO_EXTI_Callback(uint16_t GPIO_Pin) : void
102     HAL_GPIO_EXTI_IRQHandler(uint16_t GPIO_Pin) : void
103     while (1)
104     HAL_GPIO_Init(GPIO_TypeDef * GPIOx, GPIO_InitTypeDef * GPIO_Init) : void
105     HAL_GPIO_LockPin(GPIO_TypeDef * GPIOx, uint16_t GPIO_Pin) : HAL_Status
106     HAL_GPIO_ReadPin(GPIO_TypeDef * GPIOx, uint16_t GPIO_Pin) : GPIO_PinS
107     HAL_GPIO_TogglePin(GPIO_TypeDef * GPIOx, uint16_t GPIO_Pin) : void
108     HAL_GPIO_WritePin(GPIO_TypeDef * GPIOx, uint16_t GPIO_Pin, GPIO_PinSt
109     # HAL_GPIO_MODULE_ENABLED
110 }
111 /**
112 * @brief S < >
113 * @retval
114 */
115 /**
116 */
117 void SystemClock_Config(void)
118 {
119     RCC_OscInitTypeDef RCC_OscInitStruct = {0};
120     RCC_ClkInitTypeDef RCC_ClkInitStruct = {0};
121     RCC_PeriphCLKInitTypeDef PeriphClkInitStruct = {0};
122     /**
123     Configure the main internal regulator output voltage
124     */
125     HAL_PWR_VOLTAGE_SCALING_CONFIG(PWR_REGULATOR_VOLTAGE_SCALE3);
126     /**
127     Initializes the CPU, AHB and APB busses clocks
128     */
129     RCC_OscInitStruct.OscillatorType = RCC_OSCILLATORTYPE_HSI|RCC_OSCILLATOR
130     RCC_OscInitStruct.HSEState = RCC_HSE_ON;
131     RCC_OscInitStruct.HSISState = RCC_HSI_ON;
132     RCC_OscInitStruct.HSICalibrationValue = RCC_HSICALIBRATION_DEFAULT;
133     RCC_OscInitStruct.PLL.PLLState = RCC_PLL_ON;
134     RCC_OscInitStruct.PLL.PLLSource = RCC_PLLSOURCE_HSE;
135     RCC_OscInitStruct.PLL.PLLM = 15;
136     RCC_OscInitStruct.PLL.PLLN = 144;
137 }
```

## Syntax Highlight

```
SystemClock_Config(void)
{
    RCC_OscInitStruct.OscillatorType = RCC_OSCILLATORTYPE_HSI|RCC_OSCILLATOR
    RCC_OscInitStruct.HSEState = RCC_HSE_ON;
    RCC_OscInitStruct.HSISState = RCC_HSI_ON;
    RCC_OscInitStruct.HSICalibrationValue = RCC_HSICALIBRATION_DEFAULT;
    RCC_OscInitStruct.PLL.PLLState = RCC_PLL_ON;
    RCC_OscInitStruct.PLL.PLLSource = RCC_PLLSOURCE_HSE;
    RCC_OscInitStruct.PLL.PLLM = 15;
    RCC_OscInitStruct.PLL.PLLN = 144;
}
```

## File Diff/Compare

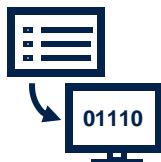
The screenshot shows a 'C Compare' interface with two files open: F746-DISCO-TEST/Src/main.c and F746-DISCO-TEST-2/Src/main.c. The left pane lists the differences, and the right pane shows the code side-by-side with red boxes highlighting specific changes.

## Block Select

The screenshot shows a code editor with a 'Block Select' feature. A large rectangular selection box highlights a block of code, including multiple lines and function definitions. A pink arrow points from the 'Block Select' header to the highlighted block.

## Code Style

The screenshot shows the 'Formatter' settings in the ST-Connect IDE. The 'Active profile' dropdown is set to 'K&R [built-in]'. Other options include 'BSD/Alman [built-in]', 'GNU [built-in]', and 'Whitesmiths [built-in]'. A preview window shows a sample C code snippet with specific styling applied.



# Build tools

## Build Analyzer

Build Analyzer Static Stack Analyzer Search

F769-DISCO-ITCM.elf - /F769-DISCO-ITCM/Debug - May 10, 2019 3:28:29 PM

Memory Regions Memory Details

Region	Start address	End address	Size	Free	Used	Usage (%)
FLASH	0x08000000	0x08200000	2048 KB	2043.22 KB	4.78 KB	0.23%
RAM	0x20000000	0x20080000	512 KB	510.45 KB	1.55 KB	0.30%
ITCMRAM	0x00000000	0x00004000	16 KB	15.48 KB	528 B	3.22%

Build Analyzer Static Stack Analyzer Search

F769-DISCO-ITCM.elf - /F769-DISCO-ITCM/Debug - May 10, 2019 3:28:29 PM

Memory Regions Memory Details

Search

Name	Run address (VMA)	Load address (LMA)	Size
ITCMRAM	0x00000000		16 KB
.itcmram	0x00000000	0x0800110c	528 B
FLASH	0x08000000		2048 KB
.itcmram	0x08000000	0x0800110c	528 B
_isr_vector	0x08000000	0x08000000	60 B
.text	0x0800003c	0x0800003c	4.16 KB
.rodata	0x080010e0	0x080010e0	16 B
.ARM	0x080010f0	0x080010f0	8 B
.preinit_array	0x080010f8	0x080010f8	0 B
.init_array	0x080010f8	0x080010f8	4 B
.fini_array	0x080010fc	0x080010fc	4 B
.data	0x20000000	0x08001100	12 B
RAM	0x20000000		512 KB
.data	0x20000000	0x08001100	12 B
.bss	0x2000000c		32 B
._user_heap_stack	0x2000002c		1.5 KB

## Static Stack Analyzer

Build Analyzer Static Stack Analyzer Search

F769-DISCO-ITCM.elf - /F769-DISCO-ITCM/Debug - May 10, 2019 3:28:29 PM

List Call graph

Hide dead code

Function	L...	Type	Location	Info
SystemClock_Config	88	STATIC	main.c:108	
NVIC_EncodePriority	40	STATIC	core_cm7.h:2071	
HAL_RCC_GetSysClockFreq	40	STATIC	stm32f7xx_hal_rcc.c:982	
HAL_NVIC_SetPriority	32	STATIC	stm32f7xx_hal_cortex.c:165	
HAL_NVIC_OscConfig	32	STATIC	stm32f7xx_hal_rcc.c:344	
__NVIC_SetPriorityGrouping	24	STATIC	core_cm7.h:1865	
HAL_RCC_ClockConfig	24	STATIC	stm32f7xx_hal_rcc.c:703	
HAL_InitTick	16	STATIC	stm32f7xx_hal.c:231	

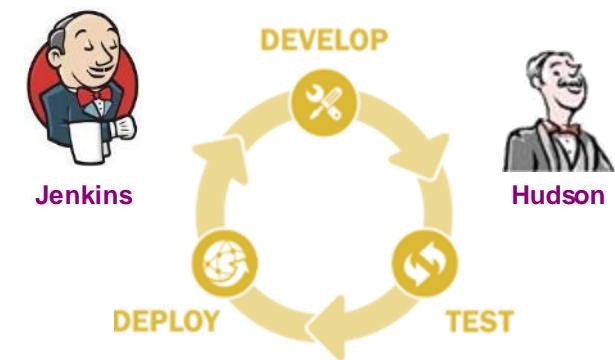
Build Analyzer Static Stack Analyzer Search

F769-DISCO-ITCM.elf - /F769-DISCO-ITCM/Debug - May 10, 2019 3:28:29 PM

List Call graph

Function	Depth	Max cost	Local cost	Type	Location
> LoopFillZeroBoss	7	208	0		stm32f7xx_it.c:182
SysTick_Handler	0	8	8	STATIC	stm32f7xx_it.c:70
NMI_Handler	0	4	4	STATIC	stm32f7xx_it.c:128
UsageFault_Handler	0	4	4	STATIC	stm32f7xx_it.c:168
PendSV_Handler	0	4	4	STATIC	stm32f7xx_it.c:169
HardFault_Handler	0	4	4	STATIC	stm32f7xx_it.c:83
HAL_IncTick	0	4	4	STATIC	stm32f7xx_hal.c:290
SVC_Handler	0	4	4	STATIC	stm32f7xx_it.c:143
DebugMon_Handler	0	4	4	STATIC	stm32f7xx_it.c:156
MemManage_Handler	0	4	4	STATIC	stm32f7xx_it.c:98
BusFault_Handler	0	4	4	STATIC	stm32f7xx_it.c:113
Reset_Handler	0	0	0		
init	0	0	0		

## Headless Build



## Continuous Integration

- Build project without opening IDE
- No GUI shown but build system becomes active
- Supported for makefile and managed projects



# Debug

## Debugger

The screenshot shows the 'Debugger' tab of the CubelDE interface. It includes a dropdown for 'Debug probe' with options like 'SEGGER J-LINK' and 'ST-LINK (ST-LINK GDB server)'. Other tabs include 'Main', 'Startup', 'Source', and 'Common'. A 'GDB Connection Settings' section has 'Autostart' checked for 'ST-LINK (OpenOCD)'.

## Live expressions

The screenshot shows the 'Live Expressions' window with a table. The first row contains the expression '<= uwTick', its type 'volatile uint32\_t', and its value '1603'. Below the table is a button 'Add new expression'.

## SWV

The screenshot shows two windows. The top window is 'SWV Statistical Profiling' with a table of functions and their usage percentages. The bottom window is 'SWV Data Trace Timeline Graph' showing three traces: 'acce[zAxis]' (blue), 'acce[xAxis]' (yellow), and 'acce[yAxis]' (red) over time from 9.5 to 13.5.

## Integrated UART Terminal

The screenshot shows the 'Integrated UART Terminal' window. It displays a 'Select Remote Connection' dialog with 'Serial Port' selected and 'F746-DISCO-VirtualCom' chosen. The main terminal window shows the text 'LD1: 1', 'LD1: 0', 'LD1: 1', 'LD1: 0', 'LD1: 1', 'LD1: 0', 'LD1: 1', and 'LD1: 0'.

## External Loader

The screenshot shows the 'External Loader' window. It includes a 'Name' field set to 'STM32469\_DISCOVERY\_QSPIPrintConfig Debug', a 'Debug probe' dropdown, and a 'GDB Connection Settings' section with 'Autostart local GDB server' checked. A 'File' browser window is open, showing a list of files related to the STM32469 Discovery board.

## Remote Debug

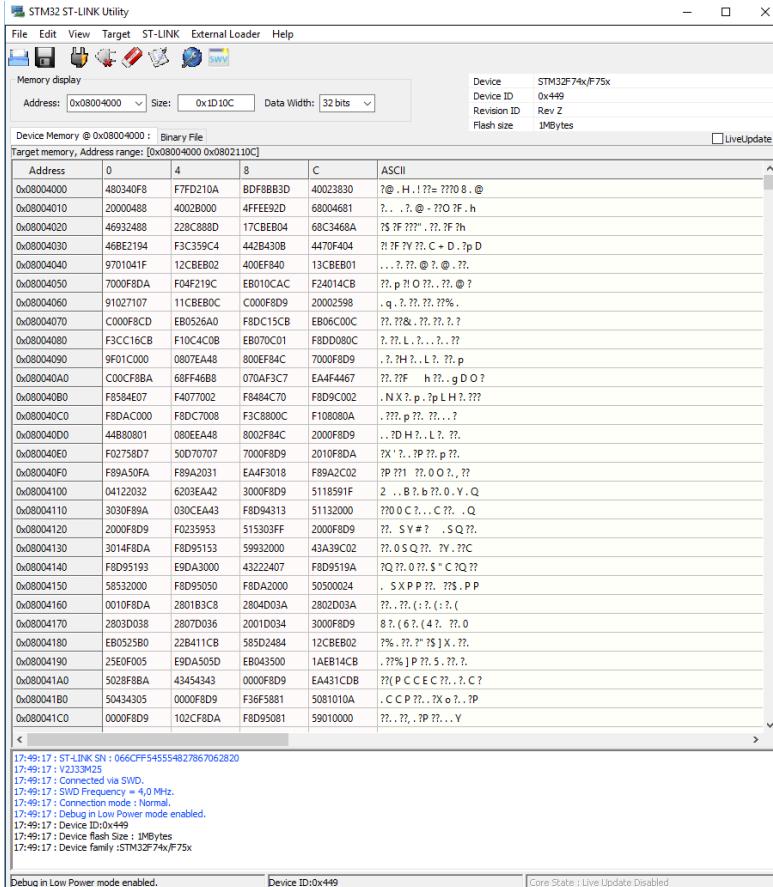
The diagram illustrates the remote debug setup. It shows 'STM32 CubelDE' connected via 'TCP/IP' to the 'ST-LINK GDB Server'. The 'ST-LINK GDB Server' is connected via 'USB' to a 'JTAG/SWD' interface, which is then connected to different debug probes: a white 'ST-LINK' probe, a grey 'F746-DISCO' probe, and a purple 'STM32' probe.

# STM32CubeProgrammer

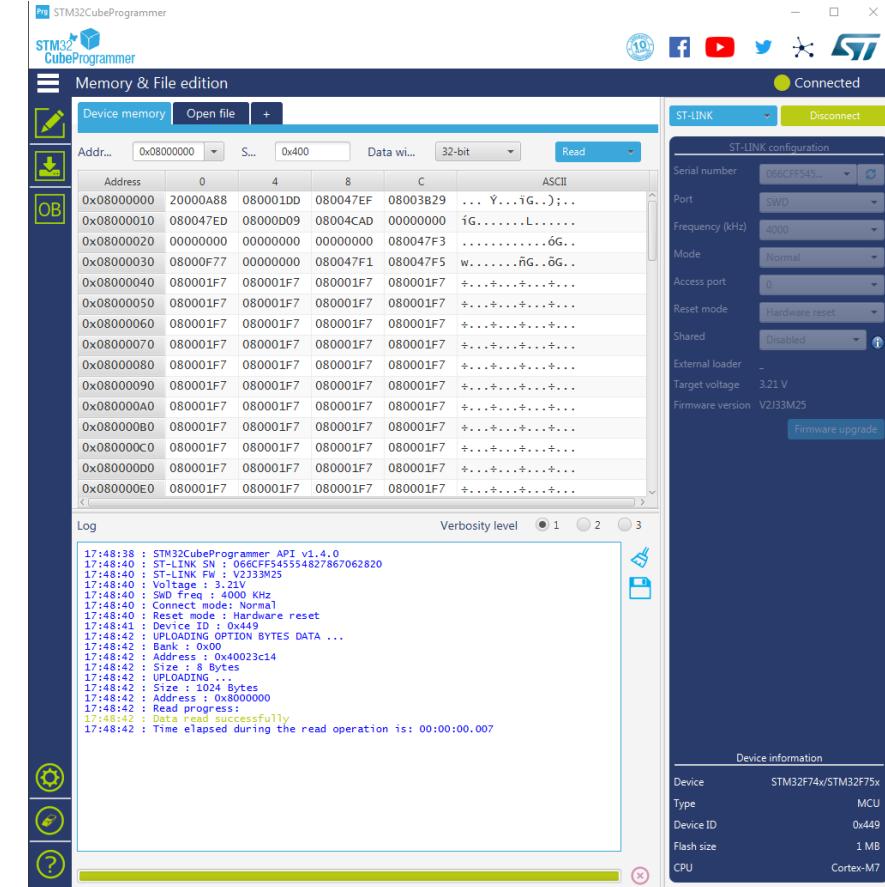
STM32  
CubeProgrammer

# From ST-LINK Utility to STM32CubeProgrammer

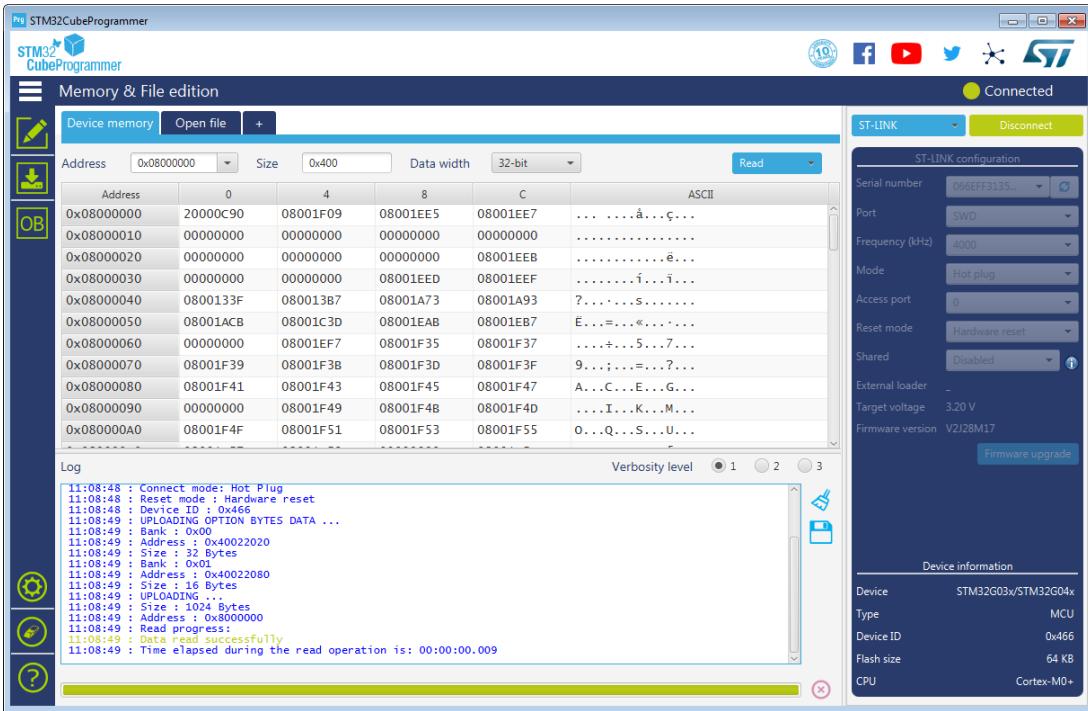
## ST-Link Utility



## STM32CubeProgrammer



# All-in-one programming software tool



Intuitive GUI

Multi-platform  
(Windows, Linux, macOS)

STLink Direct Support  
(JTAG, SWD)

Automatic Mode

Option Bytes  
Program & Upload

Bootloader Interface Support  
(USB, UART, SPI, I2C, CAN)

Internal/External  
Flash Services

API DLL  
for Custom Integration

Command Line Interface  
for Scripting

Trusted Package Creator  
(secure programming)

# From ST-Link V2 to STLink-V3

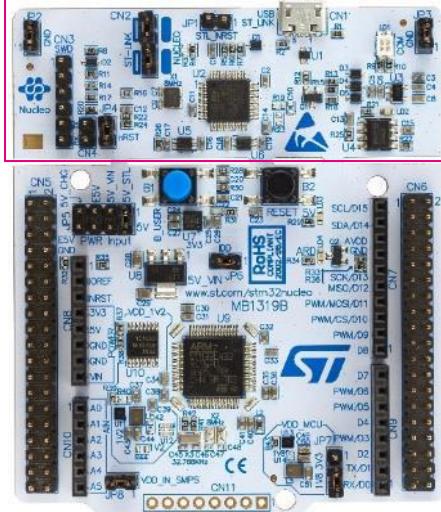
ST-Link V2



ST-LINK/V2

ST-LINK/V2-ISOL

ST-LINK/V2-1



STLink-V3

STLINK-V3MINI

STLINK-V3MODS

STLINK-V3SET



# STLINK-V3 debugger / programmer

Easier/Faster/Affordable

Stand-alone and scalable (V3SET)

Multi-path Bridge (I2C/SPI/CAN/UART/USB)

Drag&Drop Flash Programming

Compact (V3MINI) or On-board (V3MODS)

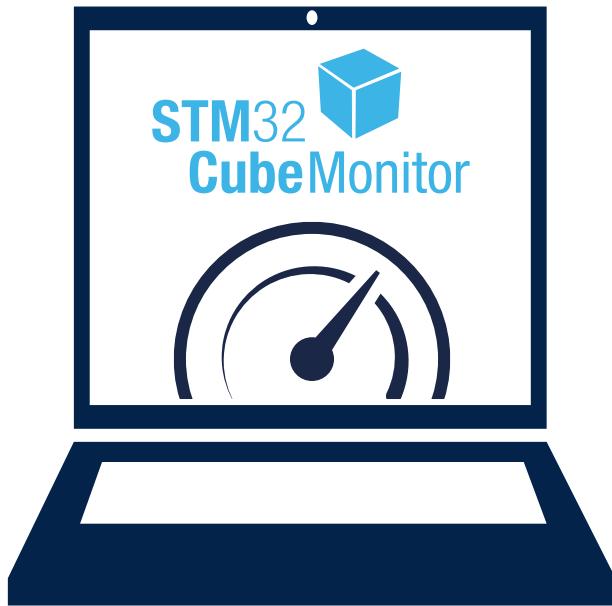


# **STM32CubeMonitor**

**STM32**  
**CubeMonitor**



# STM32CubeMonitor overview



## Monitoring application variables during runtime

- Non-intrusive tool to follow application behavior without interruption.
- Real-time analysis to finetune application configuration.

## Drag & drop creation of dashboard UI

- Large choice of graphical components (gauges, bar graphs, plots...)
- Customize settings. No need for programming.
- Direct support of the Node-RED® open community.

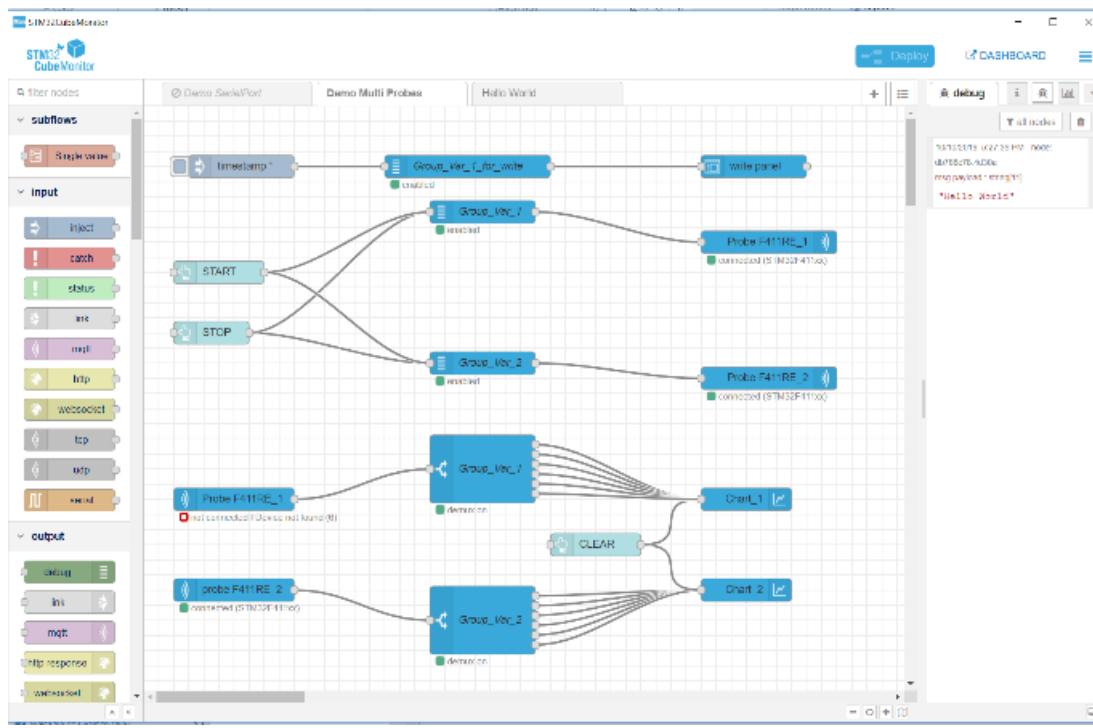
## Graphical visualization on any display

- Multi-OS tool: direct support of PC, tablets and smartphones.
- Remote monitoring.

# Graphical custom data visualization

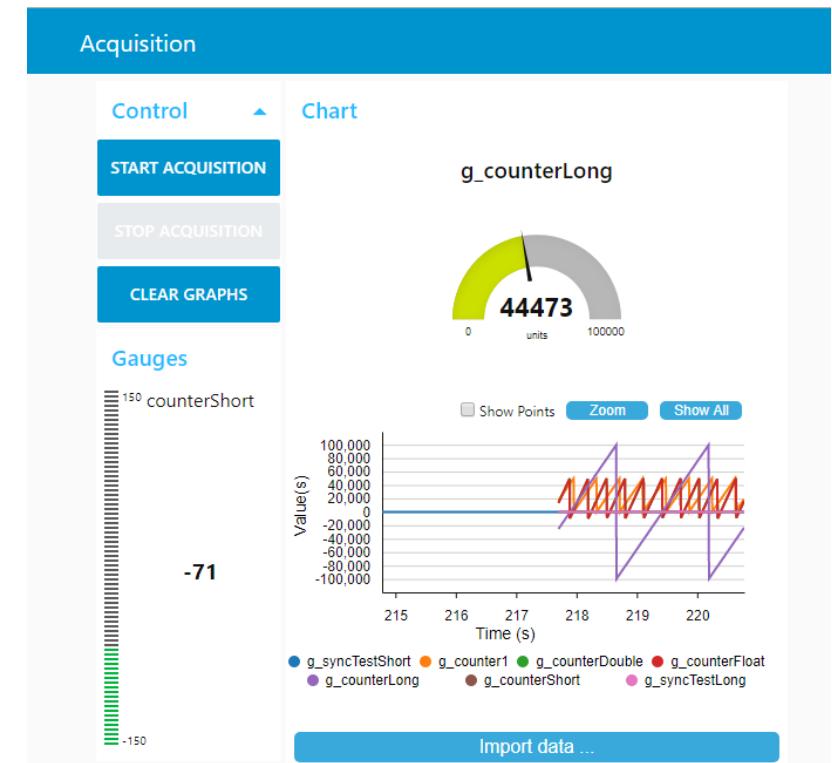
## Design mode to create

Build and edit the logical data flow and graphical rendering of the custom monitoring UI.



## Dashboard mode to visualize

Use the monitoring UI built previously and visualize locally or remotely.



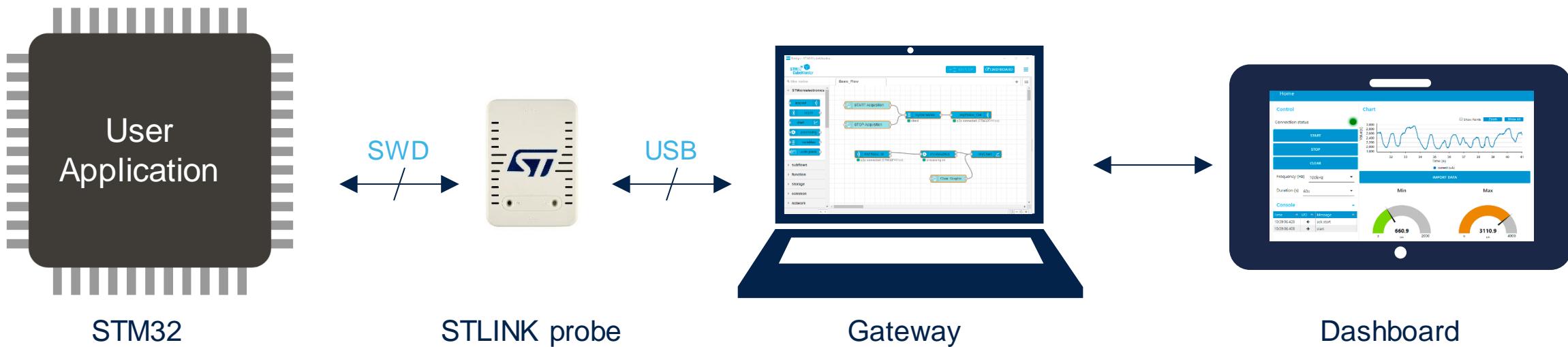
# Remote monitoring

Native support of multi-format displays

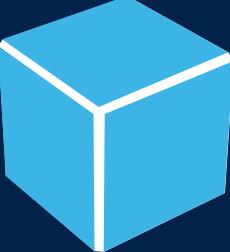
Dynamic layout of dashboard UI on PCs, tablets, smartphones.

Remote data acquisition with web server technology

Monitor across a network with a web browser

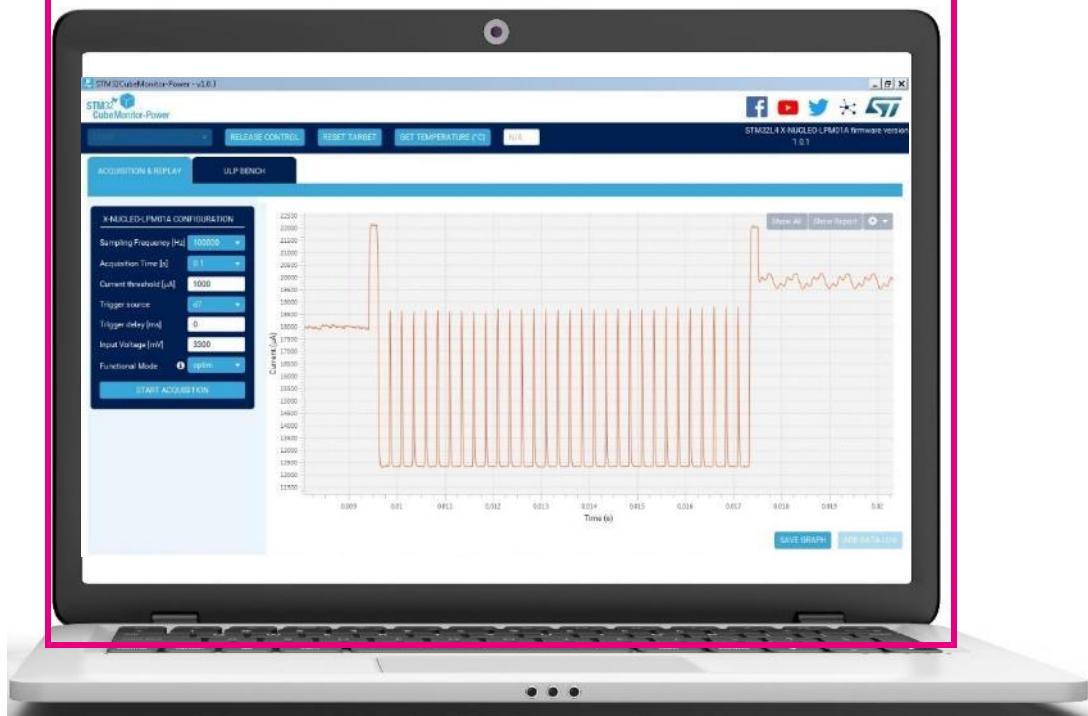


# **STM32CubeMonitor-Power**

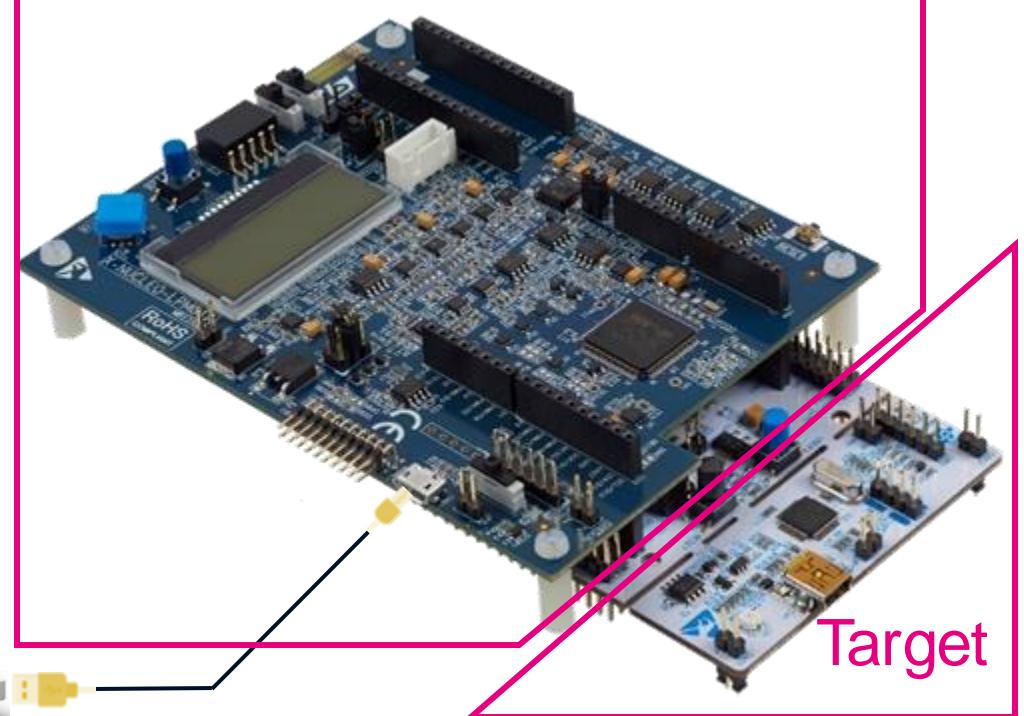
**STM32**  **CubeMonitor-Power**

# STM32CubeMonitor-Power

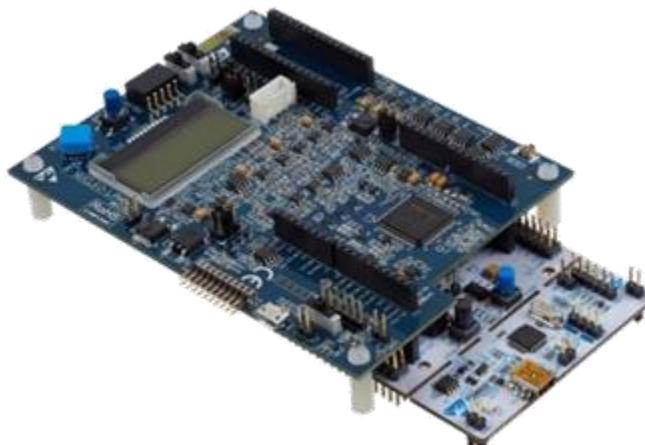
**STM32CubeMonPwr**



**X-NUCLEO-LPM01A**



# STM32 power profiling



## Ultra-Low-Power Consumption Measurements

- Supply target board from **1.8V to 3.3V**
- Dynamic current from **100 nA to 50 mA (100 dB)**
- Static current from **1 nA to 200 mA**
- Accuracy approximately **2%**

## Intuitive User Experience

- Two operating modes (**stand-alone or PC-controlled**)
- Graphical PC application (reference: **STM32CubeMonPwr**)

## Official EEMBC Energy Monitor v2.0

Direct computation of ULPMark scores

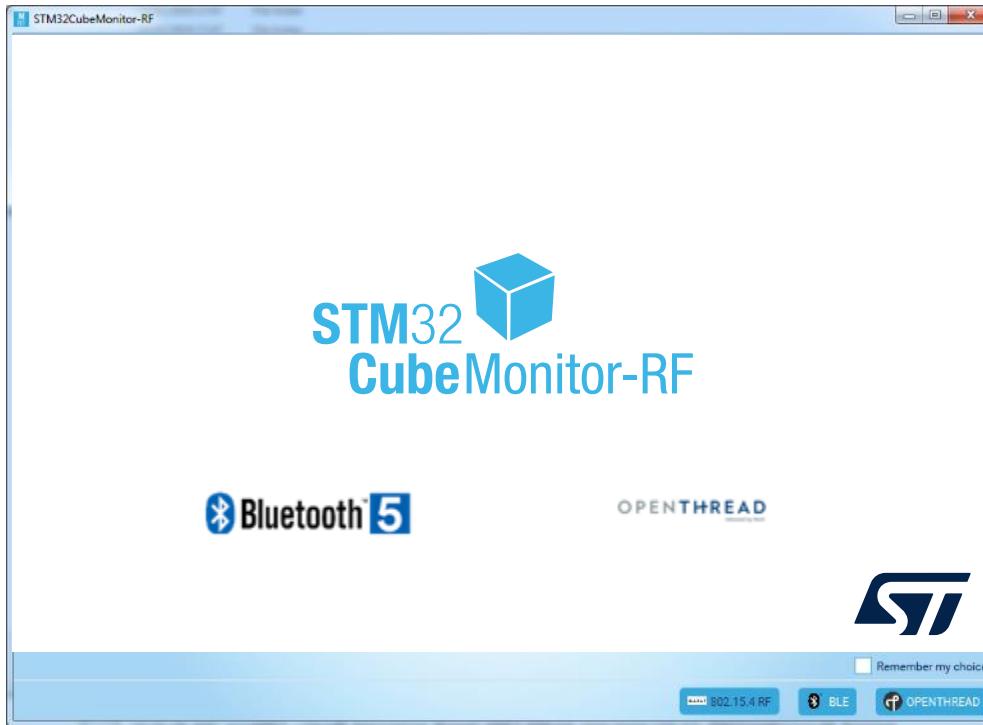


# **STM32CubeMonitor-RF**

**STM32**  
**CubeMonitor-RF**

# STM32CubeMonitor-RF

A software tool allowing to test the radio performances of STM32WB MCUs for BLE and 802.15.4 technologies



Test protocol sequences

Configure static / dynamic beacons

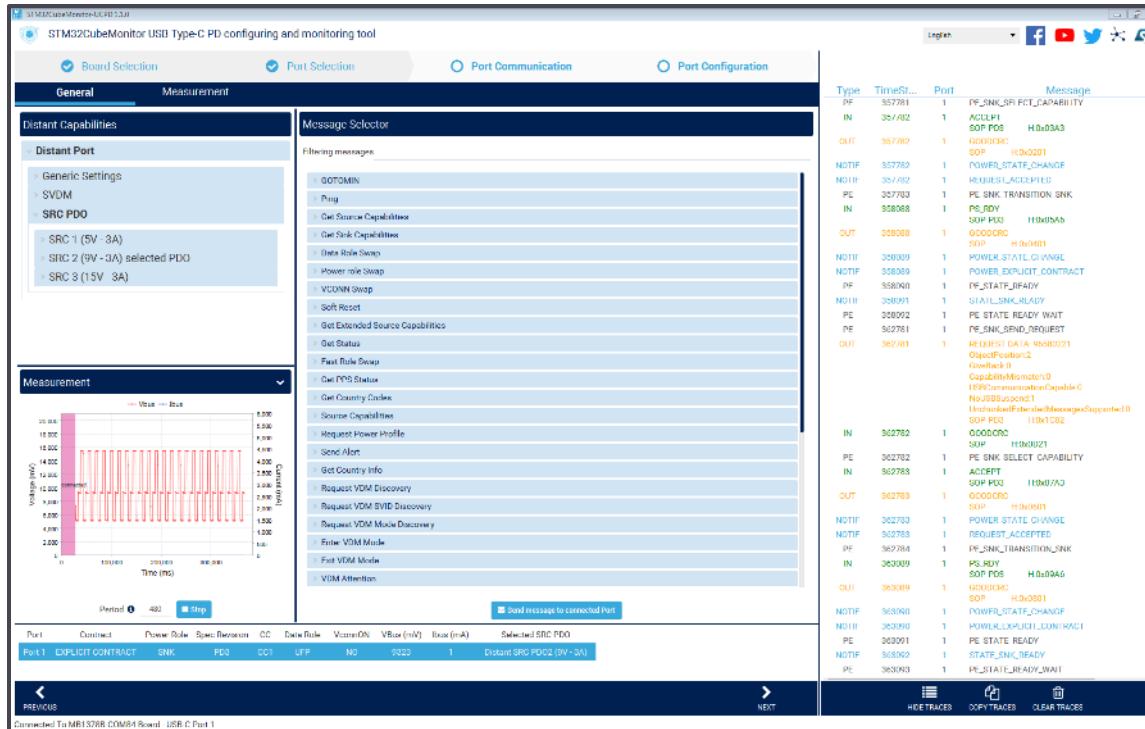
Manage Over the Air (OTA) file transfer

# **STM32CubeMonitor-UCPD**

**STM32**  
**CubeMonitor-UCPD**



## Monitoring and configuring tool for **USB Type-C™** and **USB Power Delivery** applications using STM32 microcontroller



Support of **USB Type-C™ 1.2** and **USB PD 2.0/3.0**

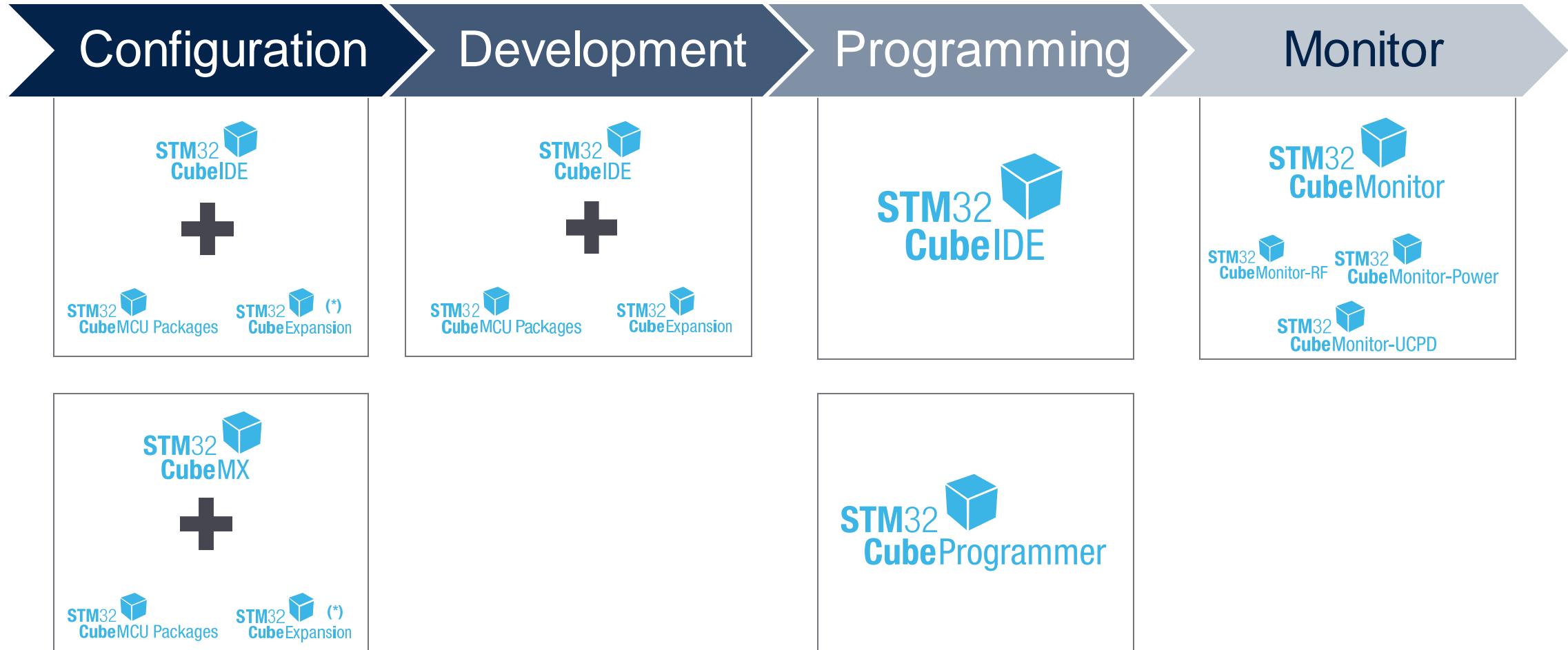
Port configuration pane for **PD setting, VDM, SOP, Source and Sink Capabilities**

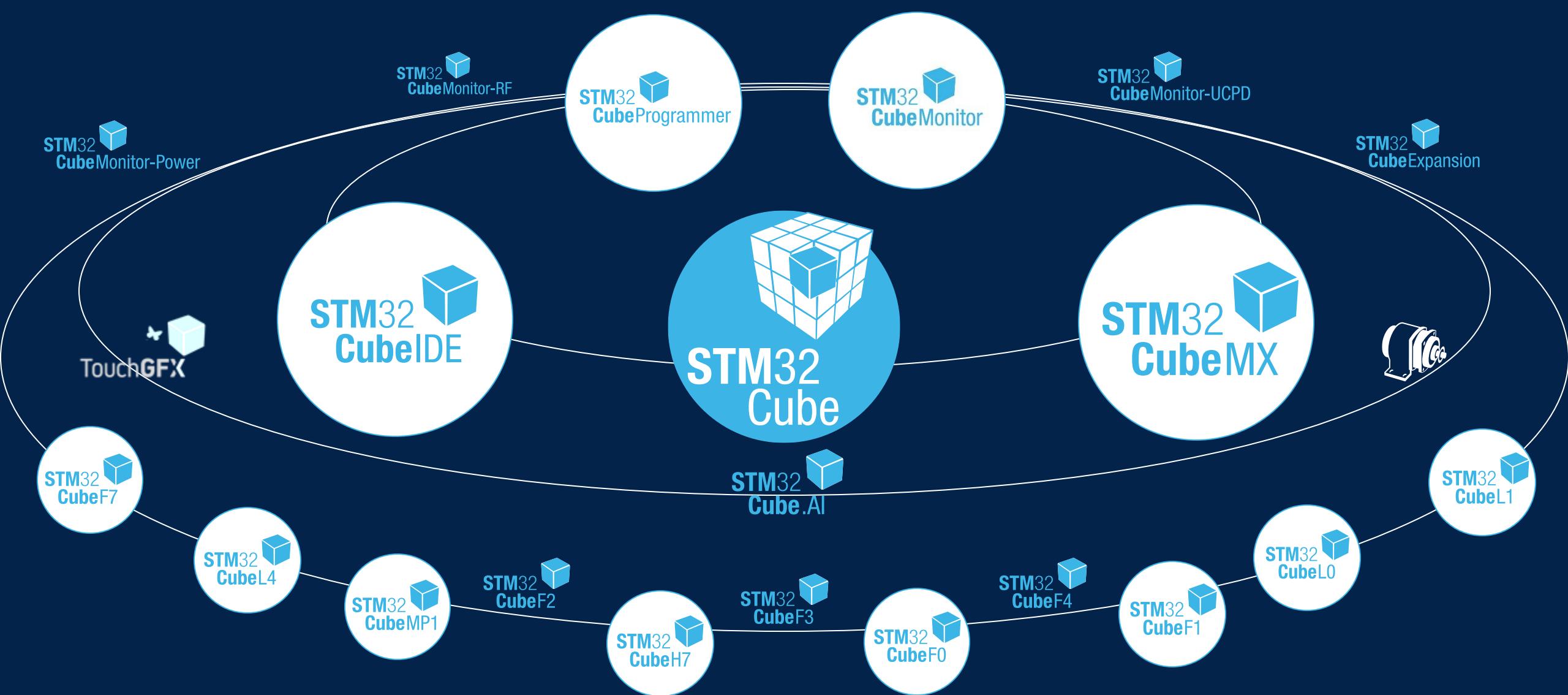
Port communication pane for **VBUS and IBUS monitoring, distant port capabilities, message selector, and real-time traces**

# Key takeaways



# Iterative development process





# Thank you

© STMicroelectronics - All rights reserved.

ST logo is a trademark or a registered trademark of STMicroelectronics International NV or its affiliates in the EU and/or other countries.

For additional information about ST trademarks, please refer to [www.st.com/trademarks](http://www.st.com/trademarks).

All other product or service names are the property of their respective owners.

