Welcome to

STM32WBA52 workshop

Hands-on #1

Build basic p2pServer application and connect

Workshop team

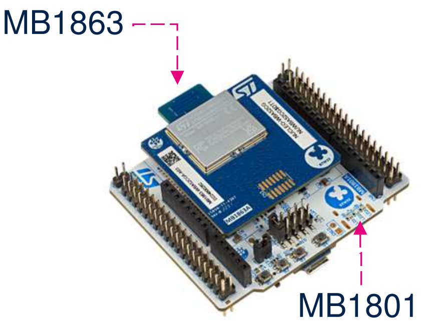
Prerequisites Refresh

SW prerequisites

- STM32CubeWBA MCU package (v1.2.0)
- IDE: STM32CubeIDE (1.14.0)
- A serial terminal (e.g. TeraTerm)
- ST BLE ToolBox Smartphone application
- Dedicated "cheat sheet"

HW prerequisites

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



ST BLE Toolbox

Agenda

1 Hands-on presentation

2 Step 1: STM32CubeMX/STM32CubeIDE initialization for STM32WBA Nucleo board

3 Step2 : Advertising and BLE application configuration and explanation

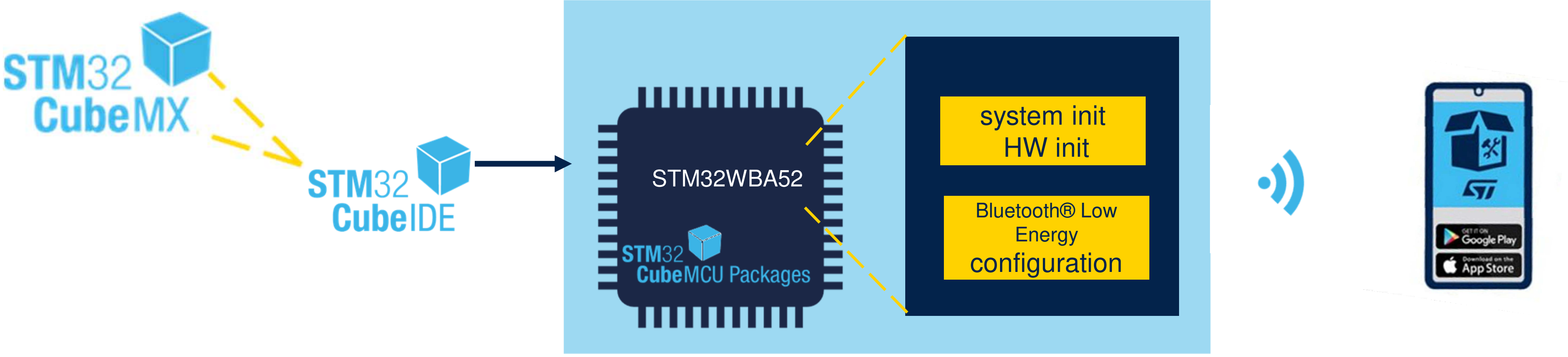
4 Step 3 : Code generation and user application code

5 “bonus track” : Adding logs

Hands-on presentation

Purpose

- The purpose is to start from WBA52 chipset level and build a basic server (p2pServer) application using STM32CubeMX/STM32CubeIDE
- In this first part, focus is to get device visible and connectable from my smartphone

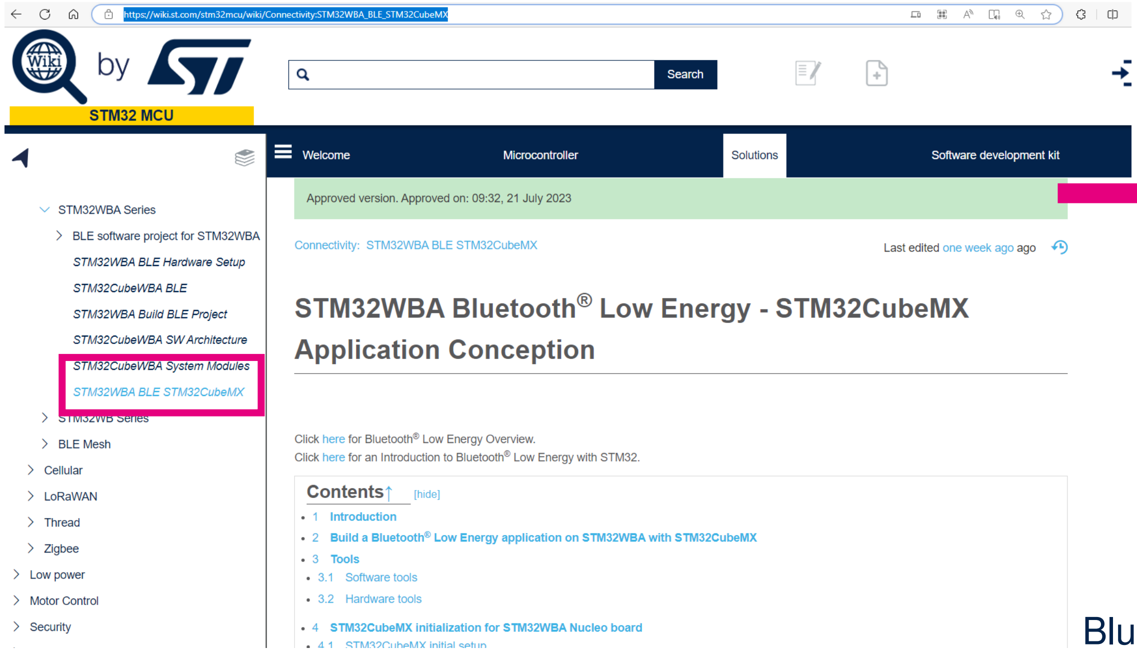


Bluetooth® Low Energy peripheral advertising

Unpack NUCLEO-WBA52, plug to laptop,
install your favorite ST BLE ToolBox App and Let’s start !

Source

Hands-on based on
https://wiki.st.com/stm32mcu/wiki/Connectivity:STM32WBA_BLE_STM32CubeMX


https://wiki.st.com/stm32mcu/wiki/Connectivity:STM32WBA_BLE_STM32CubeMX
by
STM32 MCU
Search
Welcome
Microcontroller
Solutions
Software development kit
STM32WBA Series
BLE software project for STM32WBA
STM32WBA BLE Hardware Setup
STM32CubeWBA BLE
STM32WBA Build BLE Project
STM32CubeWBA SW Architecture
STM32CubeWBA System Modules
STM32WBA BLE STM32CubeMX
STM32WB Series
BLE Mesh
Cellular
LoRaWAN
Thread
Zigbee
Low power
Motor Control
Security

Approved version. Approved on: 09:32, 21 July 2023

Connectivity: STM32WBA BLE STM32CubeMX

Last edited one week ago ago

STM32WBA Bluetooth® Low Energy - STM32CubeMX Application Conception

Click here for Bluetooth® Low Energy Overview.
Click here for an Introduction to Bluetooth® Low Energy with STM32.

Contents [hide]

- 1 Introduction
- 2 Build a Bluetooth® Low Energy application on STM32WBA with STM32CubeMX
- 3 Tools
  - 3.1 Software tools
  - 3.2 Hardware tools
- 4 STM32CubeMX initialization for STM32WBA Nucleo board
  - 4.1 STM32CubeMX initial setup

step by step guideline to build a Bluetooth® Low Energy peripheral application

Bluetooth® Low Energy peripheral exposing data to central device

Legend

- Slides including following symbol are purely theoretical ones

- Source code for development is included inside blue boxes

```
HAL_Delay(500);
```

Step 1 : STM32CubeMX initialization for STM32WBA Nucleo board

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STM32CubeMX capabilities

STM32CubeMX : “Standalone version” or “integrated version” into STM32CubeIDE allow to start design within 3 options

1 **Example application**
complete application running over NUCLEO

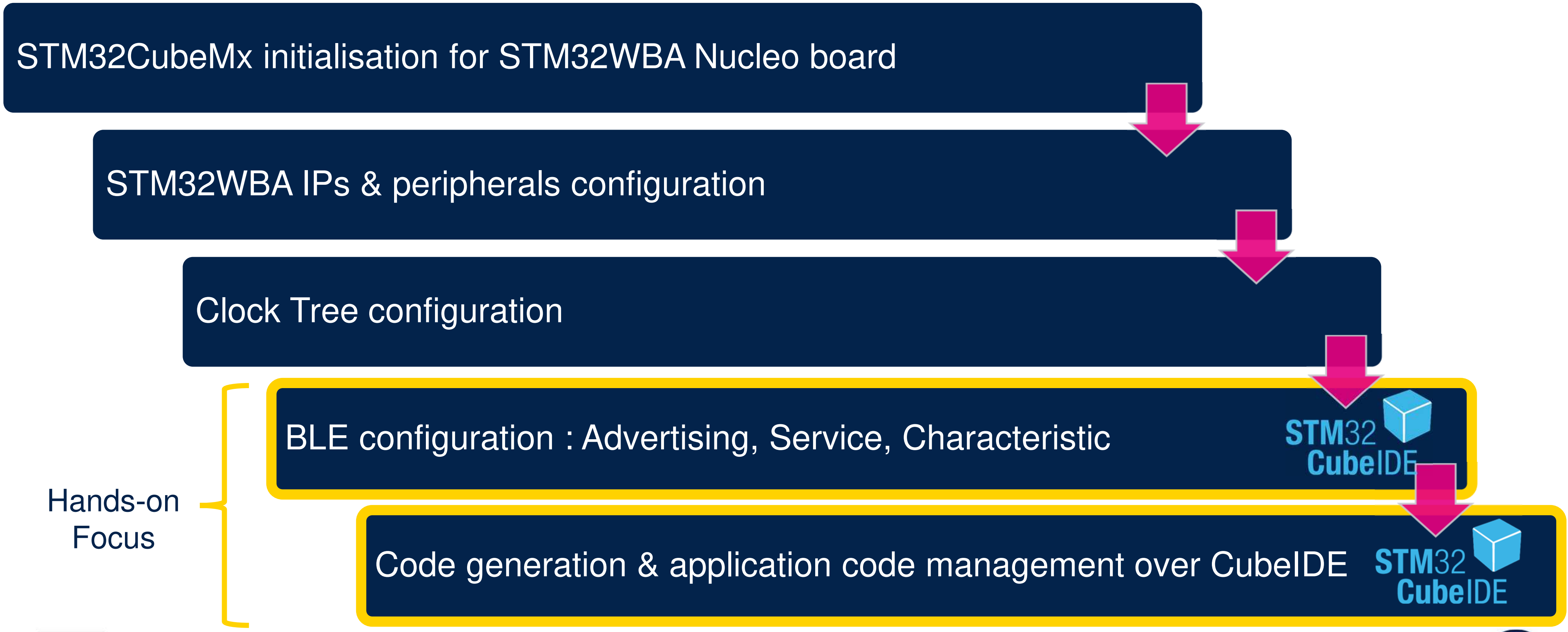
2 **Board level**
all the hardware is already configured (NUCLEO_WBA52)

3 **Chipset level**
require to configure your HW (PCB) & your application → STM32WBA wiki page focus

Hands-on focus. As customer let’s build my own App

STM32CubeMX can be standalone application but also part of STM32CubeIDE

STM32CubeMX design from chipset level complete journey



STM32CubeMx initialisation for STM32WBA Nucleo board

STM32WBA IPs & peripherals configuration

Clock Tree configuration

BLE configuration : Advertising, Service, Characteristic

Code generation & application code management over CubeIDE

Hands-on Focus

STM32CubeMx design from chipset level
Hands-on focus (1/2)

3

Chipset level
require to configure your HW (PCB) & your application

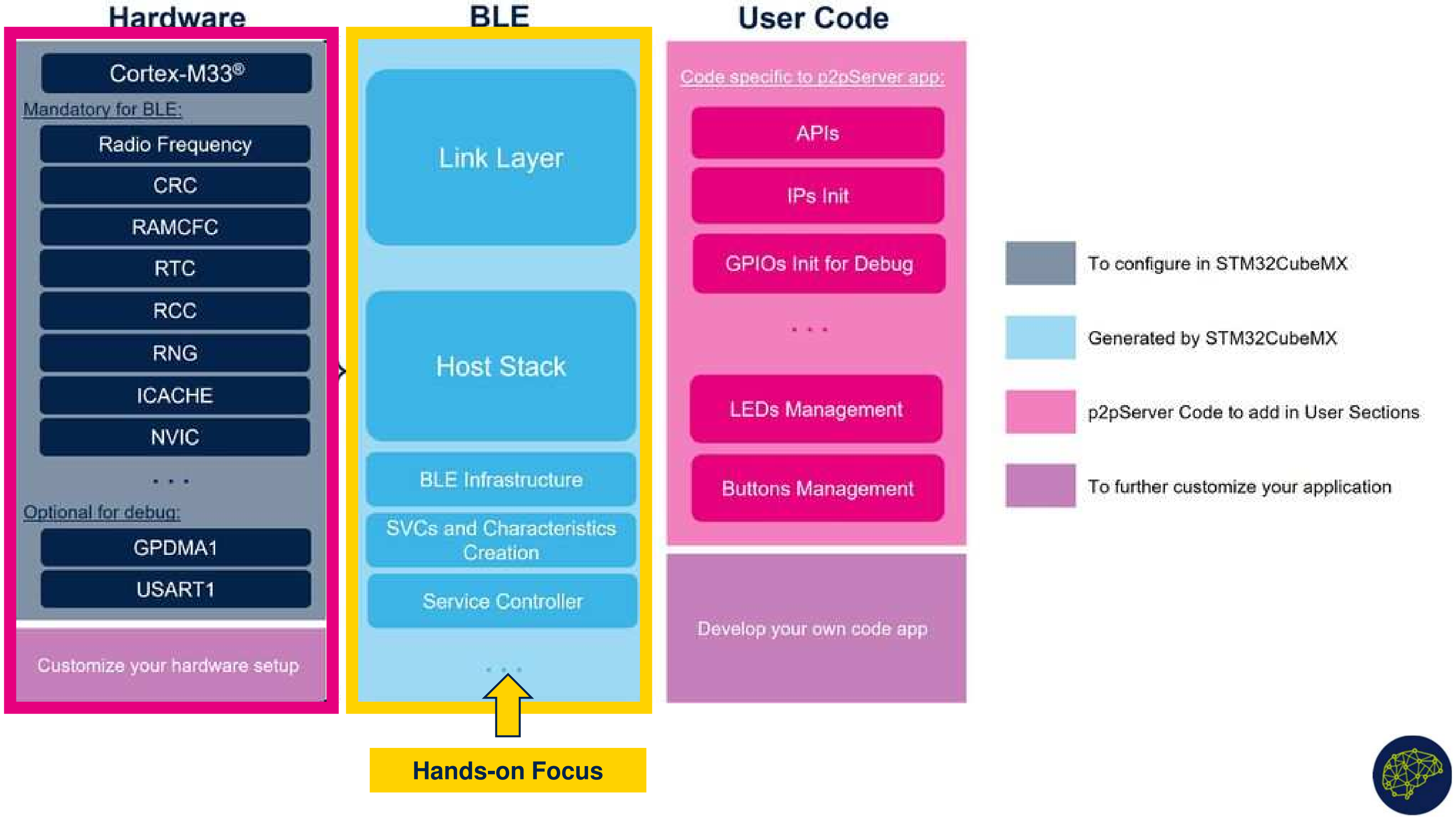
To ease Hands-on session use Hands-on_WS_WBA52.ioc
All HW IPs & required peripheral to use RF are already initialized : NVIC, RNG, RCC,...
Thanks to Hands-on_WS_WBA52.ioc let’s focus on BLE application design

↓

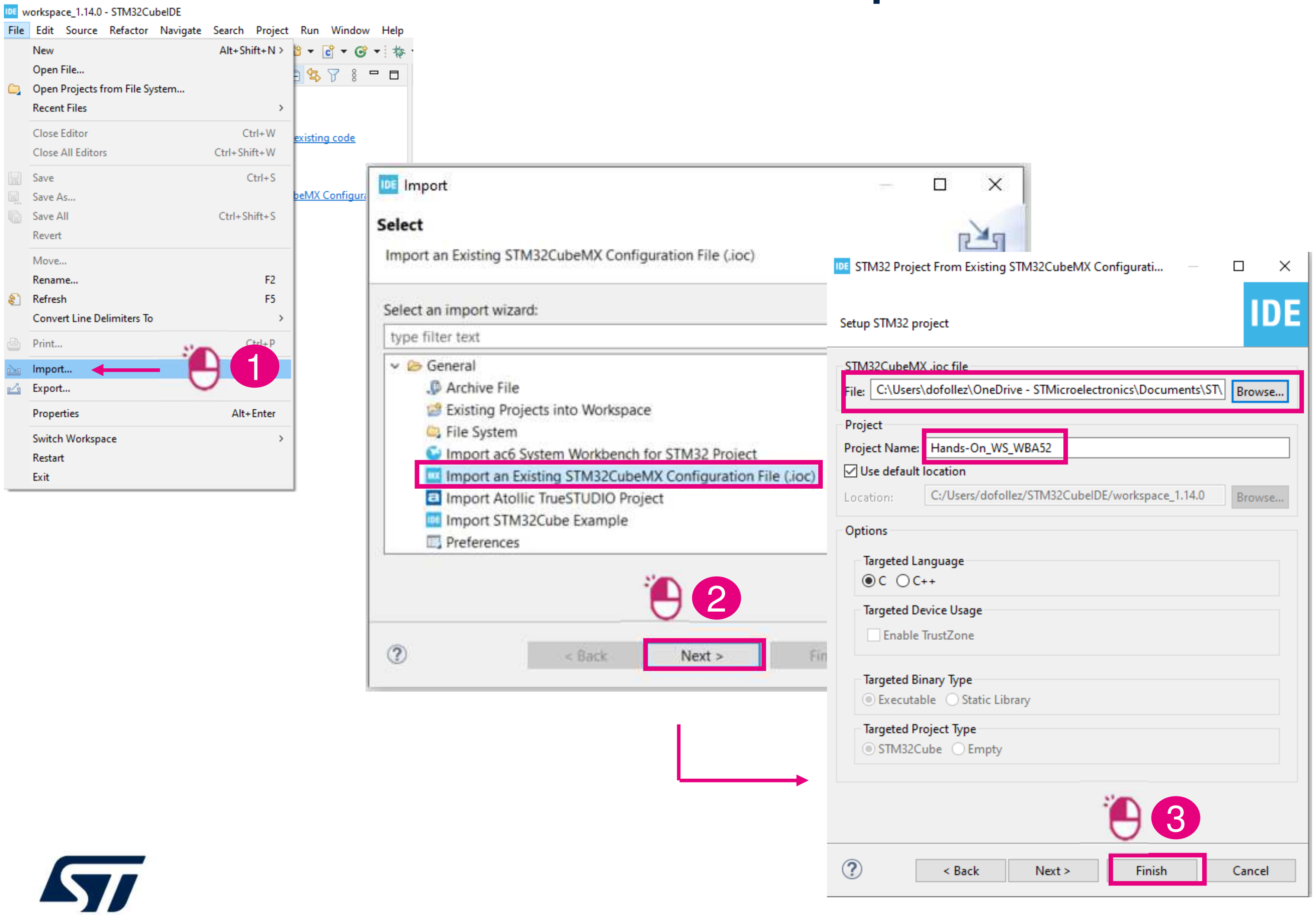
Copy Hands-on_WS_WBA52.ioc on your local repository :
example : C:\users\...\STM32WBA_WS\project

STM32CubeMx design from chipset level Hands-on focus (2/2)

Hands-On_WS_WBA52.ioc



Open and Start STM32CubeIDE


workspace_1.14.0 - STM32CubeIDE
File Edit Source Refactor Navigate Search Project Run Window Help
New Alt+Shift+N
Open File...
Open Projects from File System...
Recent Files
Close Editor Ctrl+W
Close All Editors Ctrl+Shift+W
Save Ctrl+S
Save As...
Save All Ctrl+Shift+S
Revert
Move...
Rename... F2
Refresh F5
Convert Line Delimiters To
Print... Ctrl+P
Import...
Export...
Properties Alt+Enter
Switch Workspace
Restart
Exit
existing code
beMX Configura
1
Import
Select
Import an Existing STM32CubeMX Configuration File (.ioc)
Select an import wizard:
type filter text
General
Archive File
Existing Projects into Workspace
File System
Import ac6 System Workbench for STM32 Project
Import an Existing STM32CubeMX Configuration File (.ioc)
Import Atollic TrueSTUDIO Project
Import STM32Cube Example
Preferences
2
< Back
Next >
Fin
STM32 Project From Existing STM32CubeMX Configurati...
IDE
Setup STM32 project
Browse...
Browse...
3
< Back
Next >
Finish
Cancel

STM32CubeMX .ioc file

File: C:\Users\dofollez\OneDrive - STMicroelectronics\Documents\ST\

Project

Project Name: Hands-On_WS_WBA52

☑ Use default location

Location: C:/Users/dofollez/STM32CubeIDE/workspace_1.14.0

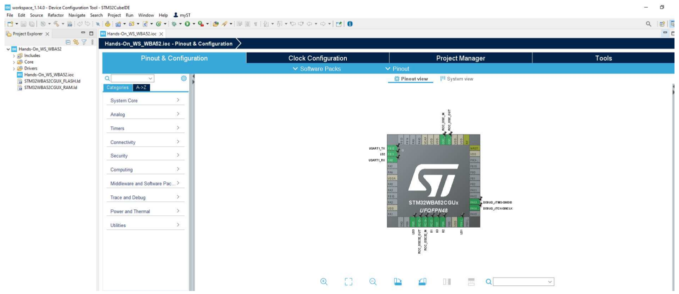
Options

Targeted Language: ● C ○ C++

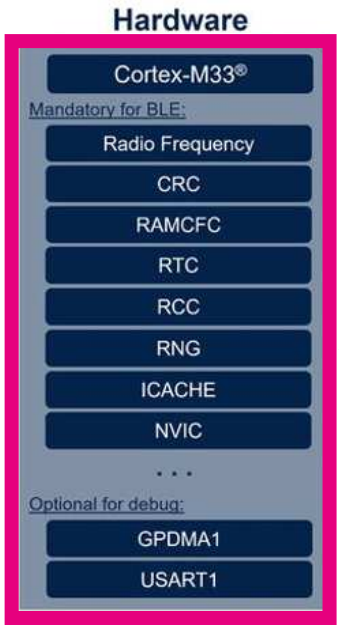
Targeted Device Usage: □ Enable TrustZone

Targeted Binary Type: ○ Executable ○ Static Library

Targeted Project Type: ○ STM32Cube ○ Empty



Peripherals in place to start BLE configuration !



Hardware

Cortex-M33®

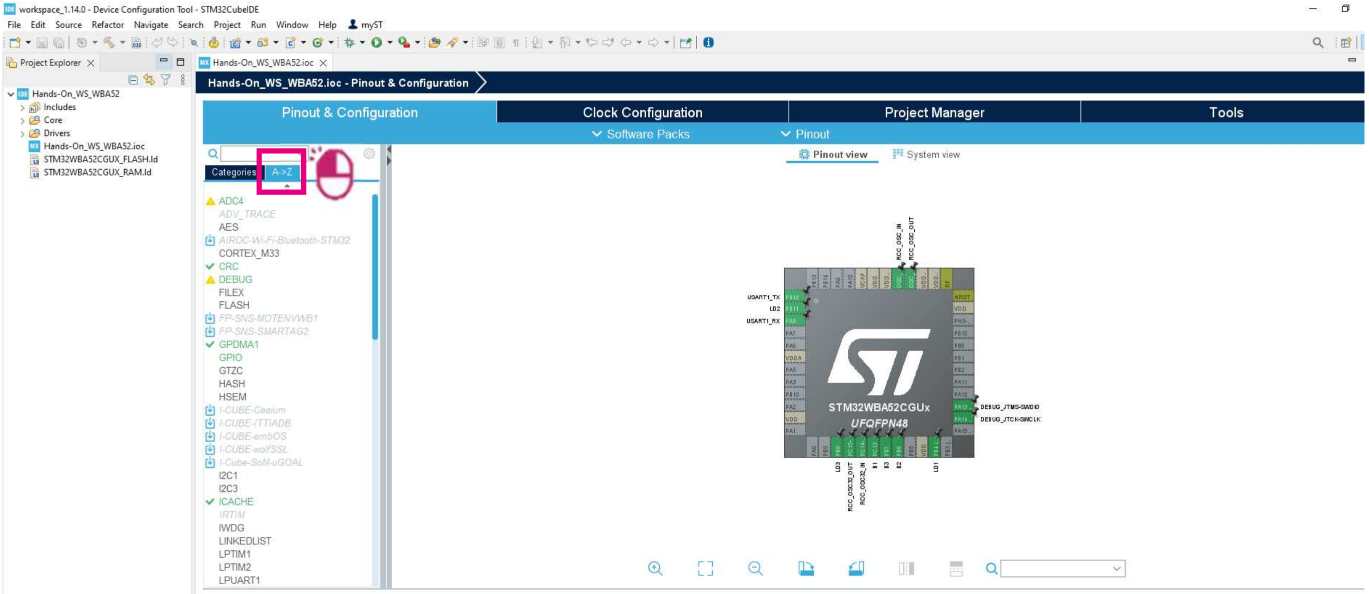
Mandatory for BLE:

- Radio Frequency
- CRC
- RAMCFC
- RTC
- RCC
- RNG
- ICACHE
- NVIC
- . . .

Optional for debug:

- GPDMA1
- USART1

⬅ Hands-On_WS_WBA52.ioc ➡

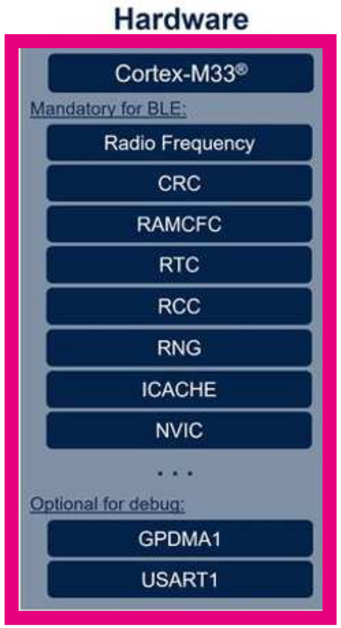


Hands-On_WS_WBA52.ioc

- HW configuraton
- enable STM32_WPAN (**BLE middleware activation**)

Peripherals in place to start BLE configuration ! Wiki explanations

https://wiki.st.com/stm32mcu/wiki/Connectivity:STM32WBA_BLE_STM32CubeMX



Hardware

Cortex-M33®

Mandatory for BLE:

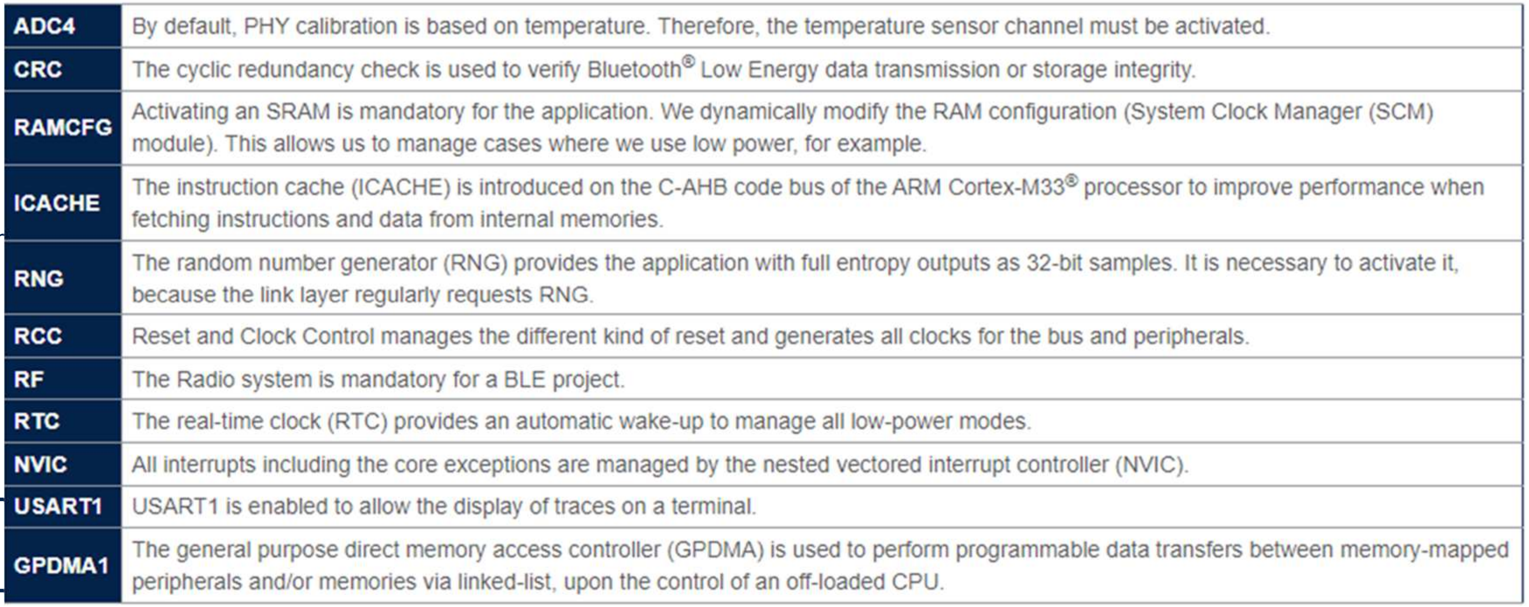
- Radio Frequency
- CRC
- RAMCFC
- RTC
- RCC
- RNG
- ICACHE
- NVIC
- . . .

Optional for debug:

- GPDMA1
- USART1

BLE activation

debug



ADC4	By default, PHY calibration is based on temperature. Therefore, the temperature sensor channel must be activated.
CRC	The cyclic redundancy check is used to verify Bluetooth® Low Energy data transmission or storage integrity.
RAMCFG	Activating an SRAM is mandatory for the application. We dynamically modify the RAM configuration (System Clock Manager (SCM) module). This allows us to manage cases where we use low power, for example.
ICACHE	The instruction cache (ICACHE) is introduced on the C-AHB code bus of the ARM Cortex-M33® processor to improve performance when fetching instructions and data from internal memories.
RNG	The random number generator (RNG) provides the application with full entropy outputs as 32-bit samples. It is necessary to activate it, because the link layer regularly requests RNG.
RCC	Reset and Clock Control manages the different kind of reset and generates all clocks for the bus and peripherals.
RF	The Radio system is mandatory for a BLE project.
RTC	The real-time clock (RTC) provides an automatic wake-up to manage all low-power modes.
NVIC	All interrupts including the core exceptions are managed by the nested vectored interrupt controller (NVIC).
USART1	USART1 is enabled to allow the display of traces on a terminal.
GPDMA1	The general purpose direct memory access controller (GPDMA) is used to perform programmable data transfers between memory-mapped peripherals and/or memories via linked-list, upon the control of an off-loaded CPU.

Step2 : Advertising and Bluetooth® Low Energy GAP/GATT custom application configuration

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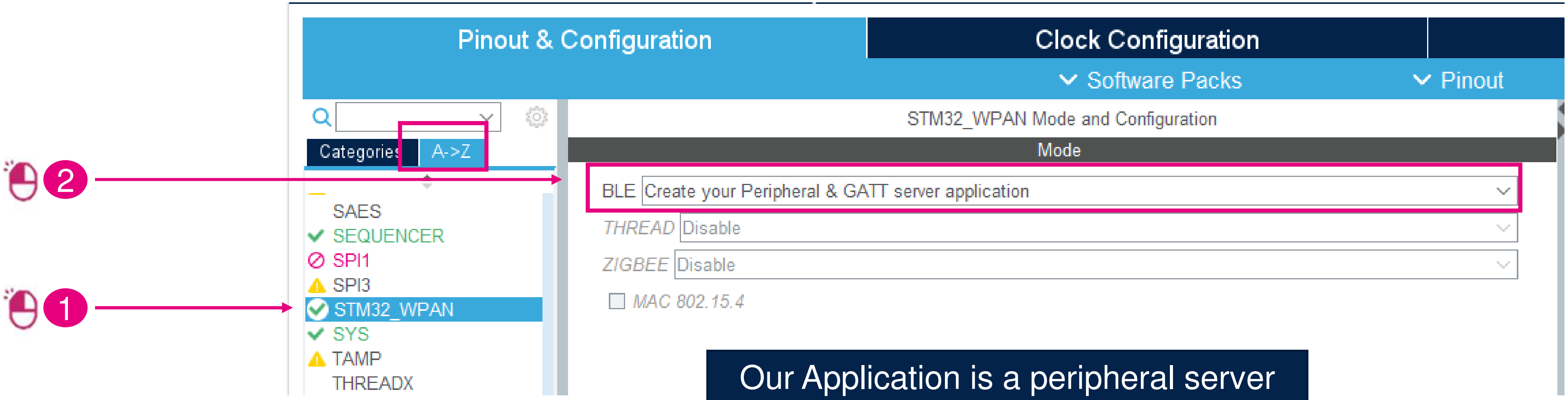
Enabling Bluetooth® Low Energy



2

1

STM32_WPAN Mode and Configuration

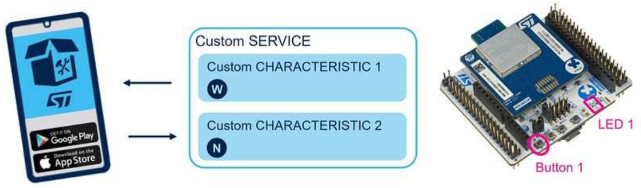
BLE Create your Peripheral & GATT server application

THREAD Disable

ZIGBEE Disable

□ MAC 802.15.4

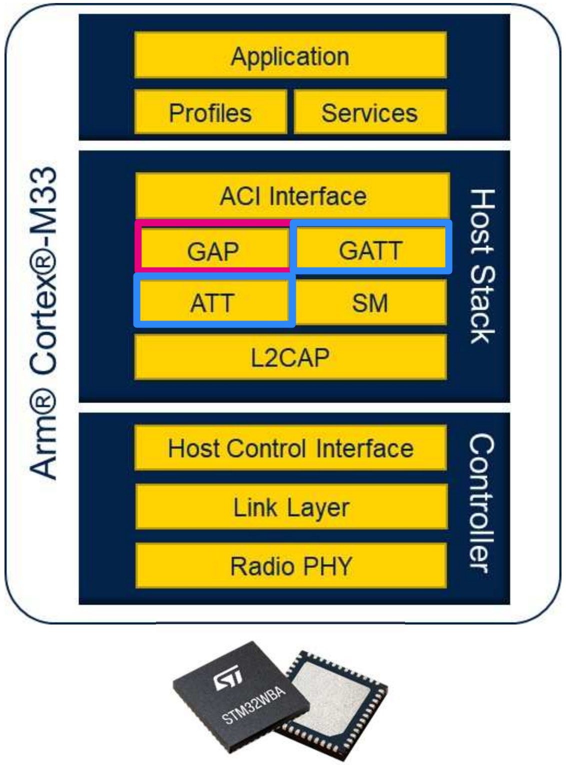
Our Application is a peripheral server application.

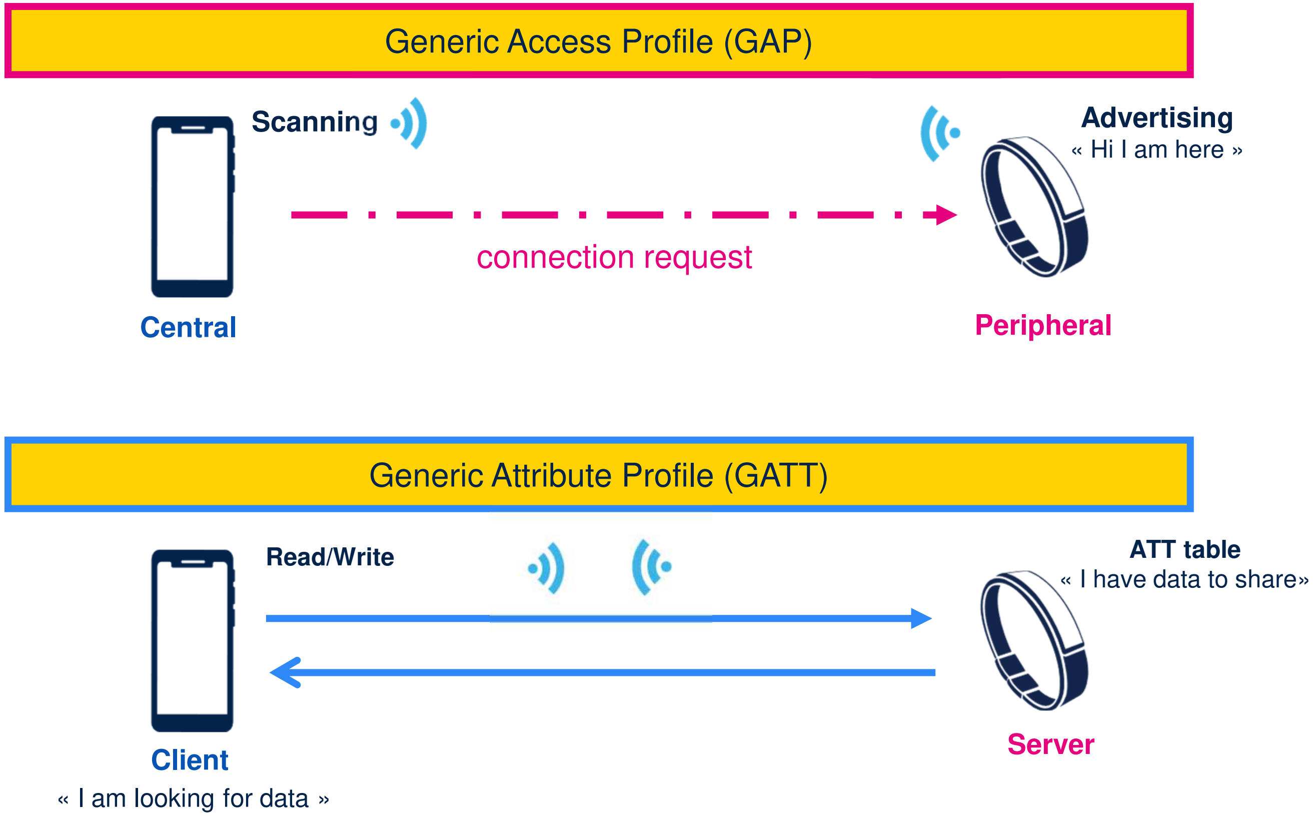


Client

Server

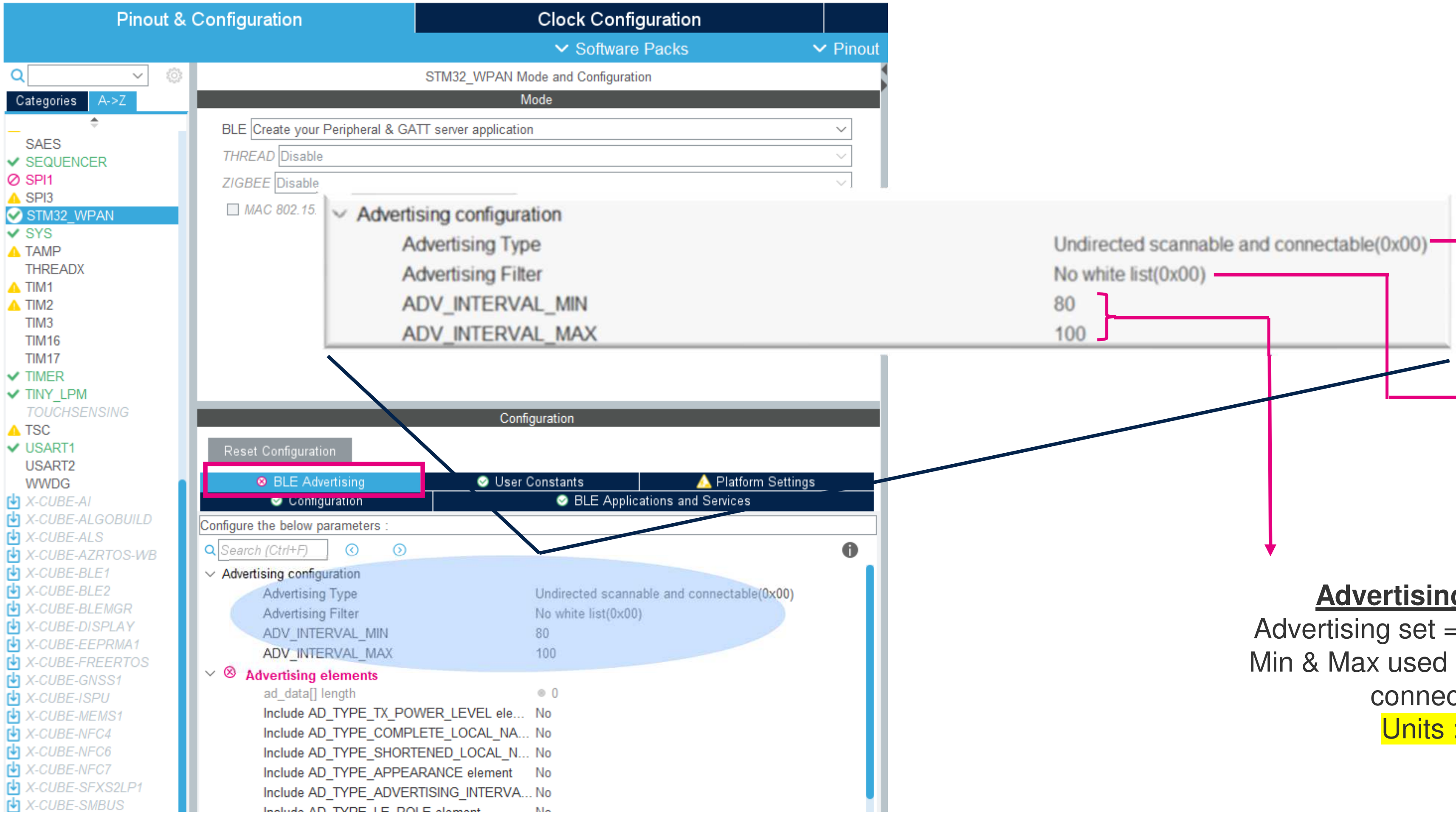
Bluetooth® Low Energy Connection roles vs. Data roles





In the general run of things….
a Central is acting as GATT Client, a peripheral as a GATT server

Advertising Configuration



BLE: Create your Peripheral & GATT server application

THREAD: Disable

ZIGBEE: Disable

□ MAC 802.15.

Advertising configuration

Advertising Type	Undirected scannable and connectable(0x00)
Advertising Filter	No white list(0x00)
ADV_INTERVAL_MIN	80
ADV_INTERVAL_MAX	100

Configure the below parameters :

Advertising configuration

Advertising Type	Undirected scannable and connectable(0x00)
Advertising Filter	No white list(0x00)
ADV_INTERVAL_MIN	80
ADV_INTERVAL_MAX	100

Advertising elements

ad_data[] length	0
Include AD_TYPE_TX_POWER_LEVEL ele...	No
Include AD_TYPE_COMPLETE_LOCAL_NA...	No
Include AD_TYPE_SHORTENED_LOCAL_N...	No
Include AD_TYPE_APPEARANCE element	No
Include AD_TYPE_ADVERTISING_INTERVA...	No
Include AD_TYPE_LE_ROLE element	No

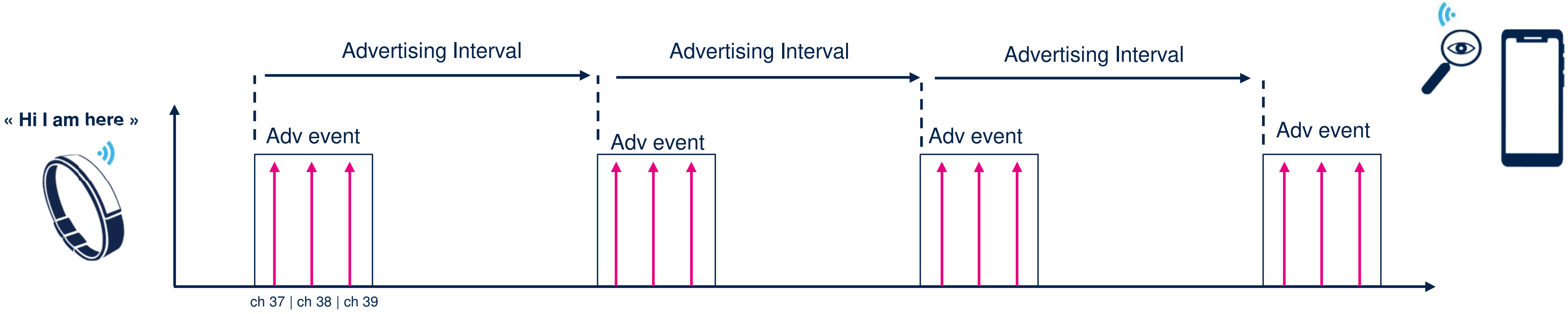
Advertising Type
accept connection
requests from any peer
device

Advertising Filter
In general, used in
case of Privacy.

Advertising Interval
Advertising set = (MIN+MAX)/2
Min & Max used in case of multi
connections
Units : **ms**

For this session, let's keep default values at this stage

Advertising Configuration
Legacy Advertising Interval

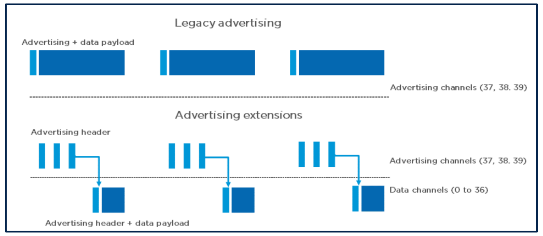


- The advertising interval value ranges all the way from **20** milliseconds up to **10.24** seconds in small increments of **625** microseconds.
- The advertising interval greatly impacts battery life and should be chosen carefully.

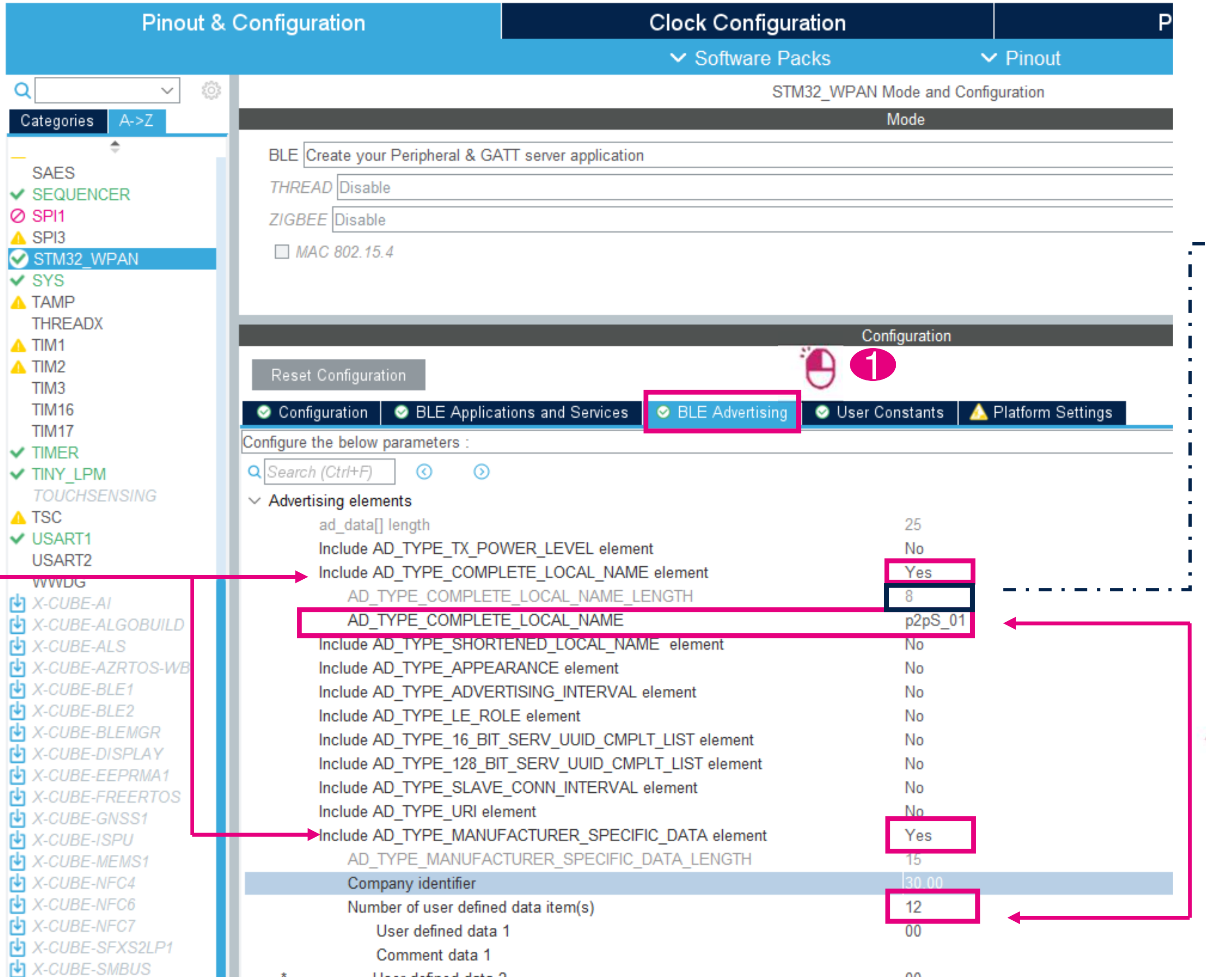
connectivity latency vs. power consumption efficiency

- The advertising event is the slot where peripheral will be able to push for advertising data “Hello I am here – this is my name”
- The advertising event is around ~**3ms** considering legacy advertising (31 bytes)

WBA5x supporting advertising extension to increase your advertising data
Thanks to adv extension , Periodic advertising supported


Legacy advertising
Advertising + data payload
Advertising channels (37, 38. 39)
Advertising extensions
Advertising header
Advertising channels (37, 38. 39)
Data channels (0 to 36)
Advertising header + data payload

Advertising Elements Local Name



STM32_WPAN Mode and Configuration

BLE Create your Peripheral & GATT server application

THREAD Disable

ZIGBEE Disable

☐ MAC 802.15.4

Configure the below parameters :

Advertising elements

ad_data[] length	25
Include AD_TYPE_TX_POWER_LEVEL element	No
Include AD_TYPE_COMPLETE_LOCAL_NAME element	Yes
AD_TYPE_COMPLETE_LOCAL_NAME_LENGTH	8
AD_TYPE_COMPLETE_LOCAL_NAME	p2pS_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_LIST element	No
Include AD_TYPE_128_BIT_SERV_UUID_CMPLT_LIST element	No
Include AD_TYPE_SLAVE_CONN_INTERVAL element	No
Include AD_TYPE_URI element	No
Include AD_TYPE_MANUFACTURER_SPECIFIC_DATA element	Yes
AD_TYPE_MANUFACTURER_SPECIFIC_DATA_LENGTH	15
Company identifier	30 00
Number of user defined data item(s)	12
User defined data 1	00
Comment data 1	
User defined data 2	00

Local Name length = Local name + 1

As a server, our application will have to advertise waiting for connection request from a client.

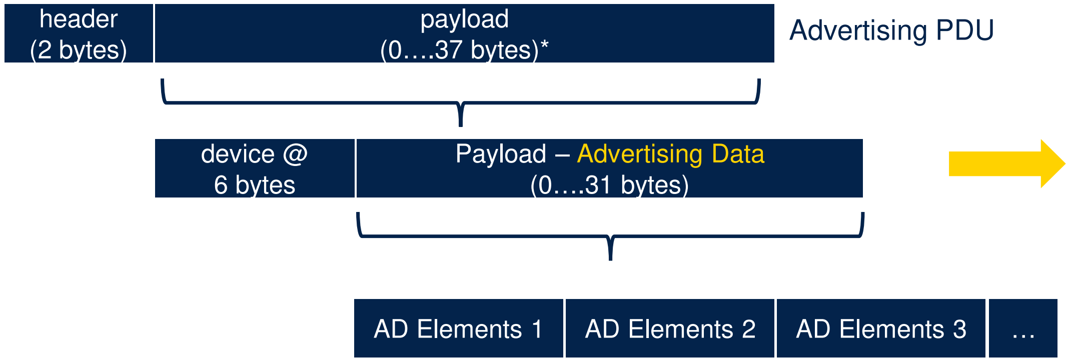
Define here your “custom” local name part of advertising frame.

Local Name length must be < 11
CubeMx contraints

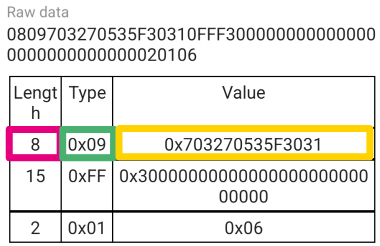
If not ST Toolbox potential crash

A0

Advertising Elements
Advertising PDU

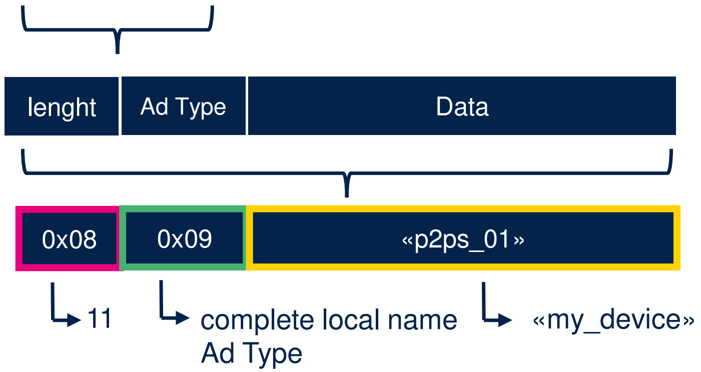


The Advertising Data consists of one or more Advertising Data elements
AD Element/Type are listed at Bluetooth SIG website



Raw data
0809703270535F30310FFF300000000000000000000000000020106

Length	Type	Value
8	0x09	0x703270535F3031
15	0xFF	0x3000000000000000000000000000
2	0x01	0x06



Most commonly used AD elements :

- 0x01 = Flags (**mandatory for connectable device**)
- 0x09 = Complete Local Name
- 0xFF = Manufacturer Data

You can push for what you want over the air ! All data need to be prefix using dedicated Ad Type

* up to 37 bytes in legacy advertising , up to 1650 in case of advertising extension (packet of 250 chained)

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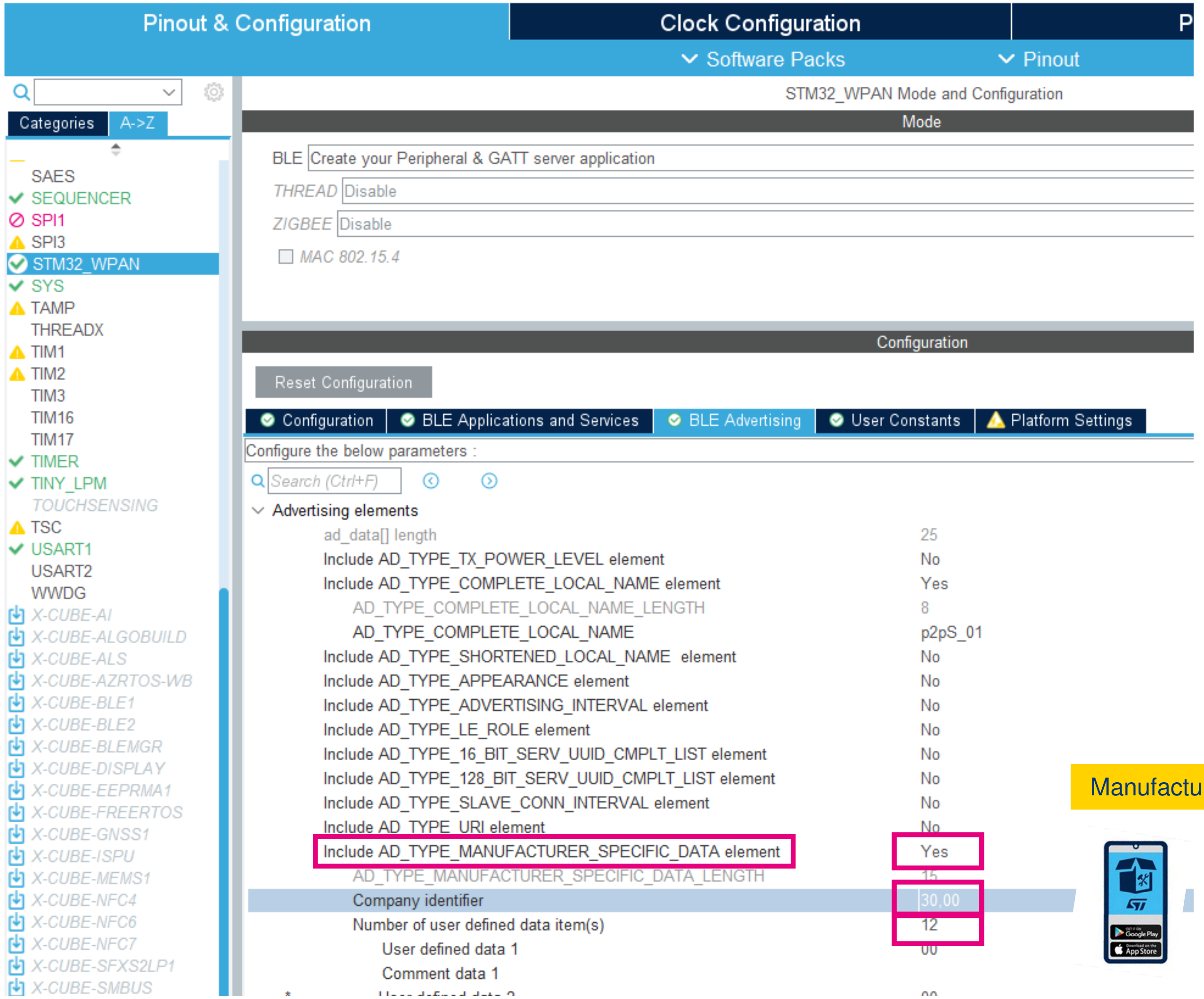
Slide 22

A0 Shall we open for scan rsp ? (adding complexity

Author; 2023-08-09T16:02:28.992

Advertising Elements Manufacturer Data



STM32_WPAN Mode and Configuration

Mode

BLE Create your Peripheral & GATT server application

THREAD Disable

ZIGBEE Disable

□ MAC 802.15.4

Configuration

Configure the below parameters :

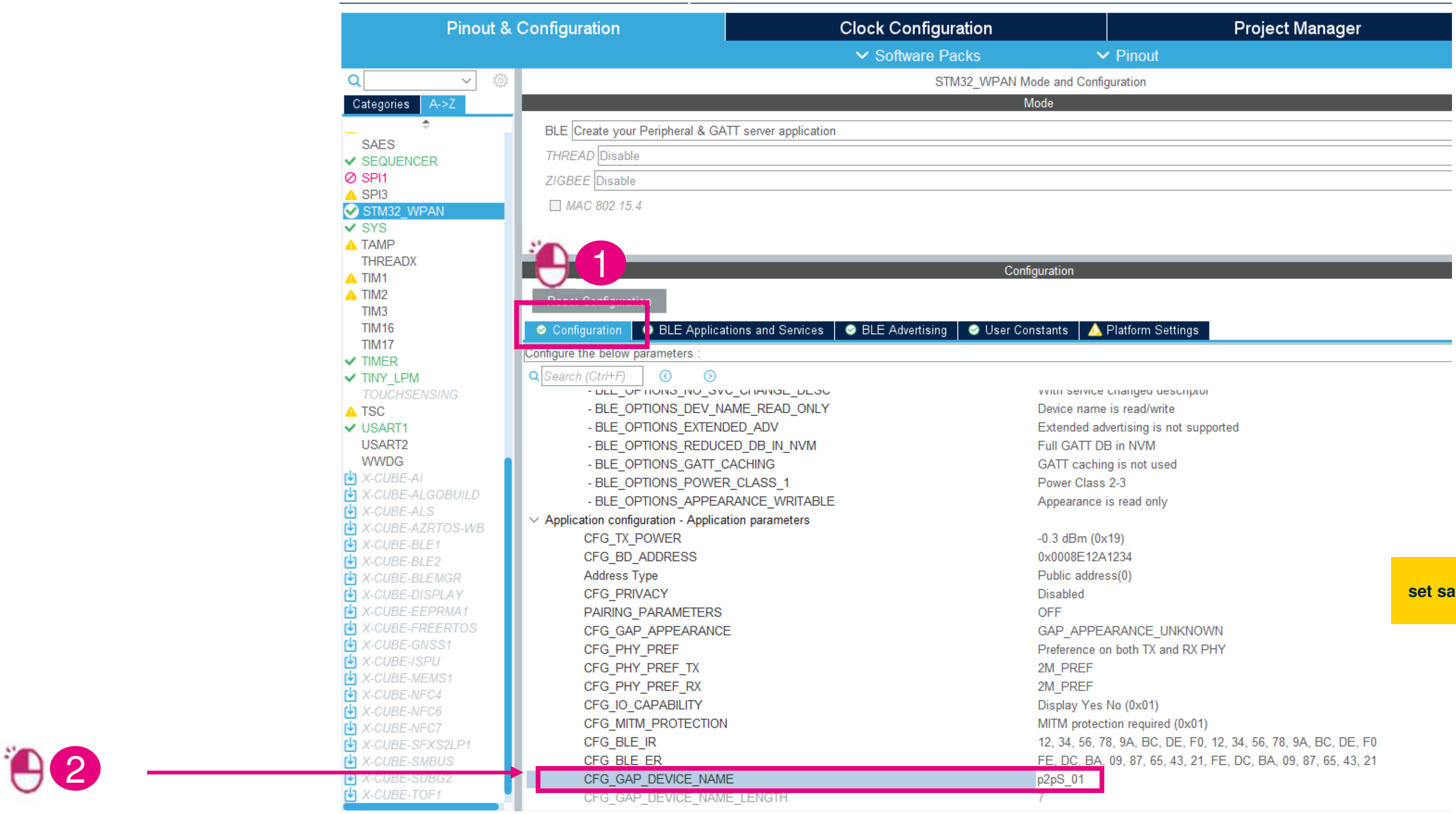
Advertising elements

ad_data[] length	25
Include AD_TYPE_TX_POWER_LEVEL element	No
Include AD_TYPE_COMPLETE_LOCAL_NAME element	Yes
AD_TYPE_COMPLETE_LOCAL_NAME_LENGTH	8
AD_TYPE_COMPLETE_LOCAL_NAME	p2pS_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_LIST element	No
Include AD_TYPE_128_BIT_SERV_UUID_CMPLT_LIST element	No
Include AD_TYPE_SLAVE_CONN_INTERVAL element	No
Include AD_TYPE_URI element	No
Include AD_TYPE_MANUFACTURER_SPECIFIC_DATA element	Yes
AD_TYPE_MANUFACTURER_SPECIFIC_DATA_LENGTH	15
Company identifier	30,00
Number of user defined data item(s)	12
User defined data 1	00
Comment data 1	
User defined data 2	00

Manufacturer Ad Type , with company ID 0x30 (STMicroelectronics)

Allow to detect device as an ST device and to connect as P2P profile

Customize Device Name



STM32_WPAN Mode and Configuration

BLE Create your Peripheral & GATT server application

THREAD Disable

ZIGBEE Disable

□ MAC 802.15.4

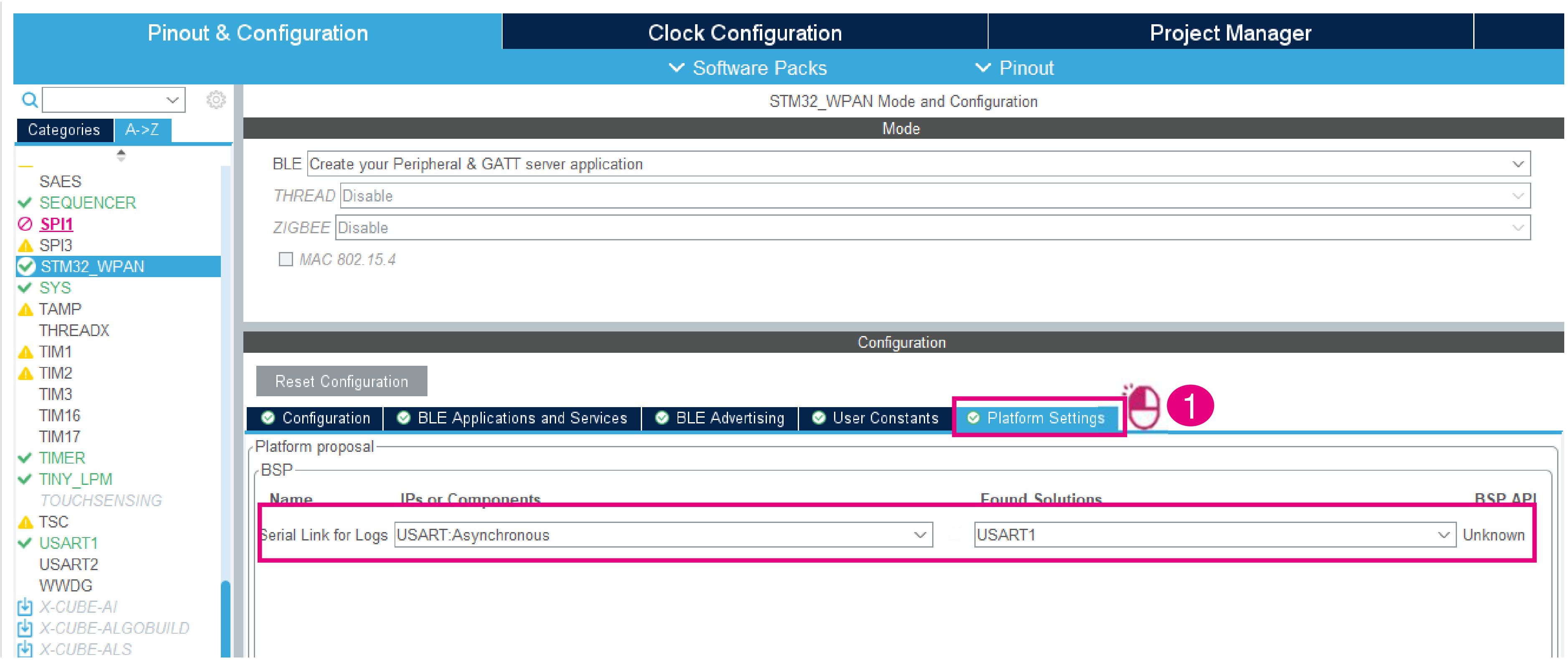
Configure the below parameters :

```
    - BLE_OPTIONS_NO_SVC_CHANGE_DESC               With service changed descriptor
    - BLE_OPTIONS_DEV_NAME_READ_ONLY               Device name is read/write
    - BLE_OPTIONS_EXTENDED_ADV                     Extended advertising is not supported
    - BLE_OPTIONS_REDUCED_DB_IN_NVM                Full GATT DB in NVM
    - BLE_OPTIONS_GATT_CACHING                     GATT caching is not used
    - BLE_OPTIONS_POWER_CLASS_1                    Power Class 2-3
    - BLE_OPTIONS_APPEARANCE_WRITABLE              Appearance is read only
∨ Application configuration - Application parameters
    CFG_TX_POWER                                   -0.3 dBm (0x19)
    CFG_BD_ADDRESS                                 0x0008E12A1234
    Address Type                                   Public address(0)
    CFG_PRIVACY                                    Disabled
    PAIRING_PARAMETERS                             OFF
    CFG_GAP_APPEARANCE                             GAP_APPEARANCE_UNKNOWN
    CFG_PHY_PREF                                   Preference on both TX and RX PHY
    CFG_PHY_PREF_TX                                2M_PREF
    CFG_PHY_PREF_RX                                2M_PREF
    CFG_IO_CAPABILITY                              Display Yes No (0x01)
    CFG_MITM_PROTECTION                            MITM protection required (0x01)
    CFG_BLE_IR                                     12, 34, 56, 78, 9A, BC, DE, F0, 12, 34, 56, 78, 9A, BC, DE, F0
    CFG_BLE_ER                                     FE, DC, BA, 09, 87, 65, 43, 21, FE, DC, BA, 09, 87, 65, 43, 21
    CFG_GAP_DEVICE_NAME                            p2pS_01
    CFG_GAP_DEVICE_NAME_LENGTH                     7
```

set same Device name = Local 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)

Platform Settings
Trace & Logs: BSP settings



STM32_WPAN Mode and Configuration

BLE Create your Peripheral & GATT server application

THREAD Disable

ZIGBEE Disable

□ MAC 802.15.4

Platform proposal

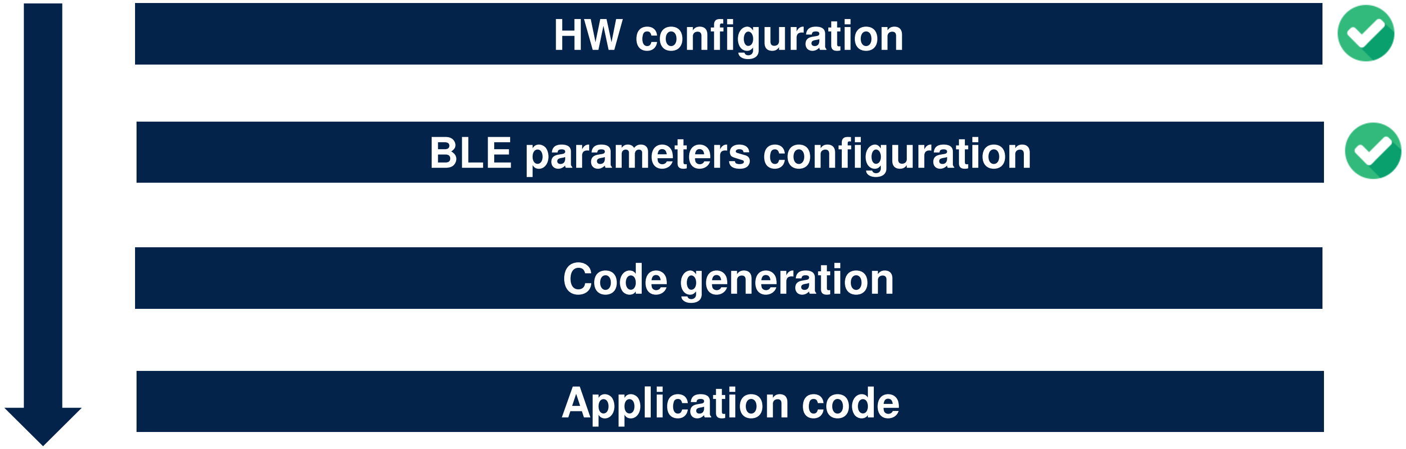
BSP

Name	IPs or Components	Found Solutions	BSP API
Serial Link for Logs	USART:Asynchronous	USART1	Unknown

Anticipate Logs activation

Logs activation would require application configuration changes

Configuration completed
What’s next : code generation ?



HW configuration ✓

BLE parameters configuration ✓

Code generation

Application code

Step 3 : Code generation and user application code

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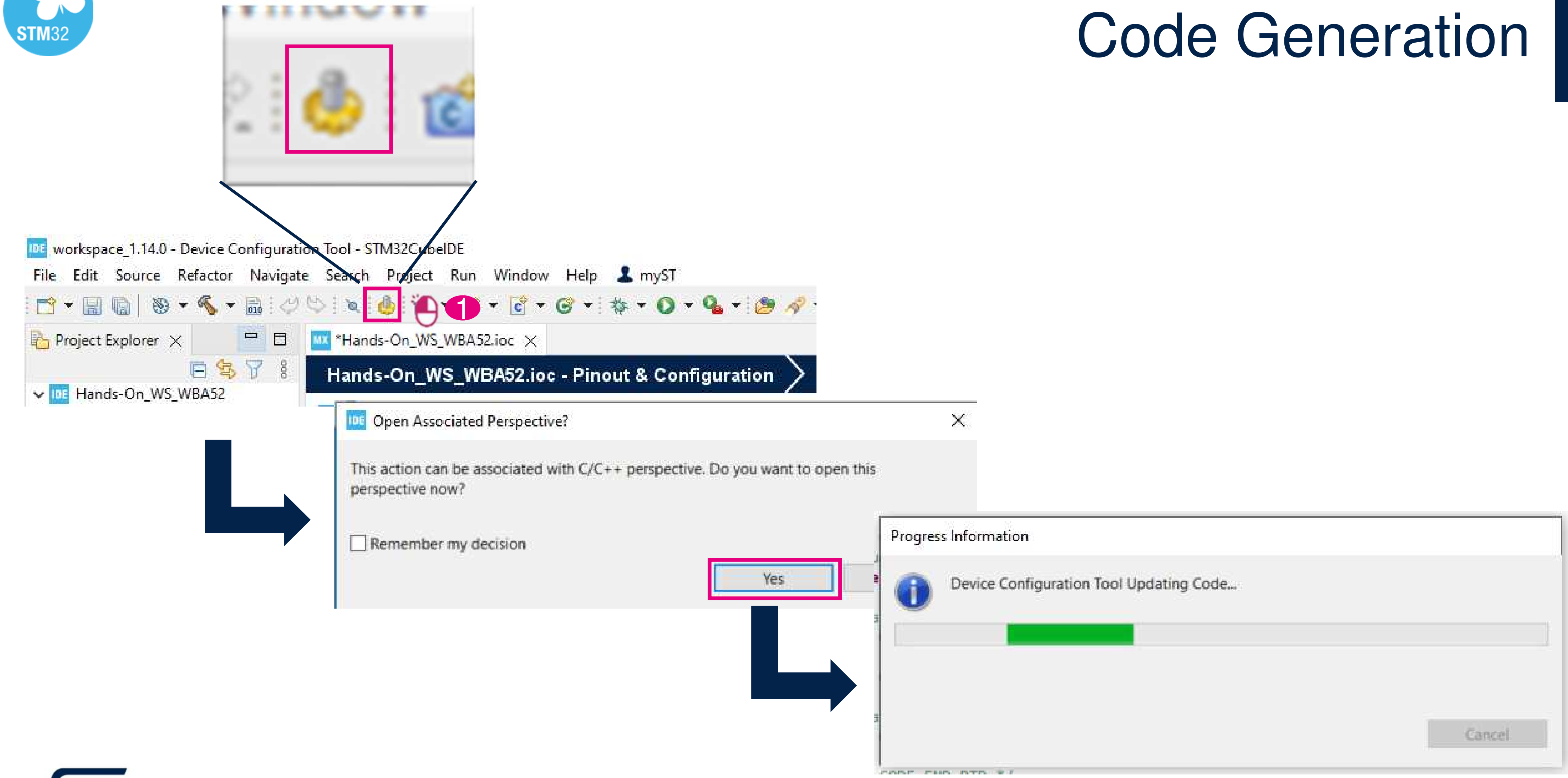
A0

Code Generation



workspace_1.14.0 - Device Configuration Tool - STM32CubeIDE

Open Associated Perspective?

This action can be associated with C/C++ perspective. Do you want to open this perspective now?

□ Remember my decision

Progress Information

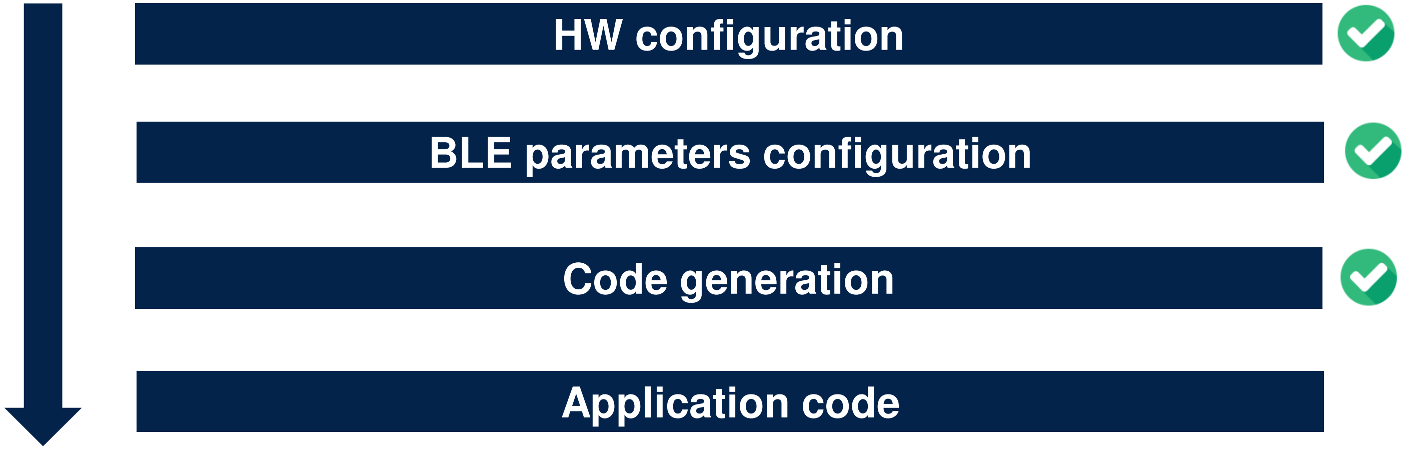
Device Configuration Tool Updating Code...

Slide 28

A0 Put a small comment also on the first two tabs

Author; 2023-08-03T11:59:22.255

Configuration completed
What’s next : code generation ?



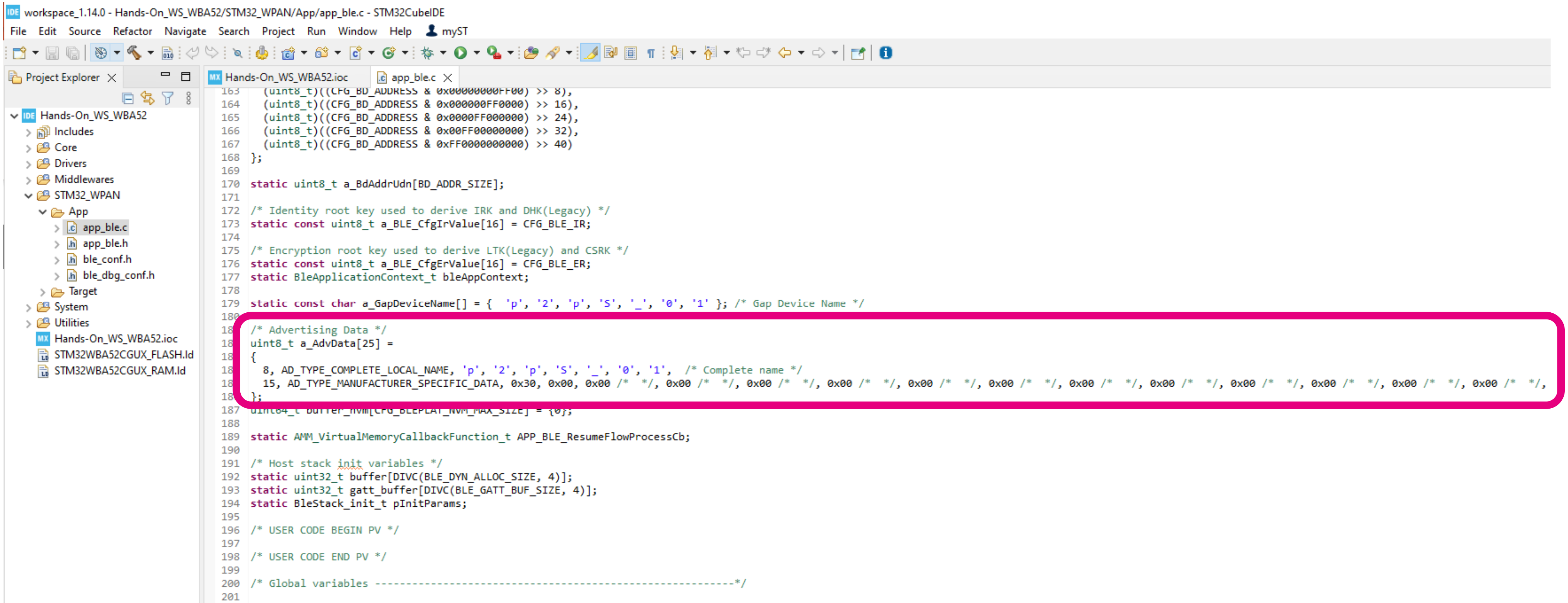
HW configuration ✓

BLE parameters configuration ✓

Code generation ✓

Application code

Here are our ADV data



```c
  (uint8_t)((CFG_BD_ADDRESS & 0x00000000FF00) >> 8),
  (uint8_t)((CFG_BD_ADDRESS & 0x000000FF0000) >> 16),
  (uint8_t)((CFG_BD_ADDRESS & 0x0000FF000000) >> 24),
  (uint8_t)((CFG_BD_ADDRESS & 0x00FF00000000) >> 32),
  (uint8_t)((CFG_BD_ADDRESS & 0xFF0000000000) >> 40)
};

static uint8_t a_BdAddrUdn[BD_ADDR_SIZE];

/* Identity root key used to derive IRK and DHK(Legacy) */
static const uint8_t a_BLE_CfgIrValue[16] = CFG_BLE_IR;

/* Encryption root key used to derive LTK(Legacy) and CSRK */
static const uint8_t a_BLE_CfgErValue[16] = CFG_BLE_ER;
static BleApplicationContext_t bleAppContext;

static const char a_GapDeviceName[] = {  'p', '2', 'p', 'S', '_', '0', '1' }; /* Gap Device Name */

/* Advertising Data */
uint8_t a_AdvData[25] =
{
  8, AD_TYPE_COMPLETE_LOCAL_NAME, 'p', '2', 'p', 'S', '_', '0', '1',  /* Complete name */
  15, AD_TYPE_MANUFACTURER_SPECIFIC_DATA, 0x30, 0x00, 0x00 /*  */, 0x00 /*  */, 0x00 /*  */, 0x00 /*  */, 0x00 /*  */, 0x00 /*  */, 0x00 /*  */, 0x00 /*  */, 0x00 /*  */, 0x00 /*  */, 0x00 /*  */, 0x00 /*  */,
};
uint64_t buffer_nvm[CFG_BLEPLAT_NVM_MAX_SIZE] = {0};

static AMM_VirtualMemoryCallbackFunction_t APP_BLE_ResumeFlowProcessCb;

/* Host stack init variables */
static uint32_t buffer[DIVC(BLE_DYN_ALLOC_SIZE, 4)];
static uint32_t gatt_buffer[DIVC(BLE_GATT_BUF_SIZE, 4)];
static BleStack_init_t pInitParams;

/* USER CODE BEGIN PV */

/* USER CODE END PV */

/* Global variables ------------------------------------------------------*/
```

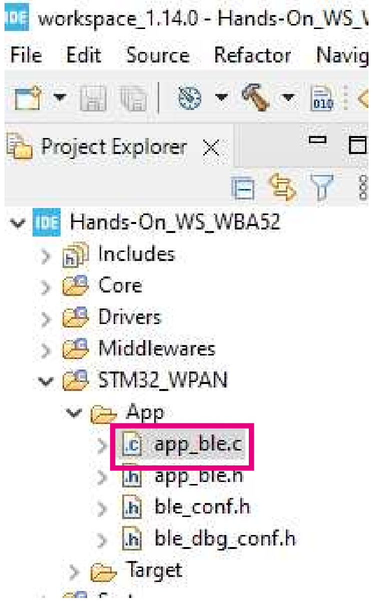
Slide 30

A0 [Mention was removed] as agreed I let you to adjust it 😊

Author; 2023-09-21T14:02:26.277

Open Project
Add application code to move to discoverable (1/2)

Set device discoverable at init :
In app_ble.c > function APP_BLE_Init()



```
/* USER CODE BEGIN APP_BLE_Init_2 */
 tBleStatus status;
 status = aci_gap_set_discoverable(ADV_TYPE, ADV_INTERVAL_MIN,ADV_INTERVAL_MAX,
                                   CFG_BD_ADDRESS_TYPE,
                                   ADV_FILTER,
                                   0, 0, 0, 0, 0, 0);
 if (status != BLE_STATUS_SUCCESS) {
     return;
 }

 status = aci_gap_delete_ad_type(AD_TYPE_TX_POWER_LEVEL);
 if (status != BLE_STATUS_SUCCESS) {
     return;
 }

 status = aci_gap_update_adv_data(sizeof(a_AdvData), (uint8_t*) a_AdvData);
 if (status != BLE_STATUS_SUCCESS) {
     return;
 }
 /* USER CODE END APP_BLE_Init_2 */
```

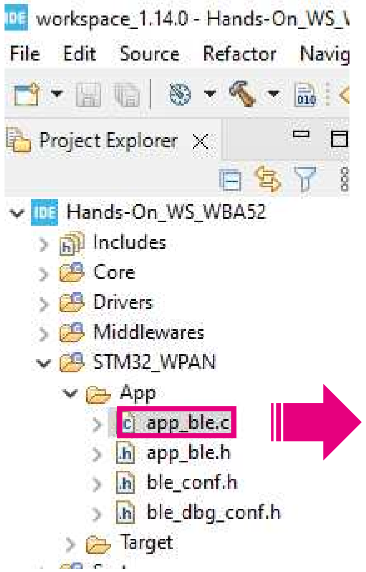
To accommodate the Advertising payload, remove the Tx power Adv Type set by stack

Search for “APP_BLE_Init_2”

Open Project → Add application code to move to discoverable → Build& Flash

Please refer to cheatsheet for copy/paste

Open Project
Add application code to move to discoverable (2/2)



Set device discoverable at disconnection :

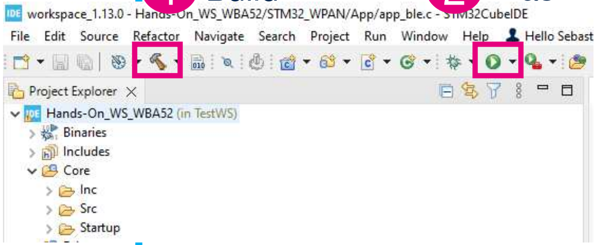
In app_ble.c > SVCCTL_App_Notification - HCI_DISCONNECTION_COMPLETE_EVT_CODE

```
/* USER CODE BEGIN EVT_DISCONN_COMPLETE */
 tBleStatus status;
 status = aci_gap_set_discoverable(ADV_TYPE, ADV_INTERVAL_MIN,ADV_INTERVAL_MAX,
                                   CFG_BD_ADDRESS_TYPE,
                                   ADV_FILTER,
                                   0, 0, 0, 0, 0, 0);
 if (status != BLE_STATUS_SUCCESS) {
     LOG_INFO_APP("==>> aci_gap_set_discoverable - fail, result: 0x%02X\n", status);
 }

 status = aci_gap_delete_ad_type(AD_TYPE_TX_POWER_LEVEL);
 if (status != BLE_STATUS_SUCCESS) {
     LOG_INFO_APP("==>> delete tx power level - fail, result: 0x%02X\n", status);
 }

 status = aci_gap_update_adv_data(sizeof(a_AdvData), (uint8_t*) a_AdvData);
 if (status != BLE_STATUS_SUCCESS) {
      LOG_INFO_APP("==>> Start Advertising Failed, result: 0x%02X\n", status);
 }
    /* USER CODE END EVT_DISCONN_COMPLETE */
```

Search for “EVT_DISCONN_COMPLETE”

1 Build

2 Flash

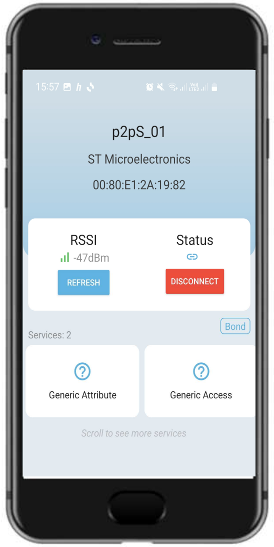

workspace_1.13.0 - Hands-On_WS_WBA52/STM32_WPAN/App/app_ble.c - STM32CubeIDE
File Edit Source Refactor Navigate Search Project Run Window Help Hello Sebast
Project Explorer
Hands-On_WS_WBA52 (in TestWS)
Binaries
Includes
Core
Inc
Src
Startup

At disconnection, stack is not moving back to advertising, this is an application decision

Open Project | Add application code to move to discoverable | Build & Flash

Please refer to cheatsheet for copy/paste

Open your “ST BLE Toolbox” App and Connect


15:57

p2pS_01

ST Microelectronics

00:80:E1:2A:19:82

RSSI
-47dBm
REFRESH

Status
DISCONNECT

Bond

Services: 2

Generic Attribute

Generic Access

Scroll to see more services

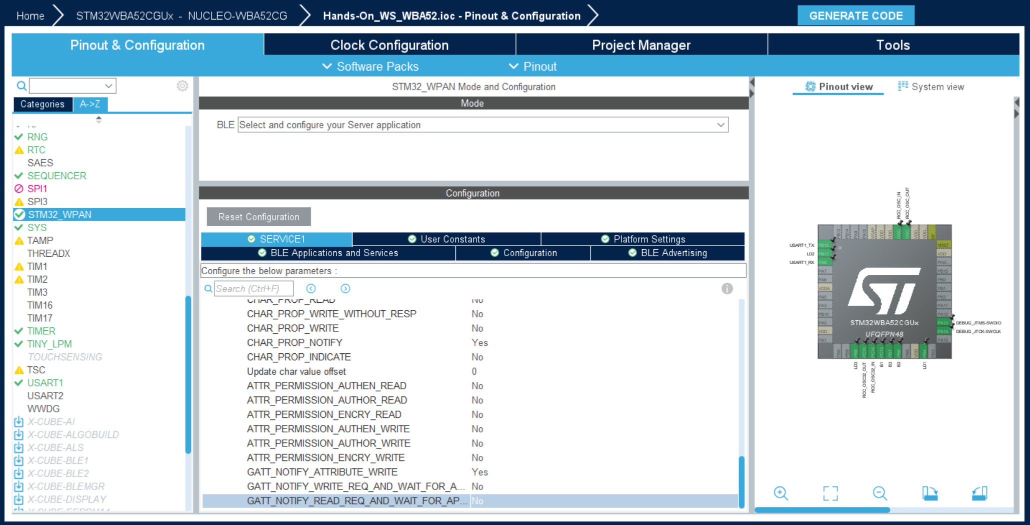
Download on the App Store

GET IT ON Google Play

Device should be visible and connectable

Bonus : Add debug capabilities

Move back to STM32CubeIDE/STM32CubeMX

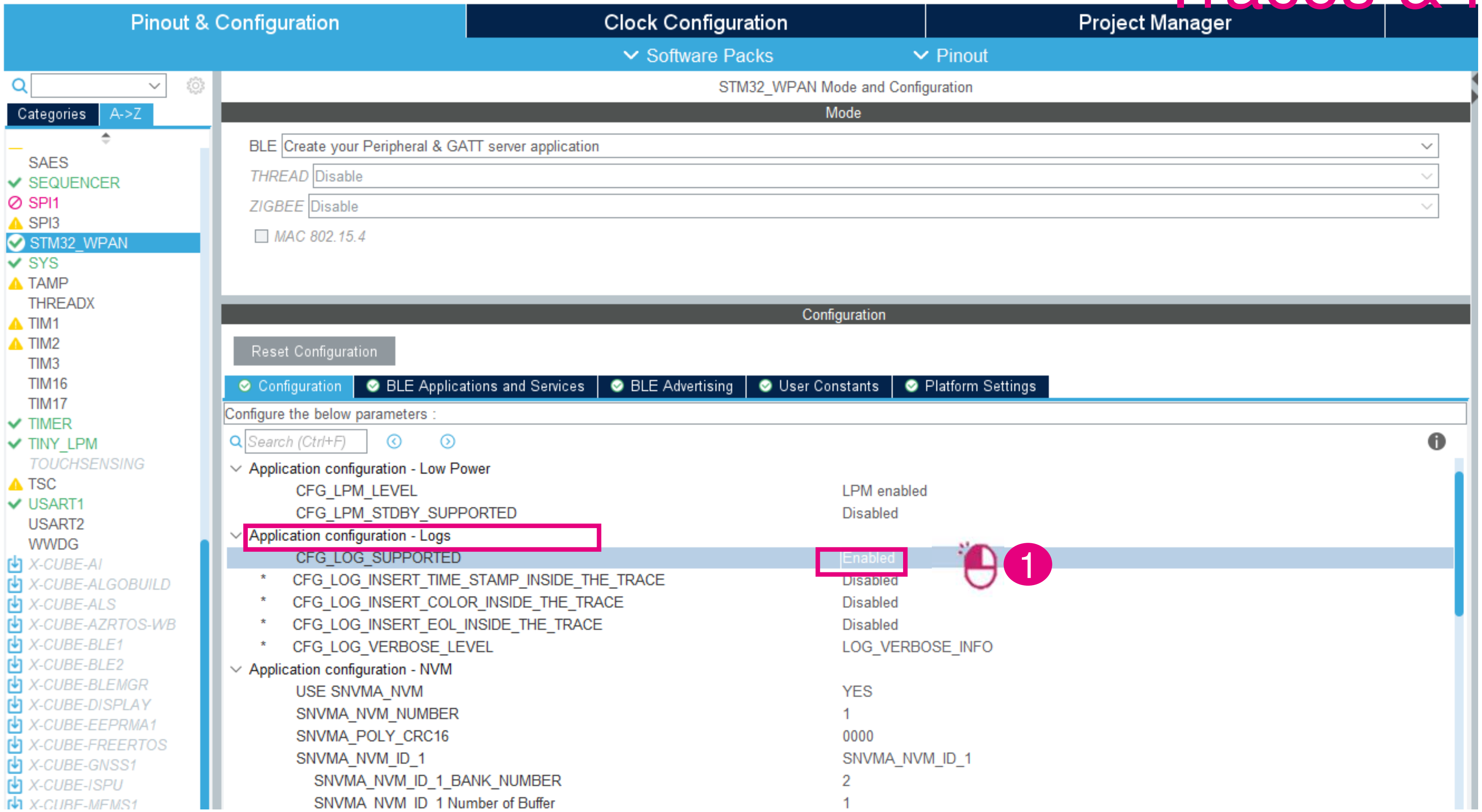


BLE: Select and configure your Server application

Configure the below parameters :

CHAR_PROP_READ	No
CHAR_PROP_WRITE_WITHOUT_RESP	No
CHAR_PROP_WRITE	No
CHAR_PROP_NOTIFY	Yes
CHAR_PROP_INDICATE	No
Update char value offset	0
ATTR_PERMISSION_AUTHEN_READ	No
ATTR_PERMISSION_AUTHOR_READ	No
ATTR_PERMISSION_ENCRY_READ	No
ATTR_PERMISSION_AUTHEN_WRITE	No
ATTR_PERMISSION_AUTHOR_WRITE	No
ATTR_PERMISSION_ENCRY_WRITE	No
GATT_NOTIFY_ATTRIBUTE_WRITE	Yes
GATT_NOTIFY_WRITE_REQ_AND_WAIT_FOR_A...	No
GATT_NOTIFY_READ_REQ_AND_WAIT_FOR_AP...	No

Application configuration
Traces & logs



STM32_WPAN Mode and Configuration

Mode

BLE Create your Peripheral & GATT server application

THREAD Disable

ZIGBEE Disable

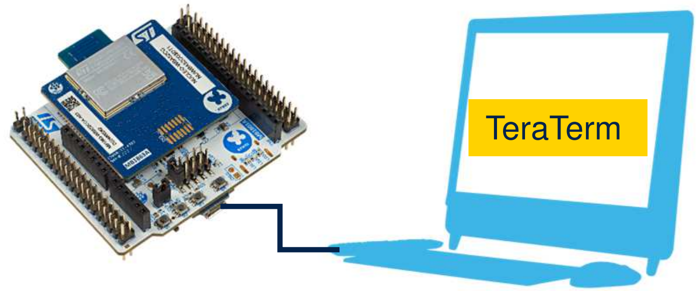
□ MAC 802.15.4

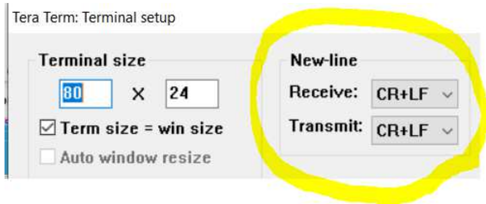
Configuration

Configure the below parameters :

```
Application configuration - Low Power
        CFG_LPM_LEVEL                                   LPM enabled
        CFG_LPM_STDBY_SUPPORTED                         Disabled
Application configuration - Logs
        CFG_LOG_SUPPORTED                               Enabled
    *   CFG_LOG_INSERT_TIME_STAMP_INSIDE_THE_TRACE      Disabled
    *   CFG_LOG_INSERT_COLOR_INSIDE_THE_TRACE           Disabled
    *   CFG_LOG_INSERT_EOL_INSIDE_THE_TRACE             Disabled
    *   CFG_LOG_VERBOSE_LEVEL                           LOG_VERBOSE_INFO
Application configuration - NVM
        USE SNVMA_NVM                                   YES
        SNVMA_NVM_NUMBER                                1
        SNVMA_POLY_CRC16                                0000
        SNVMA_NVM_ID_1                                  SNVMA_NVM_ID_1
          SNVMA_NVM_ID_1_BANK_NUMBER                    2
          SNVMA_NVM_ID_1 Number of Buffer               1
```

Open your App and Connect




Tera Term: Terminal setup

Terminal size

80 X 24

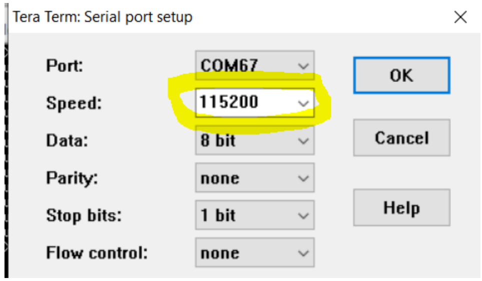
☑ Term size = win size

□ Auto window resize

New-line

Receive: CR+LF

Transmit: CR+LF


Tera Term: Serial port setup

Port: COM67

Speed: 115200

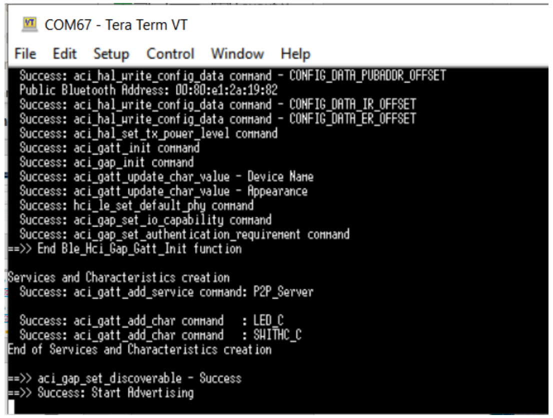
Data: 8 bit

Parity: none

Stop bits: 1 bit

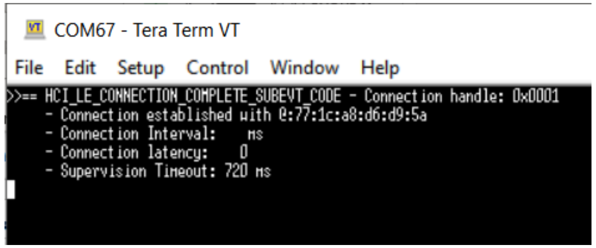
Flow control: none

1 reset device


COM67 - Tera Term VT

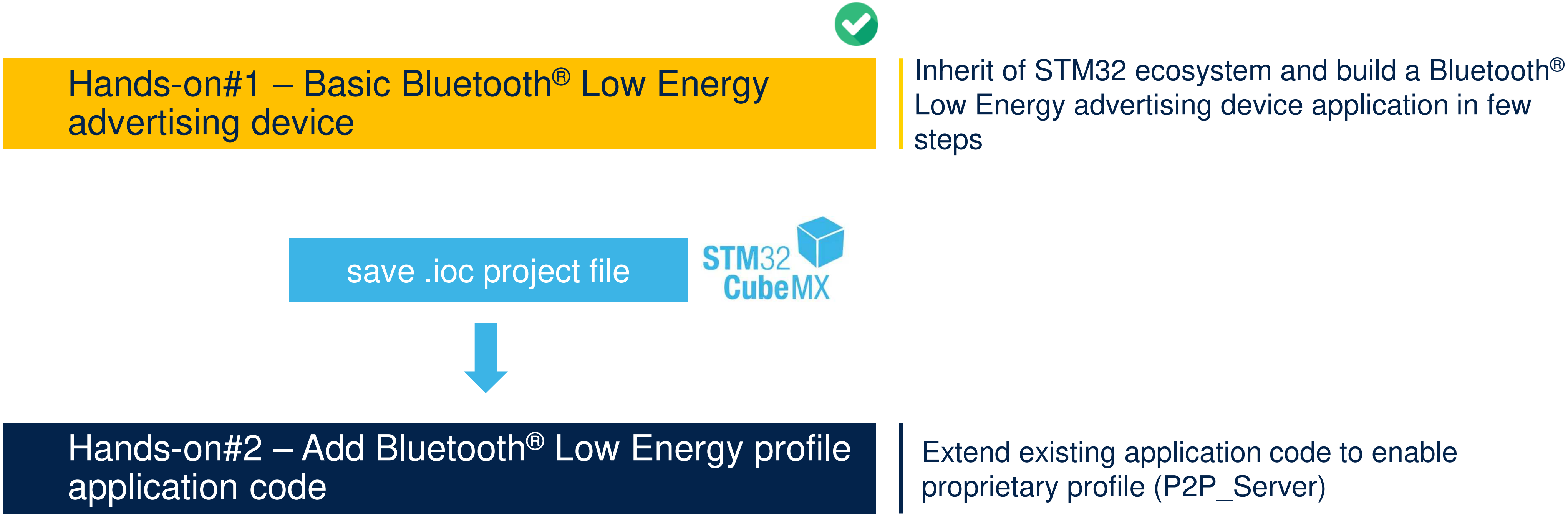
```
 Success: aci_hal_write_config_data command - CONFIG_DATA_PUBADDR_OFFSET
 Public Bluetooth Address: 00:80:e1:2a:19:82
 Success: aci_hal_write_config_data command - CONFIG_DATA_IR_OFFSET
 Success: aci_hal_write_config_data command - CONFIG_DATA_ER_OFFSET
 Success: aci_hal_set_tx_power_level command
 Success: aci_gatt_init command
 Success: aci_gap_init command
 Success: aci_gatt_update_char_value - Device Name
 Success: aci_gatt_update_char_value - Appearance
 Success: hci_le_set_default_phy command
 Success: aci_gap_set_io_capability command
 Success: aci_gap_set_authentication_requirement command
==>> End Ble_Hci_Gap_Gatt_Init function

Services and Characteristics creation
 Success: aci_gatt_add_service command: P2P_Server

 Success: aci_gatt_add_char command   : LED_C
 Success: aci_gatt_add_char command   : SWITHC_C
End of Services and Characteristics creation

==>> aci_gap_set_discoverable - Success
==>> Success: Start Advertising
```

2 Connect


COM67 - Tera Term VT

```
>>== HCI_LE_CONNECTION_COMPLETE_SUBEVT_CODE - Connection handle: 0x0001
     - Connection established with @:77:1c:a8:d6:d9:5a
     - Connection Interval:    ms
     - Connection latency:    0
     - Supervision Timeout: 720 ms
```

Takeaways
What’s next



✓

Hands-on#1 – Basic Bluetooth® Low Energy advertising device

Inherit of STM32 ecosystem and build a Bluetooth® Low Energy advertising device application in few steps

save .ioc project file

Hands-on#2 – Add Bluetooth® Low Energy profile application code

Extend existing application code to enable proprietary profile (P2P_Server)

Thank you

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