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How to Create a basic Bluetooth LE peripheral in 10 minutes using STM32CubeMX





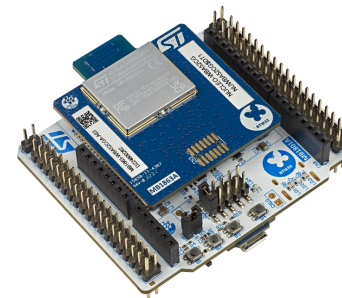
SW prerequisites

- STM32CubeMX software (v6.9.0 or up)
- STM32CubeWBA MCU package (v1.1.0 or up)
- IDE: STM32CubeIDE
- A serial terminal (e.g. TeraTerm)
- **ST BLE ToolBox Smartphone application**
- .ioc template application

HW prerequisites

- NUCLEO-WBA52
- USB A to Micro-B Cable

Prerequisites Refresh



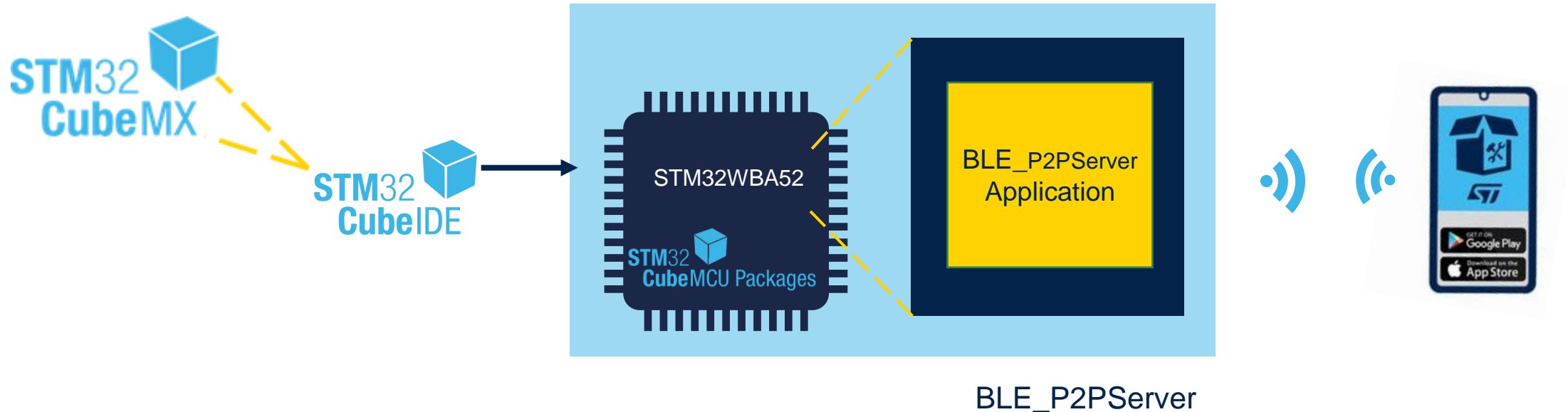
ST BLE Toolbox



Basic Peripheral in 10mn : Click & Go :

Purpose

- As a first exercise, Let's start from an existing project example **BLE_P2PServer**
- Purpose of this session is to **modify this code example to customize advertising data (Local name)**.

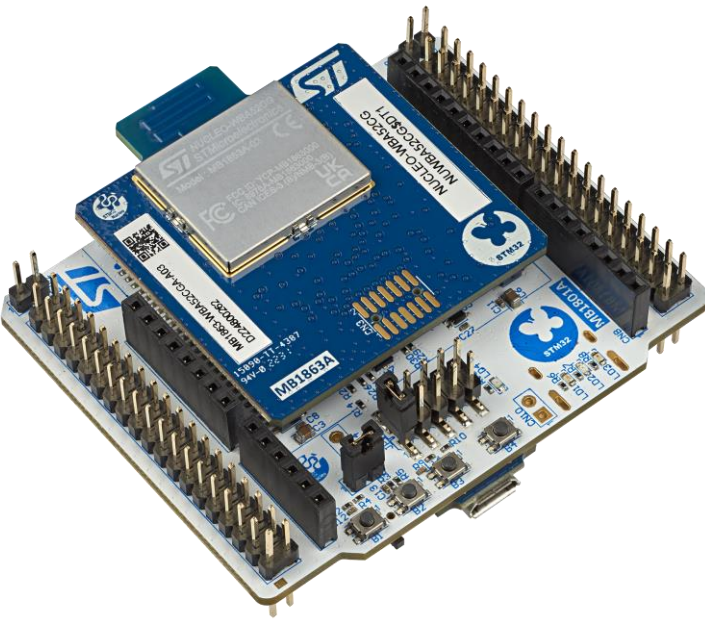


- In the second part of the Hands on we will generate associated code, flash and test over Nucleo-WBA5x board



What is a P2P Server?

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



ST BLE Toolbox



GATT Client

GAP central

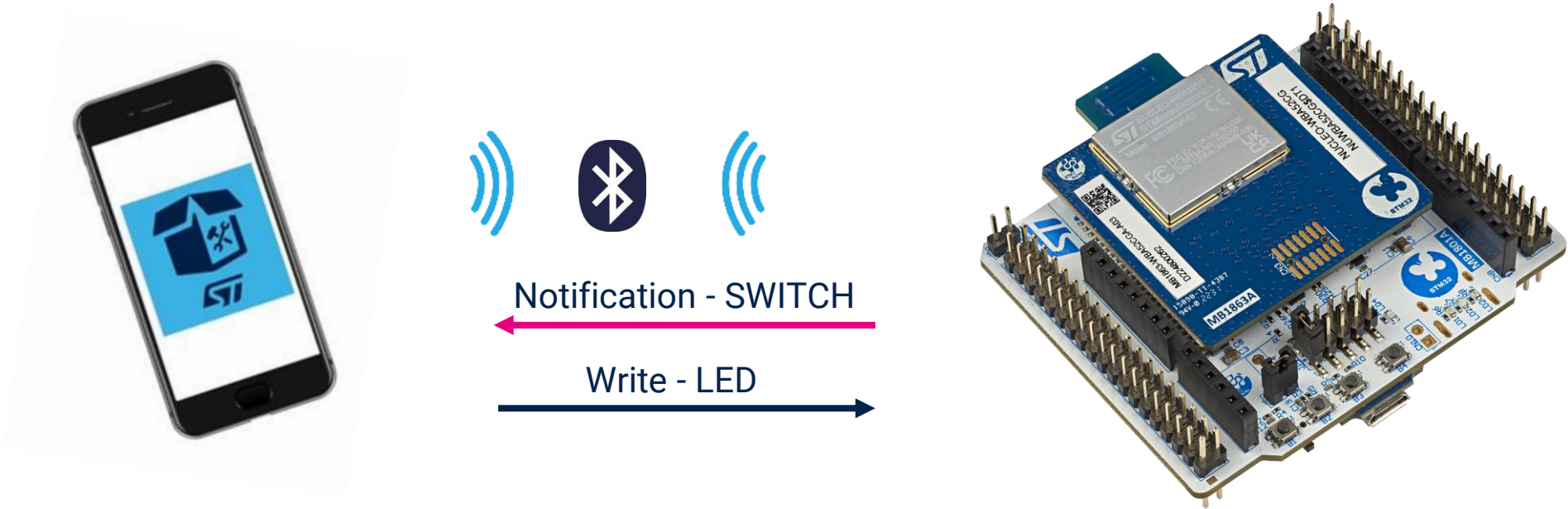
GATT Server

GAP peripheral



What is a P2P Server?

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



ST BLE Toolbox



GATT Client

GAP central

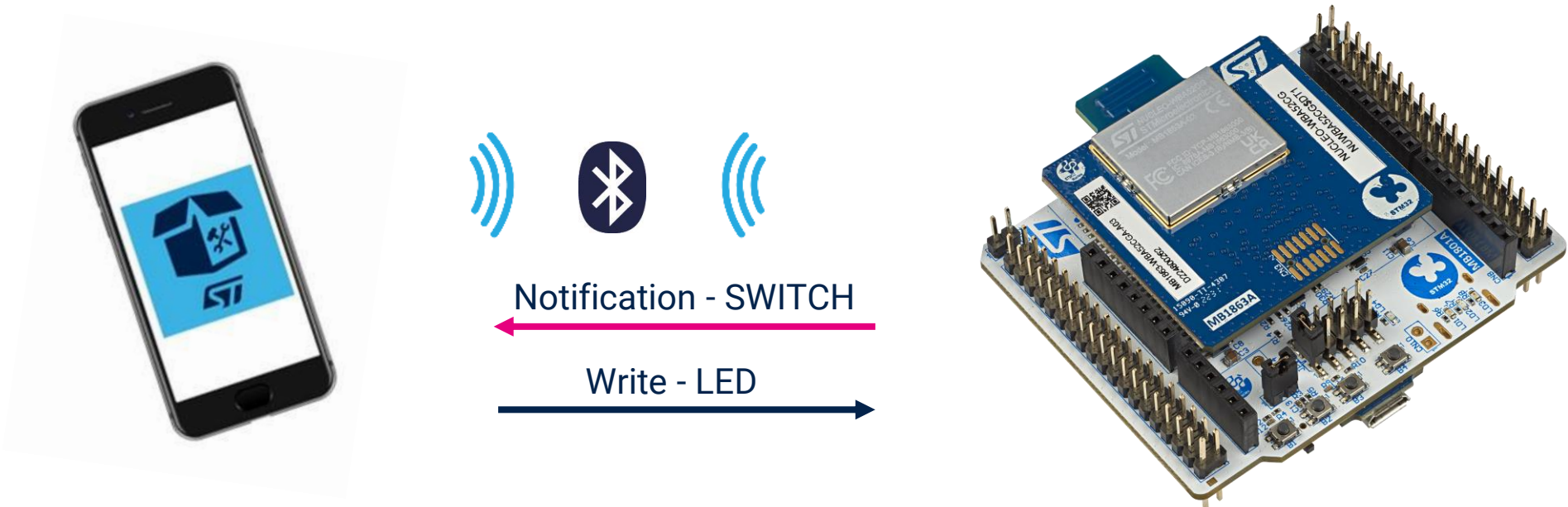
GATT Server

GAP peripheral



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



GATT Client

GAP central

GATT Server

GAP peripheral

STM32CubeMx capabilities



STM32CubeMx allow to start design within 3 options

1

Example application

complete application running over NUCLEO

2

Board level

all the hardware is already configured (NUCLEO_WBA52)

3

Chipset level

require to configure your HW (PCB) & your application

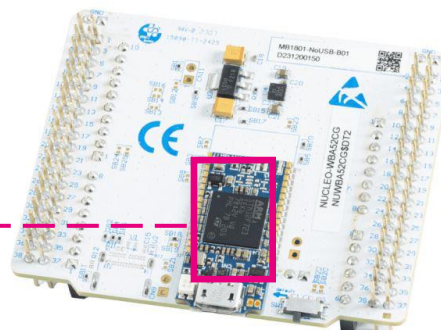
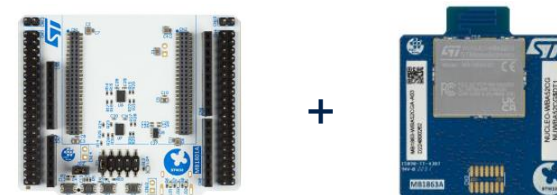
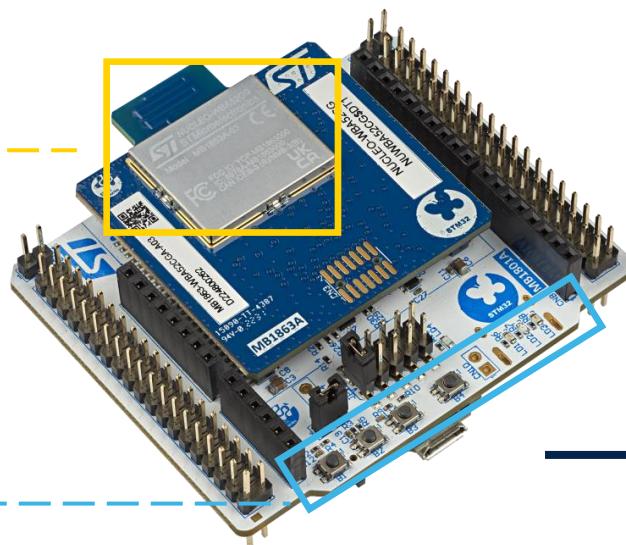
Connect the NUCLEO-WBA52CG to the PC

STM32WBA52CG

3 user LEDs
3 user buttons

STLINK-V3MODS

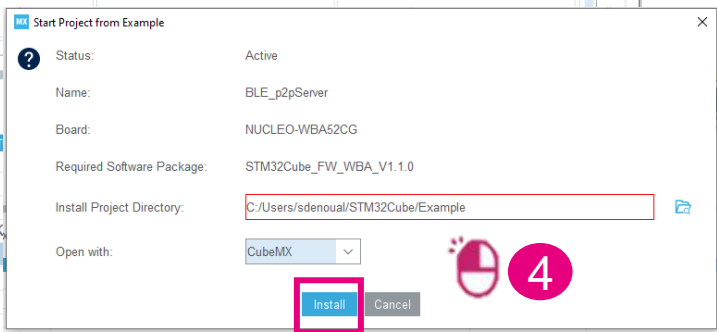
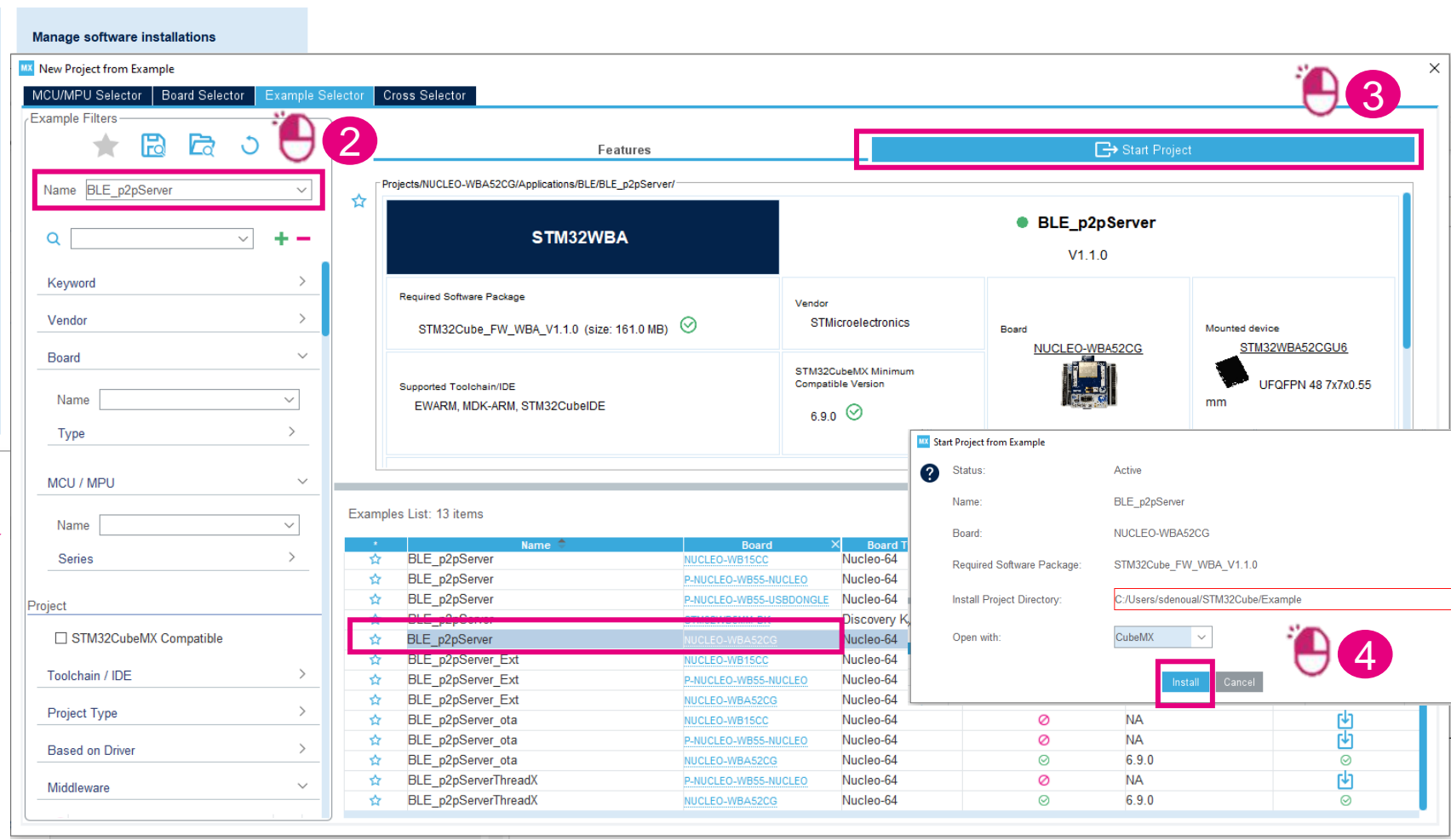
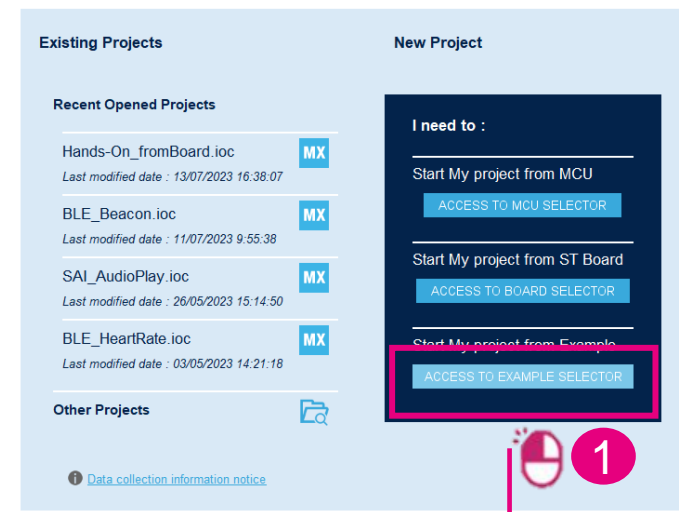
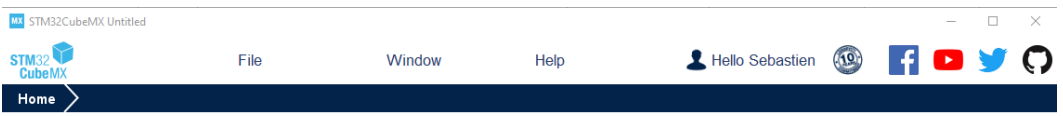
- Programming
- Debugging
- VCOM





START STM32CubeMX

Open BLE_P2PServer example



CubeMX – Nucleo Docs&Resources

Examples List: 13 items

Export

*	Name	Board	Board Type	STM32CubeMX Compatib...	STM32CubeMX Version	SW Package Installed
☆	BLE_p2pServer	NUCLEO-WB15CC	Nucleo-64	✓	6.8.0	↓
☆	BLE_p2pServer	P-NUCLEO-WB55-NUCLEO	Nucleo-64	✓	6.8.0	↓
☆	BLE_p2pServer	P-NUCLEO-WB55-USBDONGLE	Nucleo-64	✗	NA	↓
☆	BLE_p2pServer	STM32WB5MM-DK	Discovery Kit	✓	6.8.0	↓
☆	BLE_p2pServer	NUCLEO-WBA52CG	Nucleo-64	✓	6.9.0	✓
☆	BLE_p2pServer_Ext	NUCLEO-WB15CC	Nucleo-64	✗	NA	↓
☆	BLE_p2pServer_Ext	P-NUCLEO-WB55-NUCLEO	Nucleo-64	✗	NA	↓
☆	BLE_p2pServer_Ext	NUCLEO-WBA52CG	Nucleo-64	✓	6.9.0	✓
☆	BLE_p2pServer_ota	NUCLEO-WB15CC	Nucleo-64	✗	NA	↓

Features Large Picture Docs & Resources Datasheet Buy Start Project

STM32WBA Series



NUCLEO-WBA52CG is a Bluetooth® Low Energy wireless and ultra-low-power board embedding a powerful and ultra-low-power radio compliant with the Bluetooth® Low Energy SIG specification v5.3.

The ARDUINO® Uno V3 connectivity support and the ST morpho headers allow the easy expansion of the functionality of the STM32 Nucleo open development platform with a wide choice of specialized shields.

! by Clicking on the Board type we can access all the Doc & Resources related to the Nucleo-WBA52 and more in general to the STM32 product family



Customize Local Name

MX STM32CubeMX BLE_p2pServer.ioc: STM32WBA52CGUx NUCLEO-WBA52CG

File Window Help Hello Sebastian

Home STM32WBA52CGUx - NUCLEO-WBA52CG BLE_p2pServer.ioc - Pinout & Configuration GENERATE CODE

Pinout & Configuration Clock Configuration Project Manager Tools

Software Packs Pinout

STM32_WPAN Mode and Configuration

Mode

BLE [Select and configure your Server application]

Categories A-Z

- ADC4
- ✓ ADV_TRACE
- AES
- CORTEX_M33
- ✓ CRC
- DEBUG
- FILEX
- ✓ GPDMA1
- GPIO
- GTZC
- HASH
- HSEM
- I-CUBE-Cesium
- I-CUBE-embOS
- I-CUBE-wolfSSL
- I-Cube-SoM-uGOAL
- I2C1
- I2C3
- ✓ ICACHE
- IRTIM
- IWDG
- LINKEDLIST
- LPTIM1
- LPTIM2
- LPUART1
- ✓ MISC
- NVIC
- PKA
- ▲ PWR
- ✓ RAMCFG
- ▲ RCC
- ✓ RF
- ✓ RNG
- ▲ RTC
- SAES
- ✓ SEQUENCER
- SPH1
- ▲ SPI3
- ✓ STM32_WPAN
- ✓ SYS
- ▲ TAMP
- THREADX
- ▲ TIM1
- ▲ TIM2

Configuration

Reset Configuration

- ✓ SERVICE1
- ✓ User Constants
- Platform Settings
- ✓ BLE Applications and Services
- ✓ Configuration
- ✓ BLE Advertising

Configure the below parameters :

Search (Ctrl+F)

Advertising configuration

Advertising elements

ad_data[] length	21
Include AD_TYPE_TX_POWER_LEVEL element	No
Include AD_TYPE_COMPLETE_LOCAL_NAME element	Yes
AD_TYPE_COMPLETE_LOCAL_NAME LE	4
AD_TYPE_COMPLETE_LOCAL_NAME	MyName_01
Include AD_TYPE_SHORTENED_LOCAL_NAME element	No
Include AD_TYPE_APPEARANCE element	No
Include AD_TYPE_ADVERTISING_INTERVAL element	No
Include AD_TYPE_LE_ROLE element	No
Include AD_TYPE_16_BIT_SERV_UUID_CMPLT element	No
Include AD_TYPE_128_BIT_SERV_UUID_CMPLT element	No
Include AD_TYPE_SLAVE_CONN_INTERVAL element	No
Include AD_TYPE_URI element	No
Include AD_TYPE_MANUFACTURER_SPECIFIC_ID element	Yes
AD_TYPE_MANUFACTURER_SPECIFIC_ID	15

Local Name must be < 11 CubeMx constraints

Pinout view System view

STM32WBA52CGUx UFQFPN48

USART1_TX PB12

USART1_RX PA8

RCC_OSC32_OUT

RCC_OSC32_IN

DEBUG_JTMS-SWCLK

DEBUG_JTCK-SWCLK



Customize Device Name

STM32CubeMX Hands-On_WBA52.ioc*: STM32WBA52CGUx NUCLEO-WBA52CG

File Window Help myST

Home STM32WBA52CGUx - NUCLEO-WBA52CG Hands-On_WBA52.ioc - Pinout & Configuration GENERATE CODE

Pinout & Configuration Clock Configuration Project Manager Tools

Software Packs Pinout

STM32_WPAN Mode and Configuration

Mode

BLE Select and configure your Server application

Categories A-Z

- ICACHE
- IRTIM
- IWDG
- LINKEDLIST
- LPTIM1
- LPTIM2
- LPUART1
- MISC
- NVIC
- PKA
- PWR
- RAMCFG
- RCC
- RF
- RNG
- RTC
- SAES
- SEQUENCER
- SPI1
- SPI3
- STM32_WPAN
- SYS
- TAMP
- THREADX
- TIM1
- TIM2
- TIM3
- TIM16
- TIM17
- TIMER
- TINY_LPM
- TOUCHSENSING
- TSC
- USART1
- USART2
- WWDG
- X-CUBE-AI
- X-CUBE-ALGOBUILD
- X-CUBE-ALS
- X-CUBE-BLE1
- X-CUBE-BLE2
- X-CUBE-BLEMG

Configuration

Reset Configuration

BLE Advertising User Constants Platform Settings Configuration

Configure the below parameters :

Search (Ctrl+F)

PAIRING_PARAMETERS	OFF
CFG_IO_CAPABILITY	Display Yes No (0x01)
CFG_MITM_PROTECTION	MITM protection Yes No (0x01)
CFG_BLE_IRK	12, 34, 56, 78, 9A, BC, DE, FE, DC, BA, 09, 87, 65, 43, 21, FE, DC, BA, 09, 87, 65, ...
CFG_BLE_ERK	FF, DC, BA, 09, 87, 65, 43, 21, FE, DC, BA, 09, 87, 65, ...
CFG_GAP_DEVICE_NAME	My_Name_01
CFG_GAP_DEVICE_NAME_LENGTH	8

Application configuration - BLE stack

CFG_GAP_DEVICE_NAME

CFG_GAP_DEVICE_NAME

Parameter Description:

set same Device name = Local Name

Pinout view System view

USART1_TX PB12

LD2 PB11

USART1_RX PA8

PA7

PA6

VDDA

PA5

PA3

PB10

PA2

VDD

PA1

PA0

PB9

PB8

PC15

PC14

PC13

PB7

PB6

PB5

VDD

PC12

B1

B3

B2

LD1

PB4

PB3

RCC_OSC32_OUT

RCC_OSC32_IN

RCC_OSC32_IN

RCC_OSC32_OUT

NRST

VDD

PH3...

PB15

PB0

PB1

PB2

PA11

PA12

PA13

PA14

PA15

DEBUG_JTMS-SWDIO

DEBUG_JTCK-SWCLK

STM32WBA52CGUx

UFQFPN48



Generate code

STM32CubeMX BLE_p2pServer.ioc*: STM32WBA52CGUx NUCLEO-WBA52CG

File Window Help myST

Home > STM32WBA52CGUx - NUCLEO-WBA52CG > BLE_p2pServer.ioc - Project Manager > **GENERATE CODE**

Pinout & Configuration Clock Configuration **Project Manager** Tools

Project

Project Name BLE_p2pServer 1

Project Location C:\Users\marciasm\STM32Cube\Example Browse

Application Structure Advanced ☐ Do not generate the main()

Toolchain Folder Location C:\Users\marciasm\STM32Cube\Example\BLE_p2pServer\ 2

Toolchain / IDE **STM32CubeIDE** ☐ Generate Under Root

Select here your favorite IDE

Code Generator

Advanced Settings

Linker Settings

Minimum Heap Size 0x3000

Minimum Stack Size 0x1000

Thread-safe Settings

CortexM33

☐ Enable multi-threaded support

Thread-safe Locking Strategy Default - Mapping suitable strategy depending on RTOS selection.

Mcu and Firmware Package

Mcu Reference STM32WBA52CGUx

Firmware Package Name and Version STM32Cube FW_WBA V1.1.0

☒ Use Default Firmware Location

Firmware Relative Path C:/Users/marciasm/STM32Cube/Repository/STM32Cube_FW_WBA_V1.1.0 Browse

Generating user source code...



Advanced Settings

STM32CubeMX BLE_p2pServer.ioc*: STM32WBA52CGUx NUCLEO-WBA52CG

File Window Help myST

Home > STM32WBA52CGUx - NUCLEO-WBA52CG > BLE_p2pServer.ioc - Project Manager > GENERATE CODE

Pinout & Configuration Clock Configuration Project Manager Tools

Project

Code Generator

Advanced Settings

Driver Selector

Search (Ctrl+F)

RCC	HAL
GPIO	HAL
> GPDMA	HAL
PWR	HAL
RAMCFG	HAL
RTC	HAL
> USART	HAL
STM32_WPAN	HAL
> ADC	HAL
CRC	HAL

From this tab you've selected LL/ HAL for each driver

Register CallBack

Search (Ctrl+F)

ADC	DISABLE
COMP	DISABLE
CRYP	DISABLE
HASH	DISABLE
I2C	DISABLE
IWDG	DISABLE
IRDA	DISABLE
LPTIM	DISABLE
PKA	DISABLE
RAMCFG	DISABLE
RNG	DISABLE
RTC	DISABLE
SAI	DISABLE
SMARTCARD	DISABLE
SMBUS	DISABLE
SPI	DISABLE
TIM	DISABLE
TSC	DISABLE
UART	ENABLE
USART	DISABLE
WWDG	DISABLE

Enable the generation of callback define statements

Generated Function Calls

Generate Code	Rank	Function Name	Peripheral Instance Name	Do Not Generate Function Call	Visibility (Static)
<input checked="" type="checkbox"/>	1	SystemClock_Config	RCC	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	2	MX_GPIO_Init	GPIO	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	3	MX_GPDMA1_Init	GPDMA1	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	4	SystemPower_Config	PWR	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	5	MX_RAMCFG_Init	RAMCFG	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	6	MX_RTC_Init	RTC	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	7	MX_USART1_UART_Init	USART1	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	8	APPE_Init	STM32_WPAN	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	9	MX_ADC4_Init	ADC4	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	10	MX_CRC_Init	CRC	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	11	MX_RNG_Init	RNG	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	12	MX_ICACHE_Init	ICACHE	<input type="checkbox"/>	<input type="checkbox"/>





Code Generator

STM32CubeMX BLE_p2pServer.ioc*: STM32WBA52CGUx NUCLEO-WBA52CG

File Window Help myST

Home > STM32WBA52CGUx - NUCLEO-WBA52CG > BLE_p2pServer.ioc - Project Manager > GENERATE CODE

Pinout & Configuration	Clock Configuration	Project Manager	Tools
Project	STM32Cube MCU packages and embedded software packs <input type="radio"/> Copy all used libraries into the project folder <input checked="" type="radio"/> Copy only the necessary library files <input type="radio"/> Add necessary library files as reference in the toolchain project configuration file		
Code Generator	Generated files <input type="checkbox"/> Generate peripheral initialization as a pair of *.c/.h' files per peripheral <input type="checkbox"/> Backup previously generated files when re-generating		
Advanced Settings	<input checked="" type="checkbox"/> Keep User Code when re-generating <input checked="" type="checkbox"/> Delete previously generated files when not re-generated		
	HAL Settings <input type="checkbox"/> Set all free pins as analog (to optimize the power consumption) <input type="checkbox"/> Enable Full Assert		
	User Actions Before Code Generation <input type="text"/> <input type="button" value="Browse"/> After Code Generation <input type="text"/> <input type="button" value="Browse"/>		
	Template Settings Select a template to generate customized code <input type="button" value="Settings..."/>		

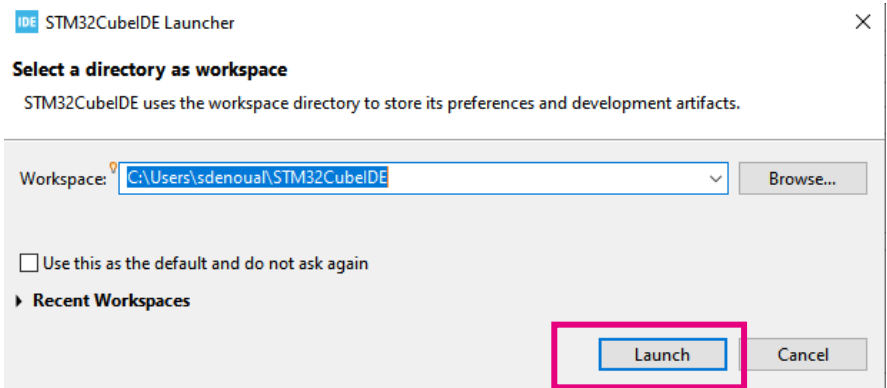
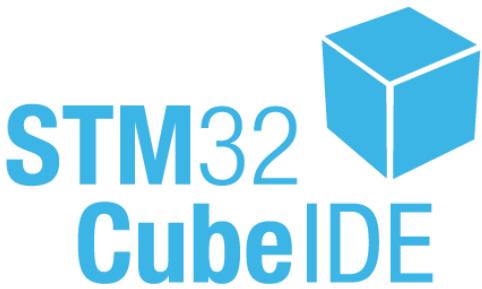
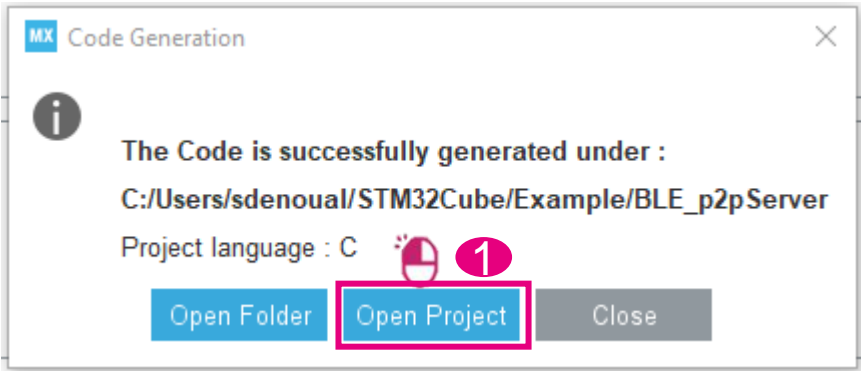
You can select how HAL .c/.h are included inside the project or backup the code that was generated previously

Here you can enable all pins as analog to save power





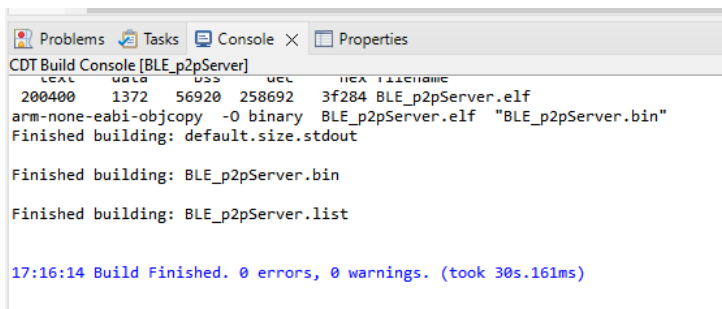
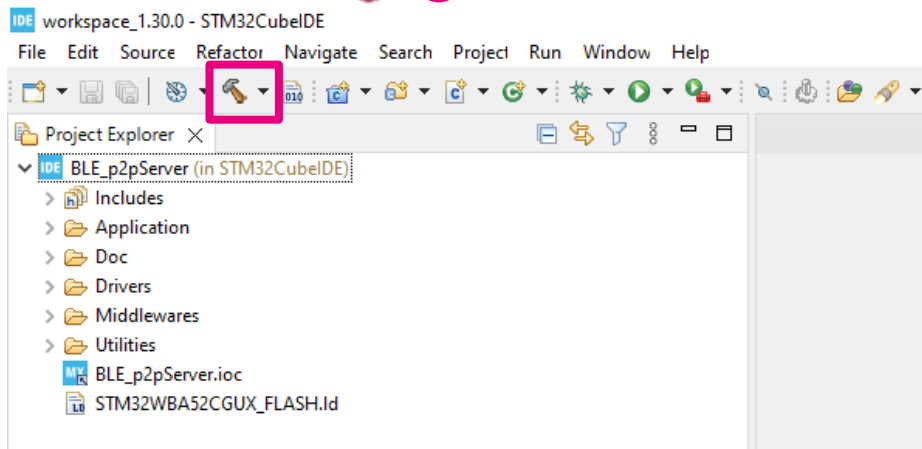
Open project





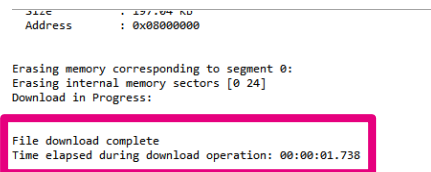
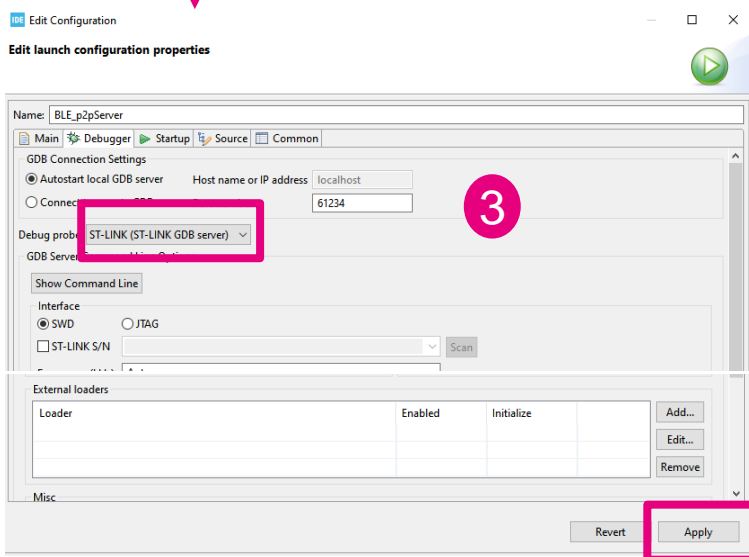
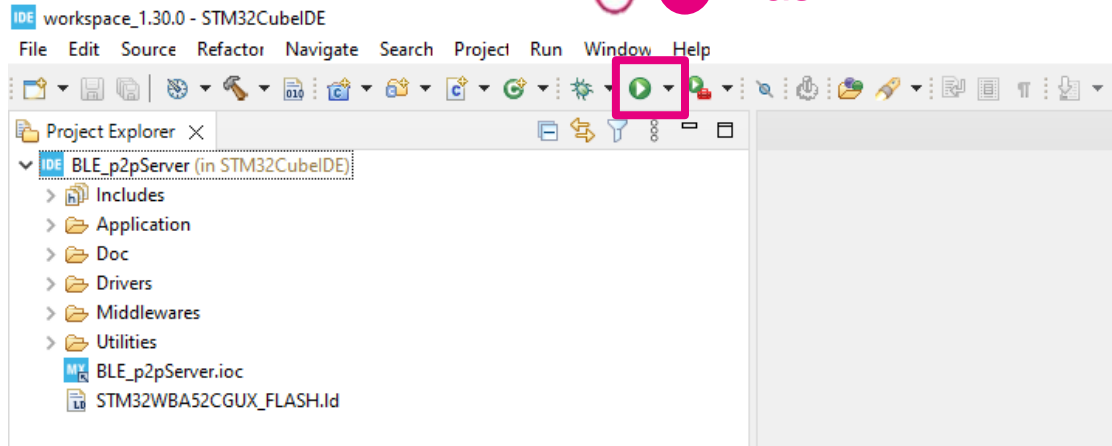
Build and flash modified project

1 Build



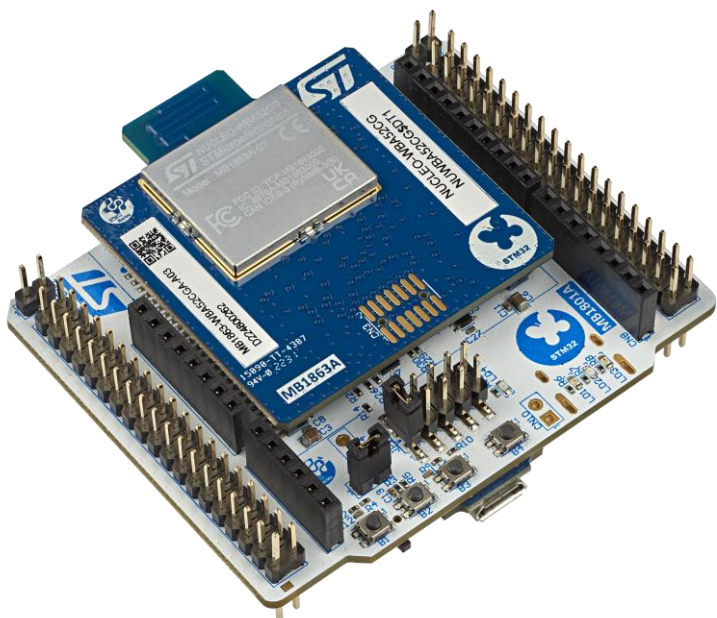
Plug the board

2 Flash





Enjoy your first STM32WBA52 project running!

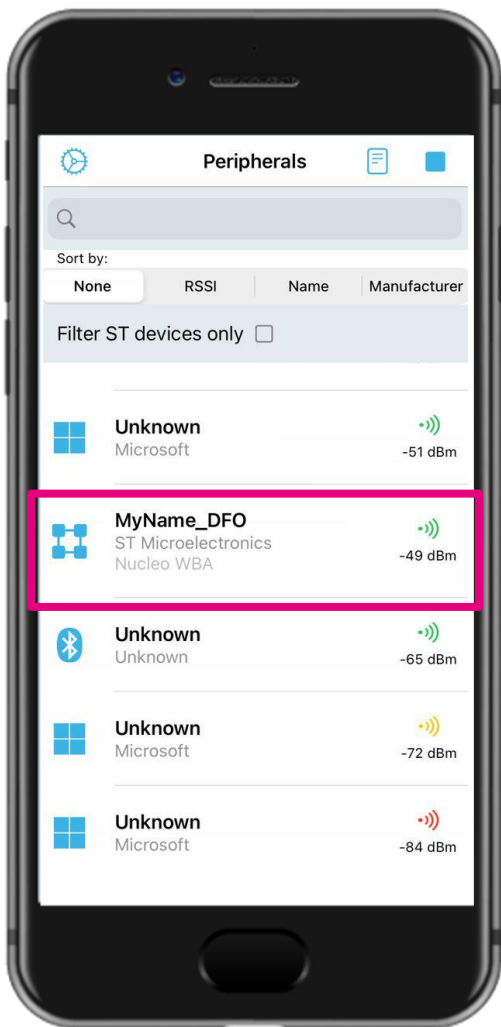


ST BLE Toolbox



STBLE Toolbox (Advertising)

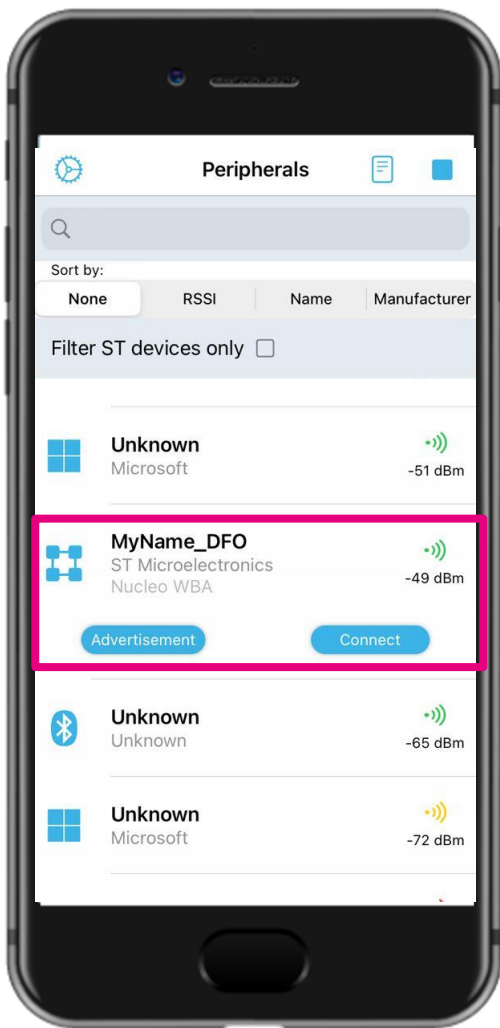
1



click on device

STBLE Toolbox (Connection)

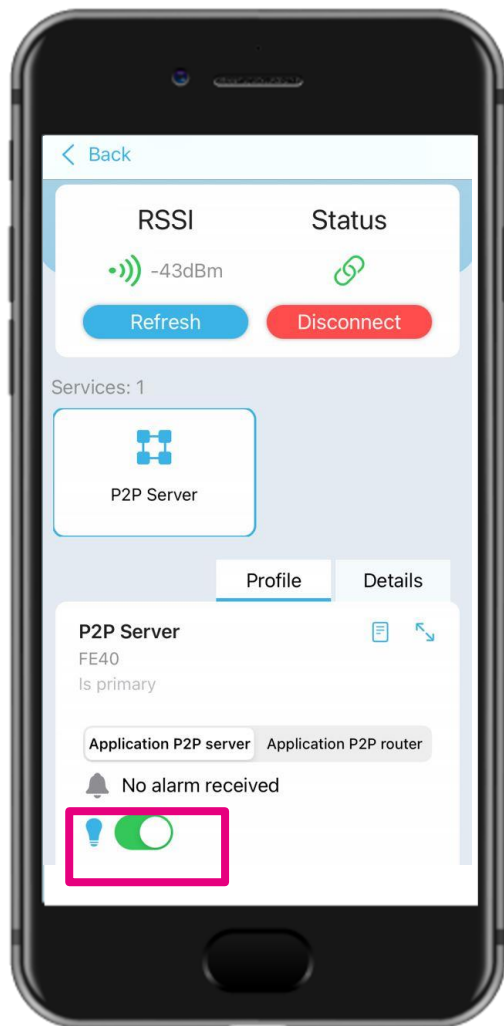
1



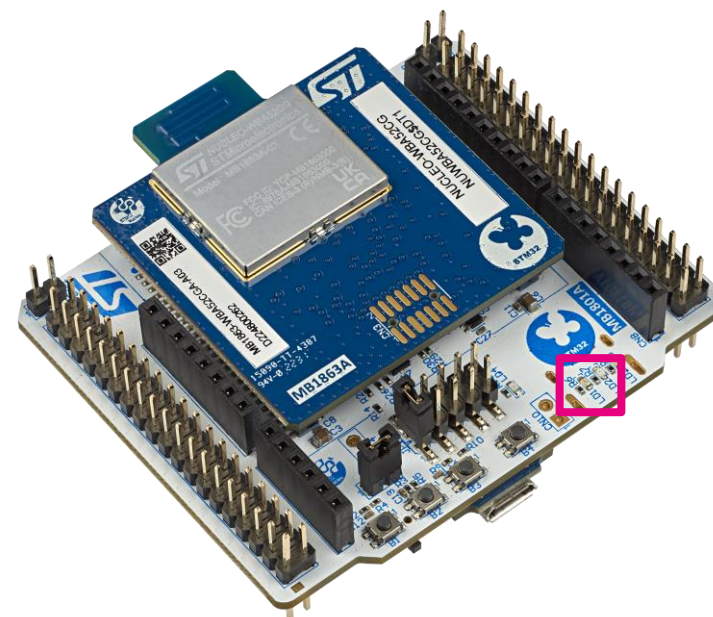
2



STBLE Toolbox (LED)



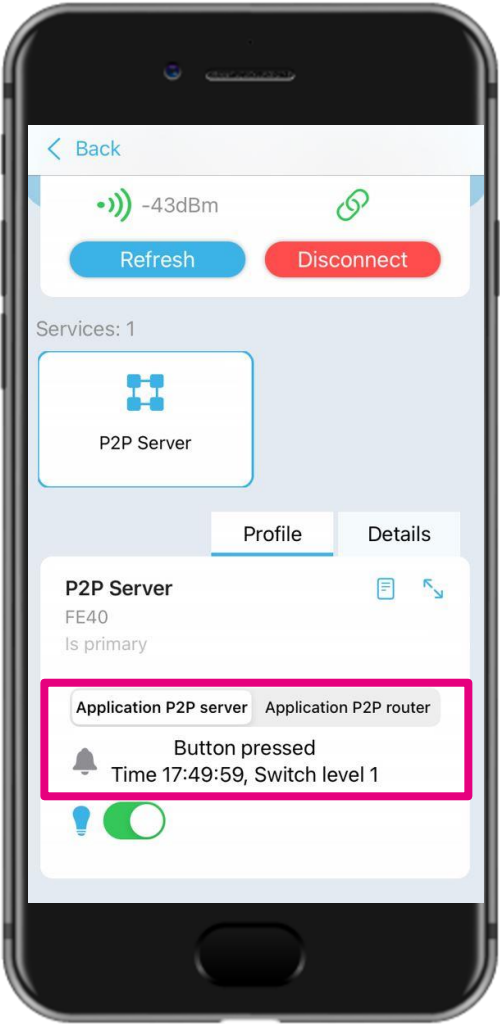
control LED status on
Nucleo





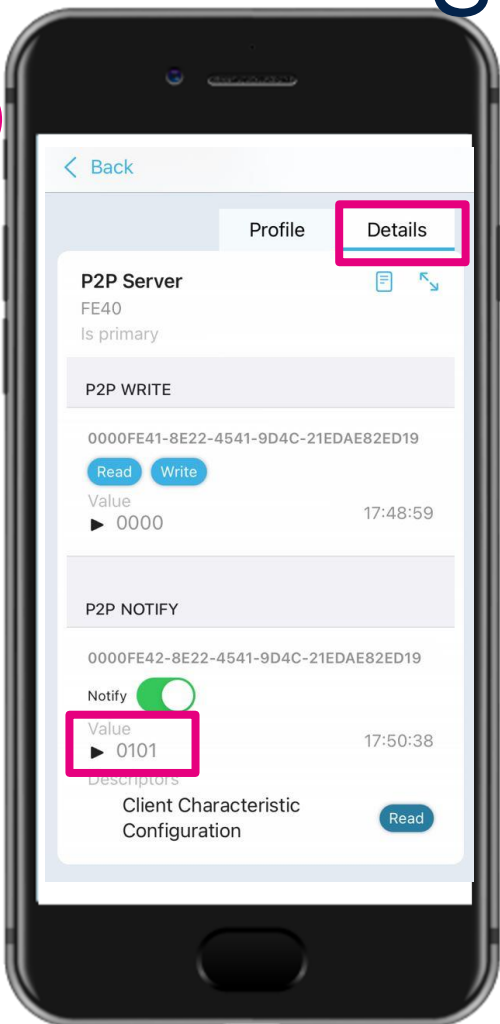
STBLE Toolbox (Push Button)

1



push button 1 and
notify device

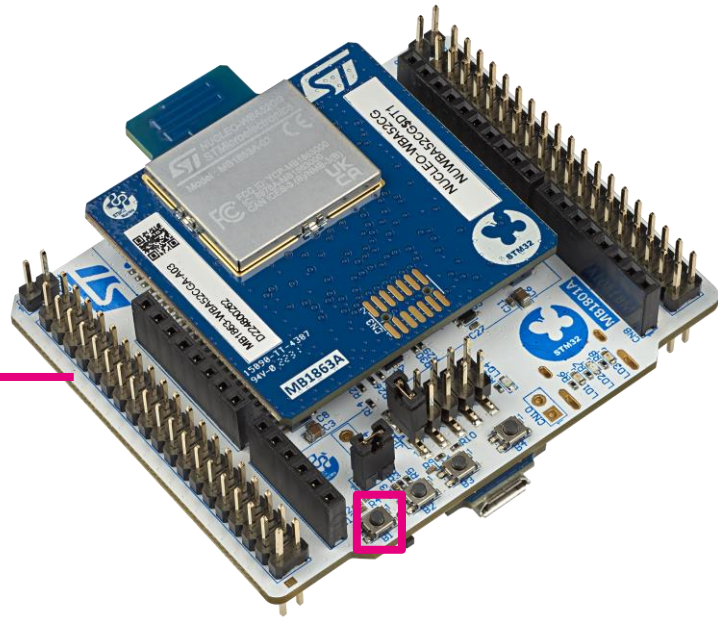
2



click on details to see
bytes sent/received



Notification - SWITCH





start and build from turn-key server application

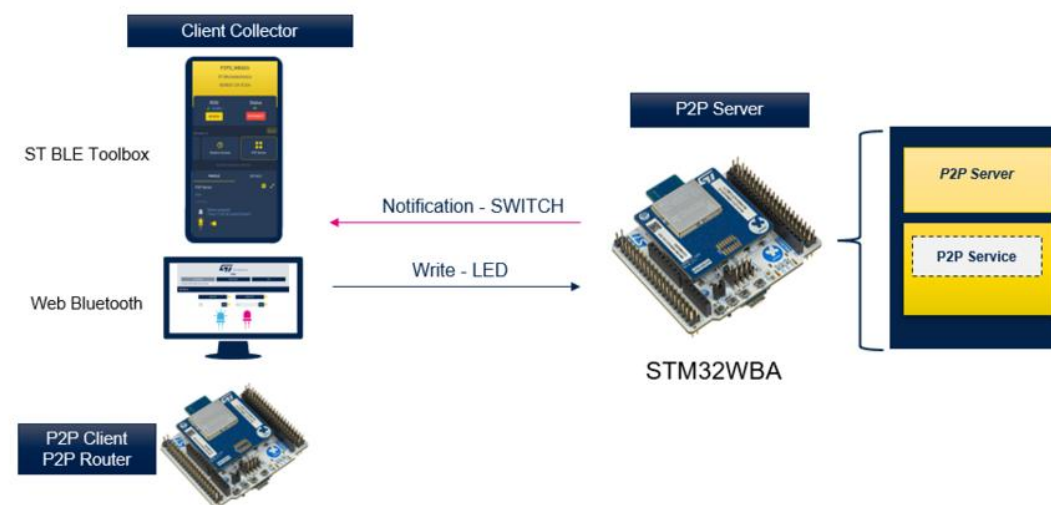
completed

start from chipset, initialize and configure BLE server application

#1 initialize your HW 🖱️

#2 configure & **understand** BLE settings (**Adv**, **service**, **characteristic**) 🧠 🖱️

#2 modify application code & build 🖱️



Our technology starts with You



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