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STM32WBA The New and Better - Hands On

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AVNET SILICA

Agenda

1. Prerequisites
2. Hands On Purpose
3. How to start WBA evaluation ?
4. Hands On: Let’s build P2P server with STM32Cube tools
5. Hands On: BLE sequences clarification
6. ST EMEA TOMAS support
7. STM32WBA Take Away

Prerequisites

Prerequisites Refresh

STM32WBA Workshop - preparation before the session

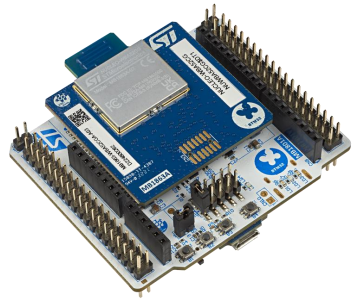
- undefined (rristm.github.io)

SW prerequisites

- STM32CubeWBA MCU package (v1.1.0 or up)
- IDE: STM32CubeIDE v 1.13.1
- A serial terminal (e.g. TeraTerm)
- ST BLE ToolBox Smartphone application

HW prerequisites

- USB A to Micro-B Cable



ST BLE Toolbox

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Hands On Purpose

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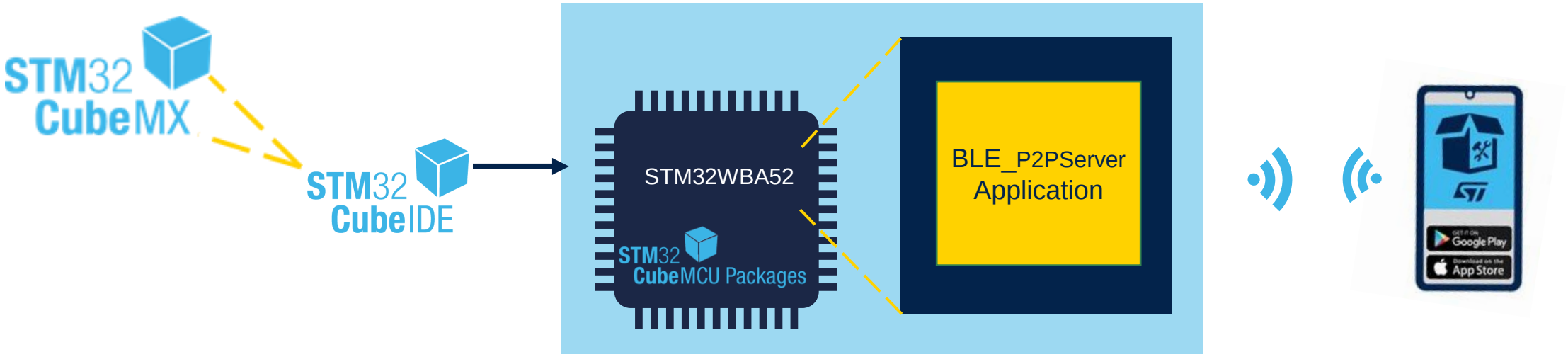
Hands On Purpose

- The purpose of this session is to start from an existing project example BLE_P2PServer & modify this code example to customize advertising data (Local name).



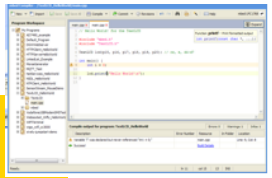
BLE_P2PServer

- During this Hands-on session, we will use ST tool STM32CubeMX & STM32CubeIDE to generate associated code, flash and test over Nucleo-WBA5x board.

How to start WBA evaluation ?

How to start with STM32WBA

Complete set of documentation
#1 understand



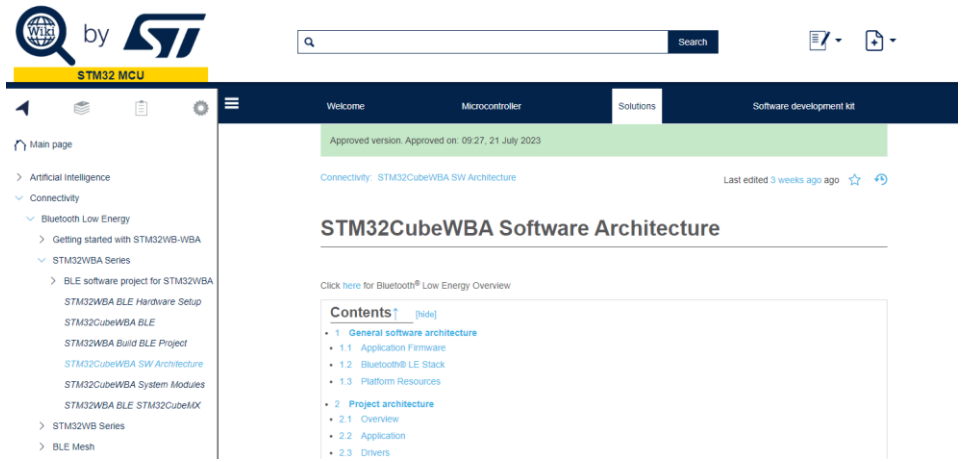
Powerful turnkey code examples
#2 evaluate & prototype

A complete ecosystem
#3 start design

NUCLEO-WBA52CG

A complete set of documentation
Getting started

STM32WBA Wiki page - Start to learn & play



- Getting started
- code architecture
- Application code explantations & tips
- certification process

by
STM32 MCU

https://wiki.st.com/stm32mcu/wiki/Category:Getting_started_with_STM32WB-WBA#Bluetooth-C2-AE_LE_overview

AN & HW guidance @st.com – Deep dive on product APIs

AN5928 - How to build a short range wireless application with STM32WBA MCUs

PM0271Guidelines for Bluetooth® Low Energy stack programming on STM32WB/ STM32WBA MCUs

AN5042How to calibrate the HSE clock for RF applications on STM32 wireless MCUs

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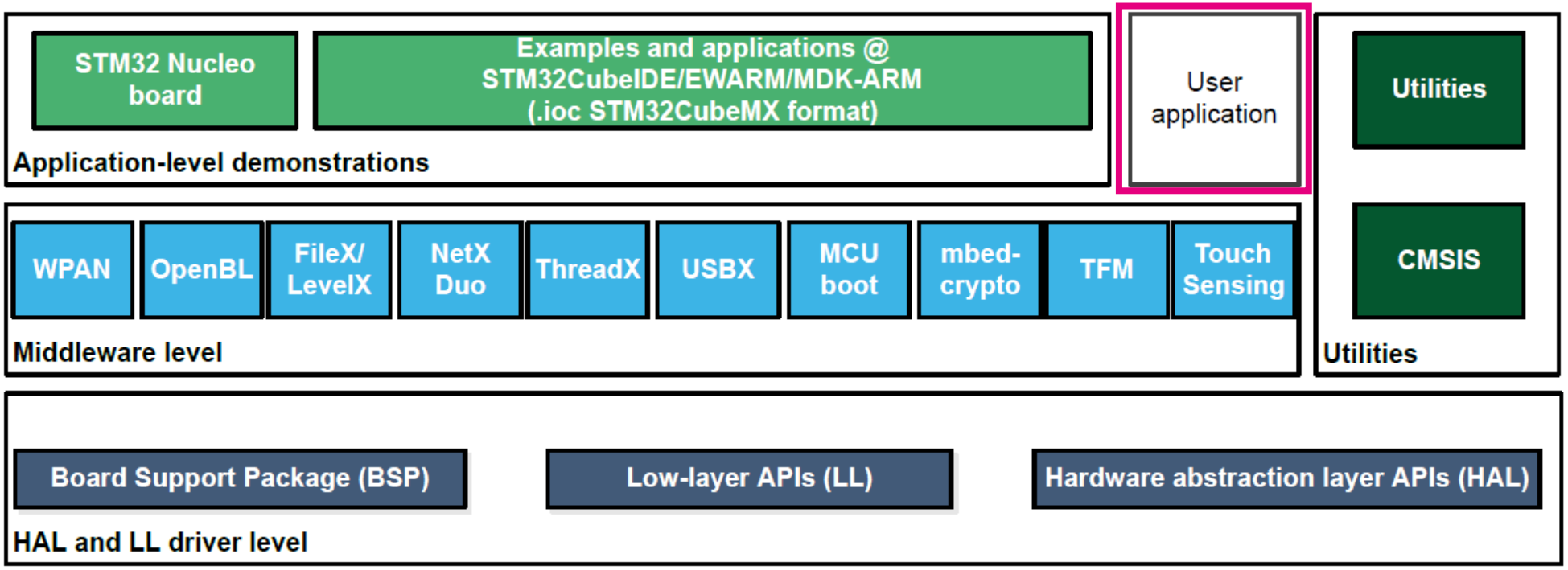
STM32CubeWBA
Evaluate and start with existing code

Package Components in a Nutshell



STM32CubeWBA
Evaluate and start based on existing code

STM32CubeWBA MCU Package provides software components running on STM32WBA Series MCU

- Application code : BLE , 802.15.4, Thread, Zigbee
- Peripheral code examples
- Utilies to ease application design : timer capabilities, sequencer, LCD

development environments

STM32 CubeIDE

arm KEIL

iar

Firmware Package for the STM32WBA series is also available on STM32CubeWBA GitHub

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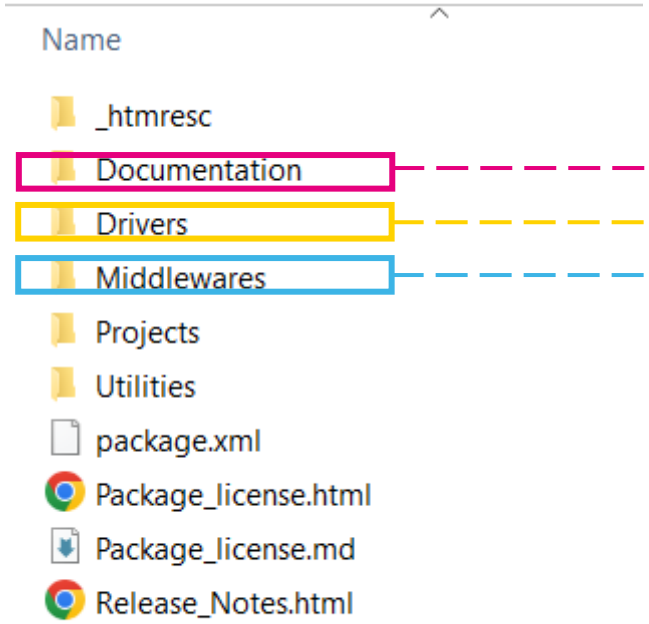
STM32CubeWBA Content 1/3

STM32CubeWBA MCU folder overview



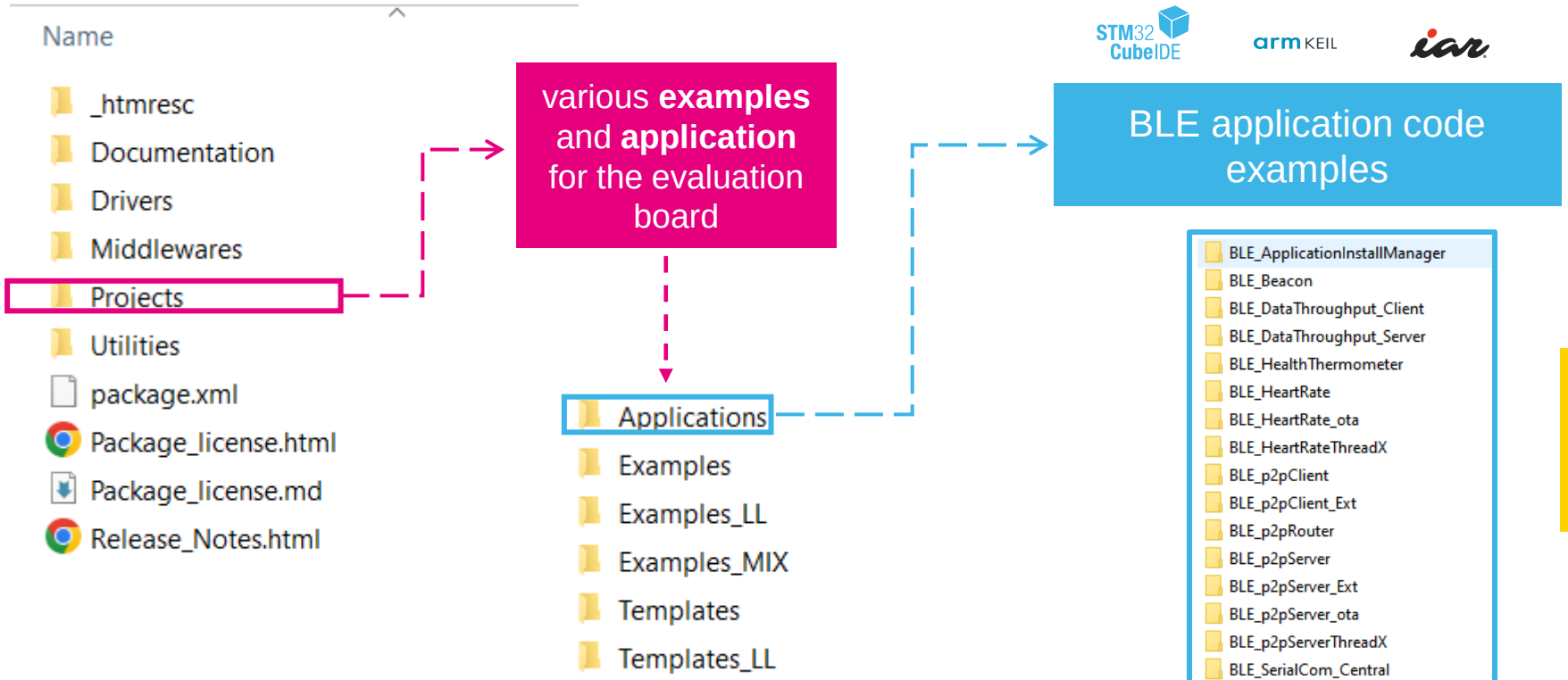
Documentation includes **STM32CubeWBA Getting Started Guide**

Driver includes BSP, CMSIS as well as HAL, LL for each peripheral

Consistent set of libraries such as Azure RTOS components such as ThreadX, FileX, LevelX, NetXDuo as well as STM32_WPAN, Touch Sensing Library, MCUboot, Crypto and TFM

STM32CubeWBA Content 2/3

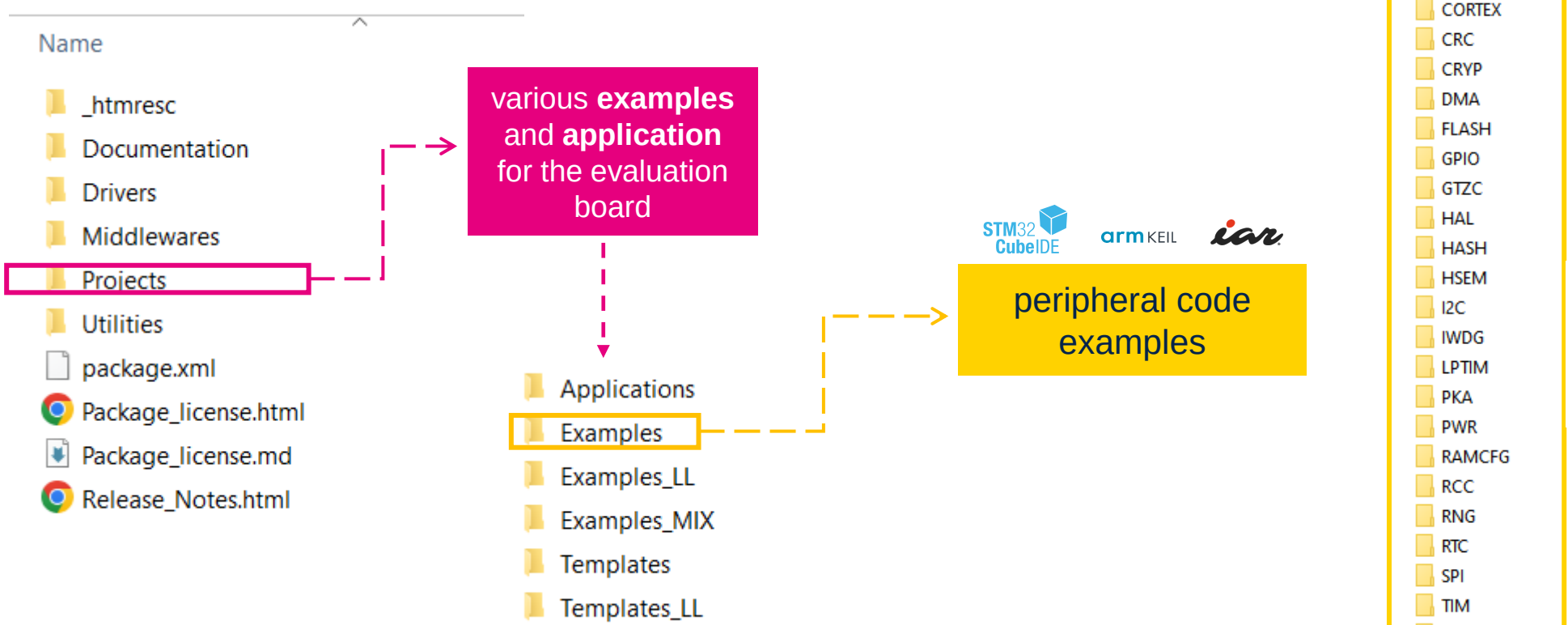
STM32CubeWBA MCU folder overview



Evaluate & understand BLE APIs
Start prototyping from existing code (proprietary BLE profile)

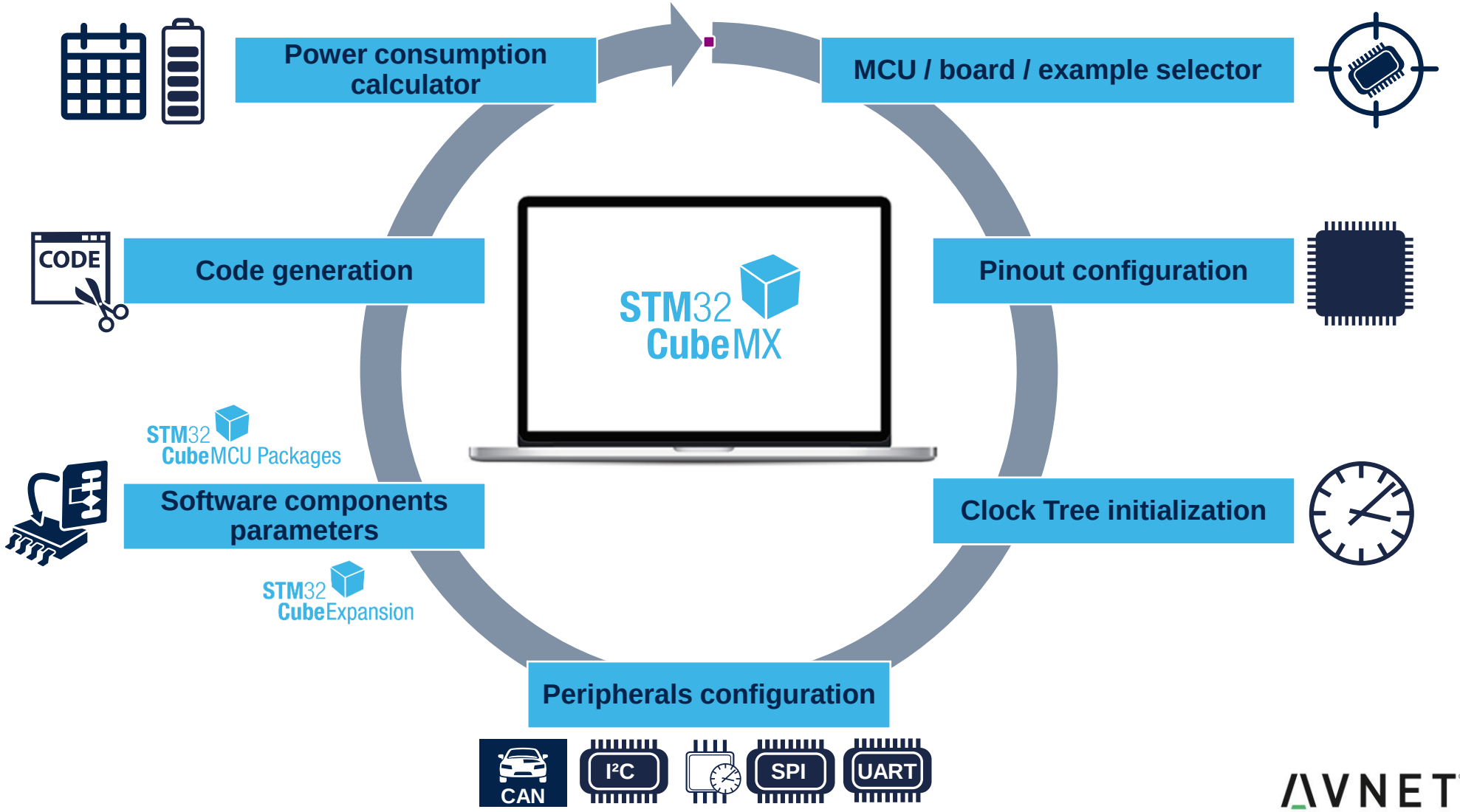
STM32CubeWBA Content 3/3

STM32CubeWBA MCU folder overview



Peripheral applications running over NUCLEO HW

STM32CubeMX key steps
Start your Design



Leveraging STM32Cube software suite

Software tools

Embedded software

Complemented with Microsoft Azure RTOS

STM32 CubeMX
Configuration

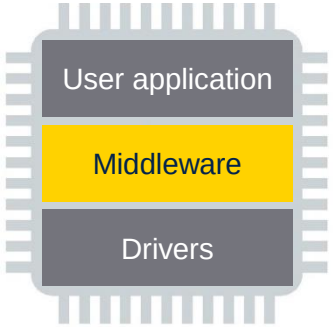
STM32 CubeIDE
Development

STM32 CubeProgrammer
Programming

STM32 CubeMonitor
Monitor

STM32 CubeMCU Packages
Packages

Github



Expansions

STM32 CubeExpansion

Azure RTOS

Azure RTOS ThreadX
Real-time operating system

Azure RTOS FileX
FAT file system, fault tolerant

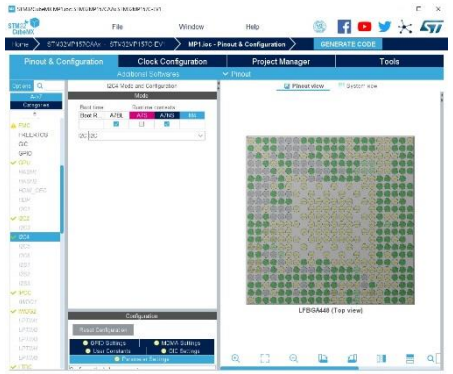
Azure RTOS NetX/NetX Duo
TCP/IP stacks

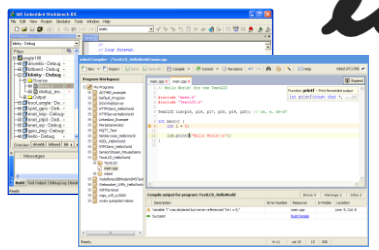
Azure RTOS USBX
USB stack, host, and device

Free-of-charge production license

STM32WBx ecosystem
Complete set of tools to ease your design

From an Idea to a certified product





STM32CubeMX

Graphical tool for easy configuration

- Configure and generate code
- Peripherals and middleware configuration

IDEs
Compile and debug

Simple, powerful solutions

- Partners IDE (Arm® Keil®) FREE
- IDE based on Eclipse FREE
- RTOS aware debug

STM32 programming & monitoring tools

STM32CubeProg
STM32CubeMonitor
STM32CubeMonRF

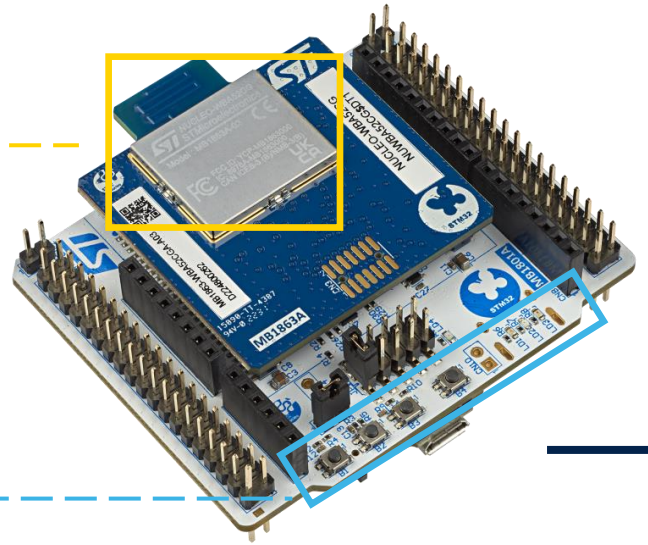
- Device and memory configuration
- Program the application
- Monitor variables at runtime , Test RF

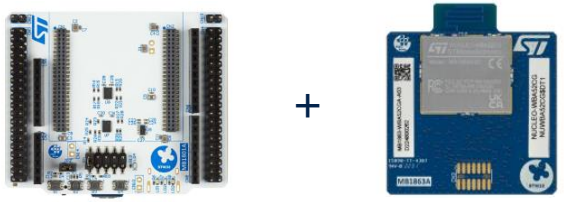
Connect the NUCLEO-WBA52CG to the PC

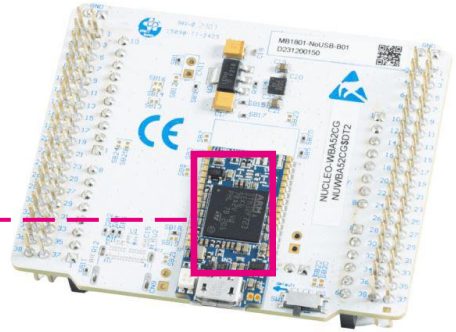
STM32WBA52CG

3 user LEDs
3 user buttons

STLINK-V3MODS
- Programming
- Debugging
- VCOM







Hands on session:
Let’s build P2P server with STM32Cube tools

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What is a P2P Server?

P2P is a Generic Attribute Profile (GATT) based on Bluetooth LE defined by STM with propietary UUIDs 128bit

ST BLE Toolbox

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GATT Client **GAP central**

GATT Server **GAP peripheral**

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What is a P2P Server?

P2P is widely used for direct connection and defined connection between GATT Server and GATT Client

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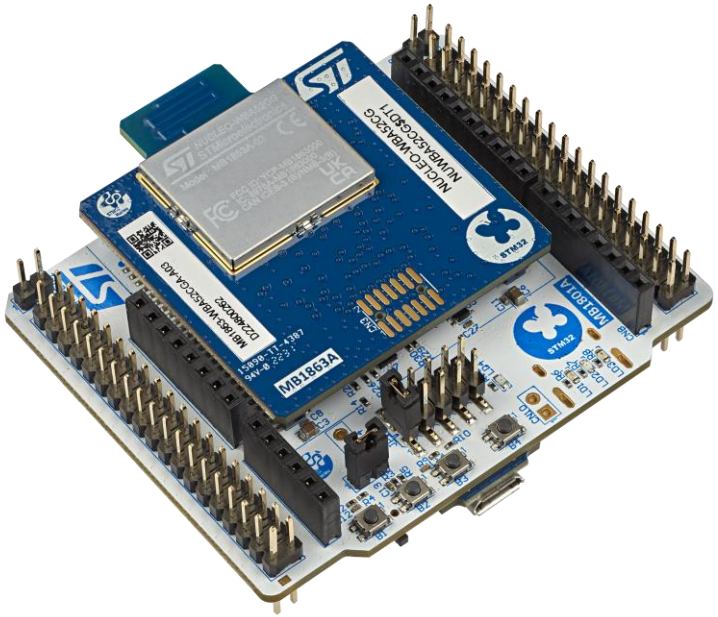
Notification - SWITCH

Write - LED



GATT Client **GAP central**

GATT Server **GAP peripheral**

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What is a P2P Server?

We will be able to control LED from Mobile and to get notification of LED status from Nucleo-WBA52

ST BLE Toolbox

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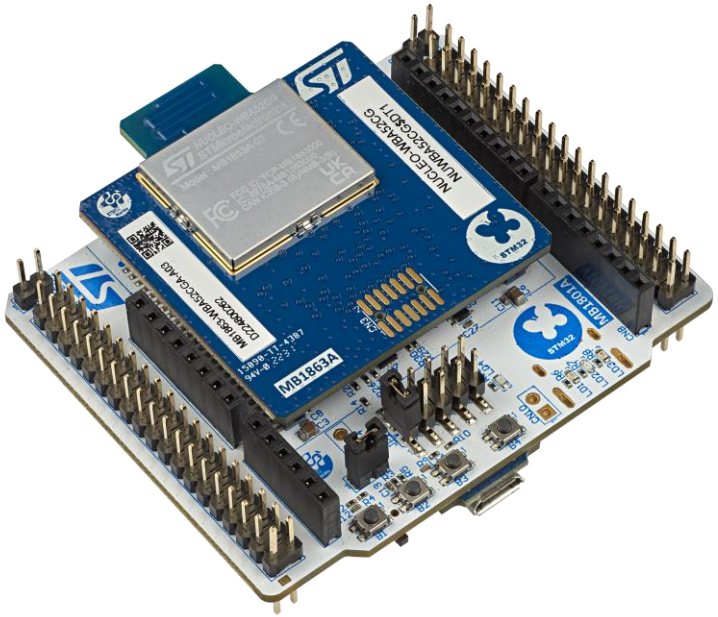
Notification - SWITCH

Write - LED



GATT Client **GAP central**

GATT Server **GAP peripheral**

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What is a P2P Server?

We will be able to have the notification on the Mobile that a button is pushed on the Nucleo-WBA52

ST BLE Toolbox

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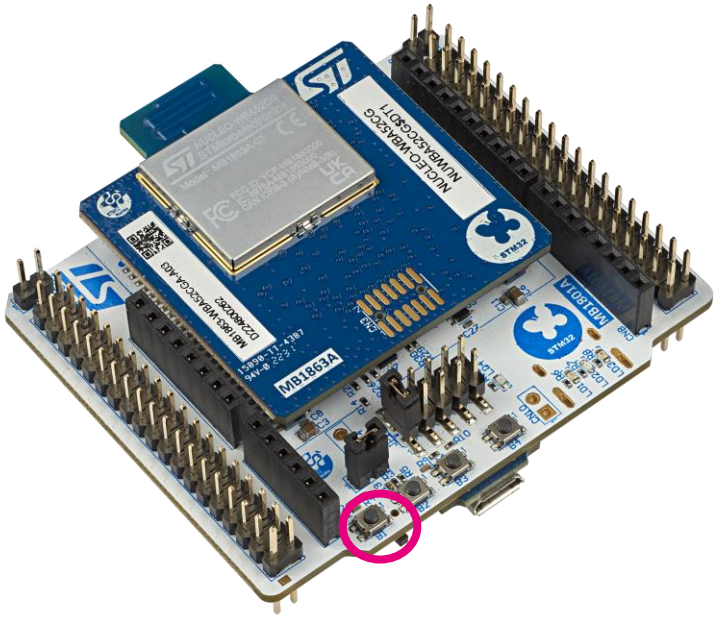
Notification – PUSH BUTTON



GATT Client **GAP central**

GATT Server **GAP peripheral**

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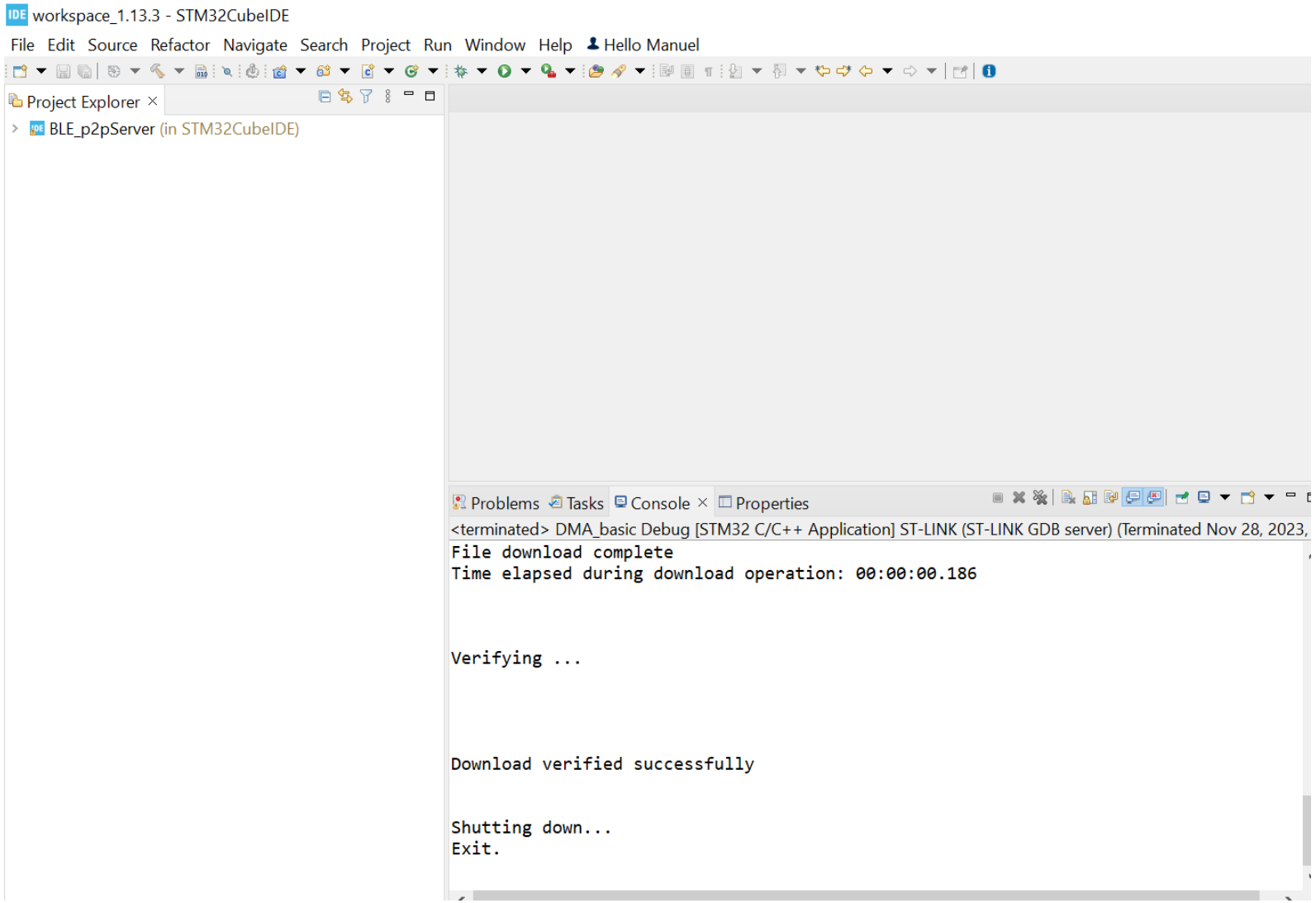
How to get started

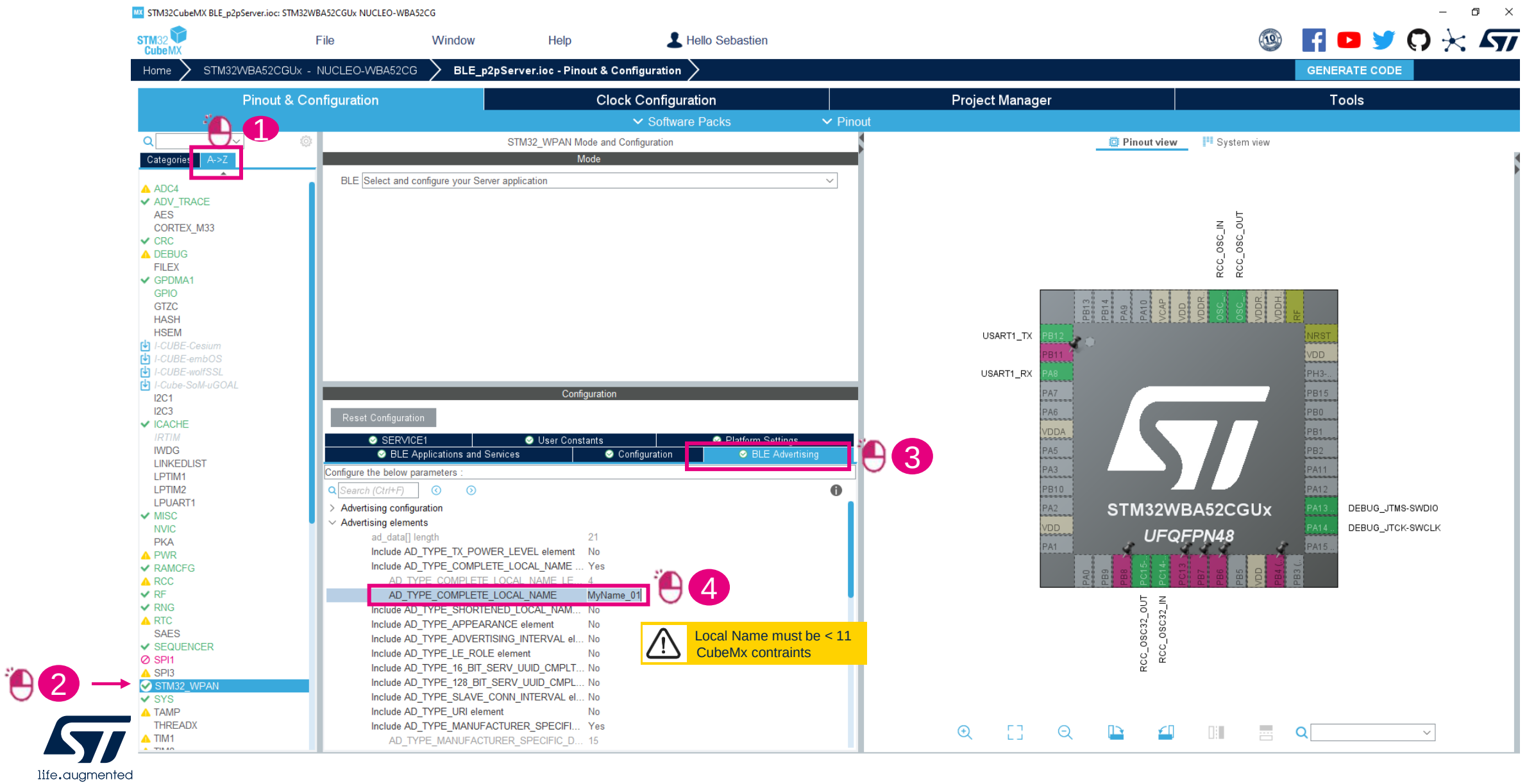
- Open Cube IDE
- Select File->Import->Existing project into Workspace
- Go to the folder STM32CubeWBA in which you have p2p Server

- Add the path to the example C:\Users\xxxxx\STM32Cube\Repository\STM32Cube_FW_WBA_V1.1.1\Projects\NUCLEO-WBA52CG\Applications\BLE\BLE_p2pServer
- Click Finish

P2P Should now appear into your workspace



Customize Local Name



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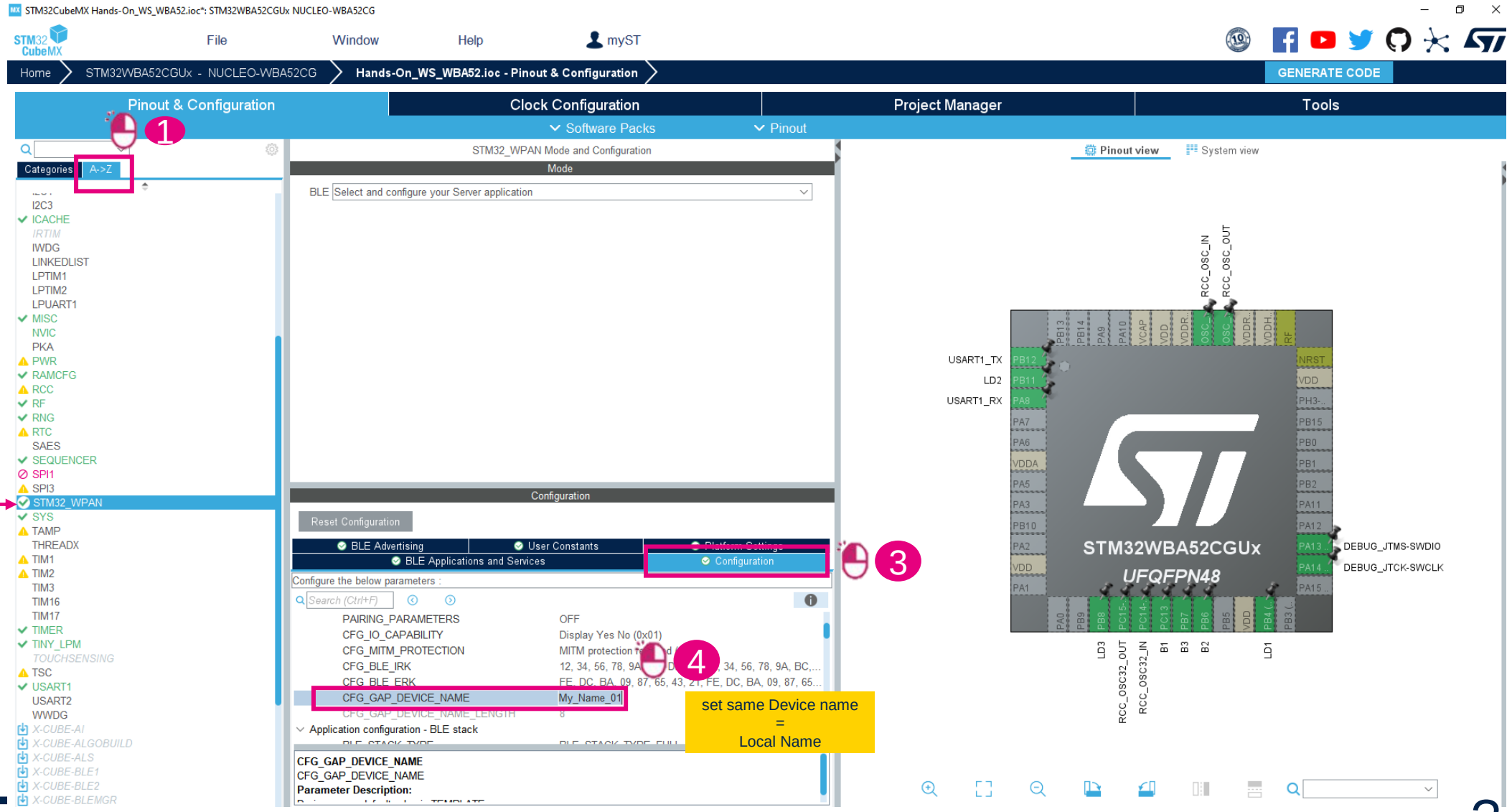
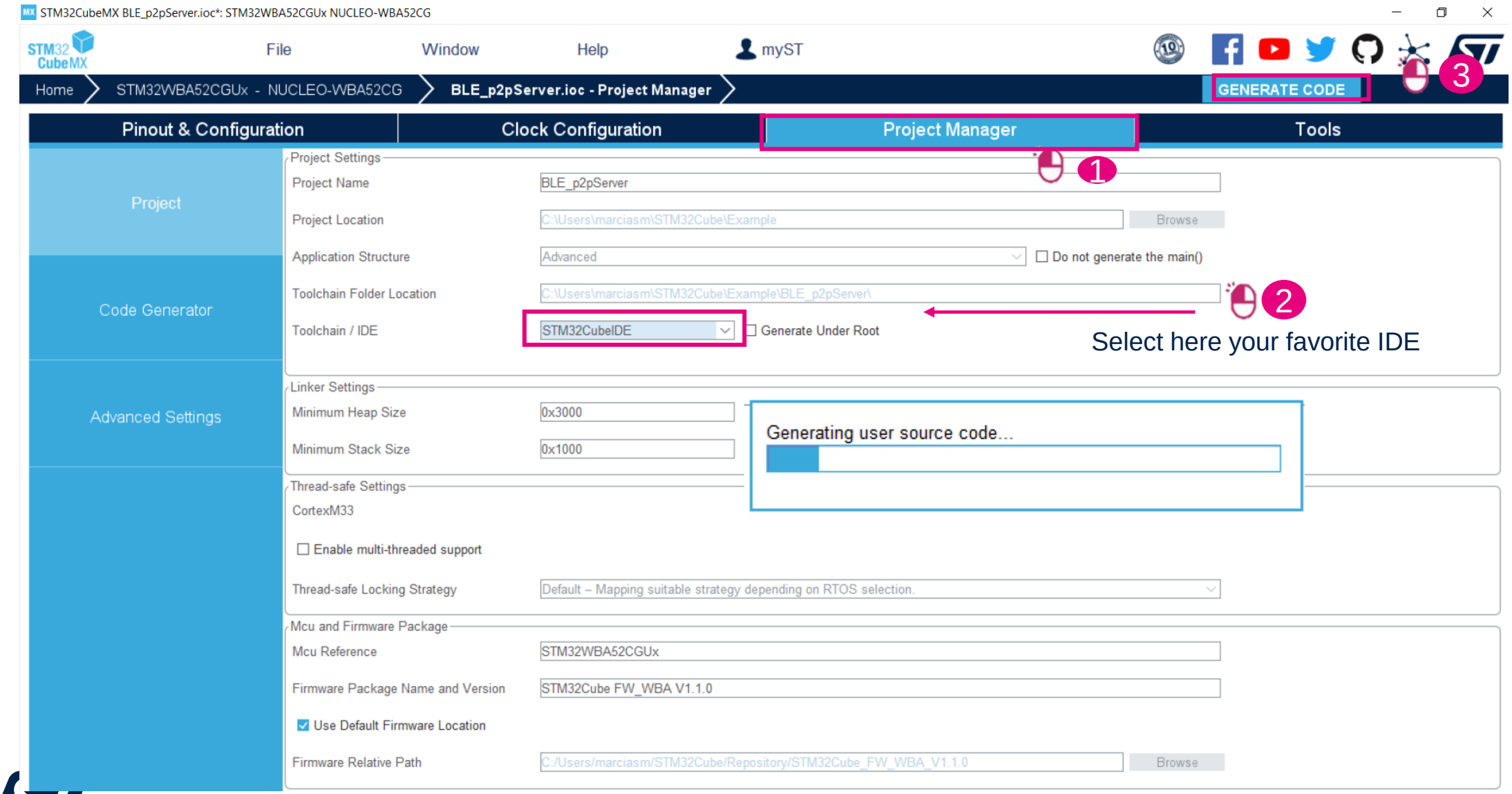
Customize Device Name



?

iOS displays Local Name (advertising data) prior to a 1st connexion.
After a 1st connexion iOS displays Device name (thanks to look up table : associates BLE MAC @ & Device Name)

Generate code



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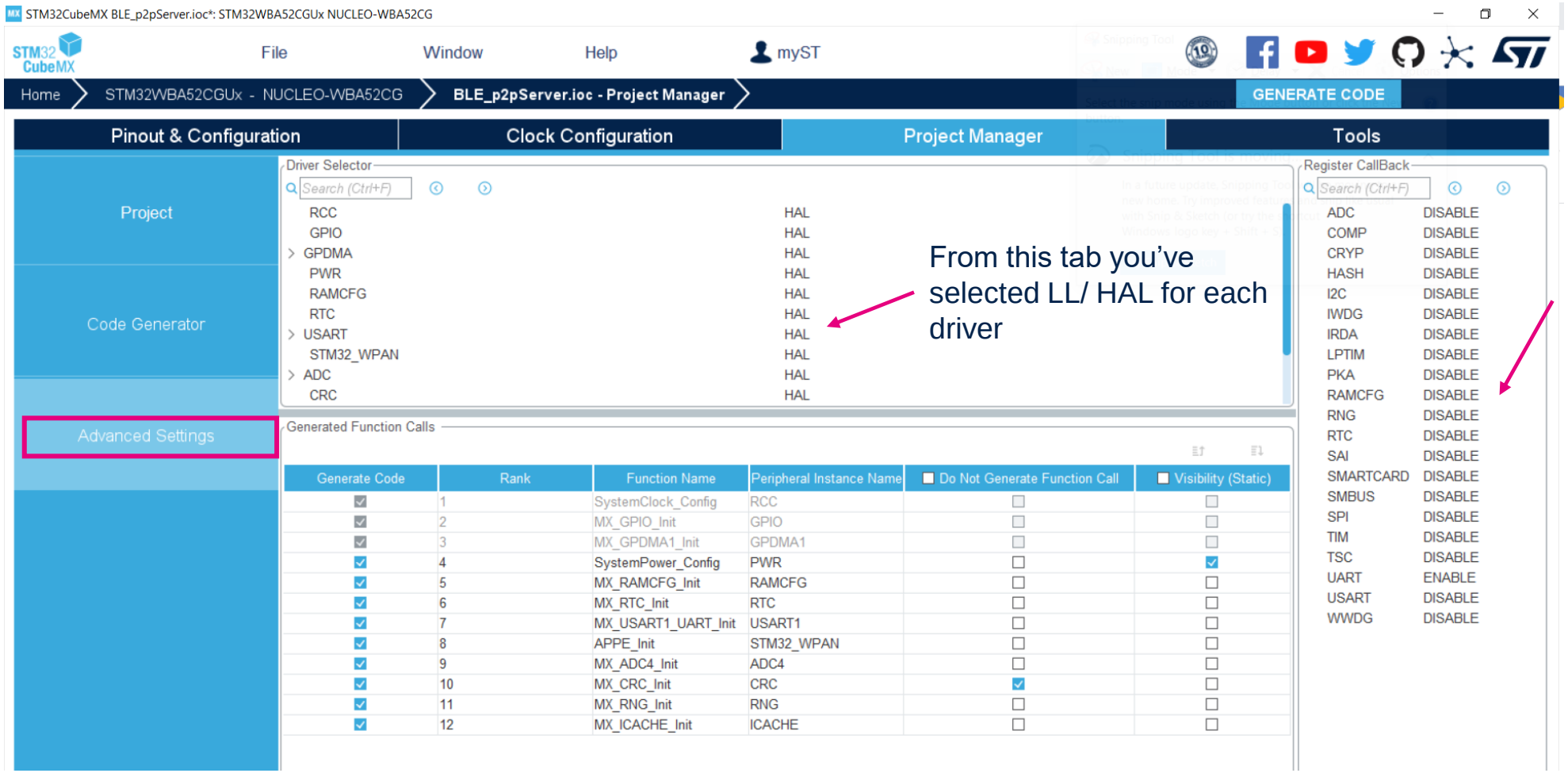
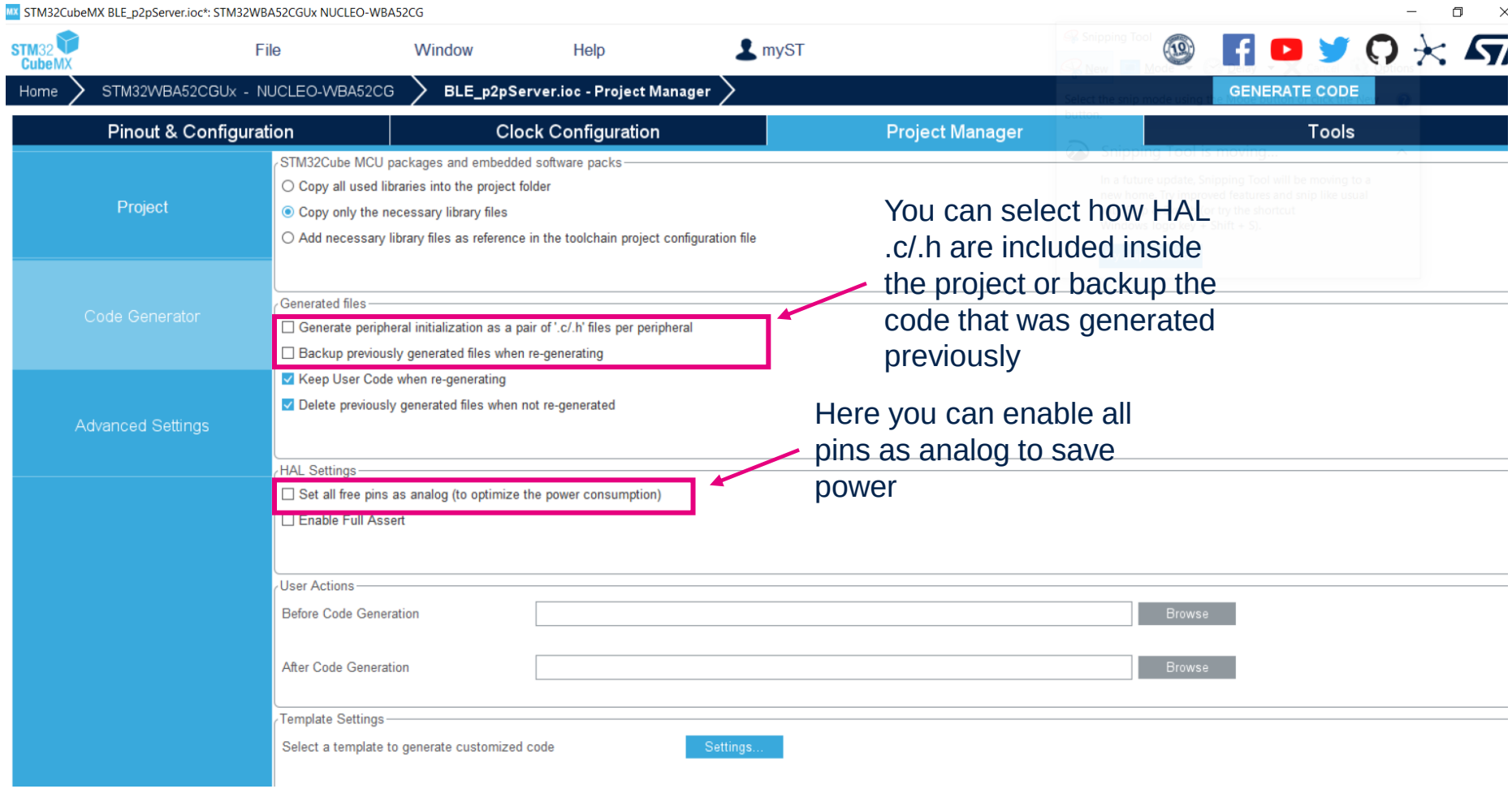
Advanced Settings



Code Generator

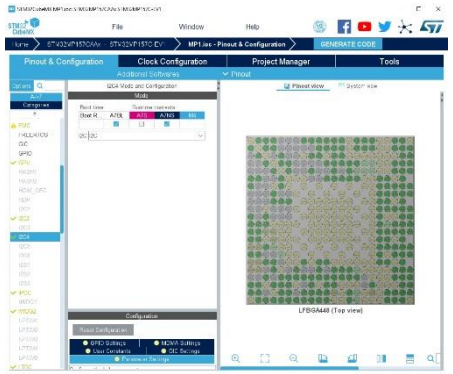


You can select how HAL .c/.h are included inside the project or backup the code that was generated previously

Here you can enable all pins as analog to save power

STM32WBx ecosystem
Complete set of tools to ease your design

From an Idea to a certified product



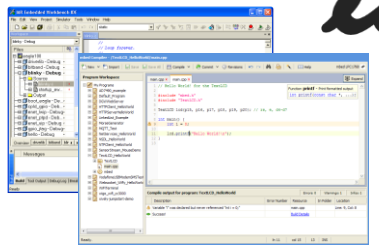
STM32 CubeMX

STM32 CubeIDE

arm KEIL

iar

eclipse



STM32 CubeProgrammer

STM32 CubeMonitor

STM32CubeMX

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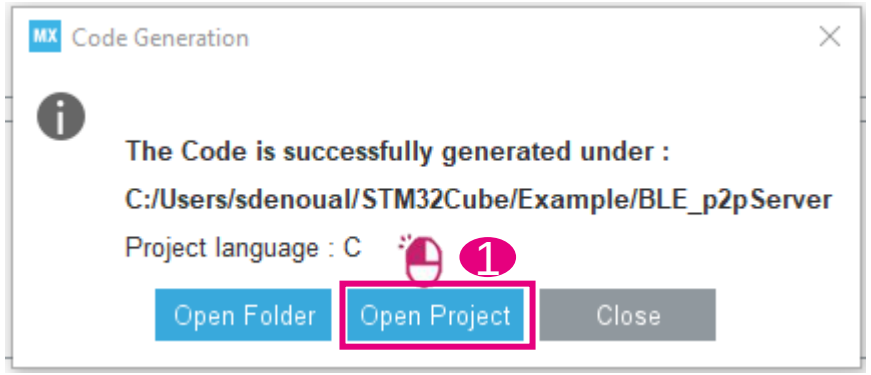
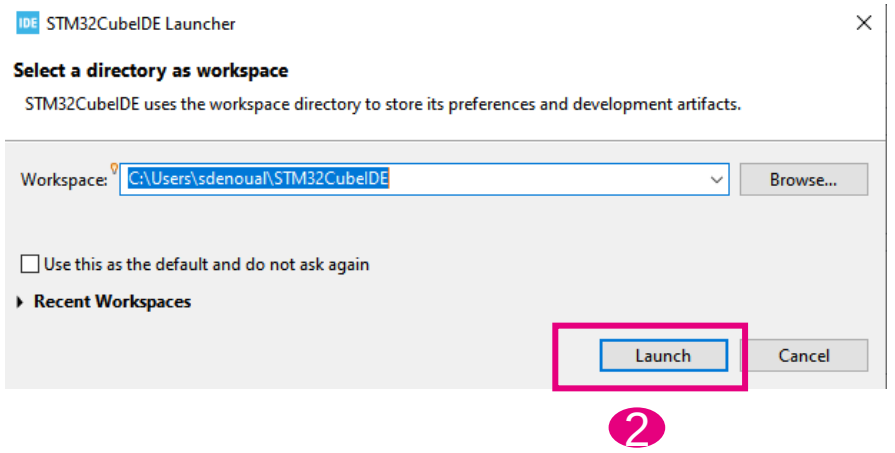
Open project



STM32 CubeIDE



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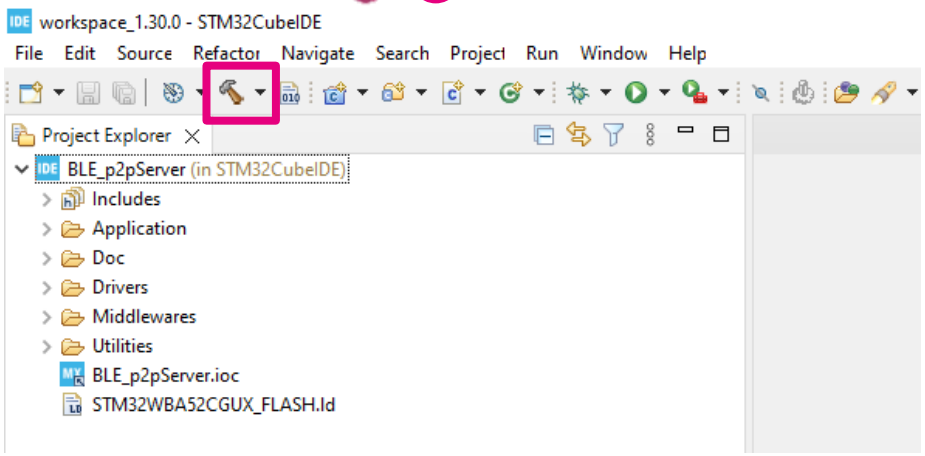
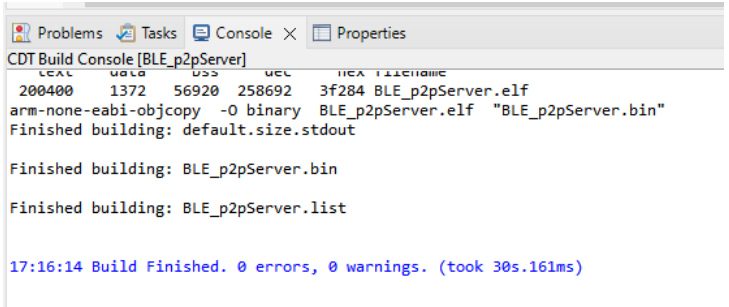
Build and flash modified project

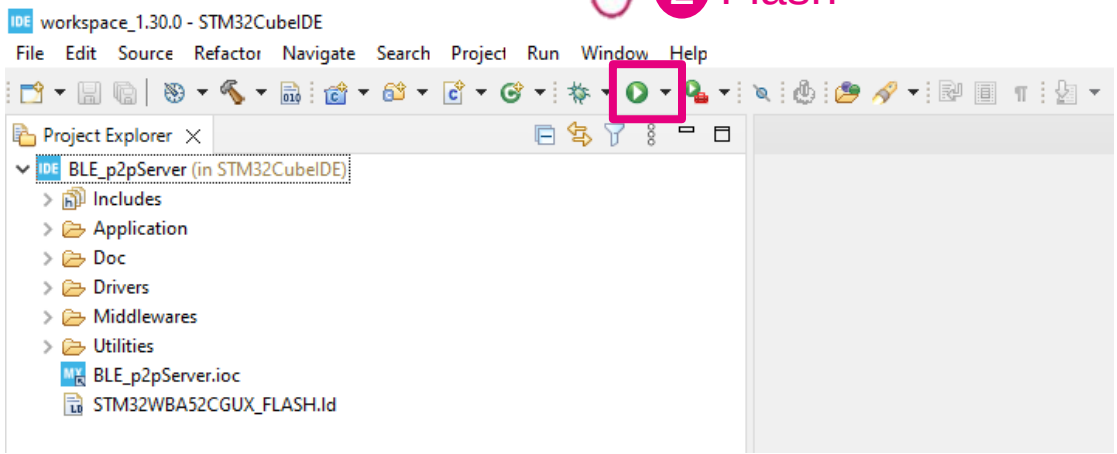
1 Build

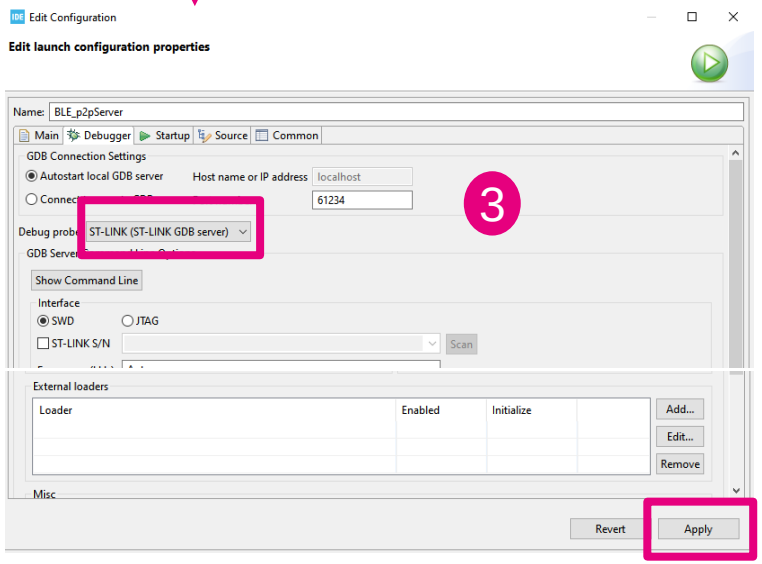


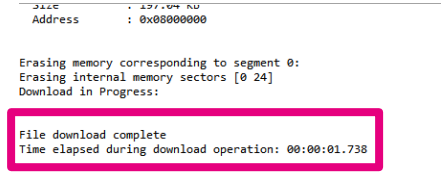


Plug the board

2 Flash







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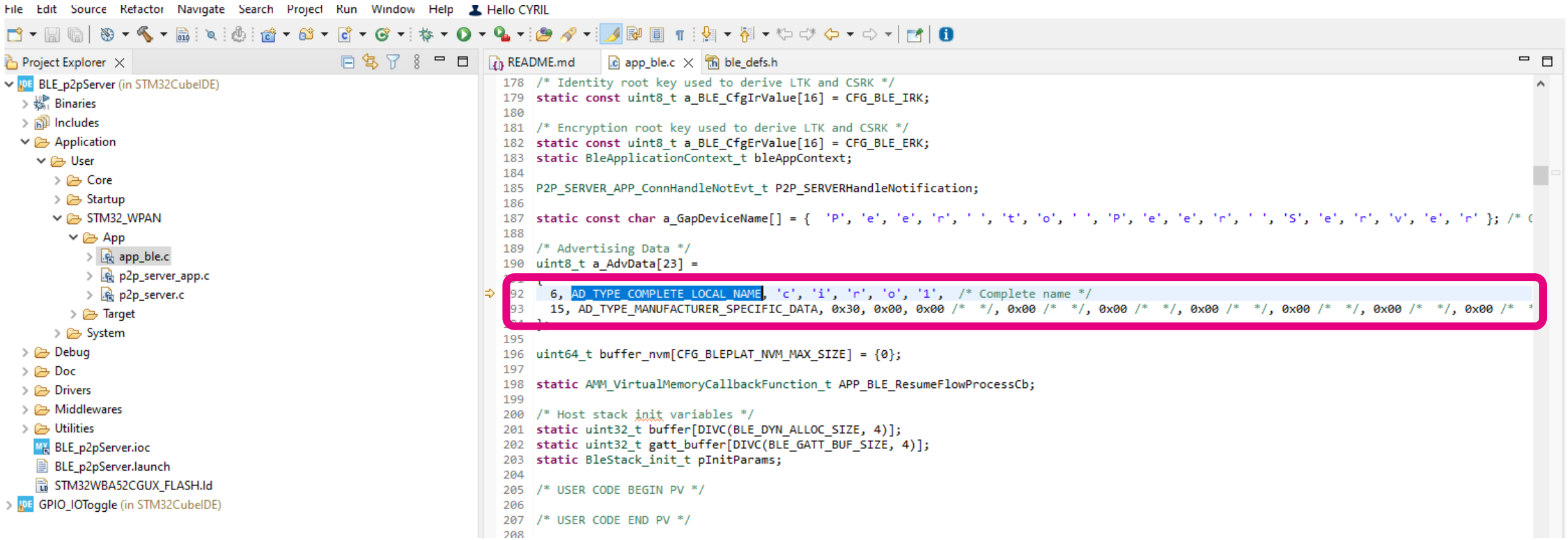
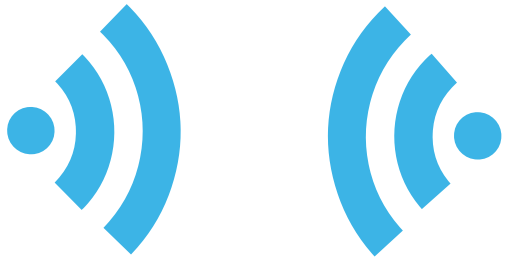
Code change with STM32 IDE



Enjoy your first STM32WBA52 project running!



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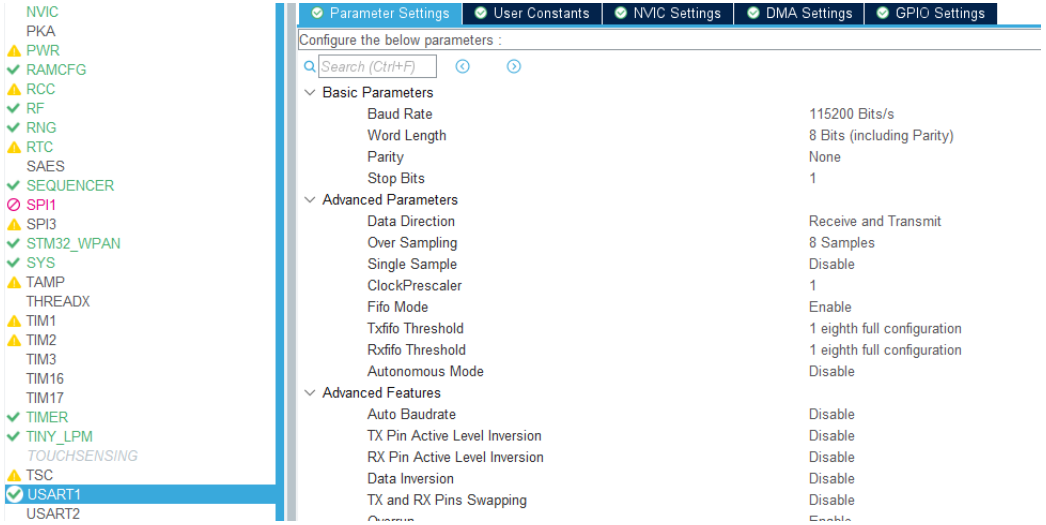
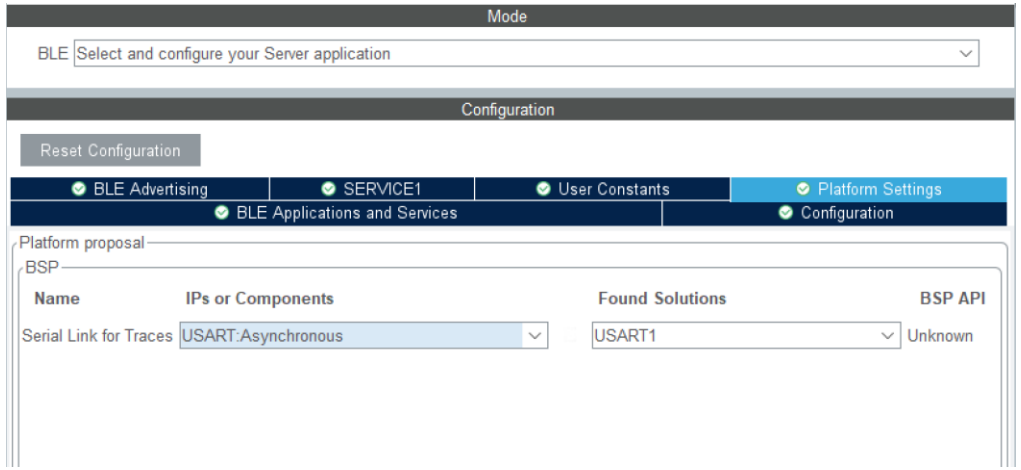
BLE sequences from Advertising to PUSH BUTTON notification

UART Terminal configuration

- Terminal must be configured as defined in STM32CubeMX:

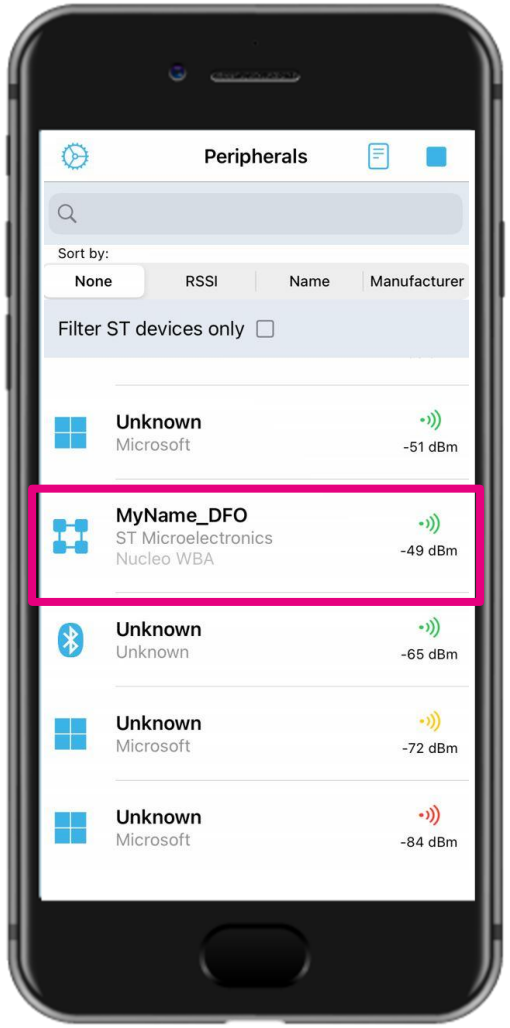




- Debug traces are also enabled:

STBLE Toolbox (Advertising)

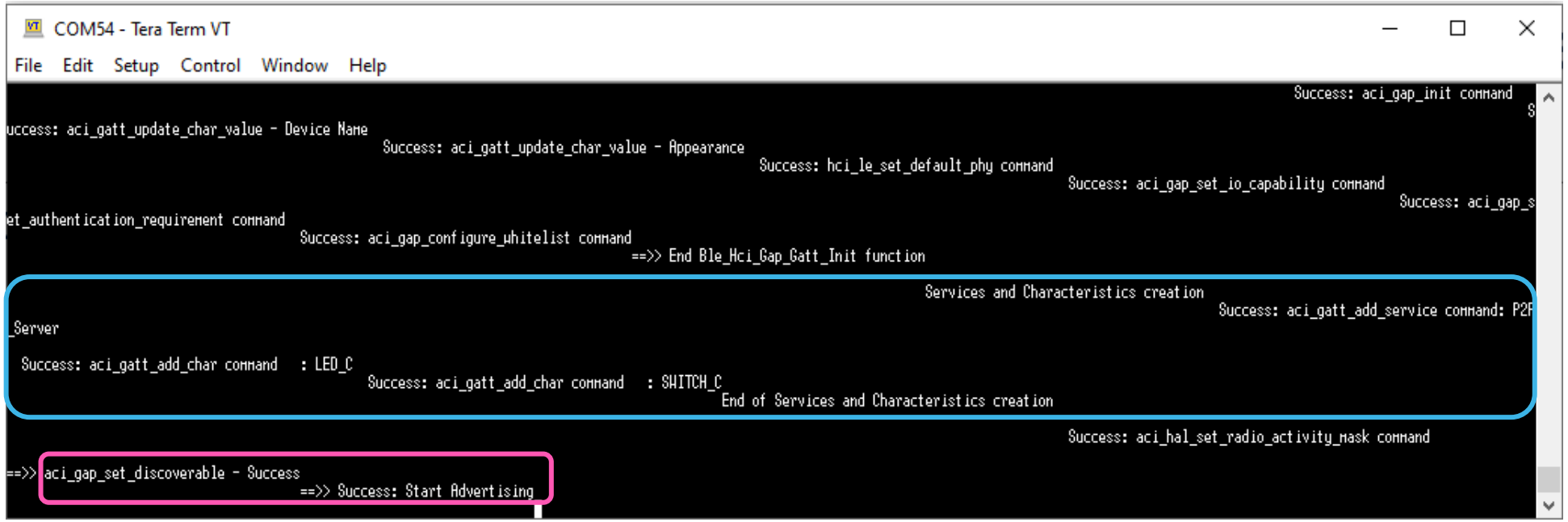
1



click on device

UART Terminal (Advertising)

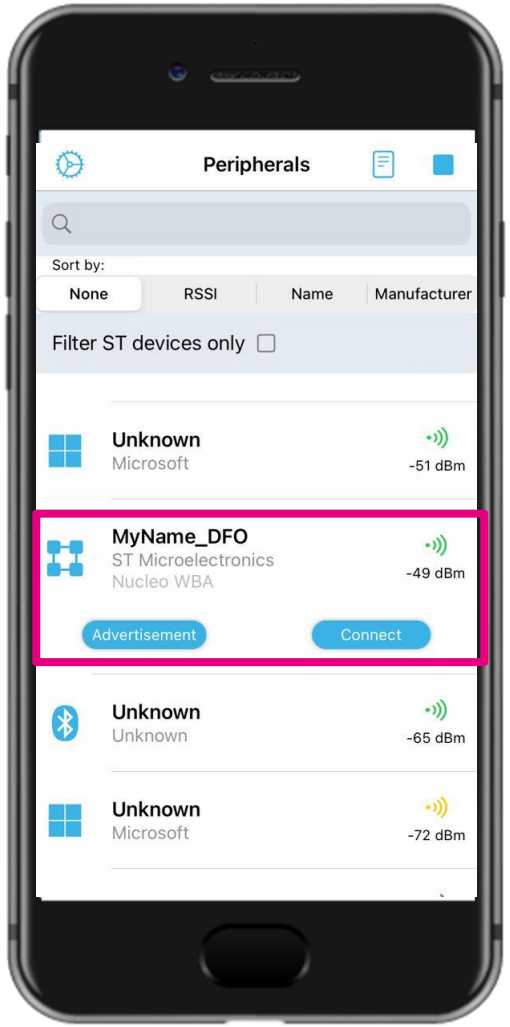
- Via the HyperTerminal, check the “Advertising” sequence after reset:



1. Creation of P2P service & characteristics
2. Advertising start

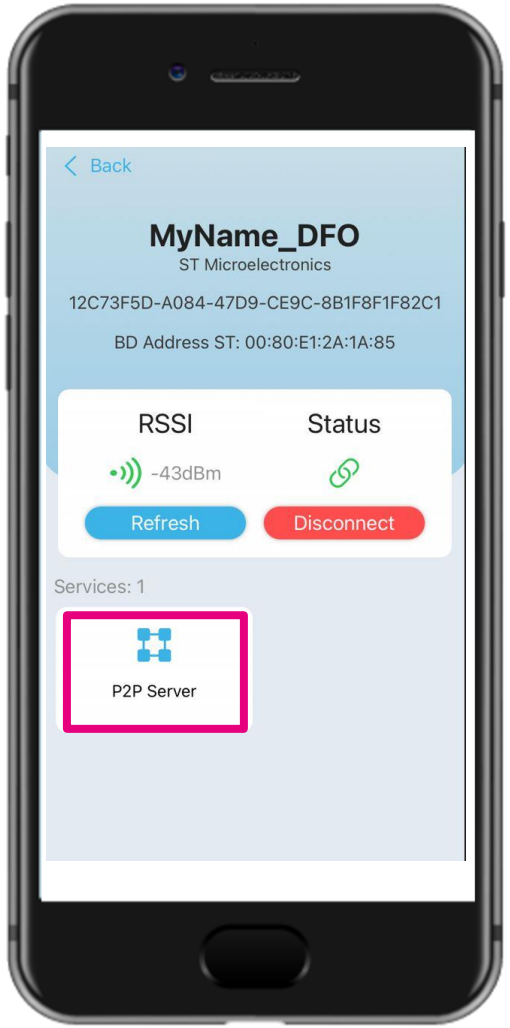
STBLE Toolbox (Connection)

1



click on connect

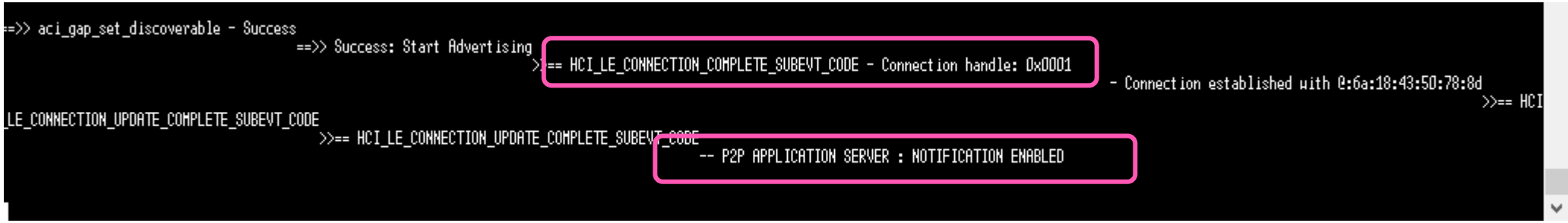
2



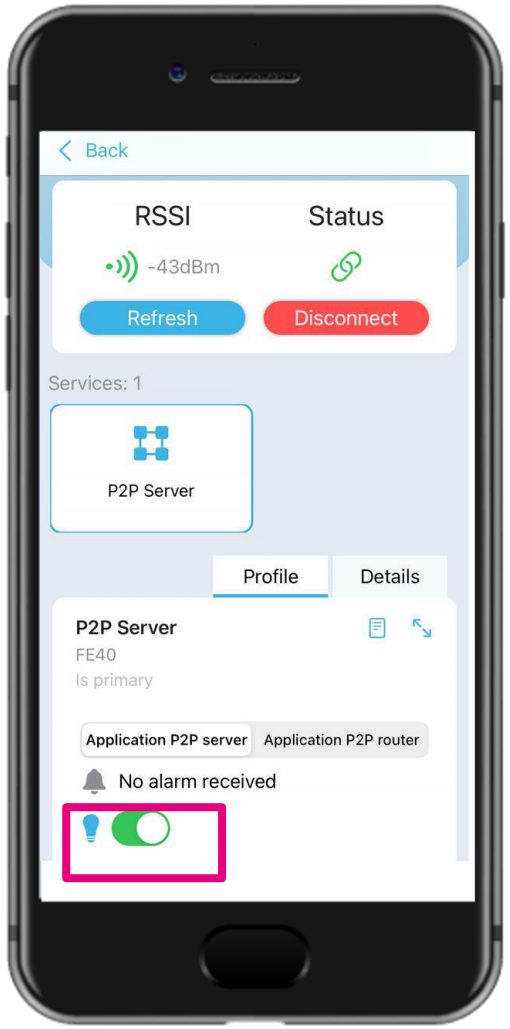
access to profile

UART Terminal (Connection & P2P profile)

- Via the HyperTerminal, check the Connection sequence & P2P profile activation

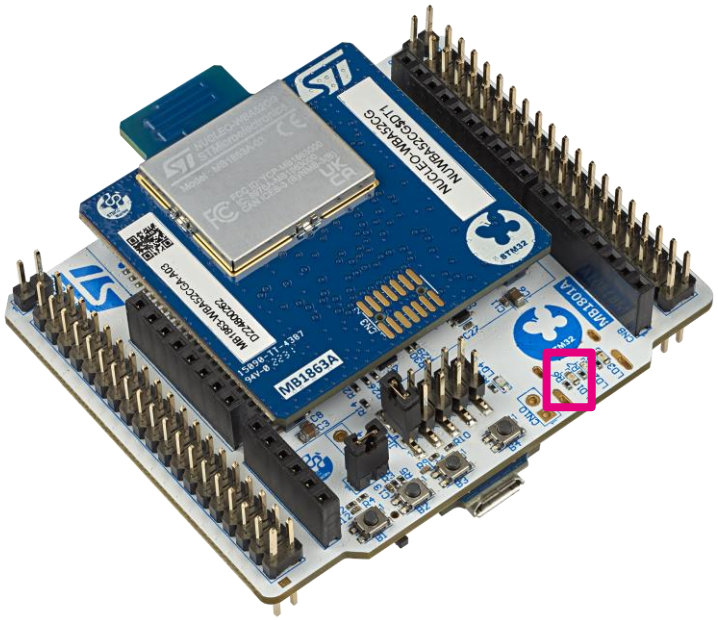


STBLE Toolbox (LED)



Notification - SWITCH

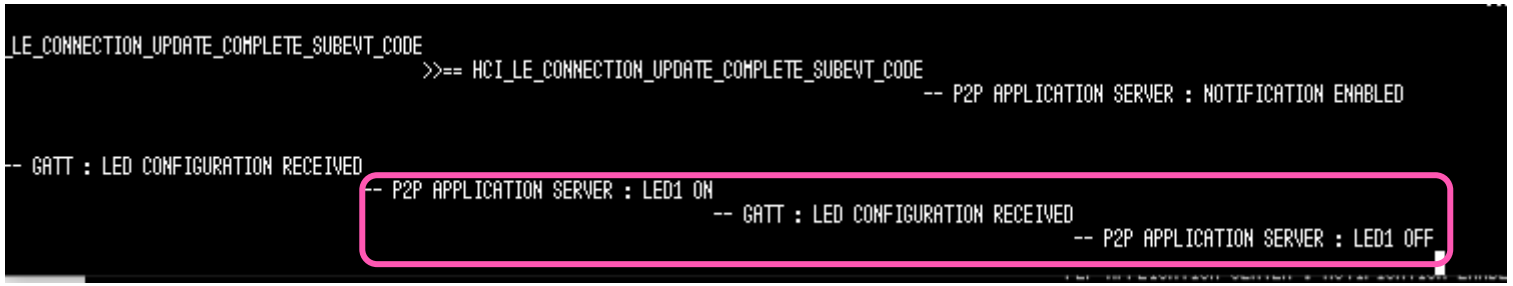
Write - LED



control LED status on Nucleo

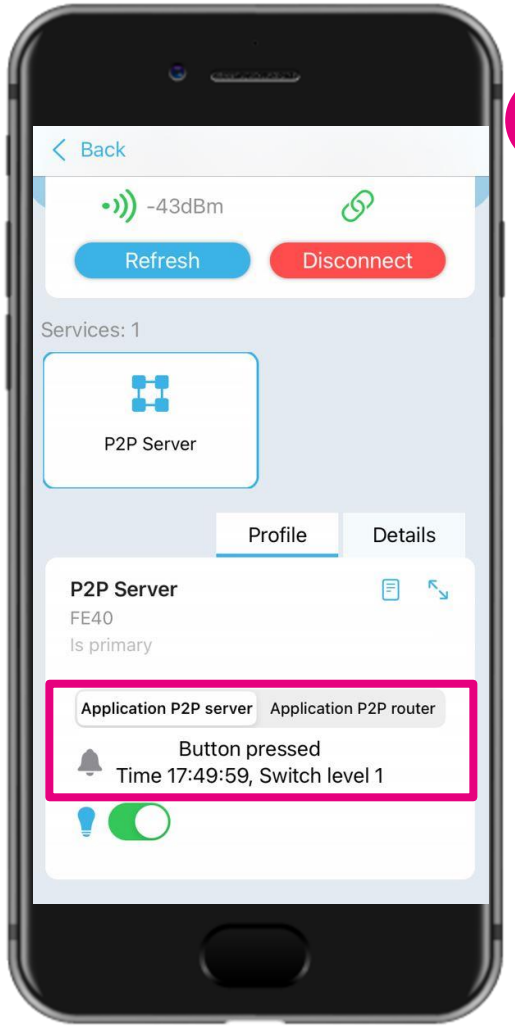
UART Terminal (LED)

- Then check the LED1 characteristic:



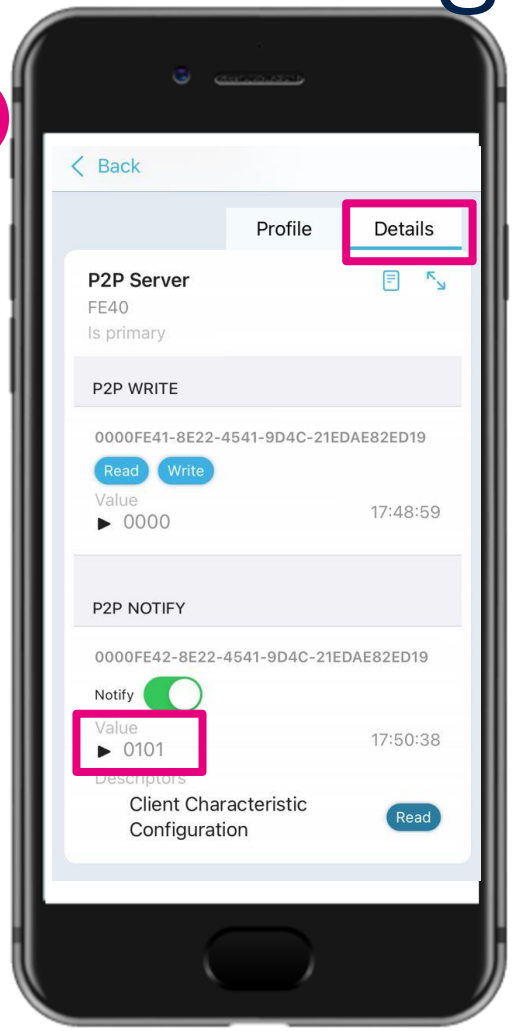
STBLE Toolbox (Push Button)

1

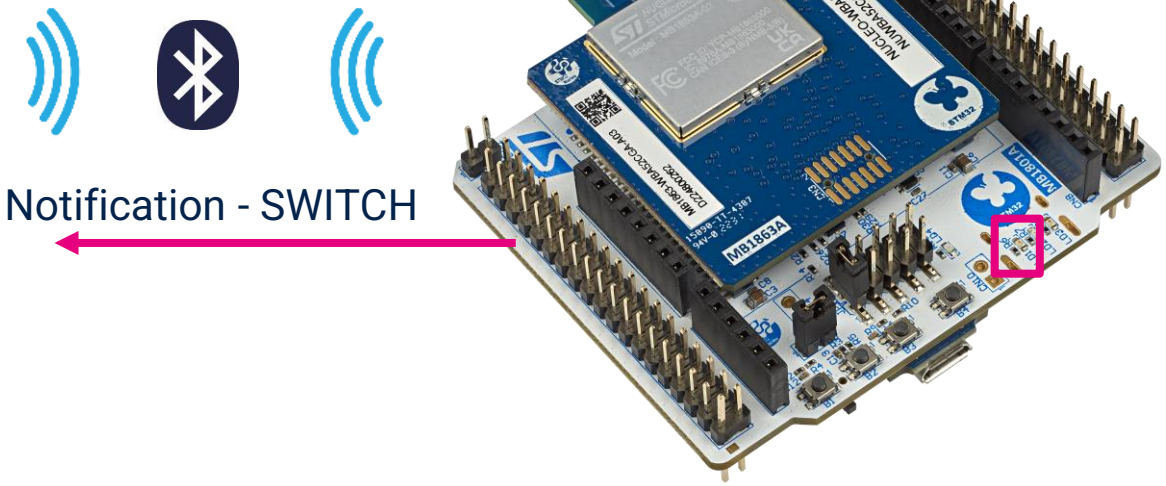


push button 1 and notify device

2



click on details to see bytes sent/received



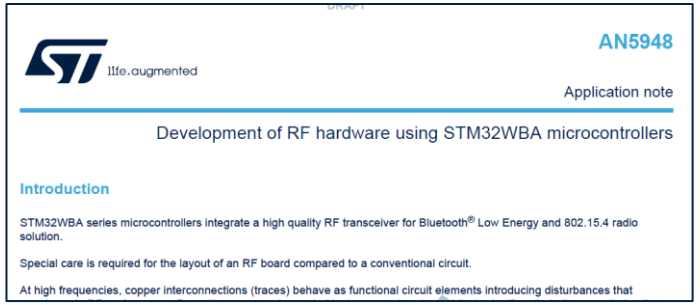
UART Terminal

- Connect an HyperTerminal to check application :

HW project development & certification

A complete set of documentation

AN5948 : Development of RF Hardware using STM32WBA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AN5948

Application note

Development of RF hardware using STM32WBA microcontrollers

Introduction

STM32WBA series microcontrollers integrate a high quality RF transceiver for Bluetooth® Low Energy and 802.15.4 radio solution.

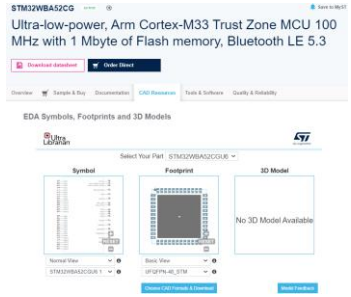
Special care is required for the layout of an RF board compared to a conventional circuit.

At high frequencies, copper interconnections (traces) behave as functional circuit elements introducing disturbances that

- RF basis generalities
- Schematics & components selection guidelines
- STM32WBA5x layout checklist & guidelines
- Soon on st.com

STM32WBA5x resources on st.com

MB1863
STM32WBA52/54
QFN48
PCB antenna



- Multiple reference design available for various part numbers & packages
- Download STM32WBA5x symbol
- Download STM32WBA5x footprint

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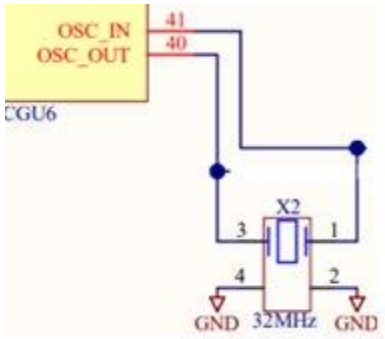
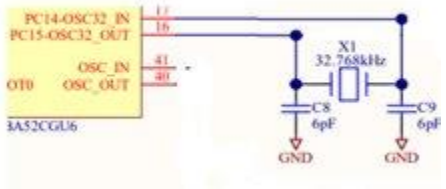
HW design with STM32WBA5x : key points

- HW design should be initiated based on documentation shown on previous slides
- Next slides are highlighting the key points you must pay attention when designing schematics and layout:
  - ➢ HSE 32MHz Xtal requirements:
    - STM32WBA5x includes internal programmable capacitances to trim the crystal frequency
    - No need external load capacitances
    - But, select 8pF load cap XTAL
    - Recommended part (or equivalent): NX1612SA-32MHZ-EXS00A-CS09166
    - Refer to AN5042 or ST team

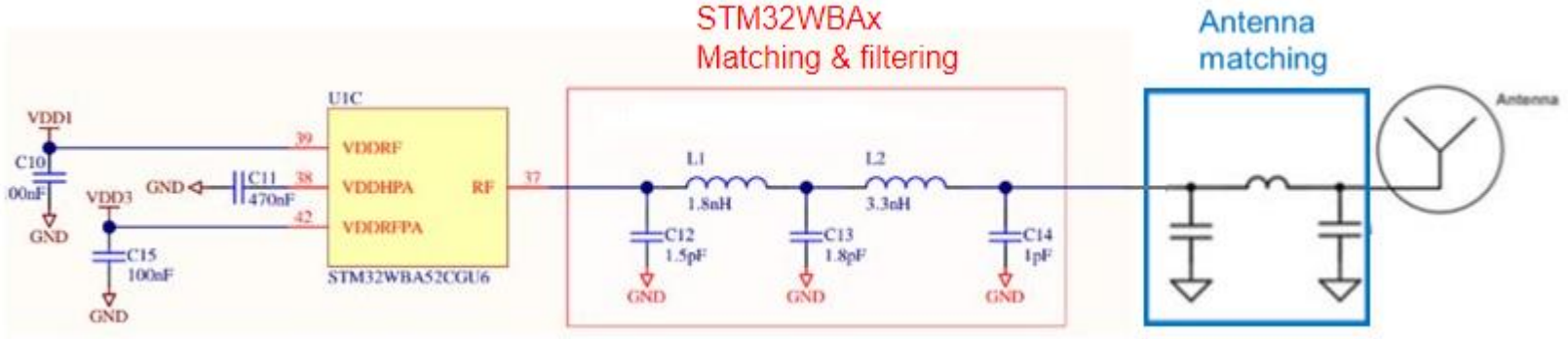


  - ➢ LSE or LSI selection. LSE 32kHz Xtal requirements if used:
    - LSE mandatory for accurate RTC calendar application
    - BOM optimized (save 32kHz Xtal cost) with LSI (OSC32 pins can be used open of as IOs)
    - Refer to AN2867 or ST team



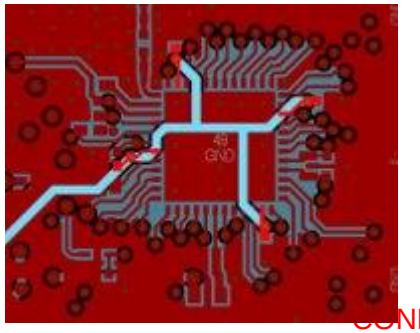
HW design with STM32WBA5x : key points

- RF matching & filtering:
  - Integrated balun so single ended RF matching.
  - Very limited number of discrete components for STM32WBAx matching and filtering.



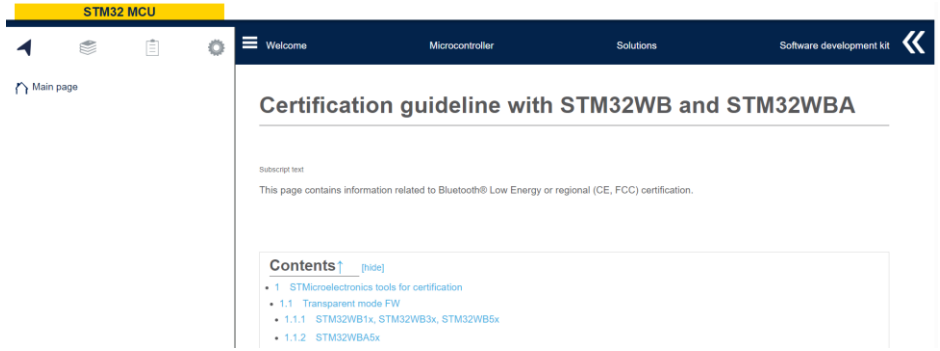
- Power management. SMPS implementation for STM32WBA55 (next WBA version) use case:
  - STM32WBA55 embeds a SMPS that can be used to improve power efficiency.
  - Apply different power supply scheme for output power target > 4dBm.

- Main layout recommendation:
  - Refer our various reference kits layout (Gerbers and Altium files available).
  - 4 layers stack-up recommended but 2 layers one is possible.



STM32WBA5x : a certified solution

- STM32WBA5x is compliant in regards of regional (CE, FCC etc.) and Bluetooth requirements.
- We are providing complete set of documentation, FW and tools to certify your product.



Full set of tools and documentation
➢ Certification guideline on wiki https://wiki.st.com/stm32mcu/wiki/Category:BLE_Certification ➢ Transparent mode FW available in STM32CubeWBA MCU Package ➢ STM32CubeMonRF PC tool

Bluetooth certification

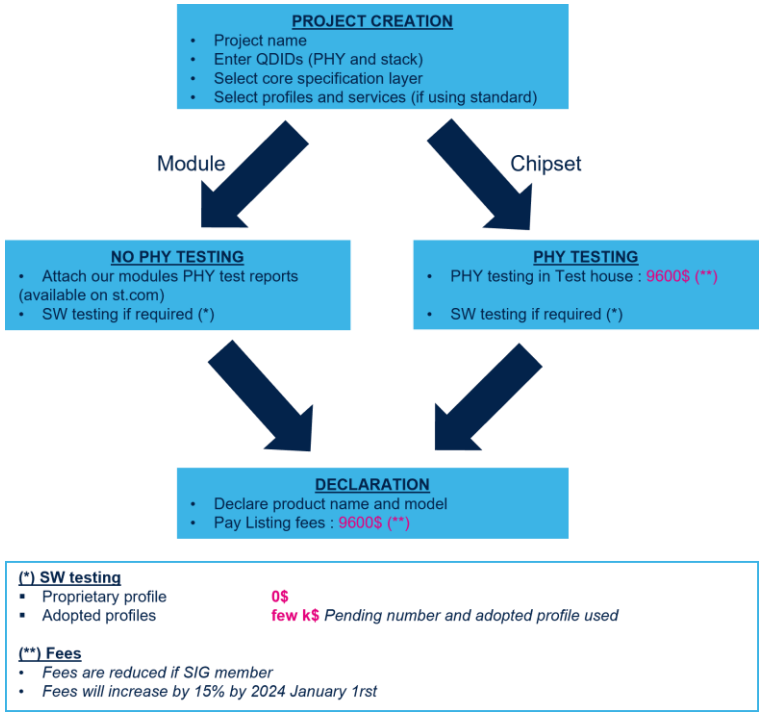
- STM32WBA5x is having reference QDIDs (components and stack) at Bluetooth SIG.
- Customer musty performed PHY testing and declare its product at Bluetooth SIG.

PHY QDID

Package	Part number	Cut version	RF PHY QDID
QFN48	STM32WBA52 (BLE5.4)	1.x	**197135** (TCRL 2022-2)

Stack QDID

Features	Host Stack version	QDID
4.0 HCI Low Energy LL with extended advertising – ATT – GAP – GATT – L2CAP with Enhanced Connected Oriented Channel -SMP BLE 5.3	STM32Cube_WBA_BLE_HCI_STACK STM32Cube_WBA_BLE_FULL_STACK	**198195** (TCRL 2022-1)



https://wiki.st.com/stm32mcu/wiki/Category:BLE_Certification

ST EMEA support

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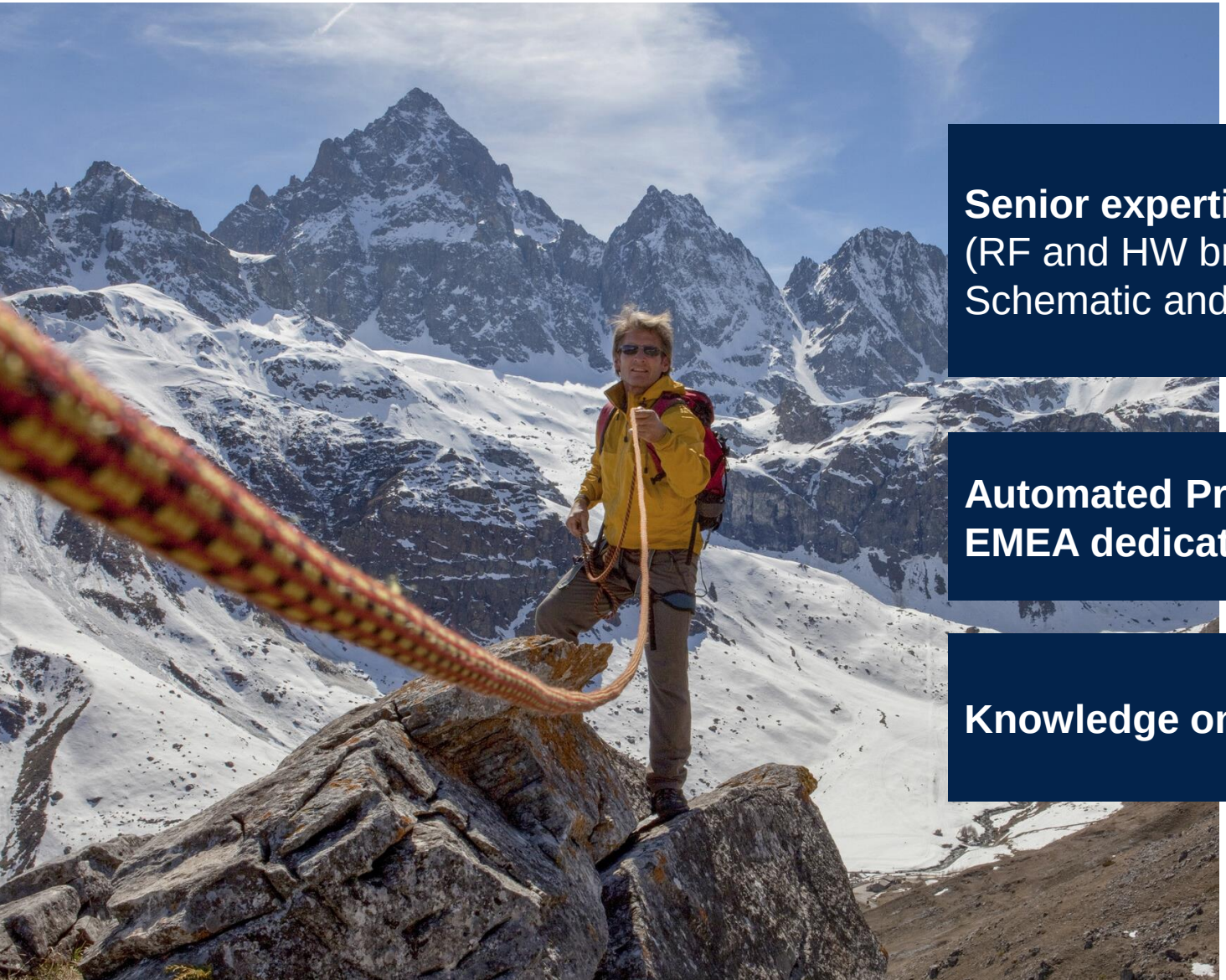
AVNET SILICA

What you can expect from our wireless support team



Senior expertise in wireless communication
(RF and HW bring-up services, SW and HW debugging, Schematic and layout review)

Automated Pre-certification capabilities
EMEA dedicated application labs

Knowledge on your application

... in a fast and agile way

Our customer wireless journey and how we can help

Support them to make the right choice

Make sure their choice was the right one

- Training
- Benchmark
- Datasheet review

- Eval kit bring-up
- Performance review

- Schematic review
- Layout review
- Software porting
- 1st PCB bring-up
- 1st RF test report
- Debugging

- Regional RF test report
- Protocol RF tests
- Corner case debugging
- Certification process guidance

- RF Production tooling
- Ramp-up support

Don’t wait too long to ask for any support.
The sooner the better!!

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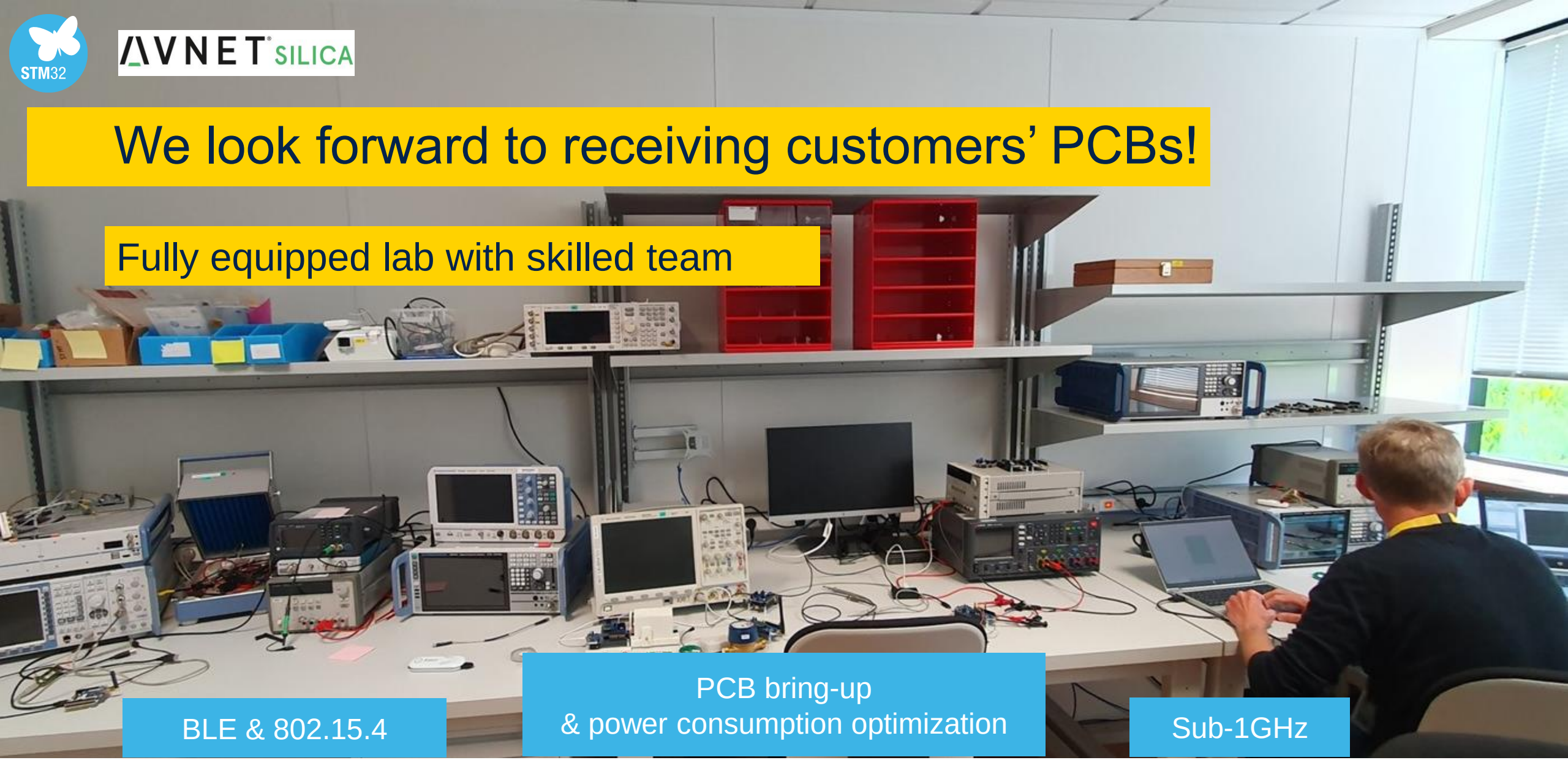
AVNET SILICA

We look forward to receiving customers' PCBs!

Fully equipped lab with skilled team



BLE & 802.15.4

PCB bring-up
& power consumption optimization

Sub-1GHz

Bluetooth
THREAD
LoRa
sigfox
matter
zigbee
Wi Fi
NFC
M-Bus wireless

STM32WBA takeaway

STM32WBA takeaway 1#2

STM32**WBA**

2.4Ghz Portfolio	Wide portfolio from NP to AP from M0 to M33 – single or dual core
Wireless	Bluetooth® Low Energy 5.3 certified Multiprotocol
Performance	Arm® Cortex®-M33 at 100 MHz Fast wake-up time , high RF power 10dBm
Power efficiency	Extended battery lifetime Autonomous low-power mode
Security	As a MUST to have ! TrustZone® - DPA resistant – SESIP L3
Integration	1 Mbyte of flash memory, 128 Kbytes RAM Reduced BOM

STM32WBA takeaway 2#2

Cost Effective	new architecture , 40nm
Large Capacity	Massive investment to support large production now and onward
Free ecosystem	Faster time to market with STM32CubeMX Enhanced design journey
RF lab	Schematic & layout review to quickly go in production

Our technology starts with You

Find out more at www.st.com

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