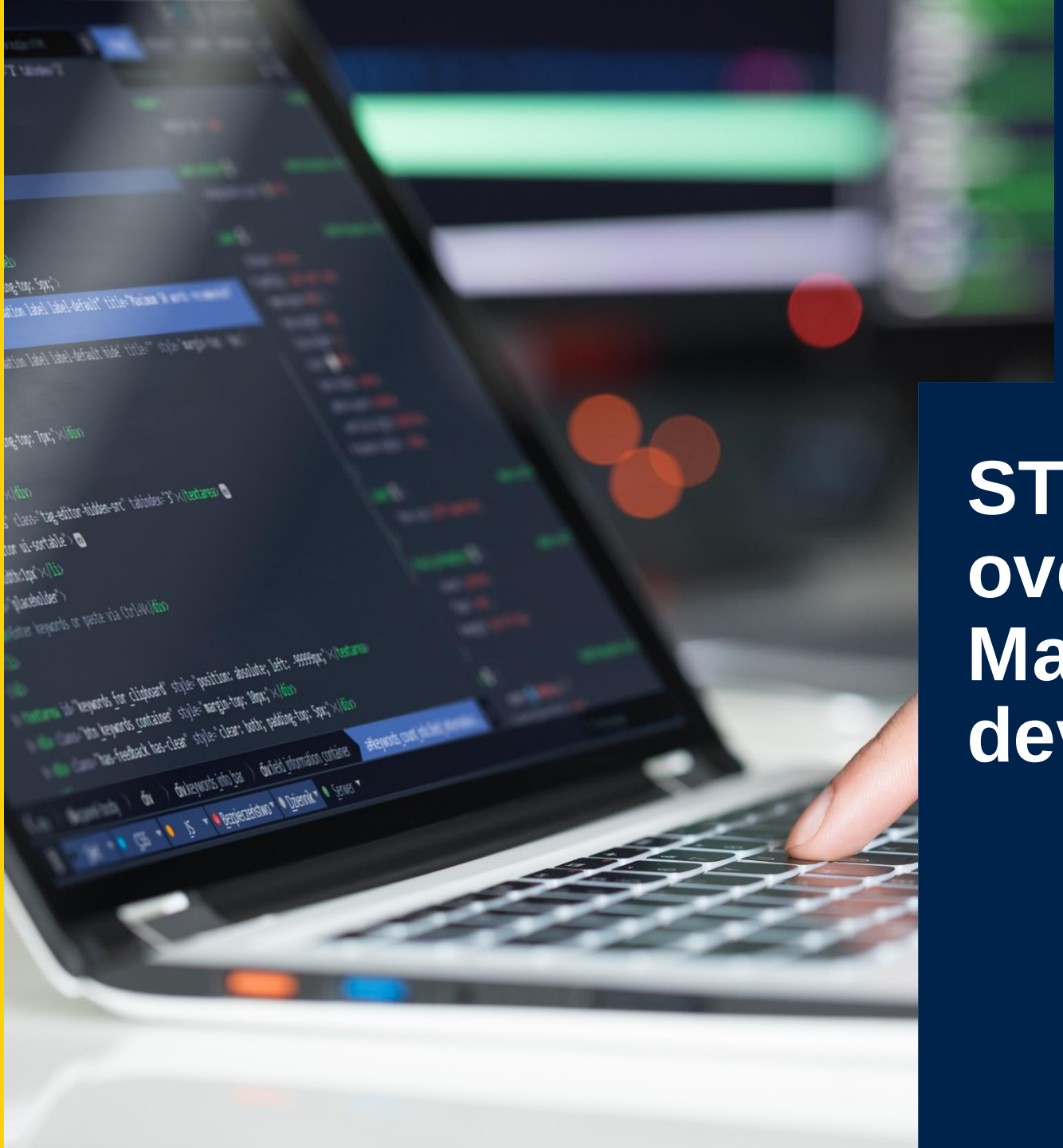


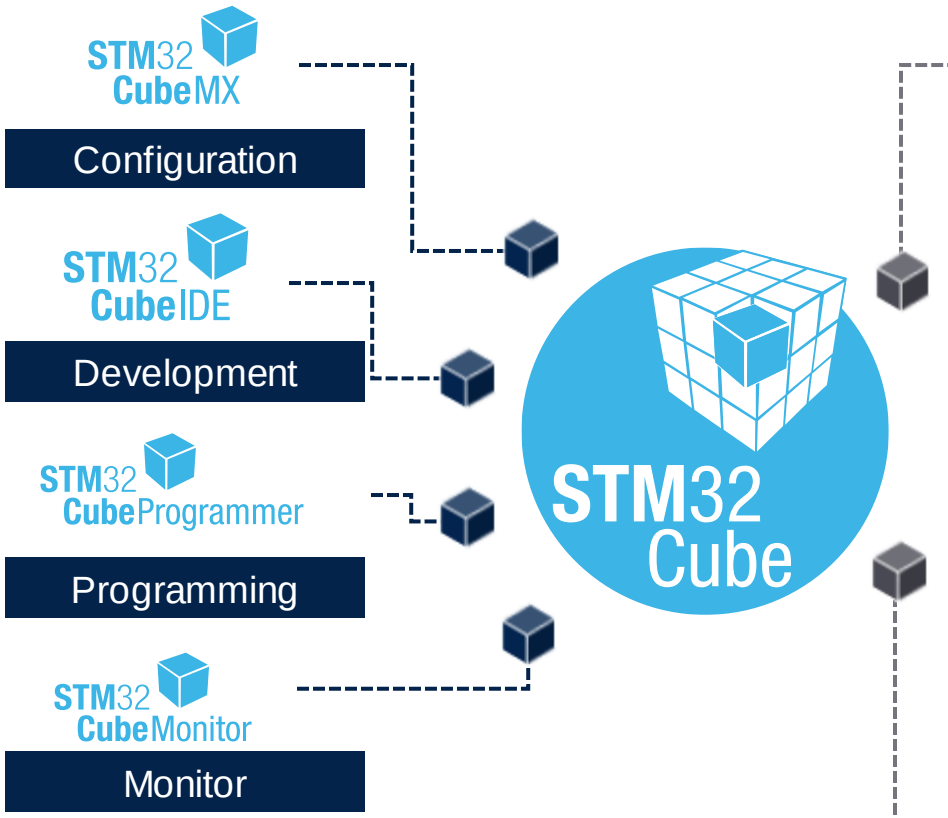
life.augmented

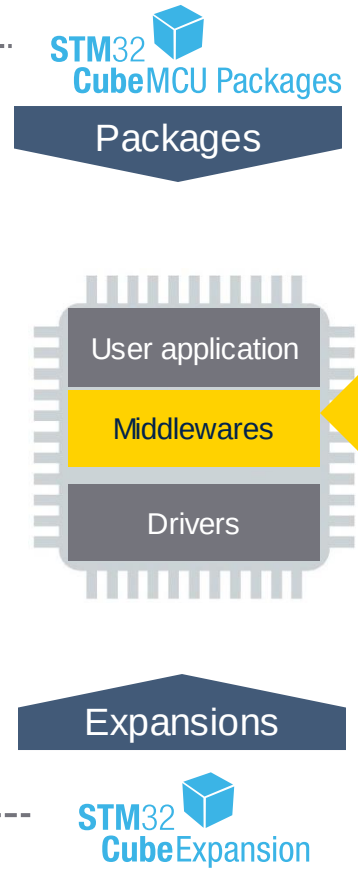
STM32Cube ecosystem overview
Making STM32 development easier

STM32 Cube

Inside the STM32Cube ecosystem

Software Tools | Embedded Software | **Complemented with Microsoft Azure RTOS**





Azure RTOS ThreadX
Real-time operating system

Azure RTOS FileX
FAT file system, fault tolerant

Azure RTOS

Azure RTOS NetX/NetX Duo
TCP/IP stacks

Azure RTOS USBX
USB stack, host and device

life.augmented

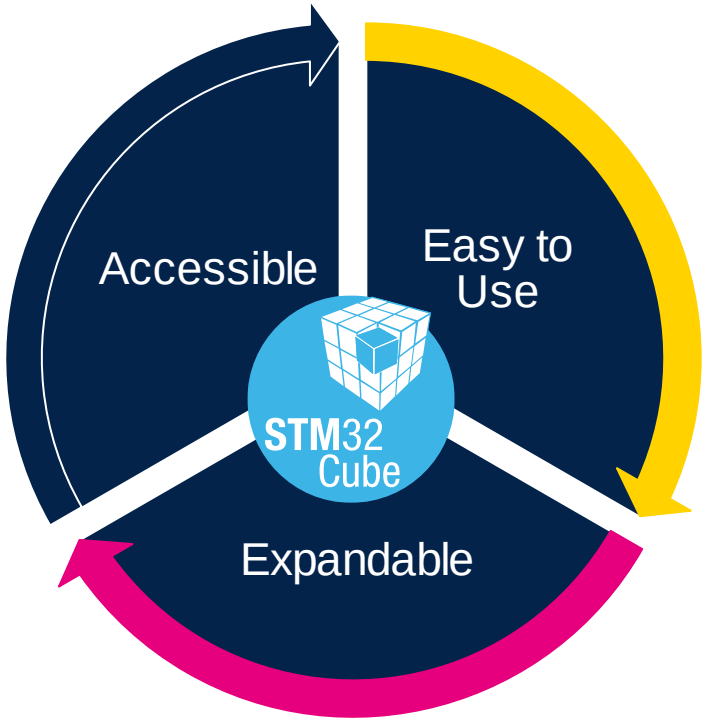
Production License for any STM32

STM32Cube Ecosystem: User benefits

Easily getting the most out of STM32 MCUs for a drastically reduced customer development cycle and time-to-market

Fits many developer profiles from beginners to experts

- Exhaustive software development framework
- Free ST IDE (GCC) and professional IDE partners
- Free of charge and business-friendly license terms



Easy and fast learning curve for a competitive advantage

- Reduced time-to-market
- Allows focusing on applicative differentiation

Fits many customer use cases

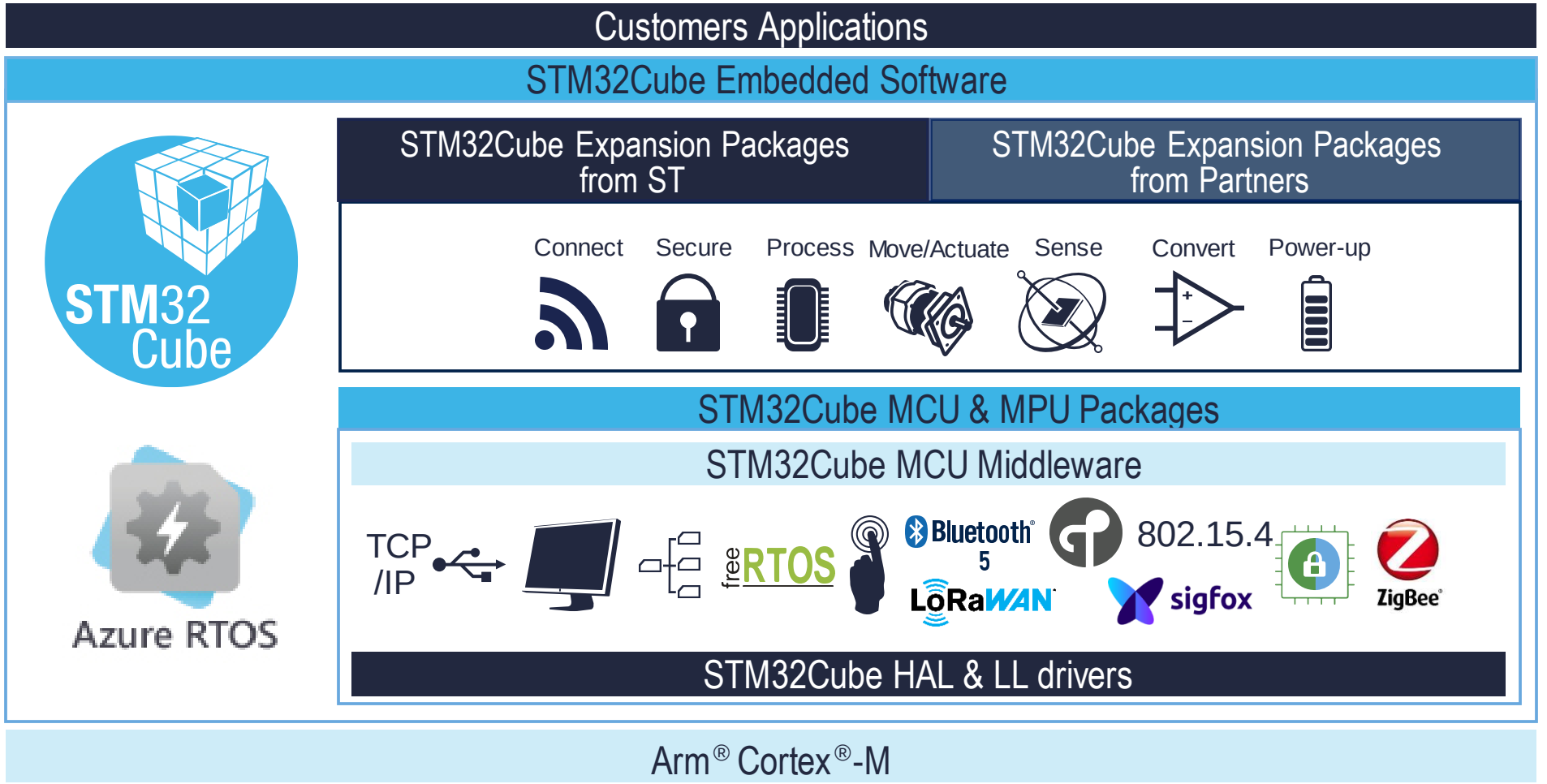
- Complemented by many solutions from official ST partners
- Production-ready

life.augmented

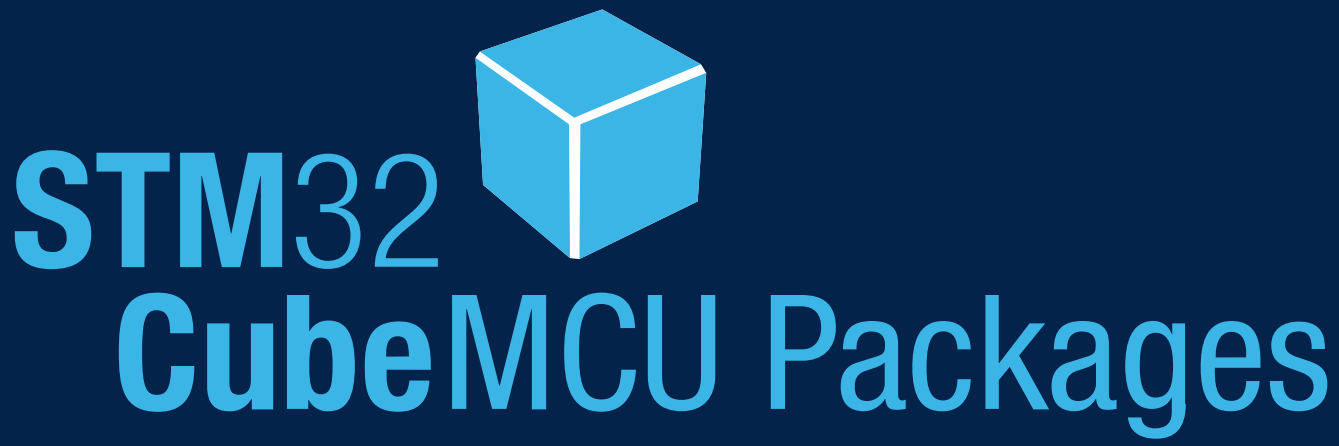
STM32Cube embedded software

life.augmented

A flexible, scalable and consistent MCU offer



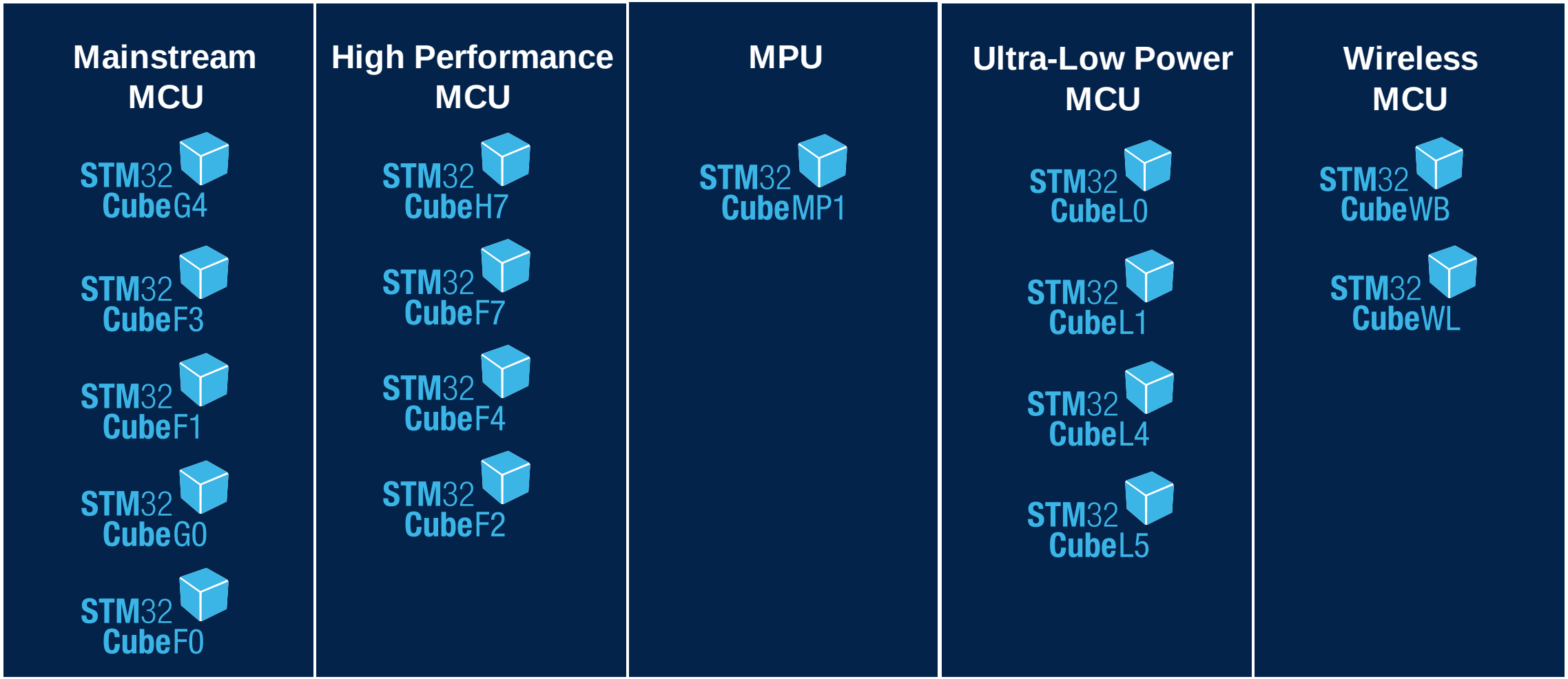
STM32Cube MCU packages



life.augmented

STM32 CubeMCU Packages

Dedicated to each STM32 Series

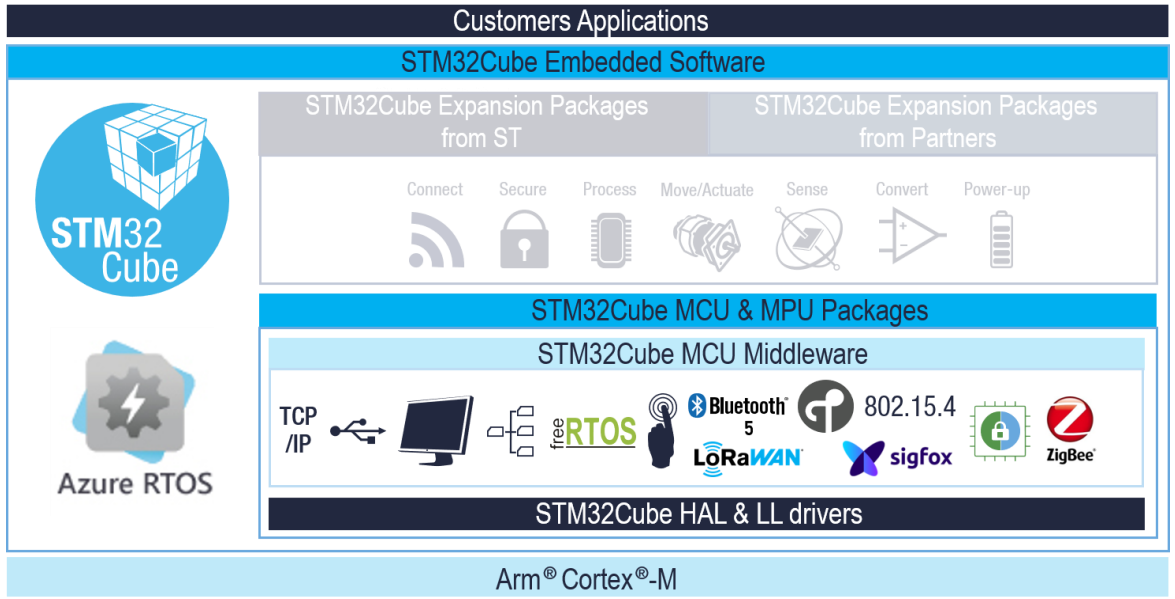


life.augmented

www.st.com/stm32cubemcupackage

STM32 CubeMCU Packages

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

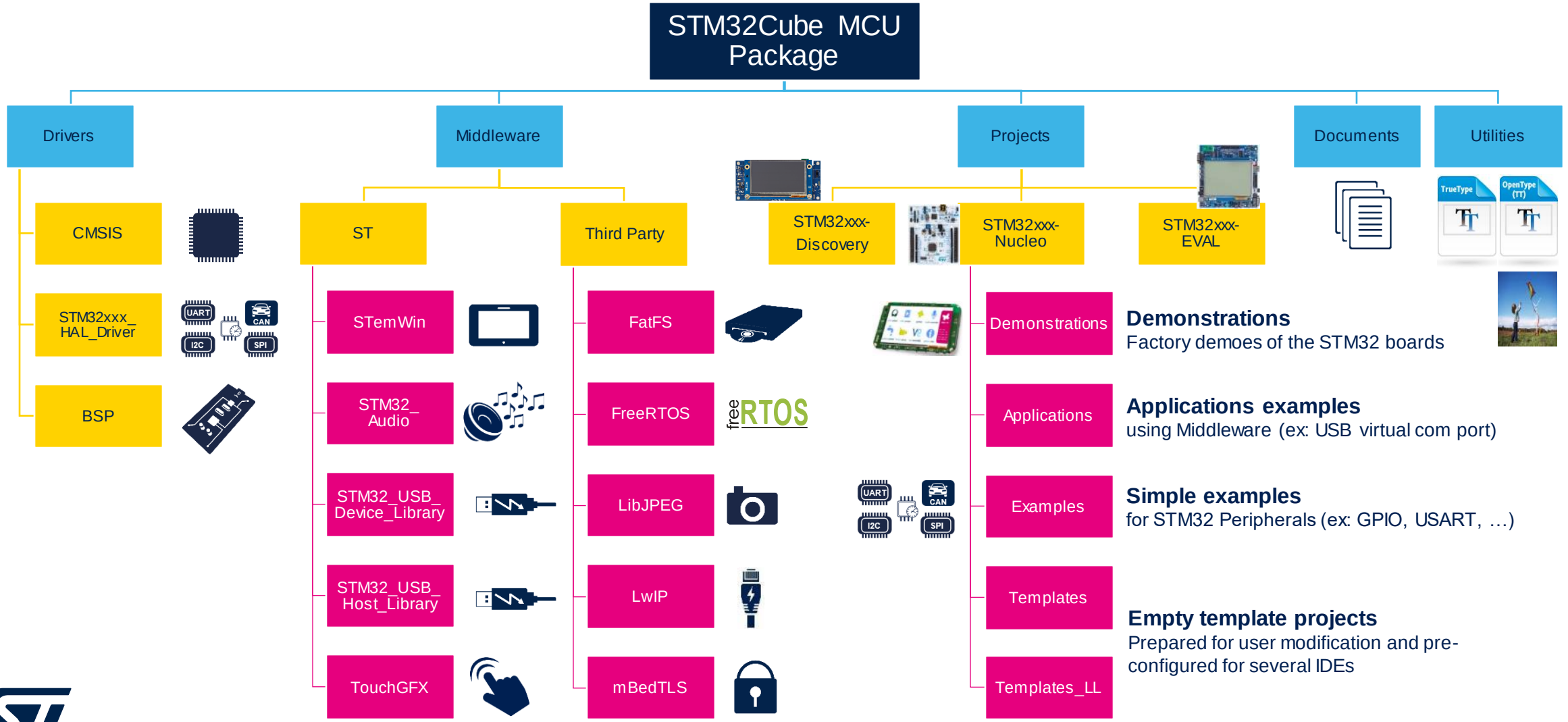
- ST Bluetooth 5 stack
- OpenThread stack
- ST 802.15.4 MAC
- Zigbee 3 stack
- STM32 WPAN
- LoRaWAN stack
- Sigfox stack
- Sub-GHz phy
- ST Key Management Services (KMS)
- TF-M
- ST USB Host & Device stacks
- STM32 Touch Sensing library
- STemWin graphics stack

life.augmented

www.st.com/stm32cubemcupackage

STM32 CubeMCU Packages

Detailed content and organization



life.augmented

STM32 CubeMCU Packages

Middleware tailored for each series

Family	LL API	HAL API	FreeRTOS	FatFS	STemWin	USB Host	USB Device	LwIP mBedTLS	Touch Sense	USB PD	OpenAMP	BLE Stack	OpenThread Stack	Zigbee 3	LoRaWAN	Sigfox	TF-M
STM32CubeF0	✓	✓	✓	✓	✓		✓		✓								
STM32CubeF1	✓	✓	✓	✓	✓	✓	✓	✓									
STM32CubeF2	✓	✓	✓	✓	✓	✓	✓	✓									
STM32CubeF3	✓	✓	✓	✓	✓		✓		✓								
STM32CubeF4	✓	✓	✓	✓	✓	✓	✓	✓									
STM32CubeF7	✓	✓	✓	✓	✓	✓	✓	✓									
STM32CubeH7	✓	✓	✓	✓	✓	✓	✓	✓			✓						
STM32CubeG0	✓	✓	✓	✓						✓							
STM32CubeG4	✓	✓	✓	✓			✓			✓							
STM32CubeL0	✓	✓	✓	✓			✓		✓								
STM32CubeL1	✓	✓	✓	✓	✓	✓	✓		✓								
STM32CubeL4	✓	✓	✓	✓	✓	✓	✓		✓								
STM32CubeL5	✓	✓	✓	✓			✓		✓	✓							✓
STM32CubeWB	✓	✓	✓	✓			✓		✓			✓	✓	✓			
STM32CubeWL	✓	✓	✓	✓											✓	✓	
STM32CubeMP1	✓	✓	✓								✓						

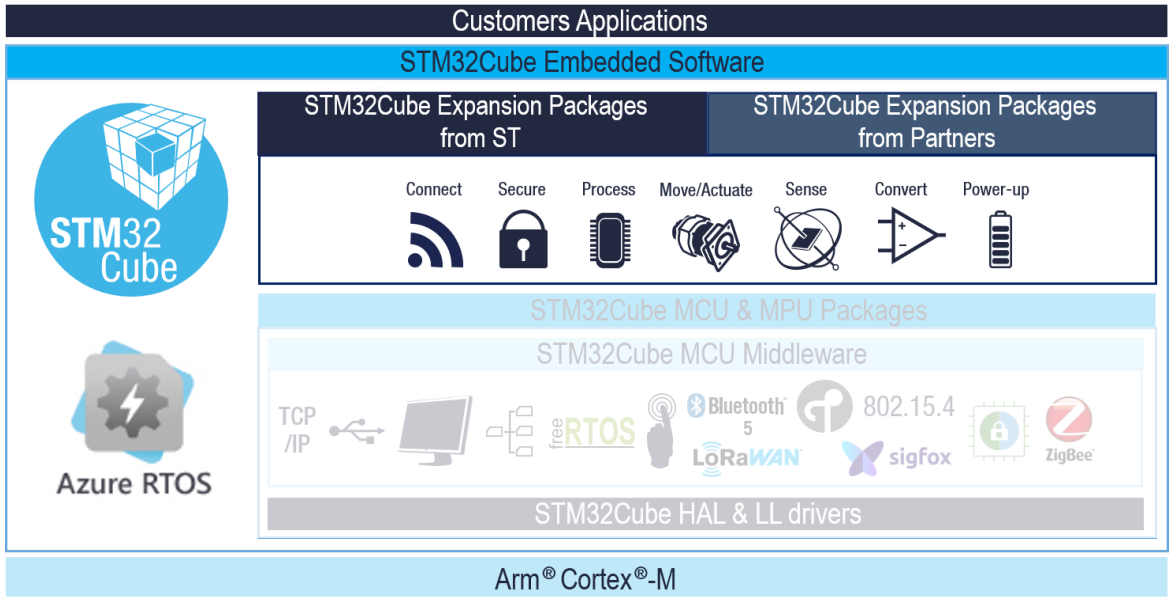
STM32Cube expansion packages

life.augmented

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

Function Pack (FP)

Advanced applicative projects and libraries



X-CUBE packages

From ST

Ex: X-CUBE-AZRTOS-H7, X-CUBE-AI, X-CUBE-TOUCHGFX, X-CUBE-SBSFU, X-CUBE-CRYPTO, …

I-CUBE packages

From 3rd parties

Ex: I-CUBE-EMBOS, I-CUBE-UNISON, I-CUBE-CANOPEN…

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

www.st.com/x-cube

STM32 CubeExpansion

Expansions with middleware

Azure RTOS

X-CUBE

X-CUBE-AZRTOS-H7

Enhanced for STM32 Toolset

- Azure RTOS ThreadX
  Real-time operating system
- Azure RTOS NetX/NetX Duo
  TCP/IP stacks
- Azure RTOS FileX
  FAT file system, fault tolerant
- Azure RTOS USBX
  USB stack, host and device

life.augmented

STM32 CubeExpansion

Expansions with middleware

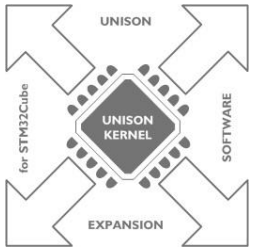
UNISON

MadeForSTM32 V2

I-CUBE

I-CUBE-UNISON

Enhanced for STM32Toolset



RoweBots

WolfSSL

MadeForSTM32 V2

I-CUBE

I-CUBE-WOLFSSL

Enhanced for STM32Toolset

wolfSSL

wolfSSL

CANopen

MadeForSTM32 V1

I-CUBE

I-CUBE-CANOPEN

CANopen

ellotas embedded communication

embOS

MadeForSTM32 V2

I-CUBE

I-CUBE-EMBOS

Enhanced for STM32Toolset

embOS OS

SEGGER It simply works!

life.augmented

STM32 CubeExpansion

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[1]

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 — Enhanced for STM32 Toolset
- X-CUBE-BLE2 — Enhanced for STM32 Toolset

NFC

X-CUBE

- X-CUBE-NFC4[2] — Enhanced for STM32 Toolset

GRAPHICS

X-CUBE

- X-CUBE-TOUCHGFX — Enhanced for STM32 Toolset

(1) Contact STMicroelectronics local representative

(2) Non-exhaustive list, please refer to st.com

life.augmented

STM32 CubeExpansion

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

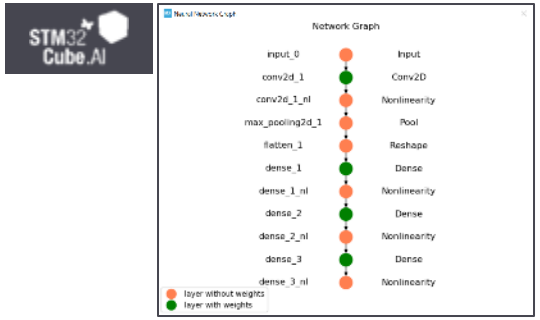
FP

- 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

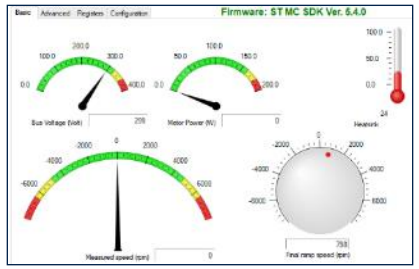
life.augmented

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/approbation 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

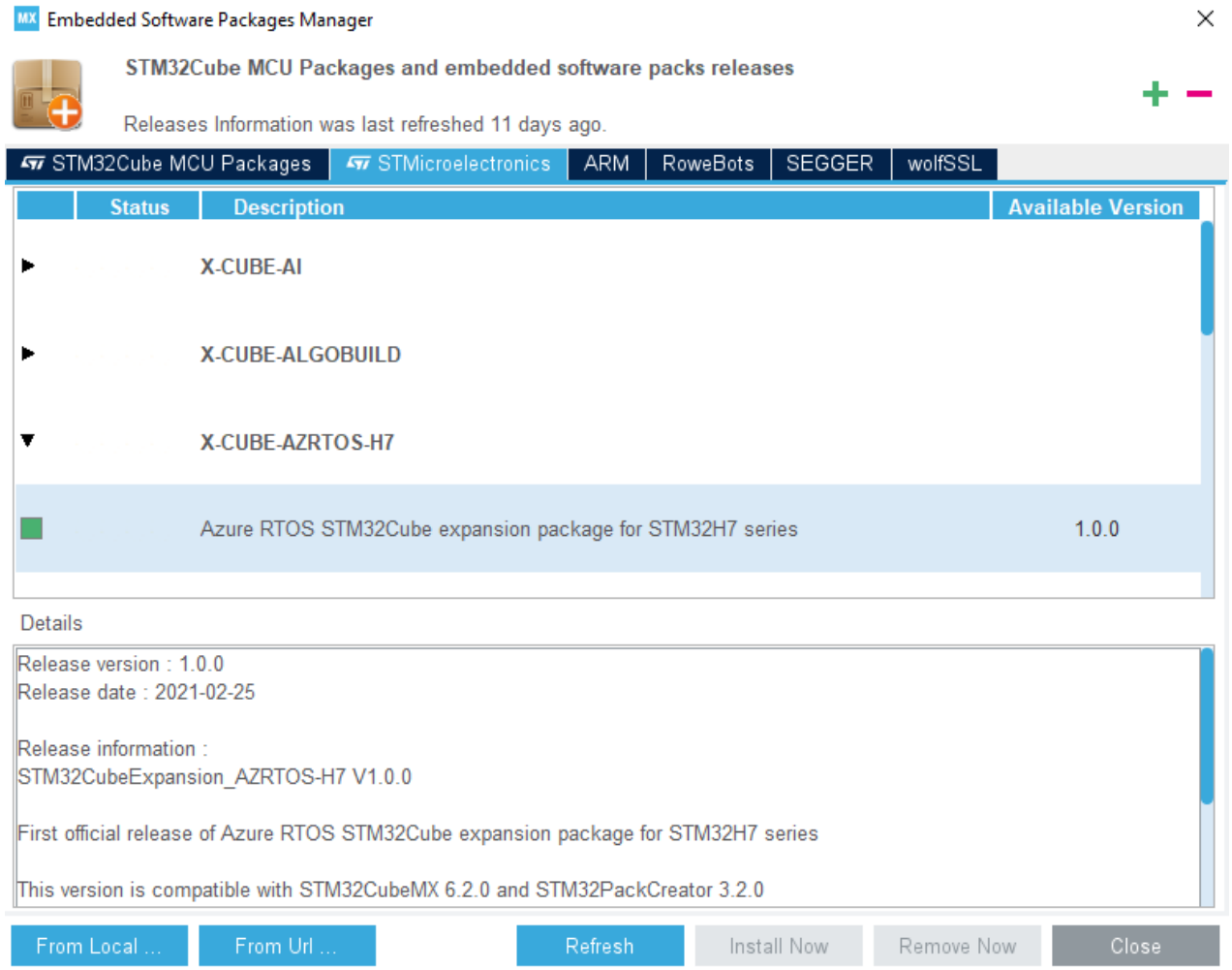
X-CUBE-SPN2
Two axes stepper motor driver software expansion for STM32Cube

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

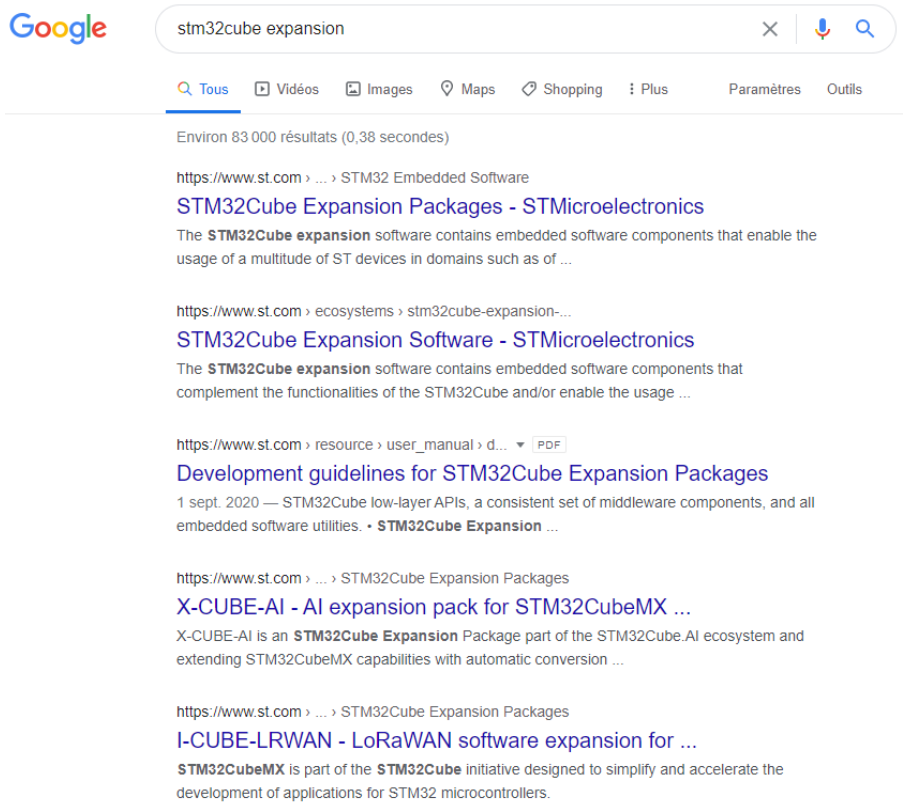
Expansions enhanced for STM32 Toolset

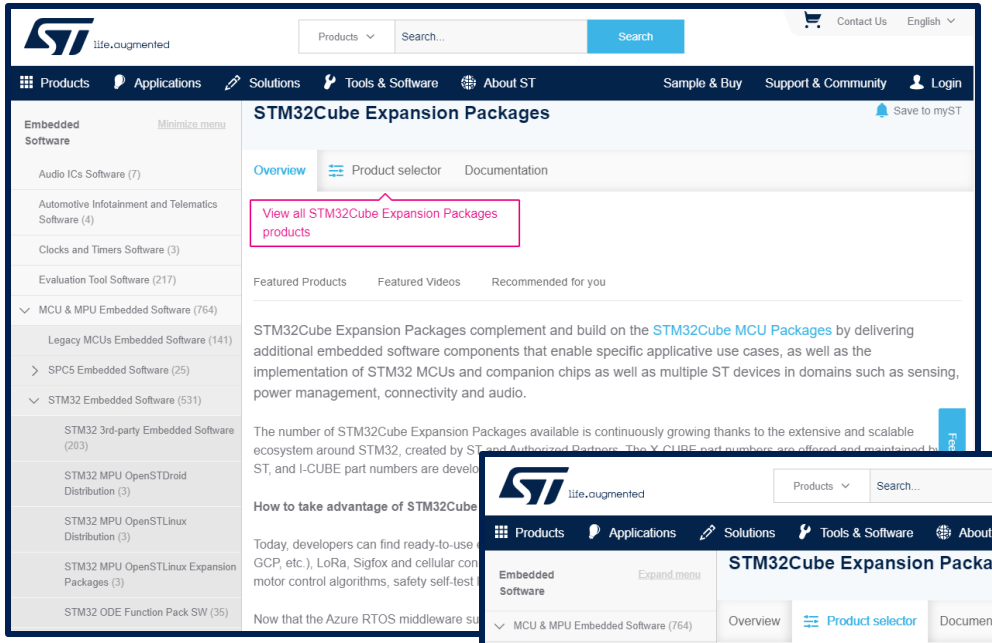


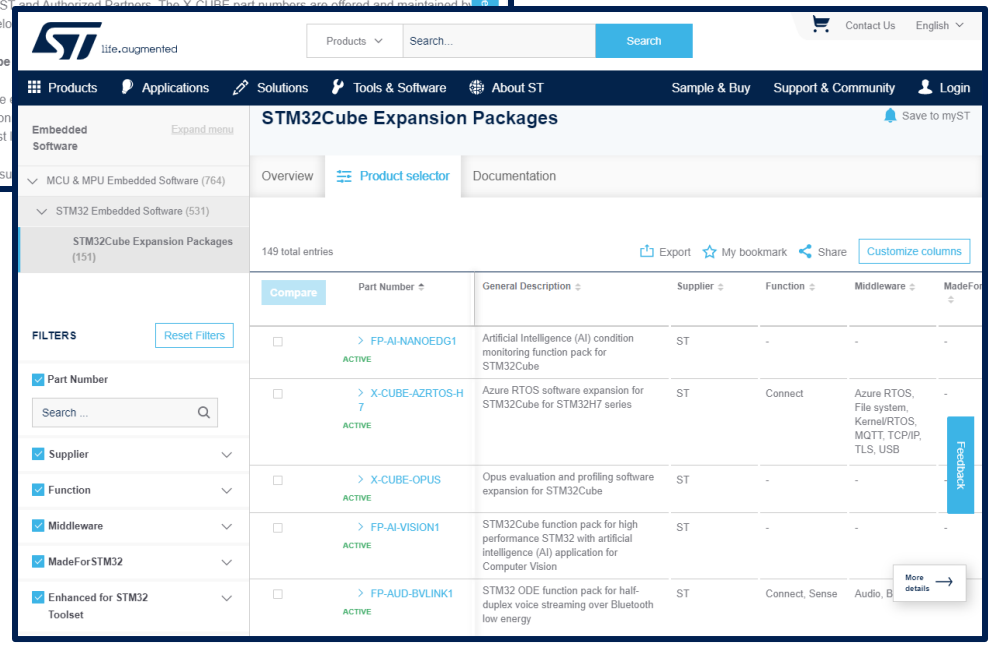
I-CUBE-EMBOS
I-CUBE-UNISON
I-CUBE-WOLFSSL
X-CUBE-AI
X-CUBE-ALGOBUILD
X-CUBE-BLE1
X-CUBE-BLE2
X-CUBE-EEPRMA1
X-CUBE-GNSS1
X-CUBE-MEMS1
X-CUBE-NFC4
X-CUBE-SUBG2
X-CUBE-SFXS2LP1
X-CUBE-TOUCHGFX

Get you up and running faster on your own STM32 board prototype

STM32Cube expansions on ST website



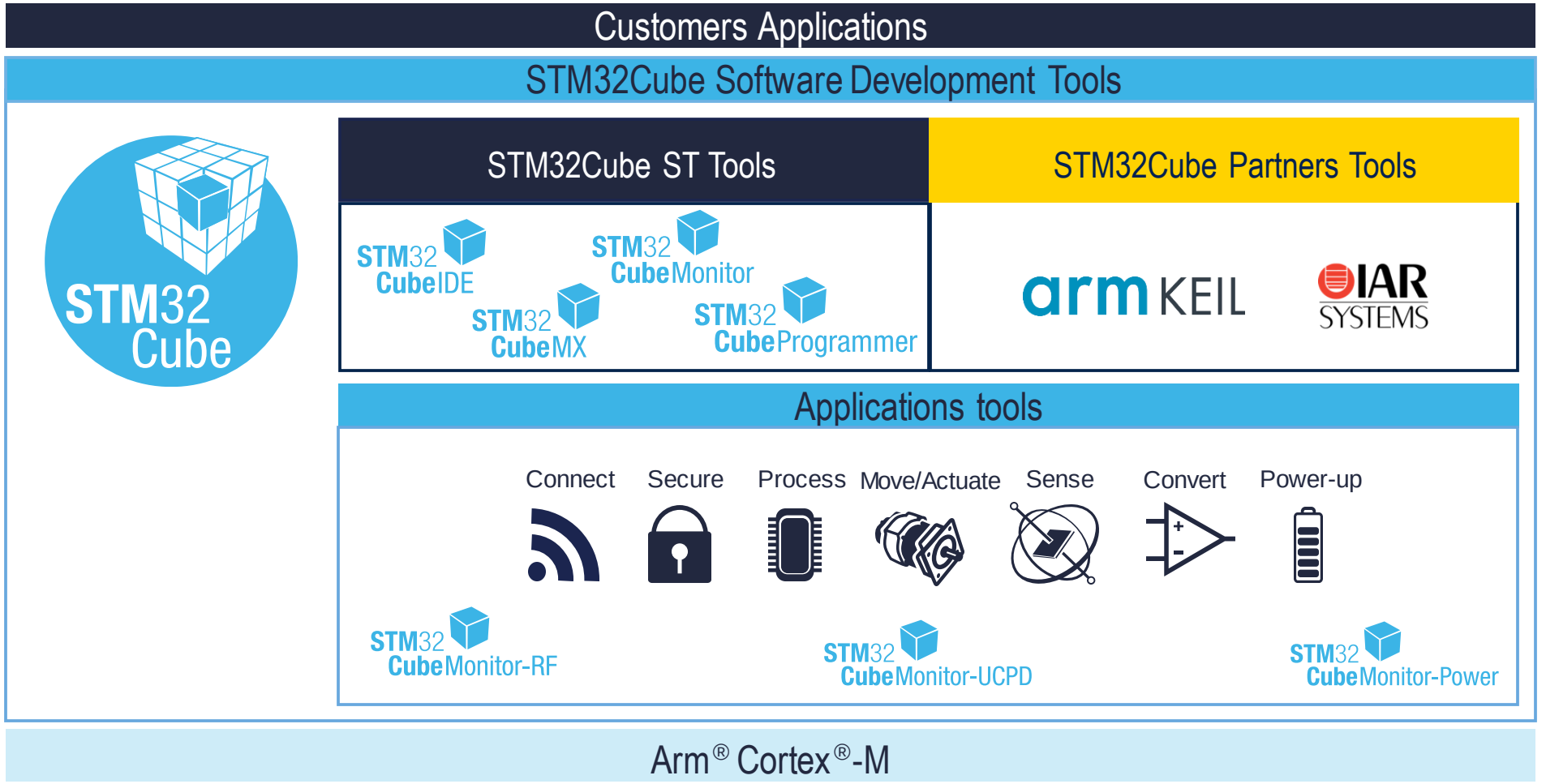




STM32Cube software
Development tools

life.augmented

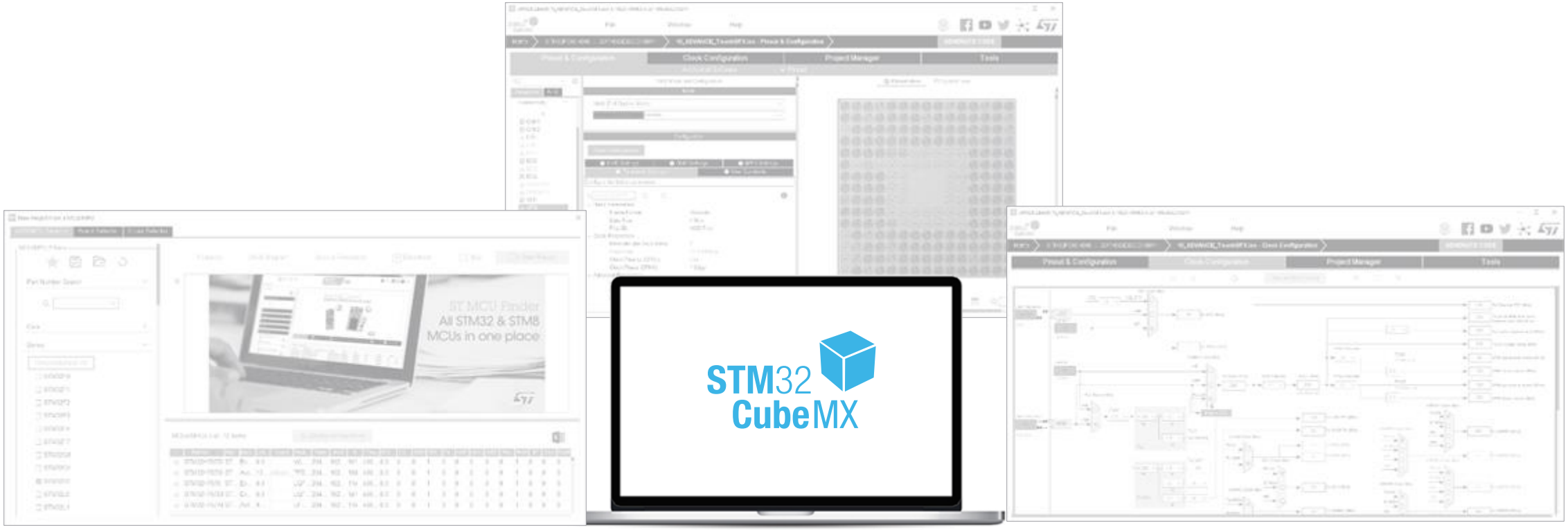
A complete Software Development Tools offer



STM32CubeMX

life.augmented

What's STM32CubeMX?

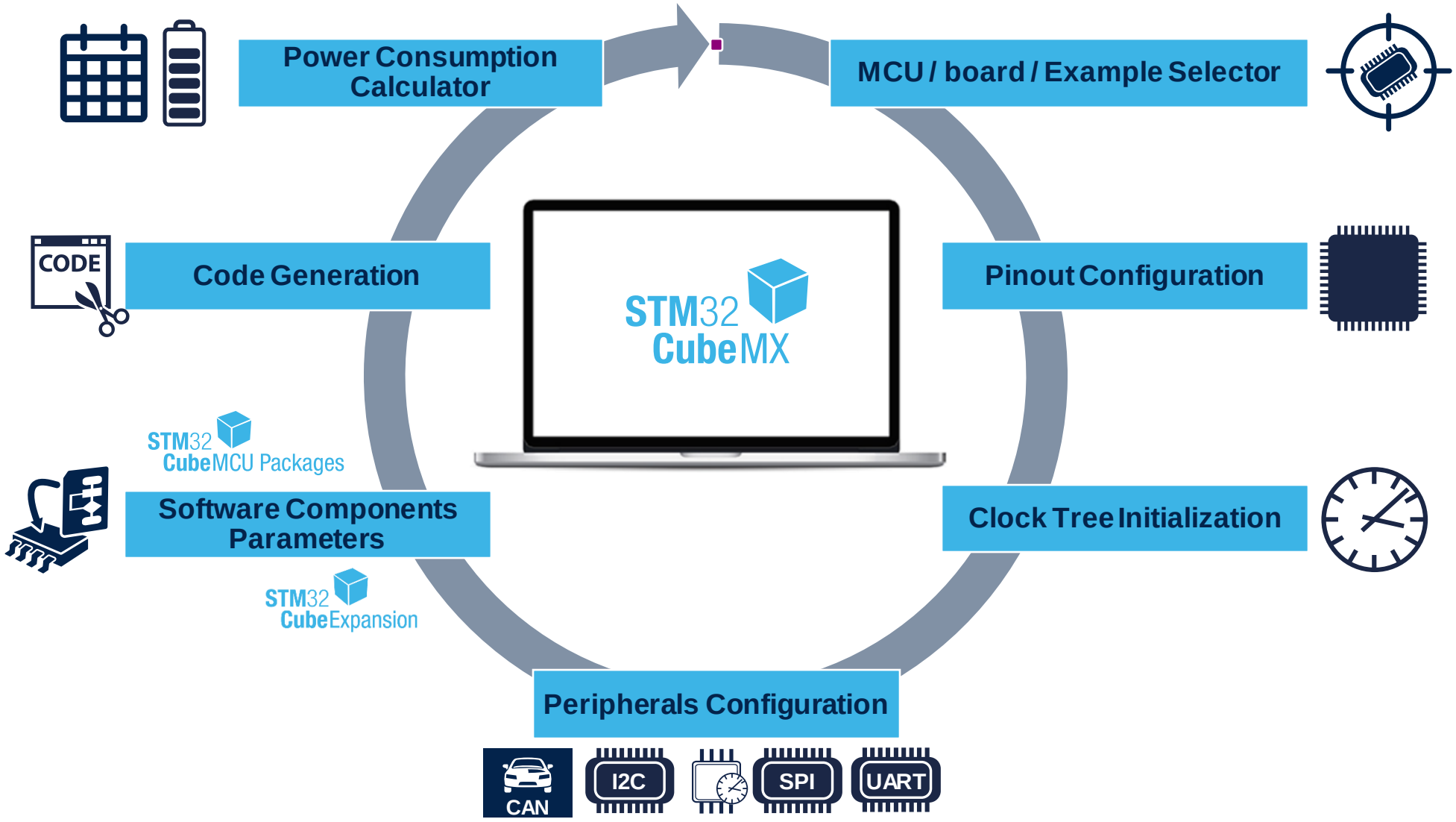


Graphical Configuration
(Pinout/Peripherals/Middleware/Clock-Tree)

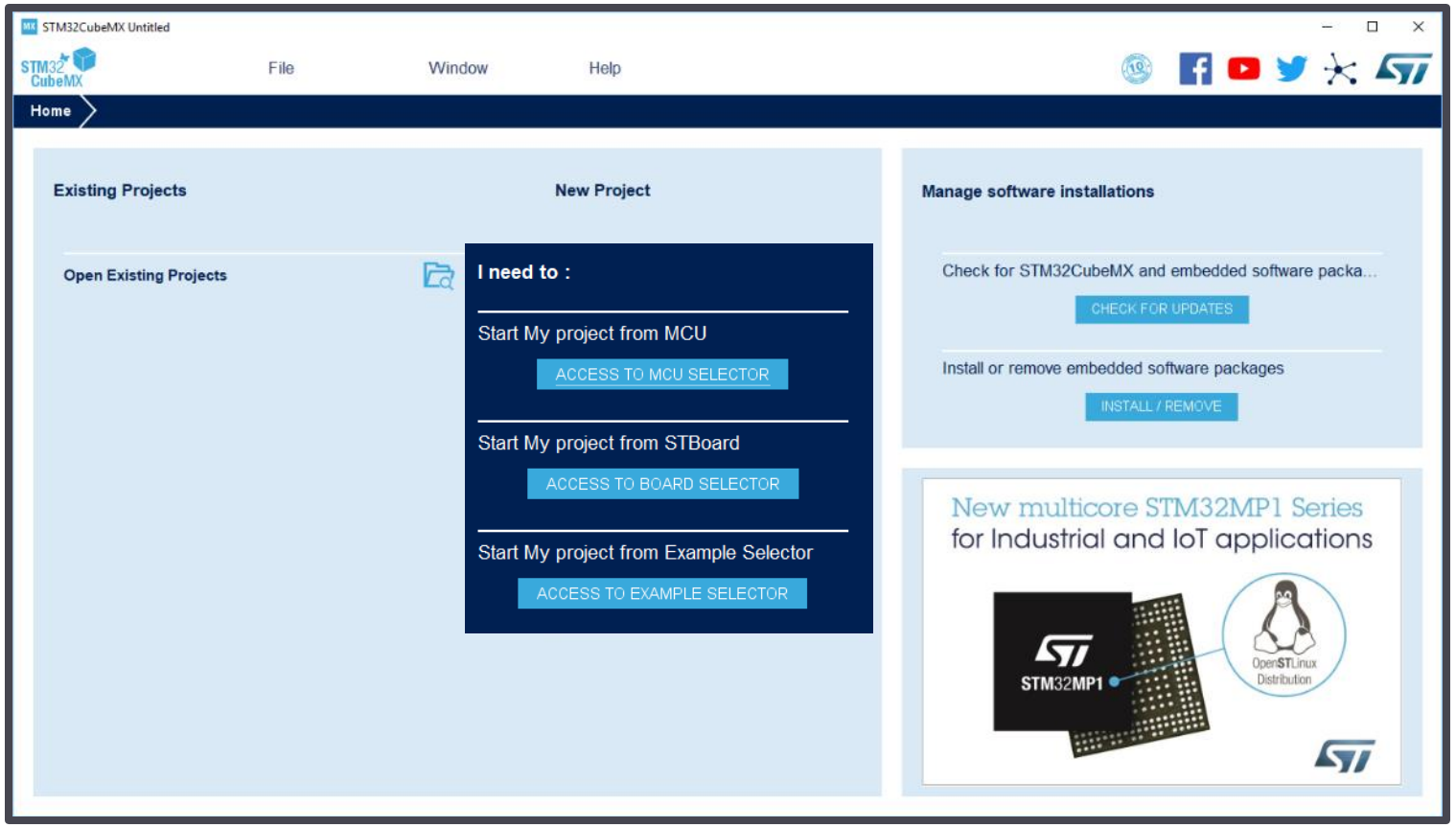
IDE Project Generation
(IAR™, Keil™ and GCC compilers)

Multi-platform
(Windows, Linux, macOS)

STM32CubeMX key steps



MCU / MPU selection



MCU / MPU SELECTOR

BOARD SELECTOR

EXAMPLE SELECTOR

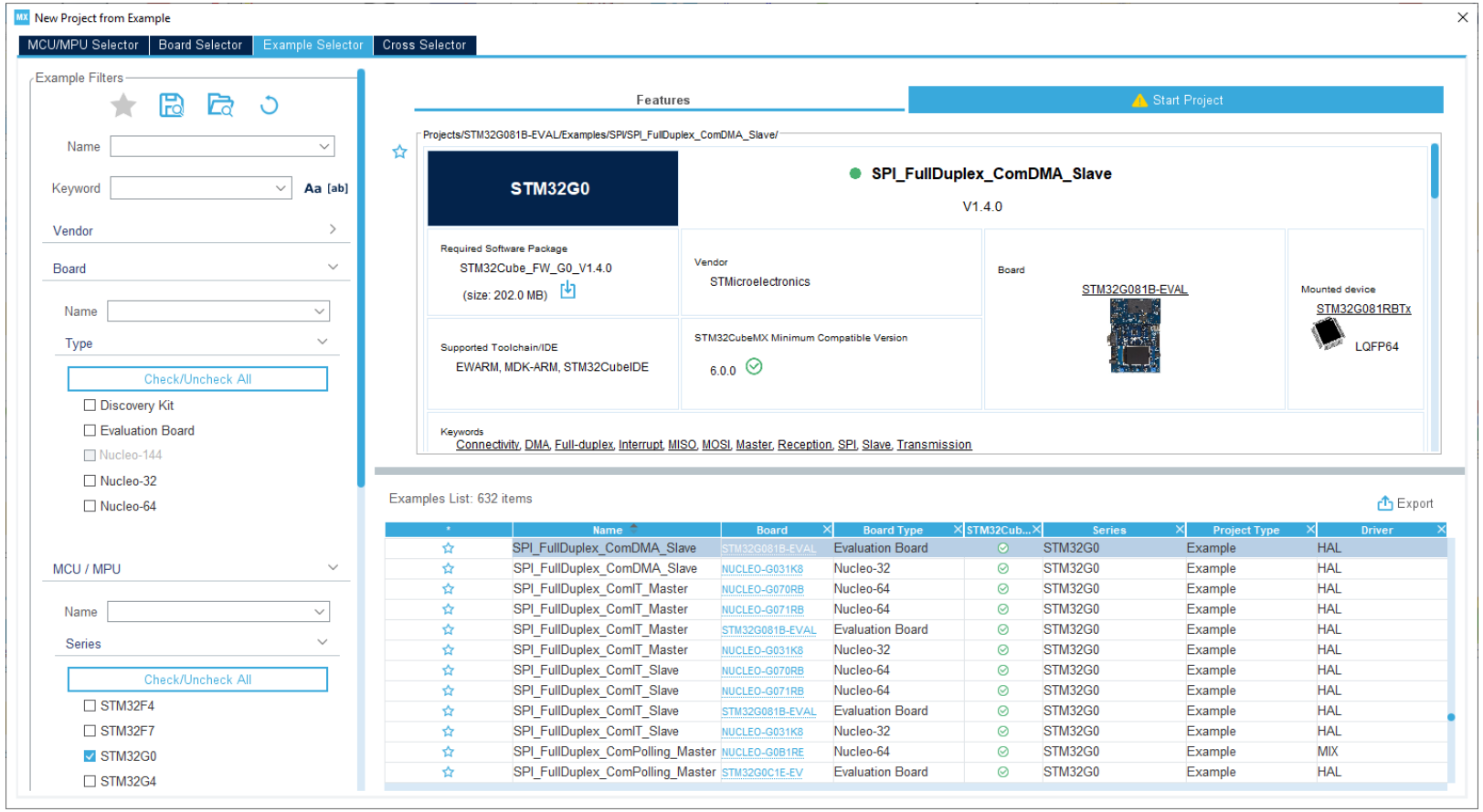
life.augmented

MCU/MPU selector

MCU / MPU SELECTOR

BOARD SELECTOR

EXAMPLE SELECTOR



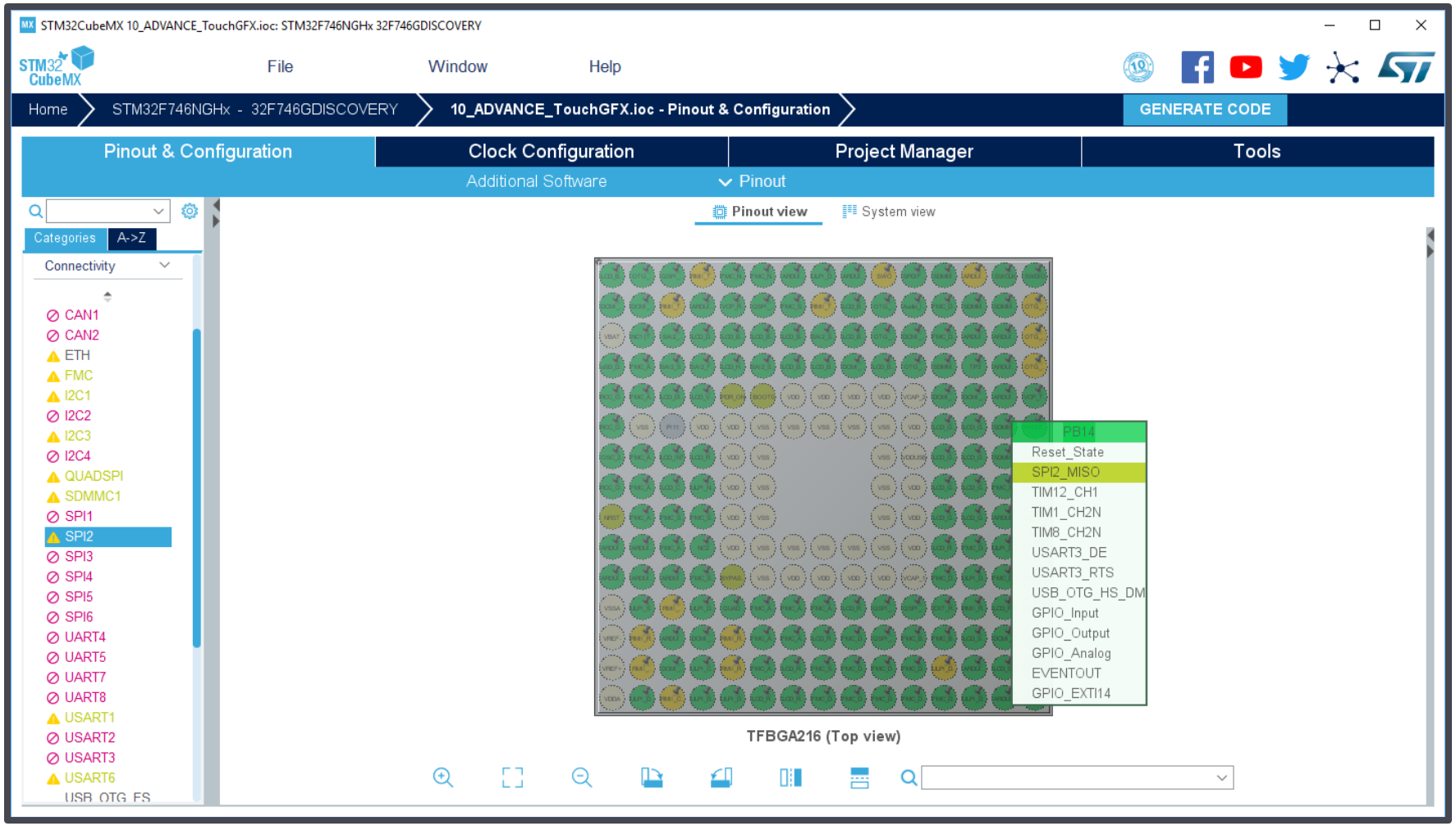
DEDICATED FILTERS

DESCRIPTION & INFORMATION

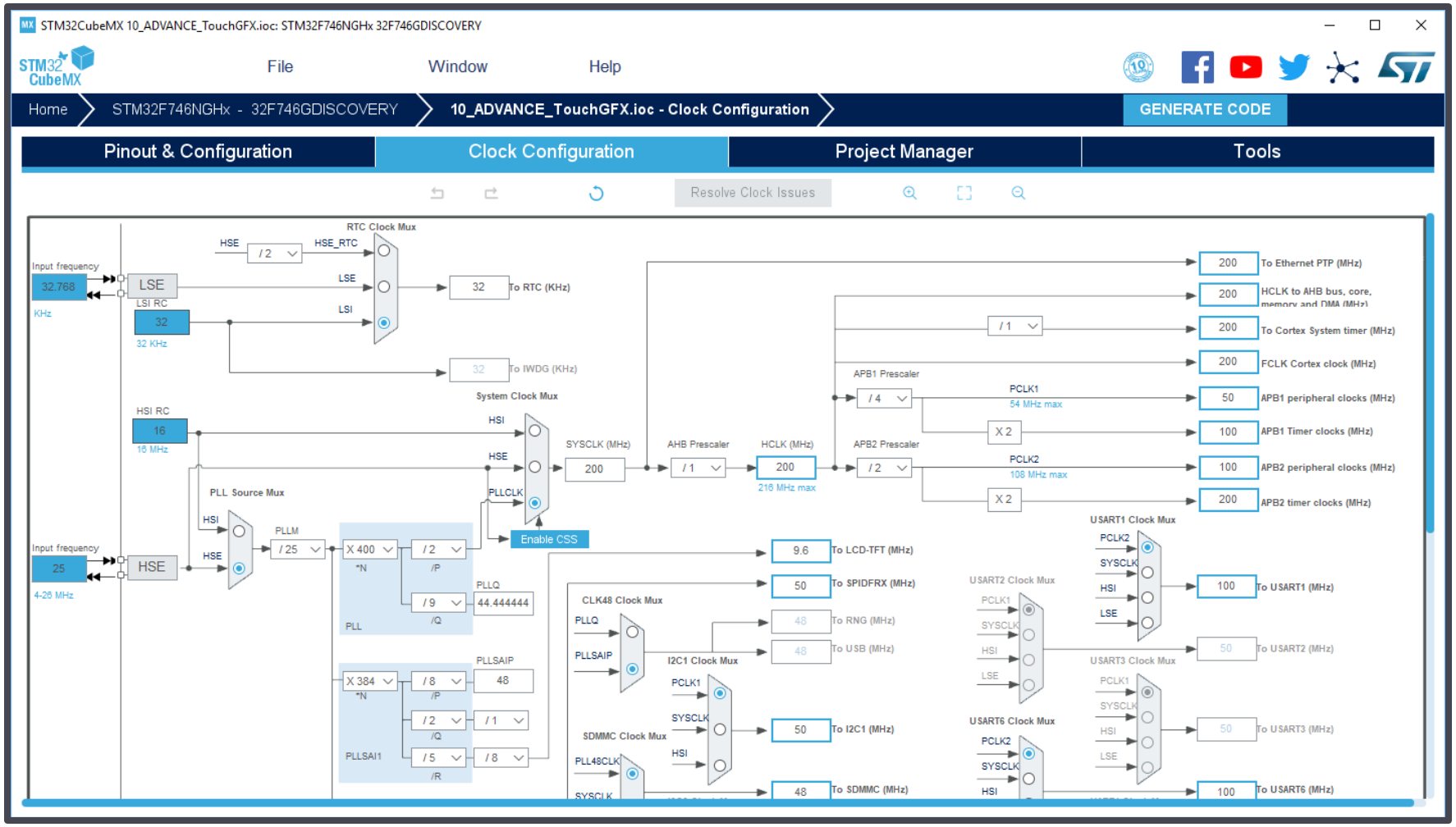
PRODUCT LIST

life.augmented

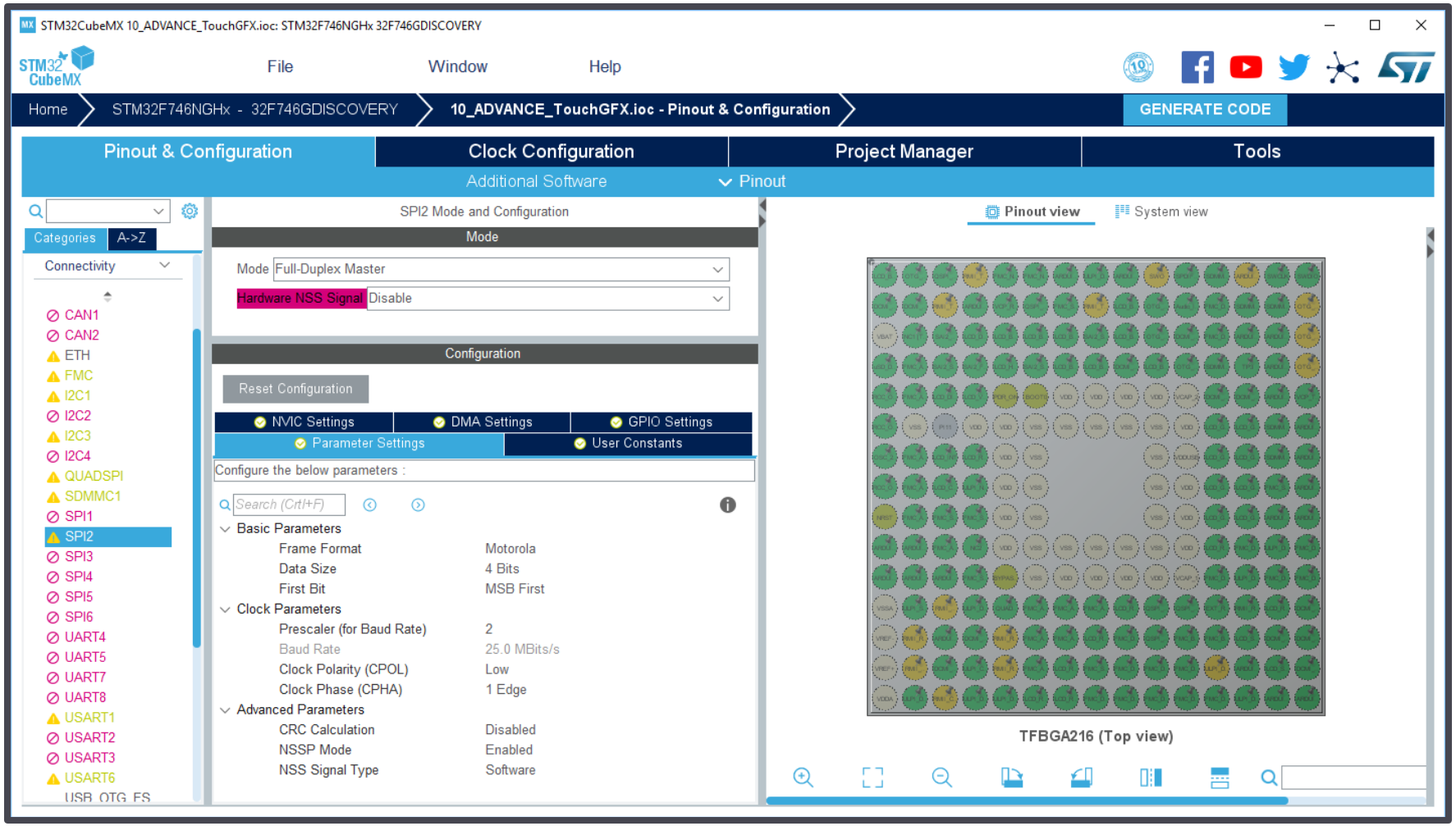
Pinout configuration



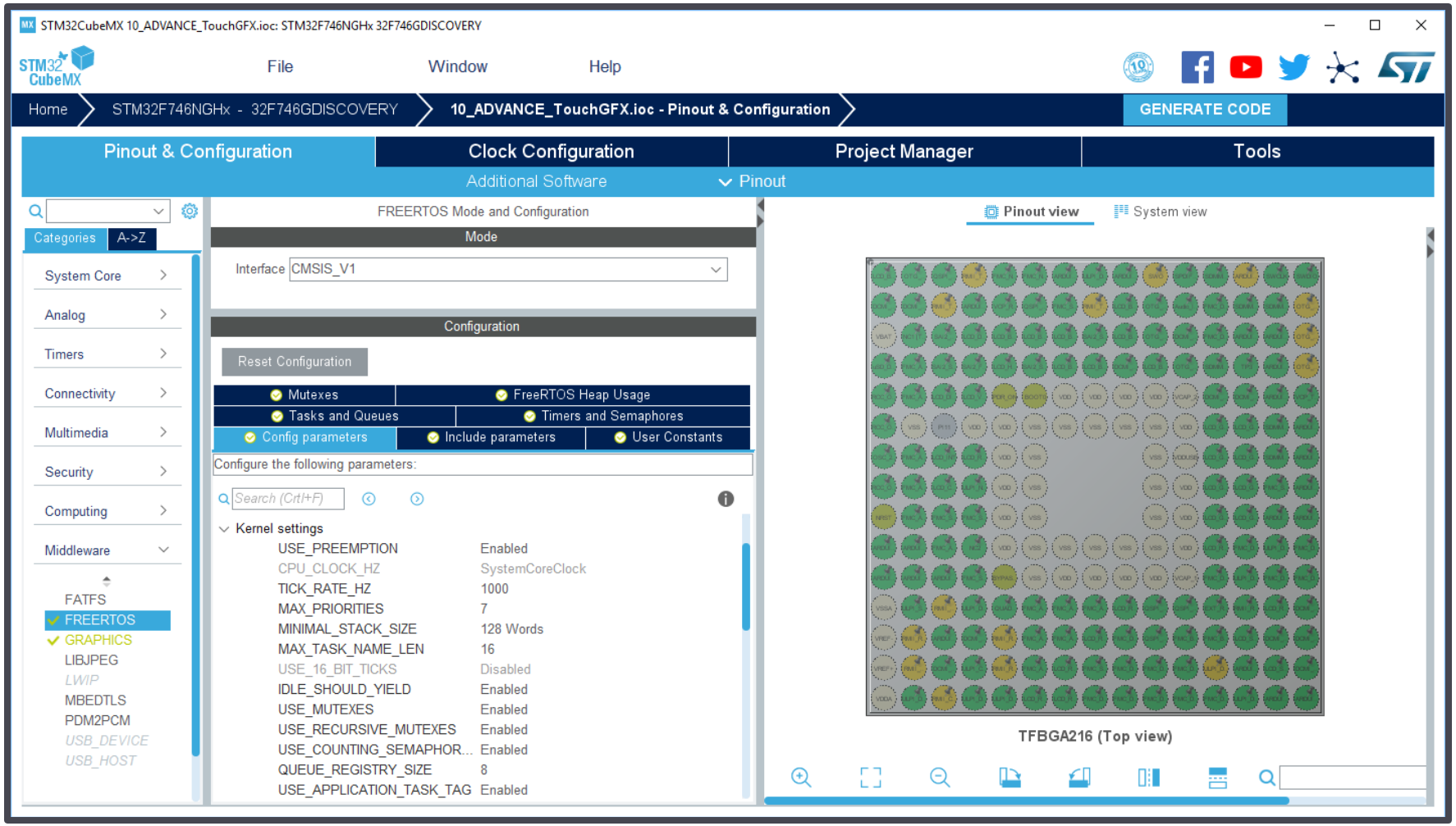
Clock-tree configuration



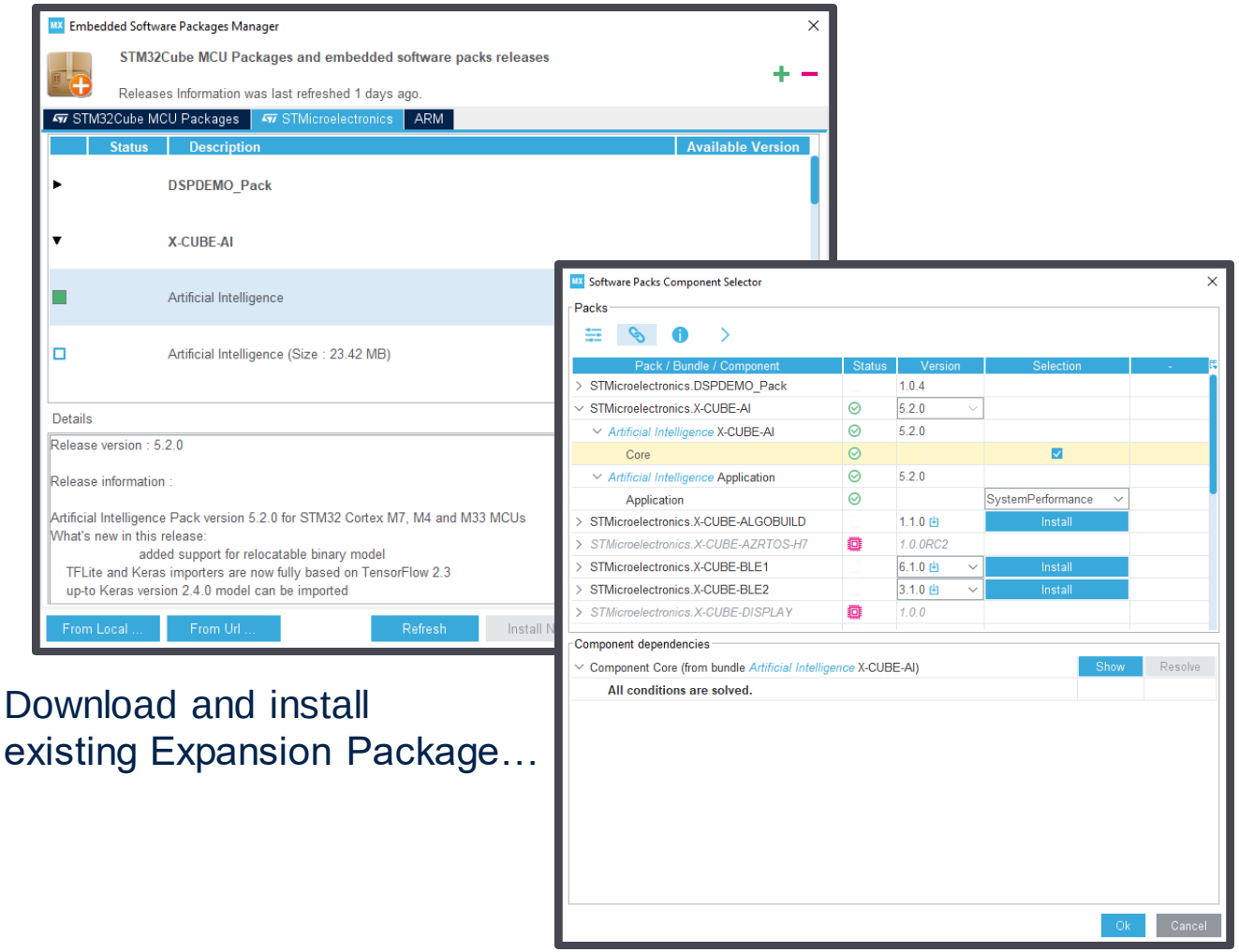
Peripheral parameters



Middleware and software components parameters



Add Expansion Middleware and build your own



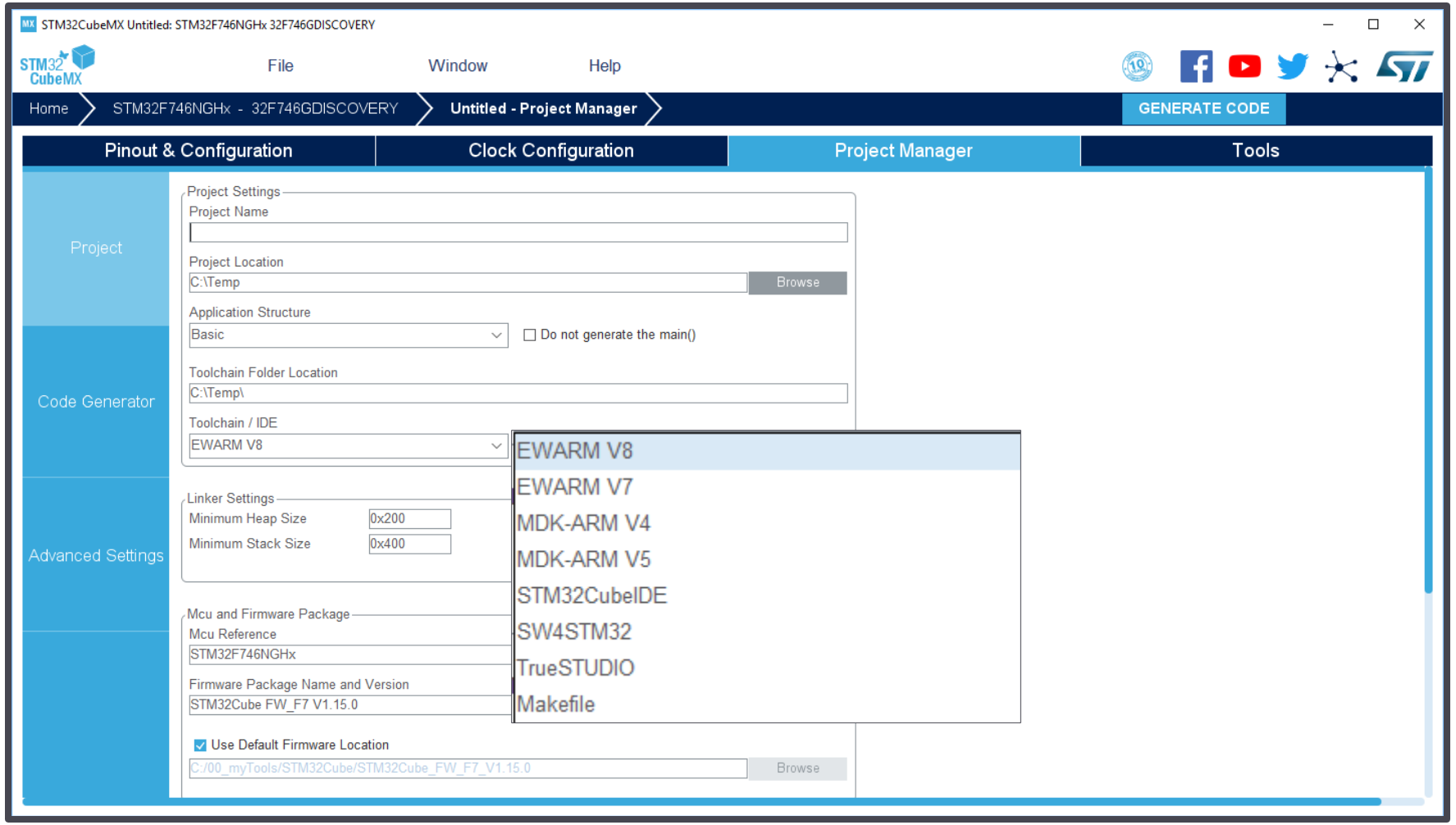
Download and install existing Expansion Package…

or

Build your own Expansion Package with **STM32PackCreator**

…and select components to add to your project

Code generation



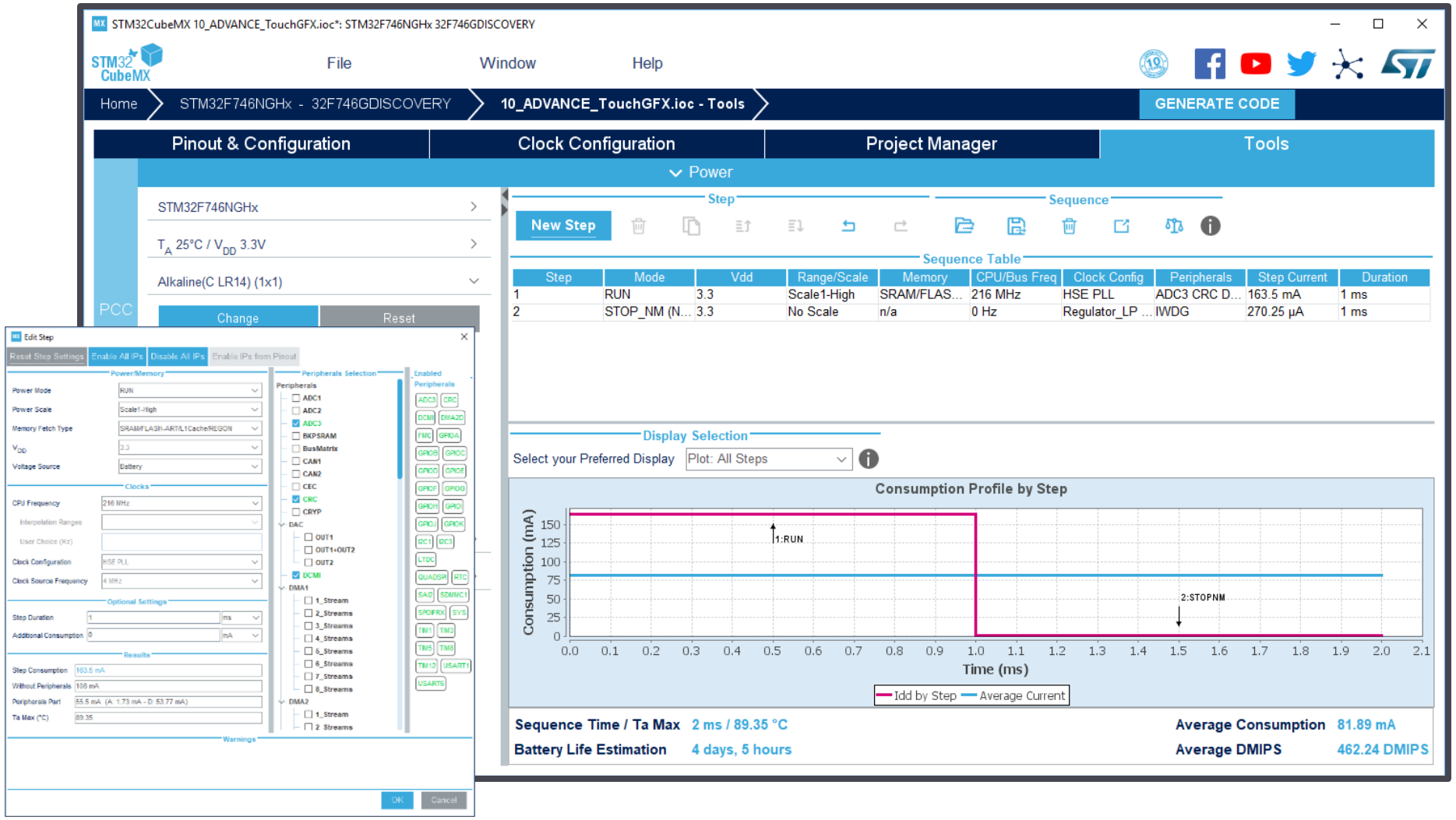
STM32 CubeIDE

IAR SYSTEMS

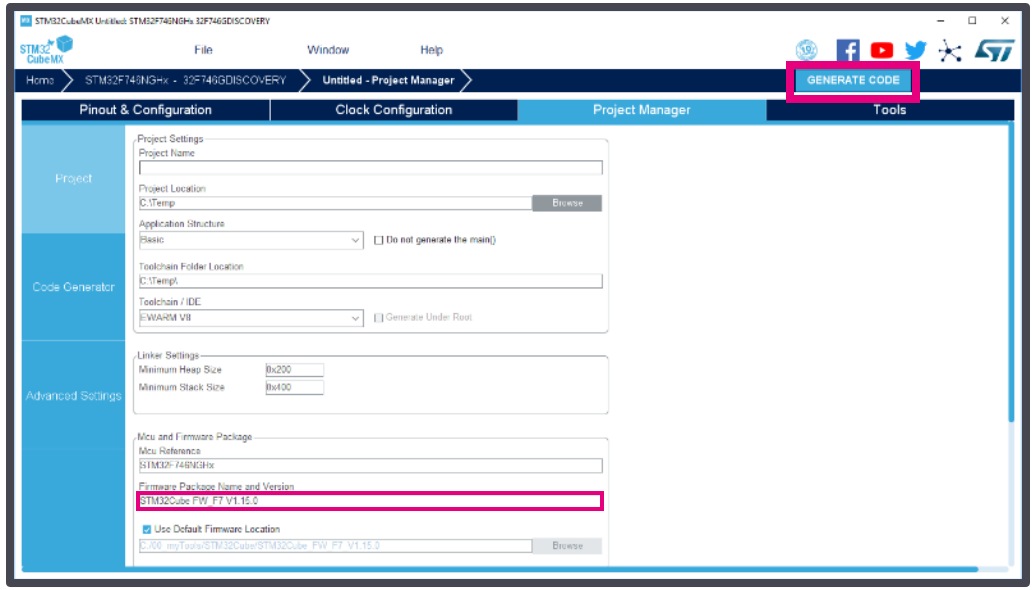
arm KEIL

life.augmented

Power consumption calculator

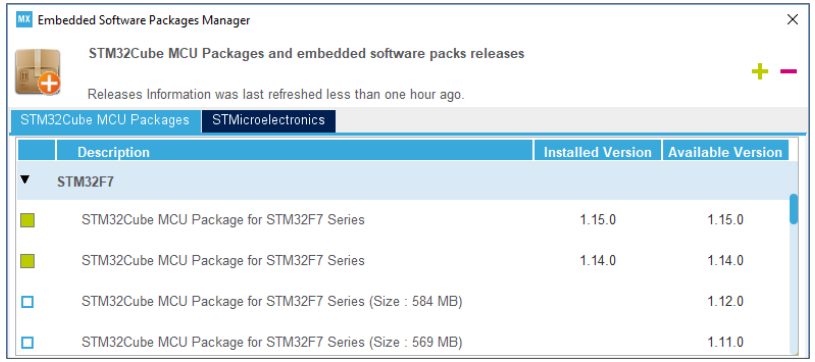


STM32CubeMX repository



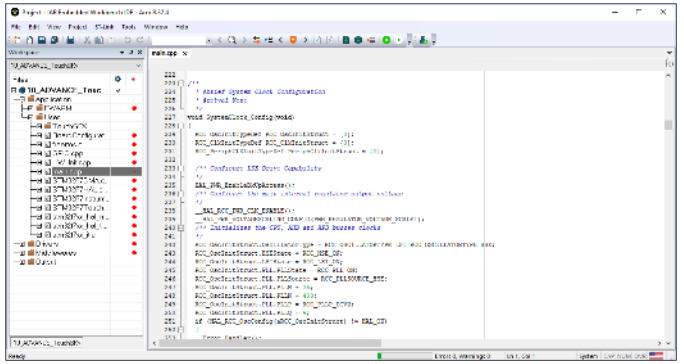
After pressing “GENERATE CODE”:

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

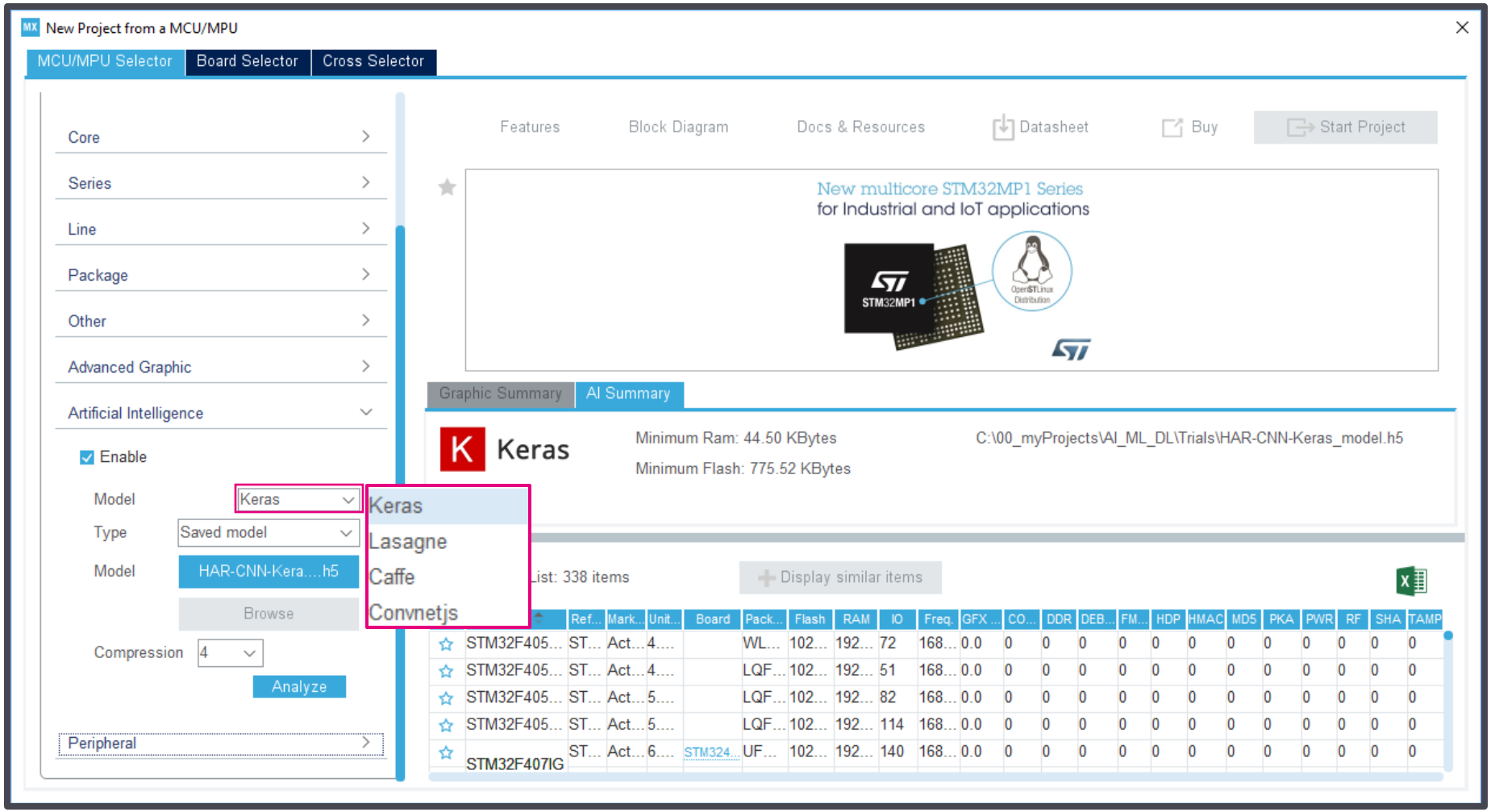


STM32CubeMX Repository

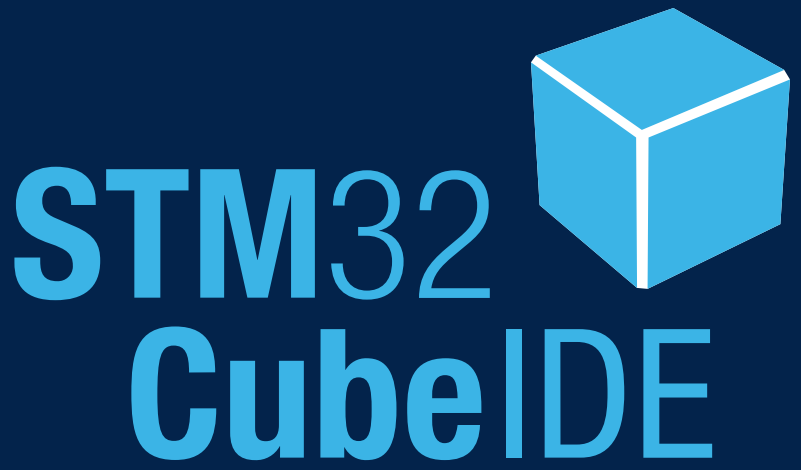
IDE Project



MCU/MPU selection for AI application



STM32CubeIDE



life.augmented

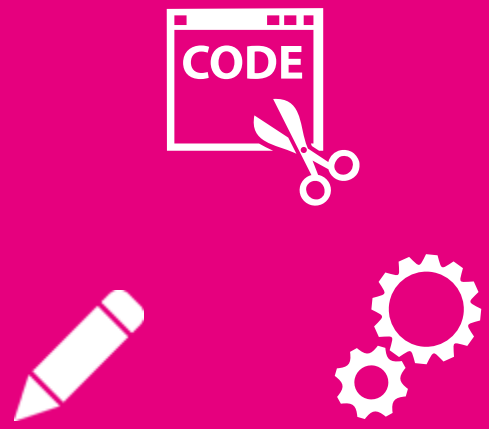
Background of STM32CubeIDE

History

One tool for all your STM32 development

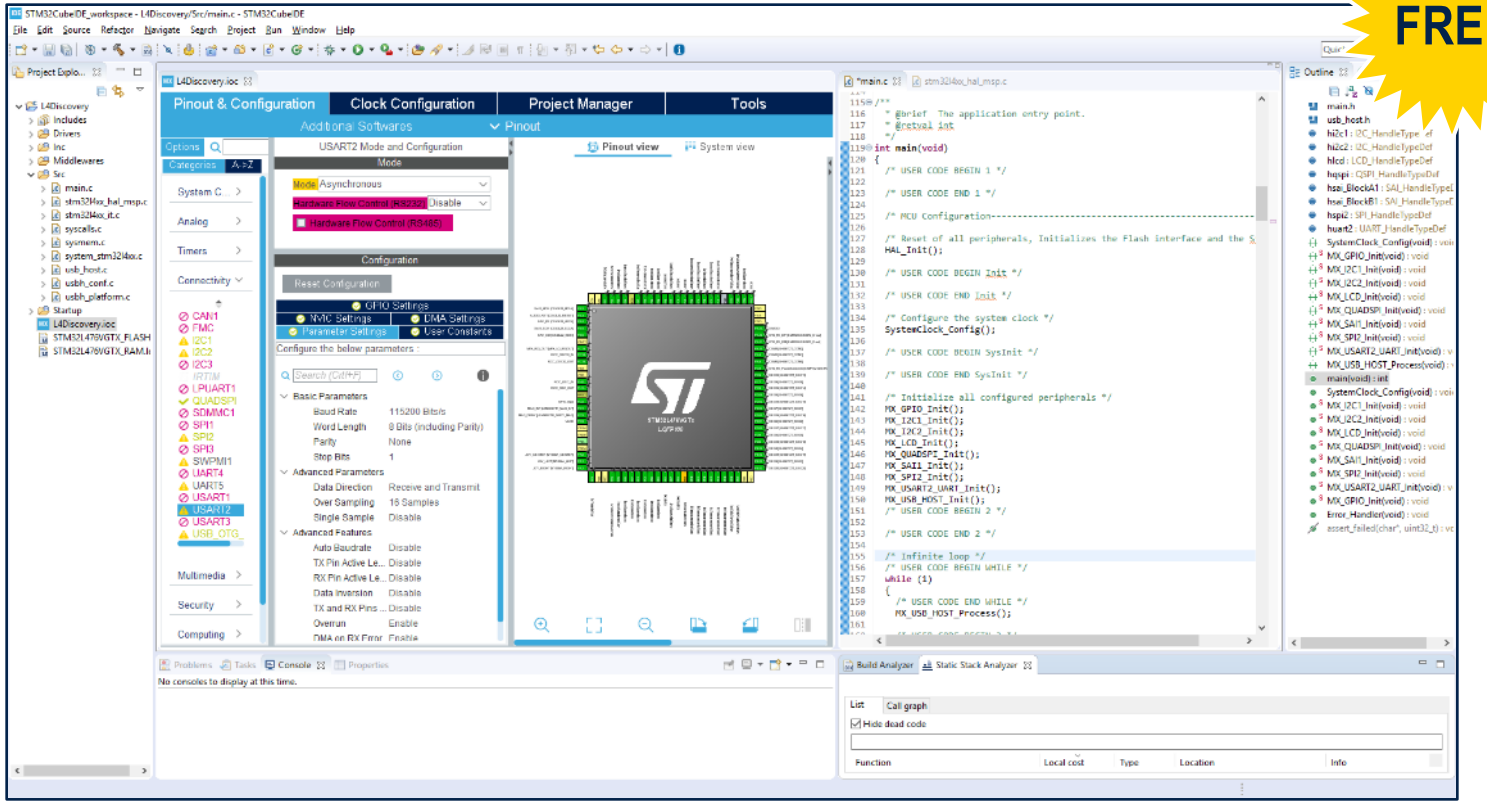
Chipset / Board Configuration

Code Development



Validation Debug

Free multi-platform development tool



eclipse

GCC

Windows

macOS

Eclipse/GCC Based

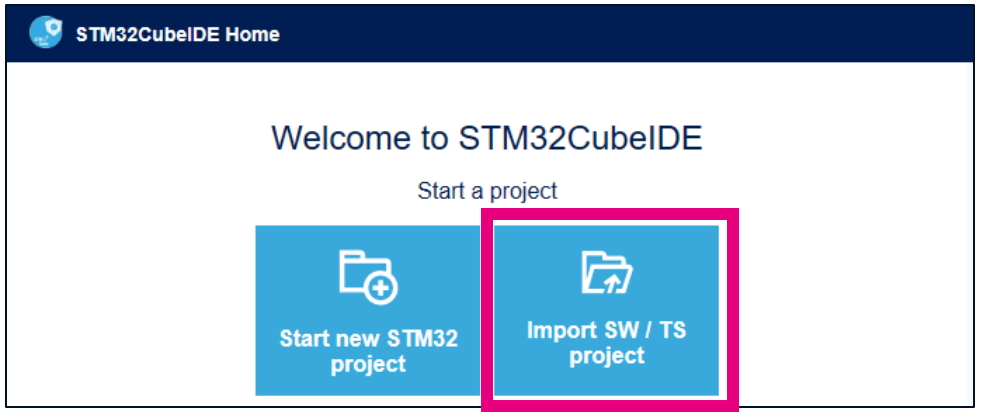
Free for Commercial Development

Multi-OS Support

life.augmented

Project management

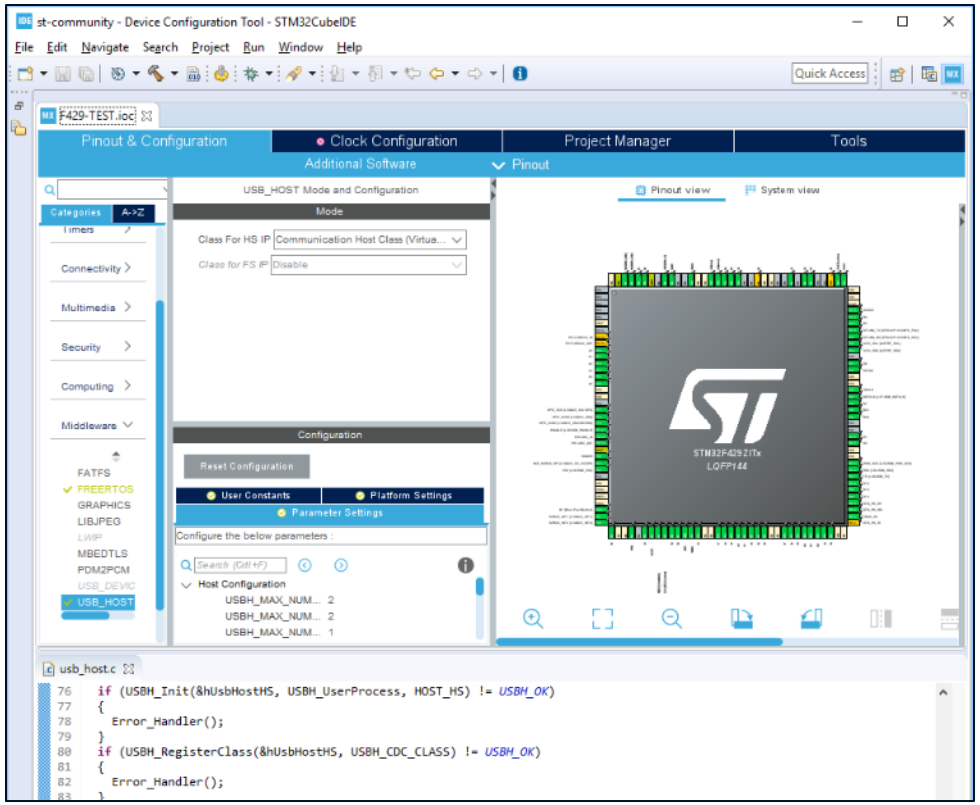
Importer



TrueSTUDIO Project

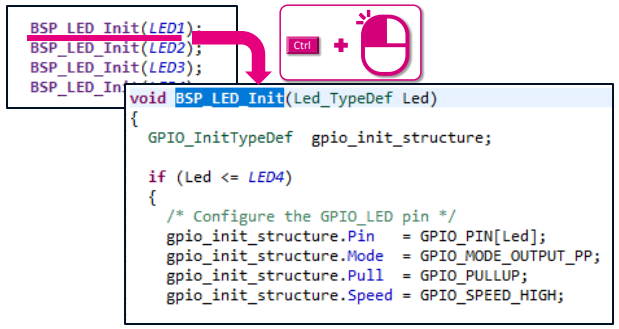
SW4STM32 Project

IOC Editor

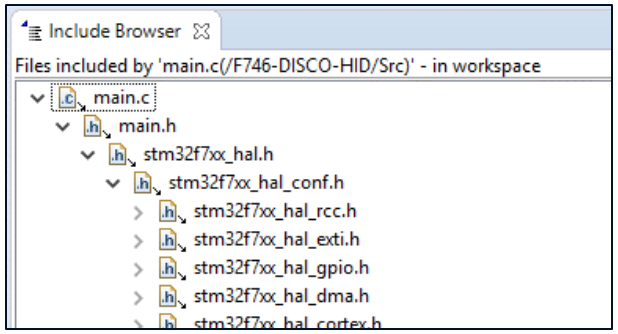


Code editor – navigation

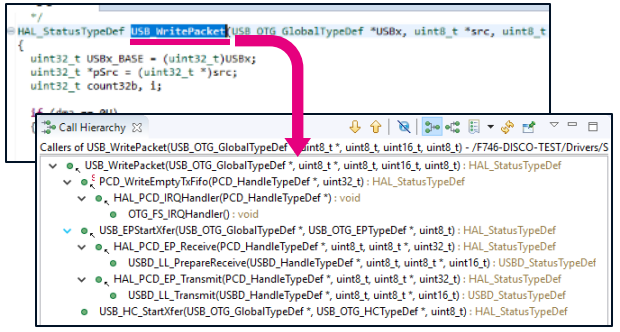
Symbol Hyperlink



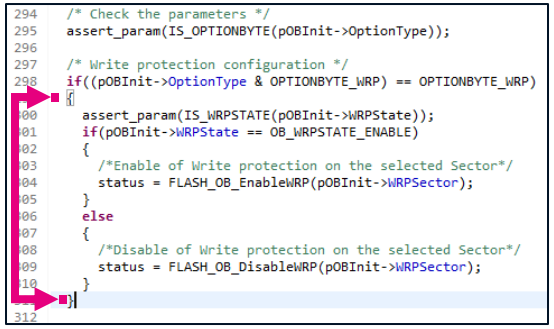
Include Browser



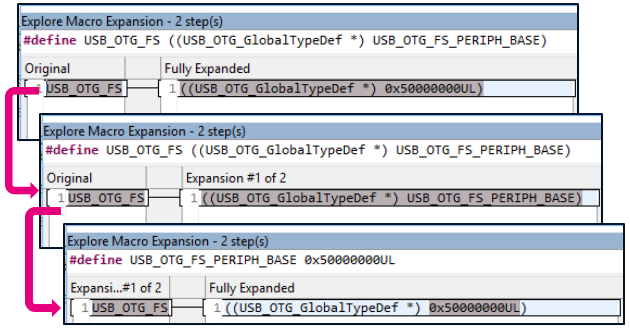
Call Hierarchy



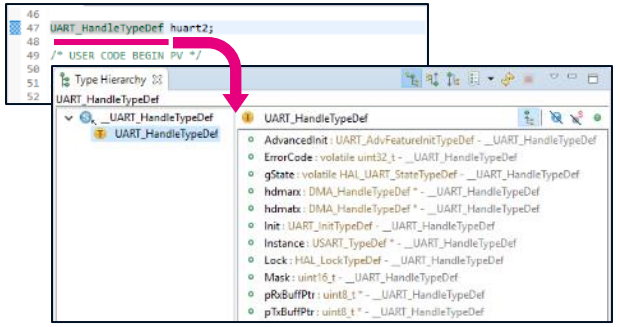
Brace Navigation



Macro Expansion Browser



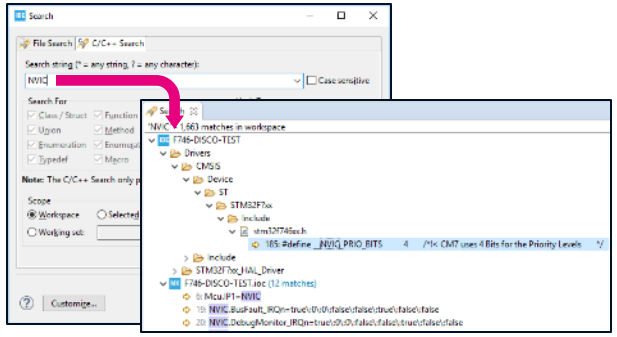
Type Hierarchy



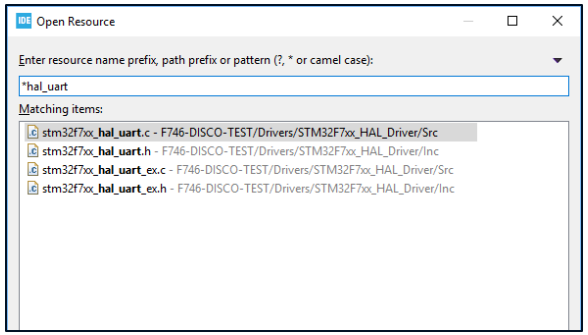
Code editor – navigation (2/2)

Outline View

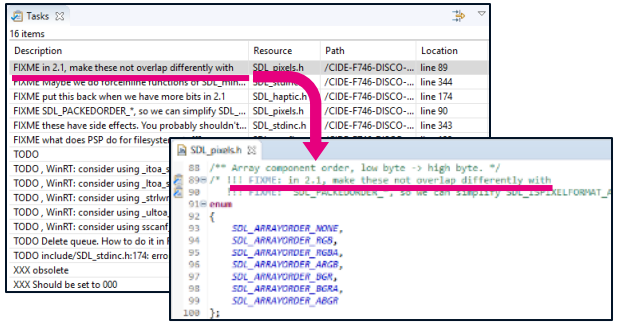
Powerful Search



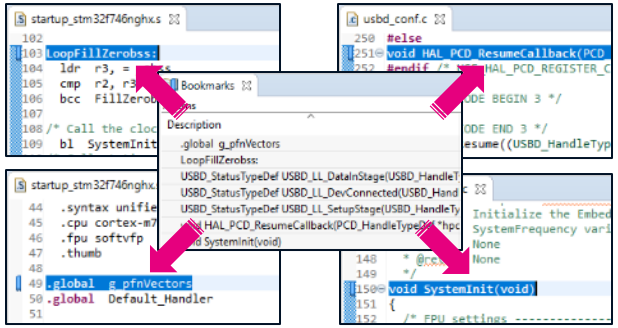
Open Resource



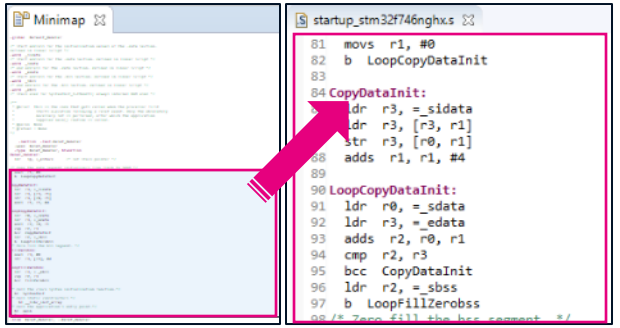
Task Tags



Bookmark

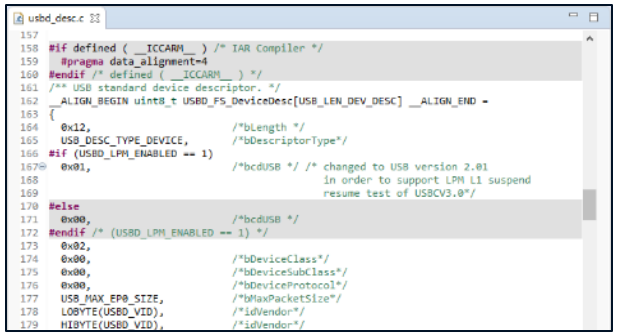


Minimap

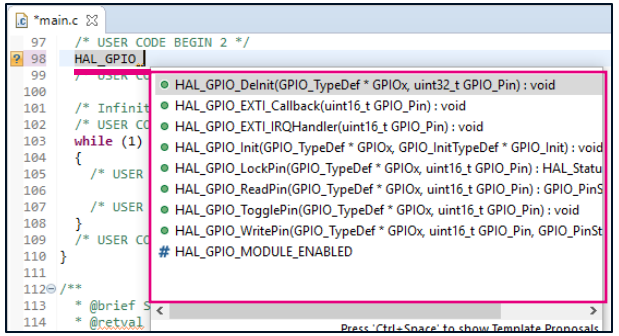


Code editor – writing

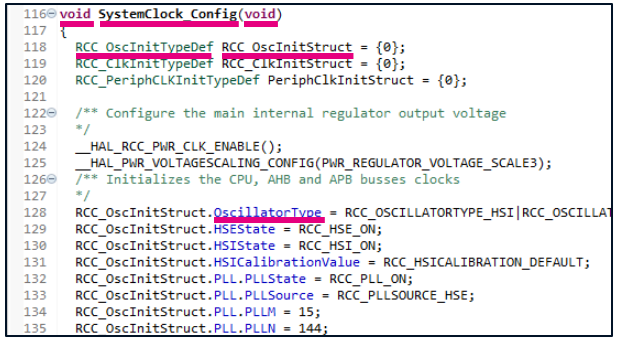
Highlight Inactive Code



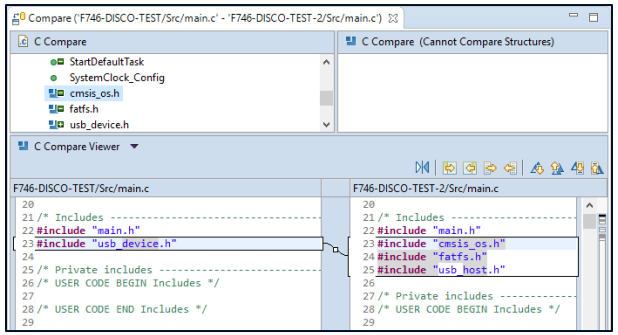
Auto-Complete



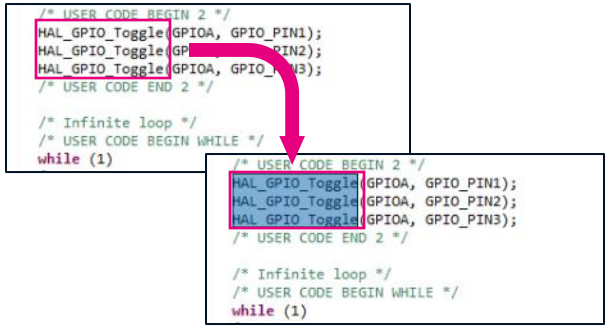
Syntax Highlight



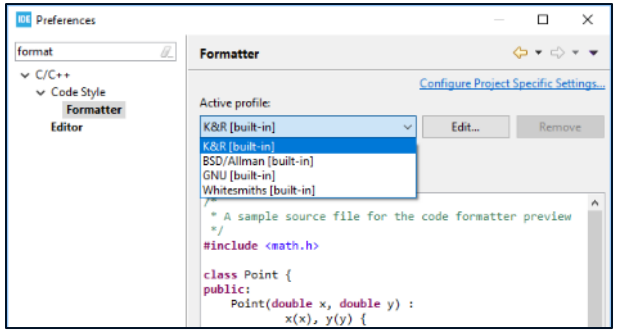
File Diff/Compare



Block Select



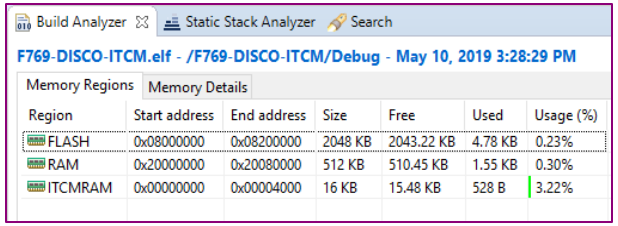
Code Style

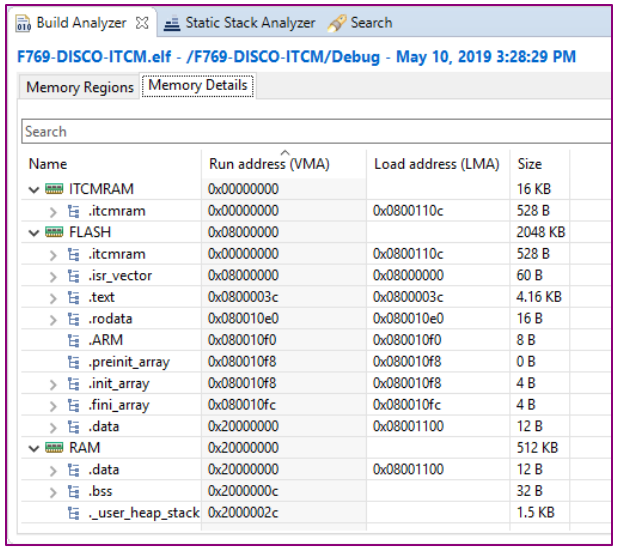


life.augmented

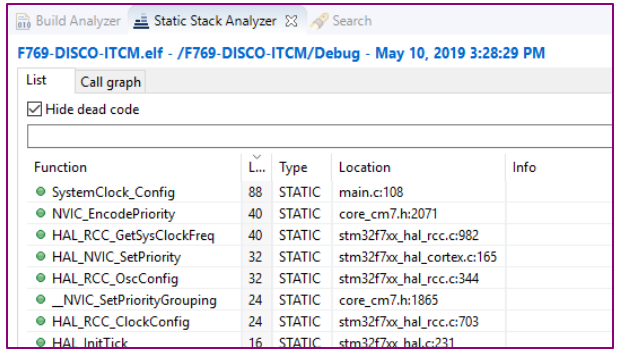
Build tools

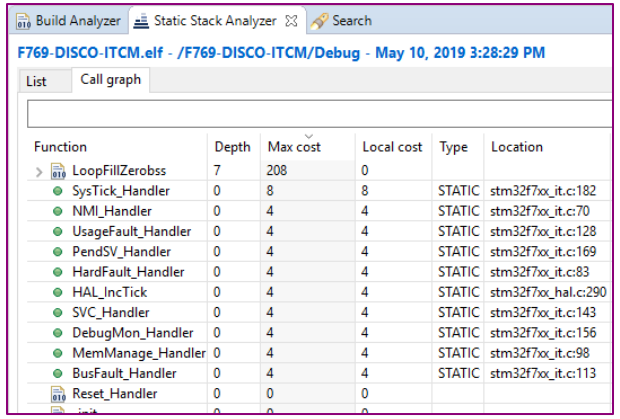
Build Analyzer





Static Stack Analyzer





Headless Build

Continuous Integration

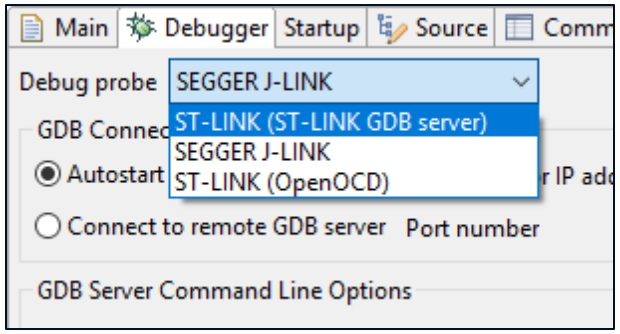
- Build project without opening IDE

  No GUI shown but build system becomes active

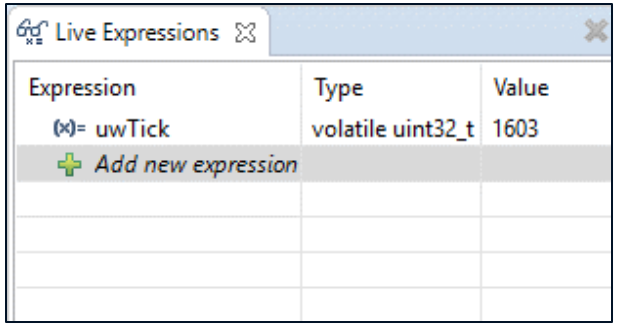
- Supported for makefile and managed projects

Debug

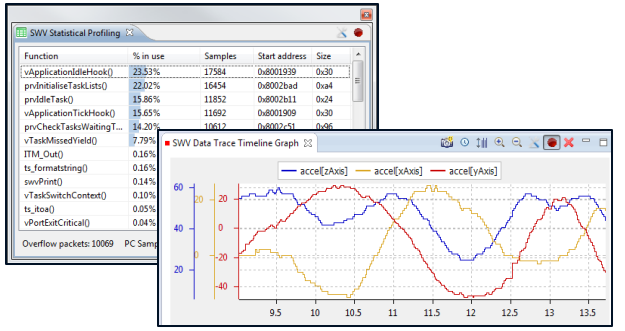
Debugger



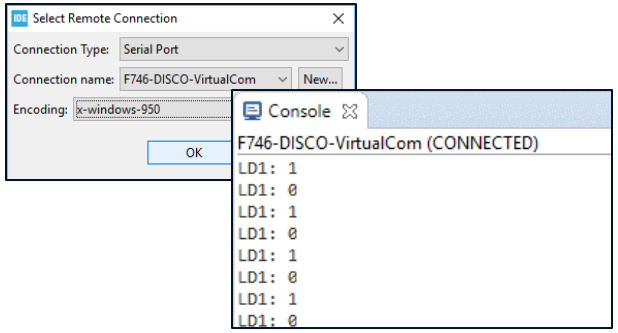
Live expressions



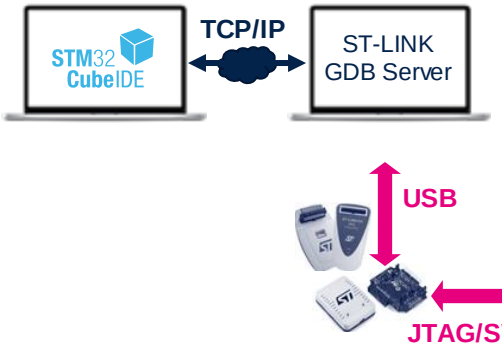
SWV



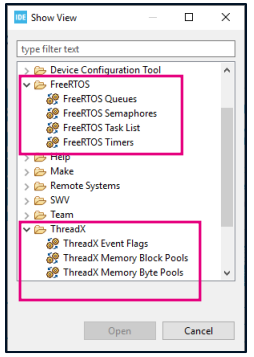
Integrated UART Terminal



Remote Debug



RTOS aware Debug



FreeRTOS

ThreadX Microsoft Azure

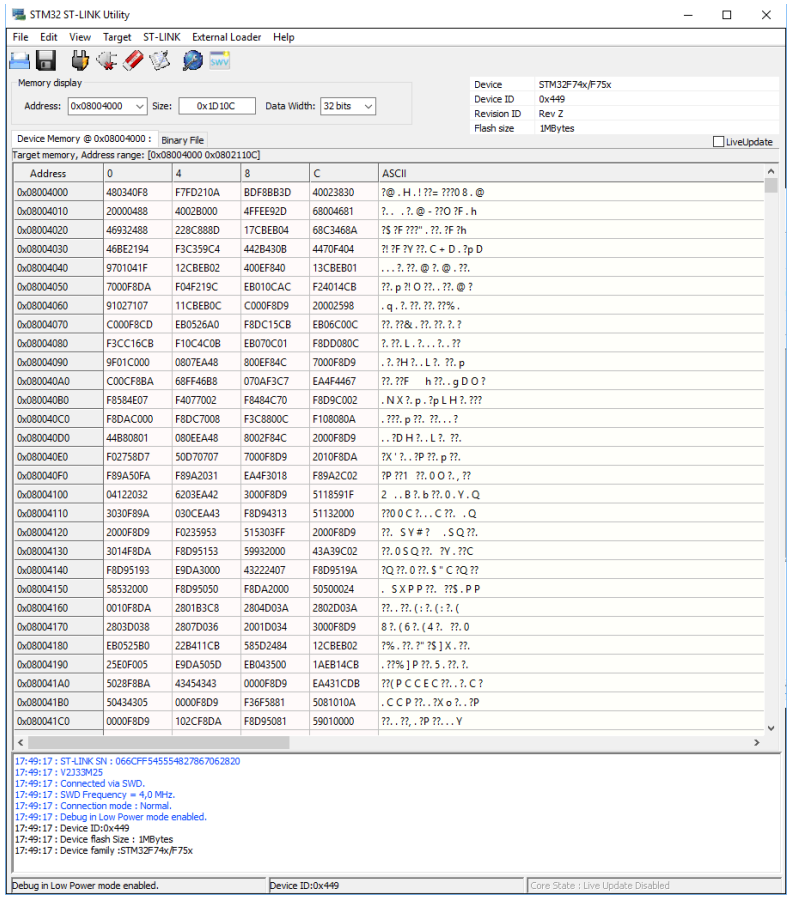
life.augmented

STM32CubeProgrammer

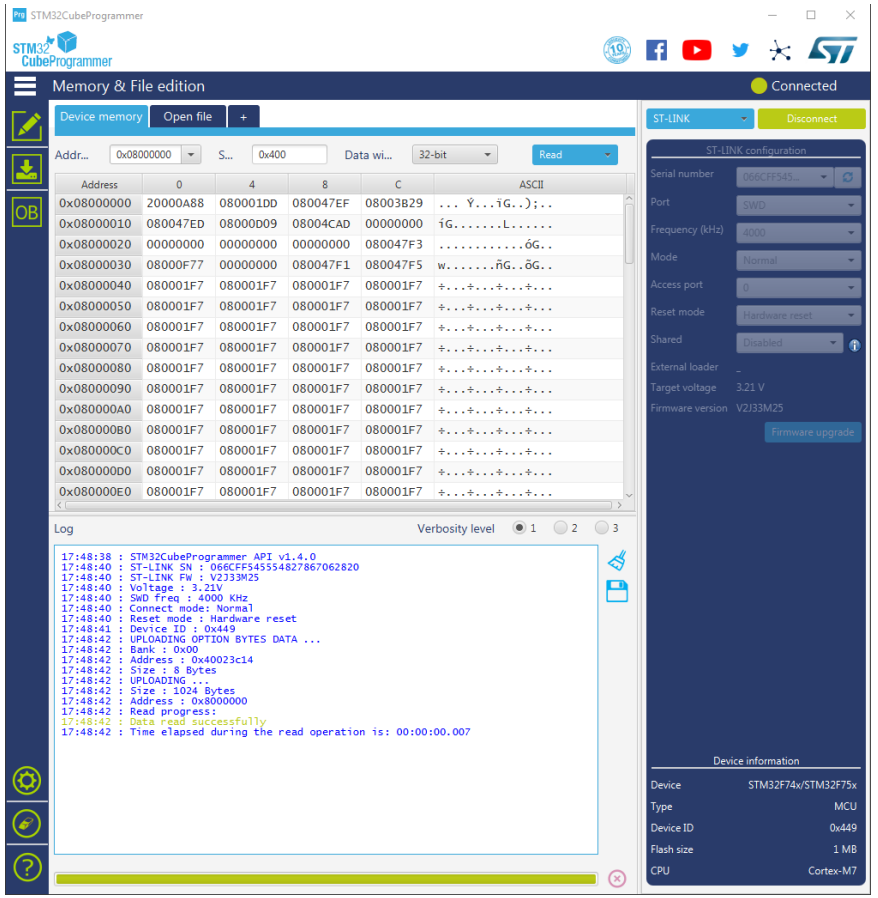
life.augmented

From ST-LINK Utility to STM32CubeProgrammer

ST-Link Utility

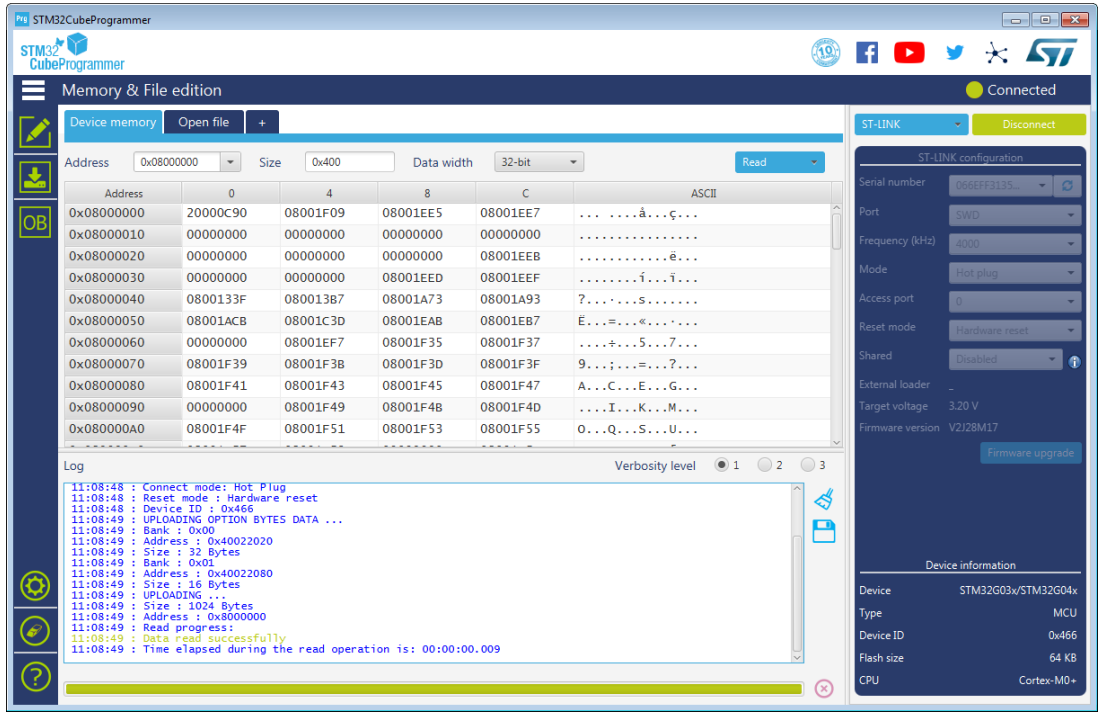


STM32CubeProgrammer



All-in-one programming software tool

STM32 CubeProgrammer



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)

life.augmented

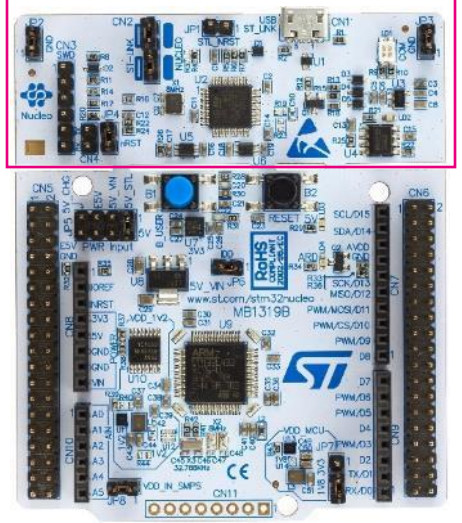
From ST-Link V2 to STLink-V3

ST-Link V2

ST-LINK/V2

ST-LINK/V2-ISOL

ST-LINK/V2-1

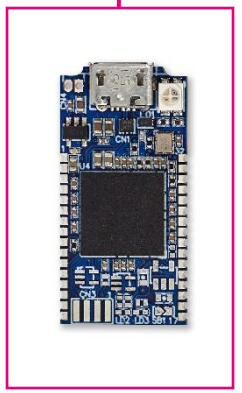


STLink-V3

STLINK-V3MINI

STLINK-V3MODS

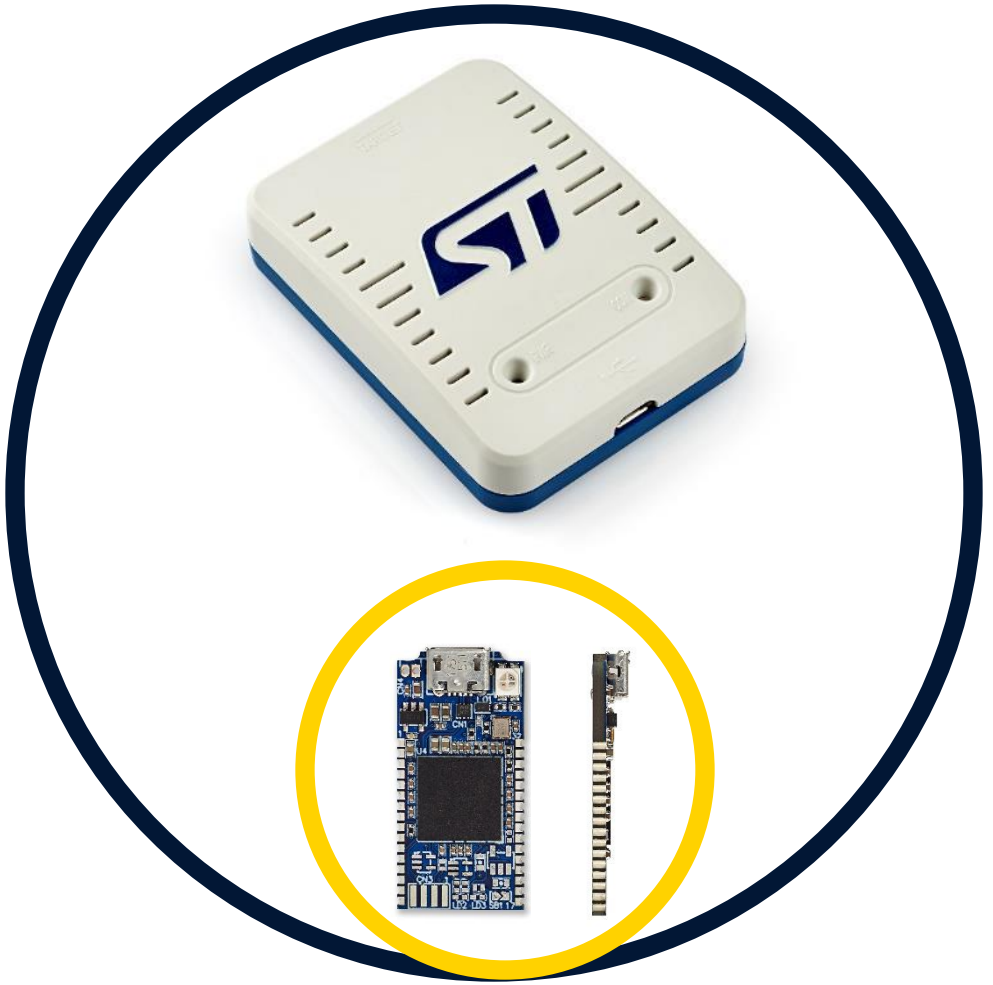
STLINK-V3SET



life.augmented

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)

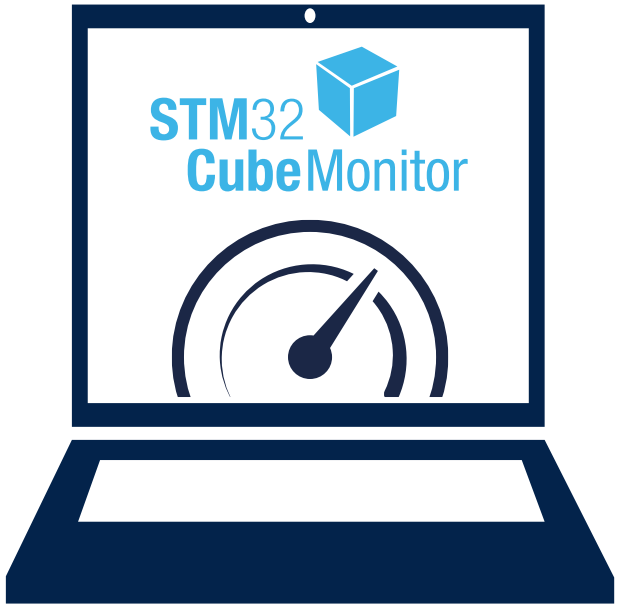


life.augmented

STM32CubeMonitor

life.augmented

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.

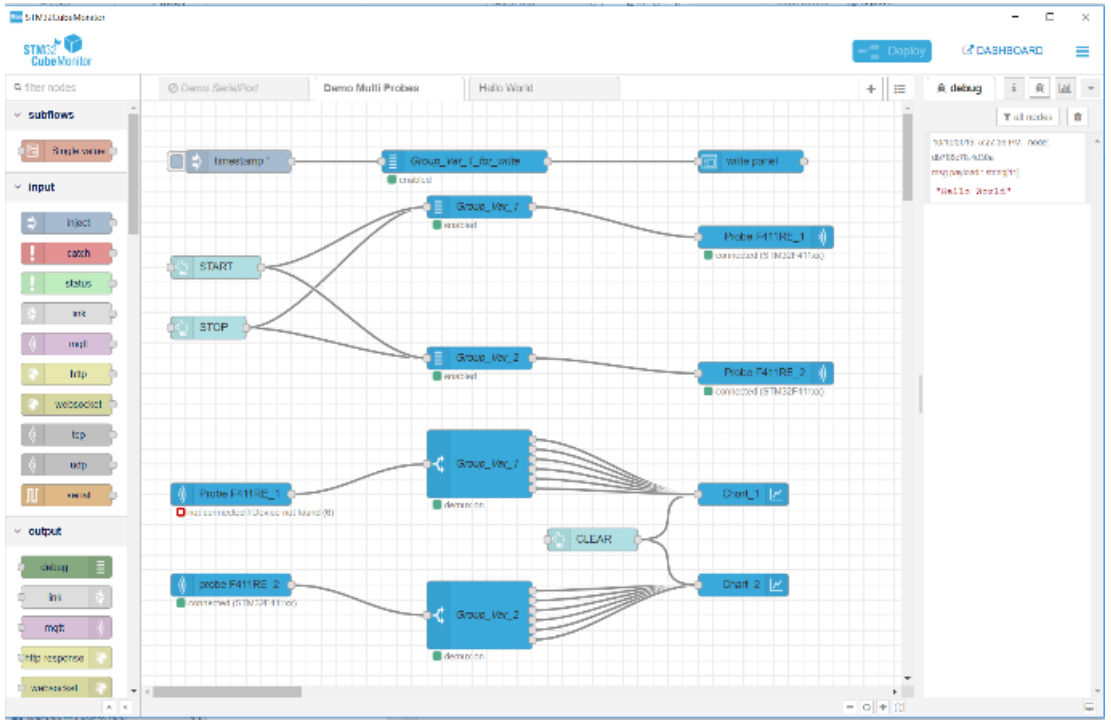
Graphical visualization on any display

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

Graphical custom data visualization

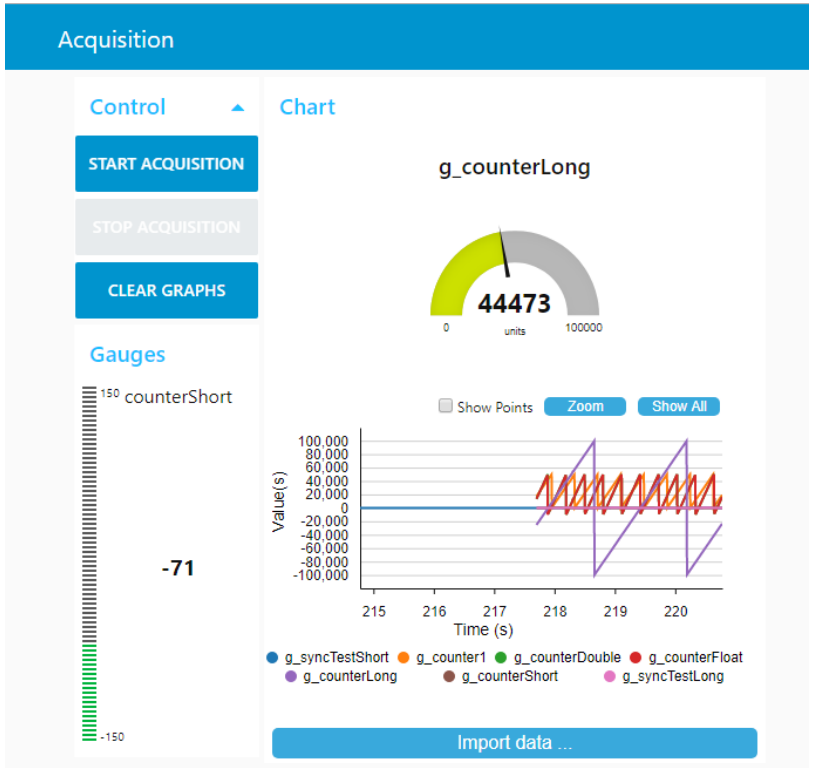
Design mode to create

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.



STM32 CubeMonitor

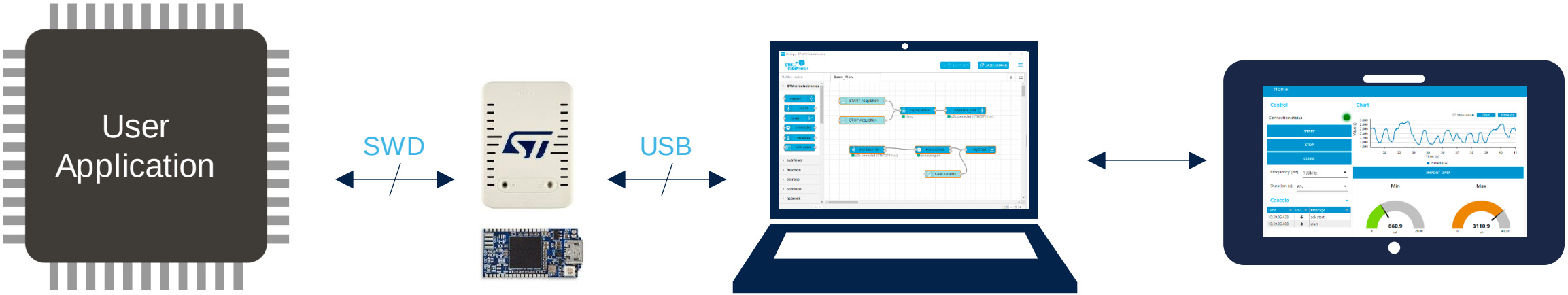
Remote monitoring

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



STM32 | STLink probe | Gateway | Dashboard

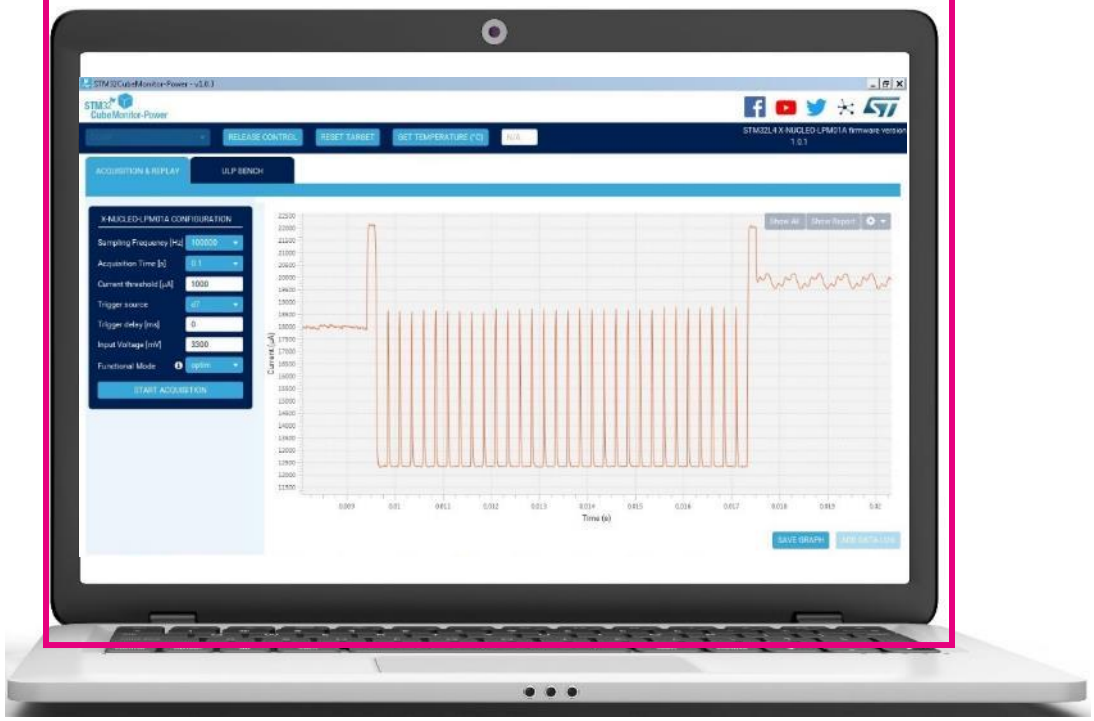
life.augmented

STM32CubeMonitor-Power

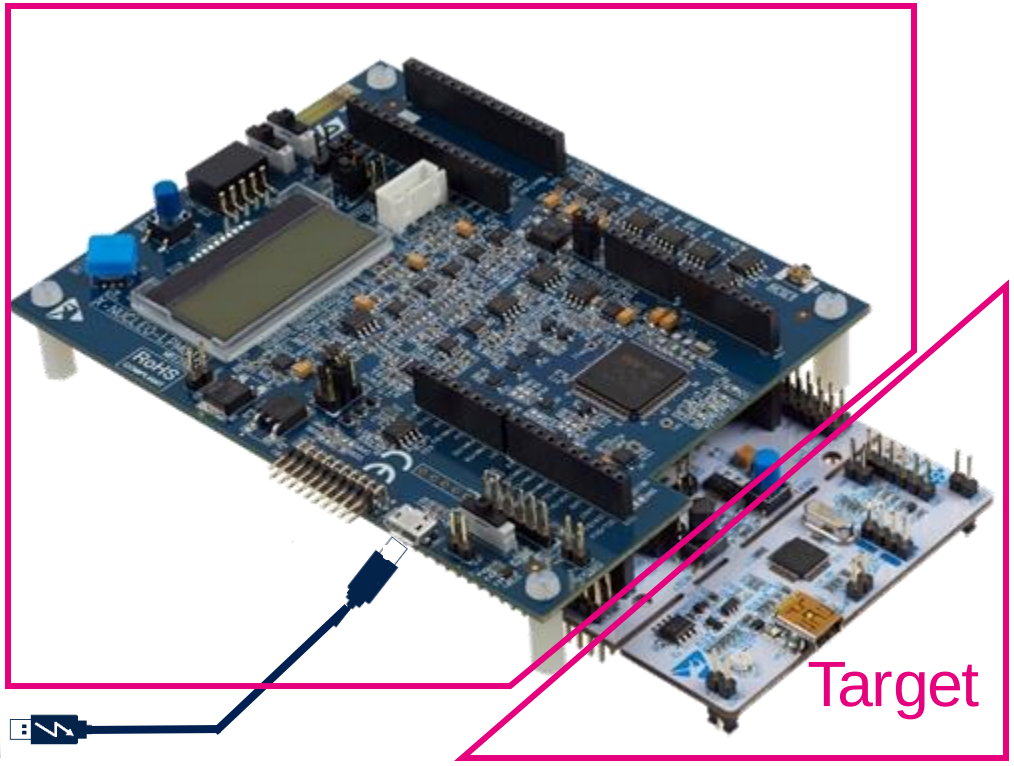
life.augmented

STM32CubeMonitor-Power

STM32CubeMonPwr



X-NUCLEO-LPM01A



STM32 CubeMonitor-Power

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

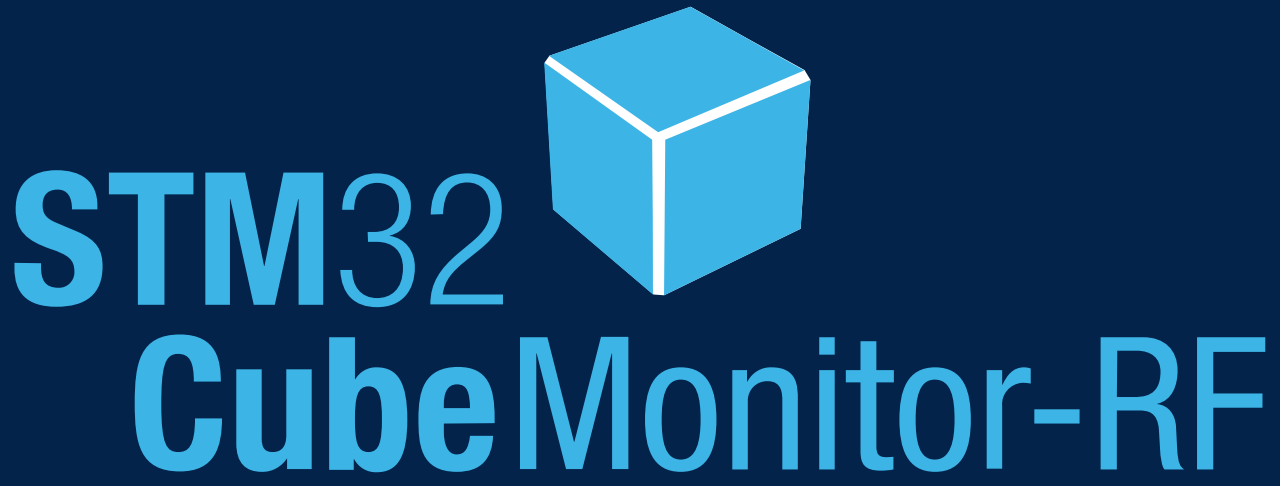
- Two operating modes (**stand-alone** or **PC-controlled**)
- Graphical PC application (reference: **STM32CubeMonPwr**)

Official EEMBC Energy Monitor v2.0

Direct computation of ULPMark scores

life.augmented

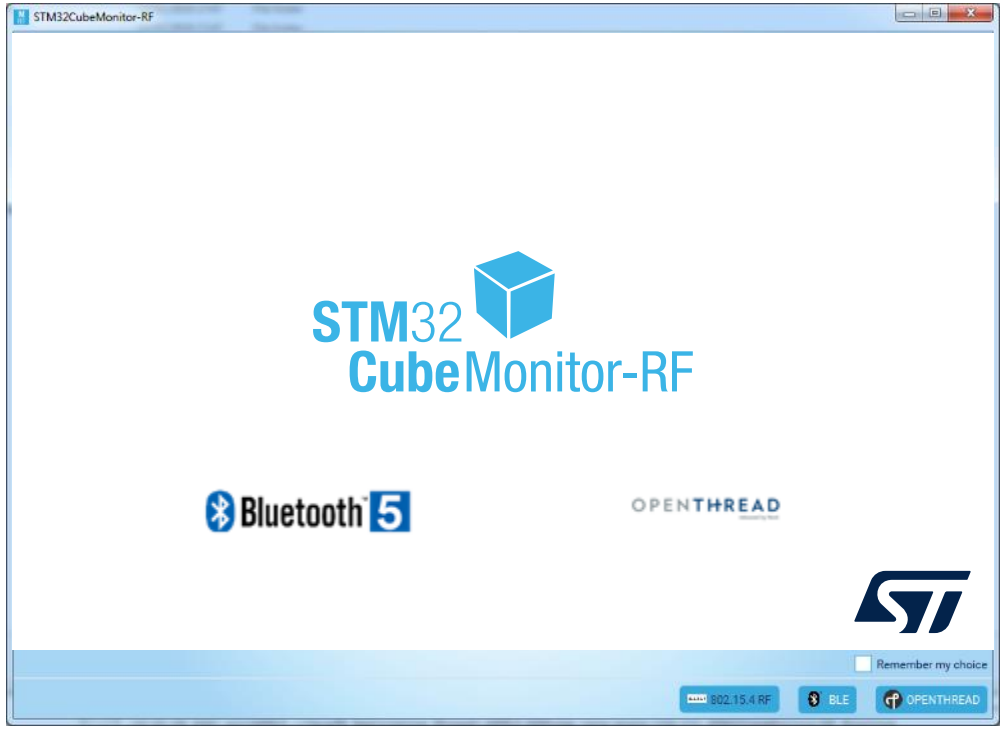
STM32CubeMonitor-RF



life.augmented

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

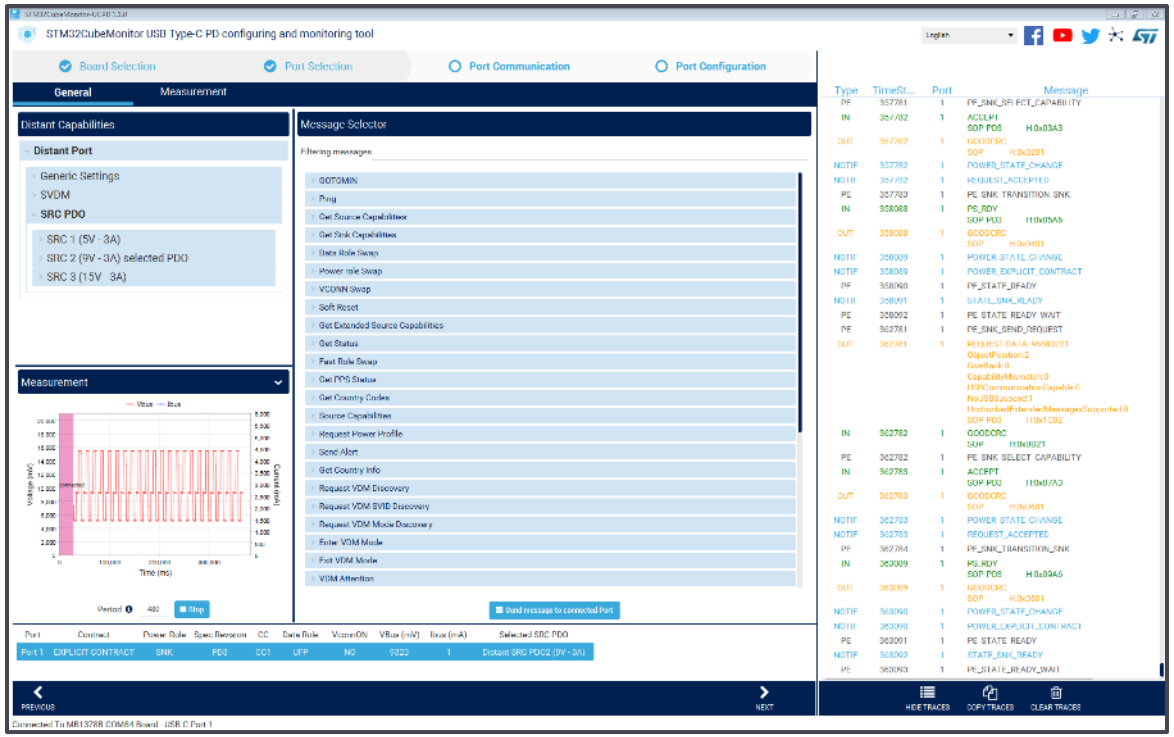
life.augmented

STM32CubeMonitor-UCPD

life.augmented

STM32CubeMonitor-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**

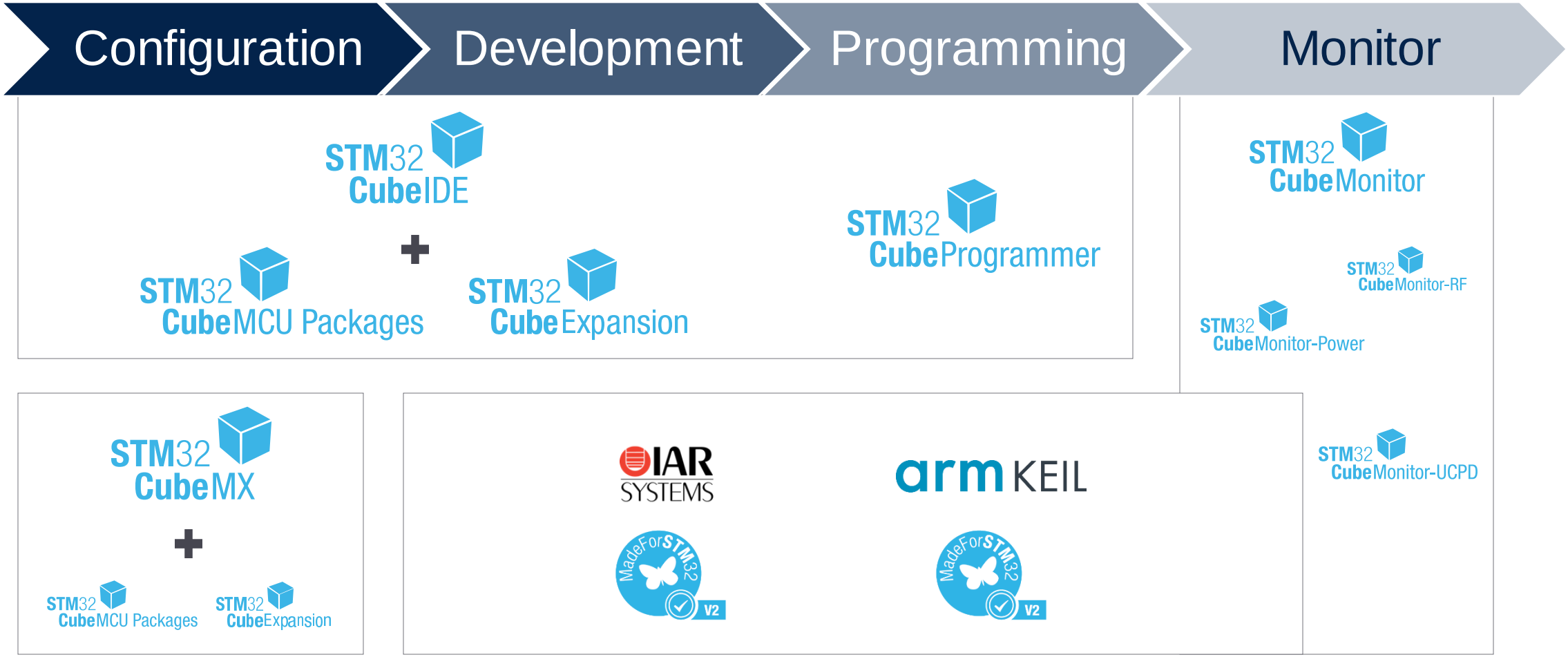
Port communication pane for **VBUS** and **IBUS monitoring**, **distant port capabilities**, **message selector**, and **real-time traces**

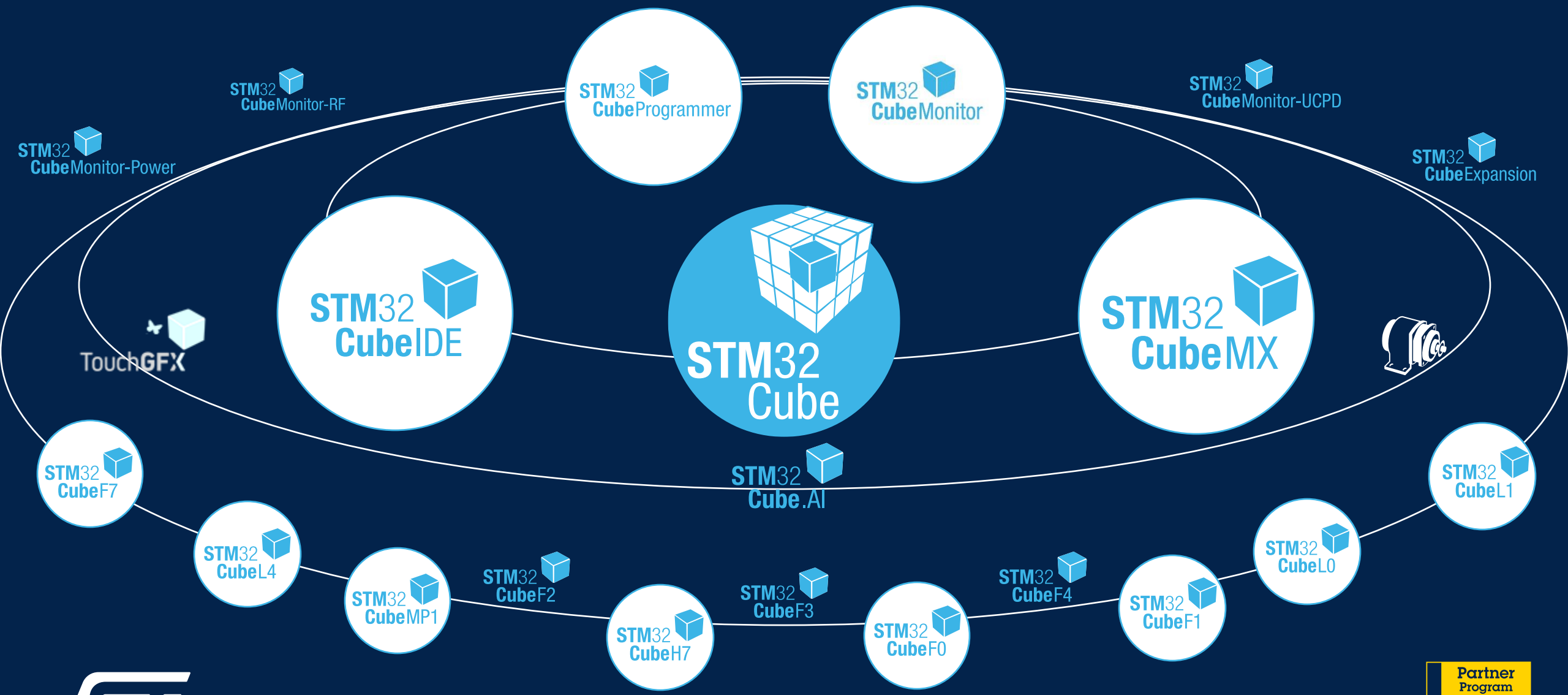
life.augmented

Key takeaways

life.augmented

Iterative development process





life.augmented

Partner Program

Our technology starts with You

Find out more at www.st.com/STM32Cube

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

life.augmented