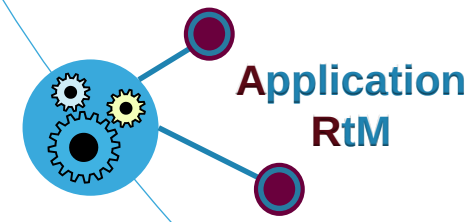
BlueNRG Guideline
From evaluation to production

April 2nd, 2015

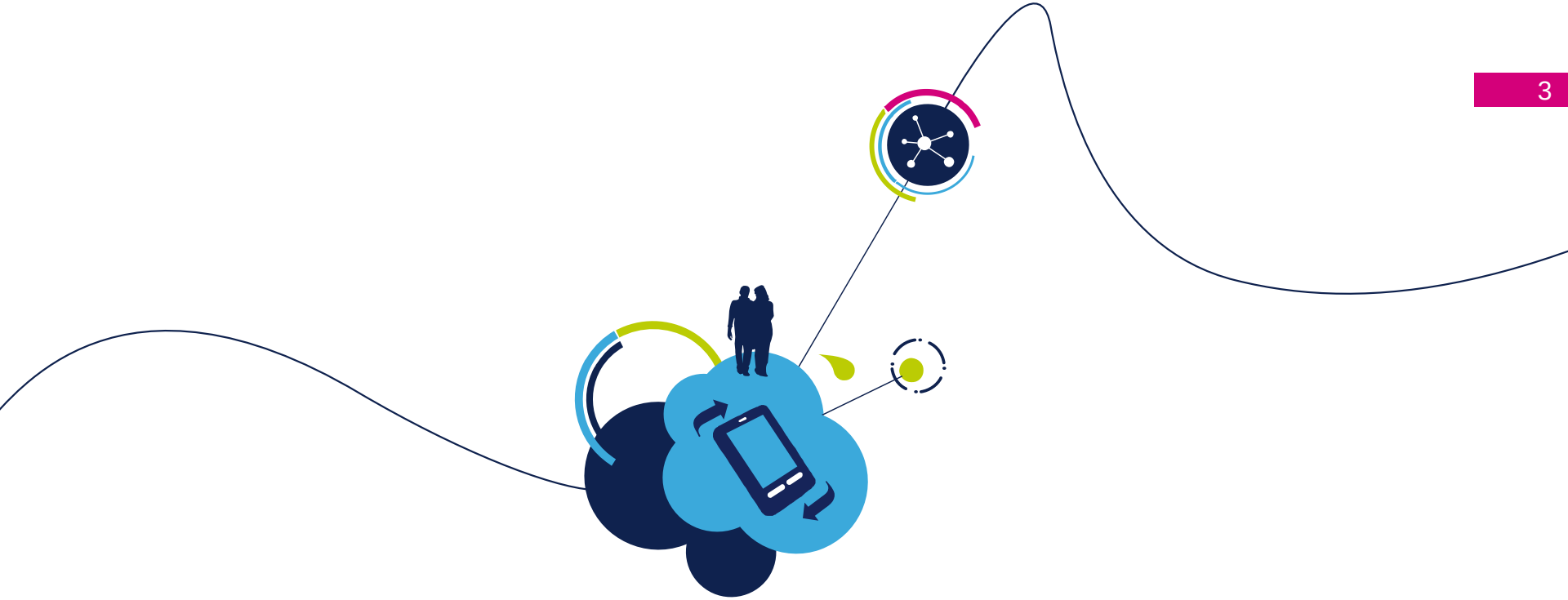
RF Application Team
EMEA Region



life.augmented

Agenda


BlueNRG Main Takeaways
BlueNRG Development Kits
BlueNRG evaluation
From prototyping to production
Key messages



BlueNRG
Main takeaways

BLE main applications

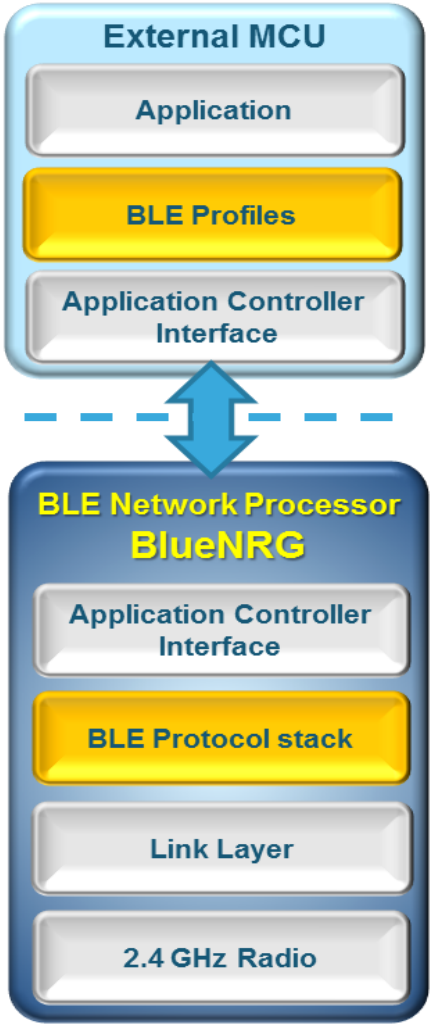
FITNESS

HEALTHCARE

SECURITY& PROXIMITY

HOME AUTOMATION

BlueNRG 4.0 & BlueNRG-MS 4.1 Network processor



Bluetooth qualified
- Master & slave qualified
- QDID (BlueNRG/MS CSP & QFN)

Superior Battery life (DCDC)
- RX 7.3mA
- TX 8.2mA @0dBm
- Sleep 1.7µA
- Shut Down 5nA

Excellent RF performances

RX 7.3 mA / TX 8.2 mA @ 0 dBm
Up to +8dBm
Down to -88dBm
IPD balun available

2 Package flavors

WCSP34 2.65x2.56mm
QFN32 5x5 mm.

life.augmented

BlueNRG What's new

BlueNRG-MS = BlueNRG + BLE 4.1

BLE 4.1 feature: Master and Slave simultaneously supported

Master → Smart-shoe = Slave

Slave ← Smartphone = Master

BLE 4.1 = reduced latency

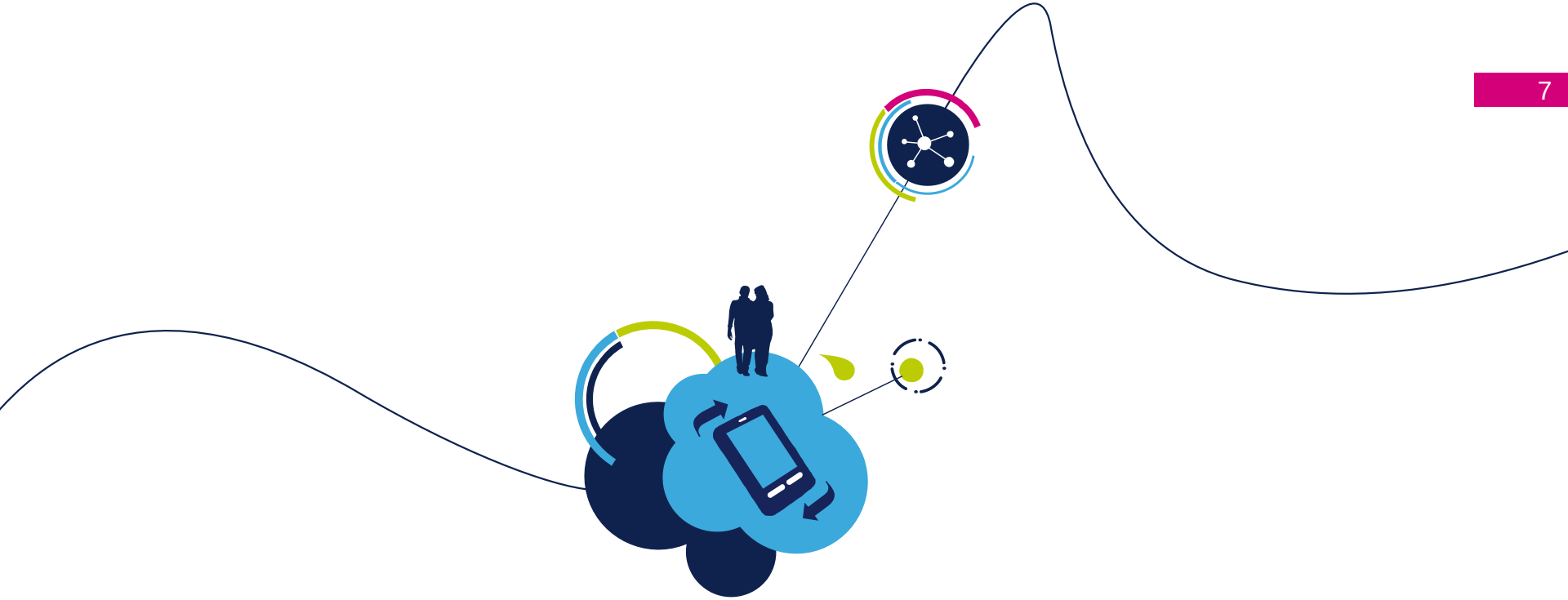
Pin 2 pin compatible (QFN/CSP)

available

BlueNRG BLE4.0

BlueNRG-MS BLE 4.1

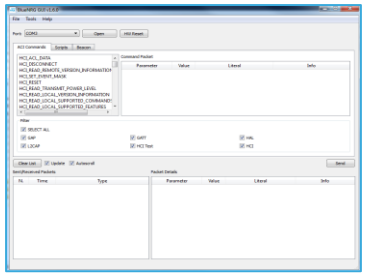
life.augmented

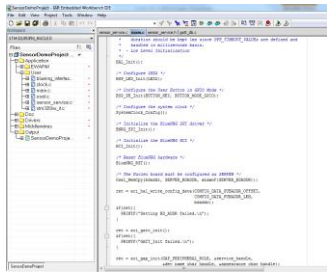


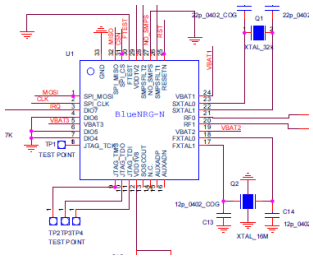
BlueNRG
Development Kits

BlueNRG DK : 2 flavors

1 STEVAL-IDB002V1 & STSW-BLUENRG-DK





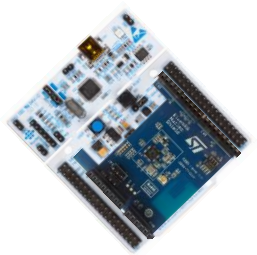


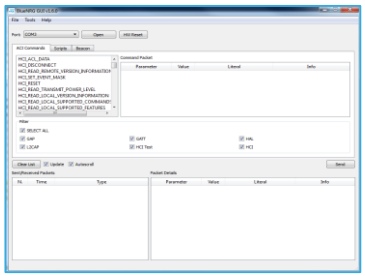
Evaluation thanks to GUI

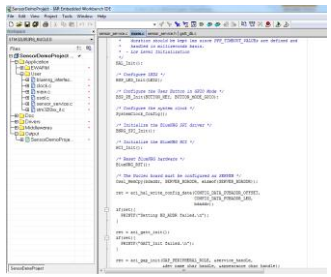
Application code prototyping **over L1** (source code examples : **ie Beacon**)

HW guidelines **AN : Application Bring up Guide**

2 X-NUCLEO-IDB04A1 & X-CUBE-BLE1/OSXSmartConnPS







Evaluation thanks to GUI

Application code prototyping over **L0 & F4** X-CUBE-BLE1 source code examples & **standard profile in lib part of** OSXSmartConnPS

life.augmented

BlueNRG DK : What's new

1 STEVAL-IDB002V1 & STSW-BLUENRG-DK

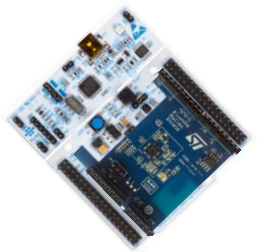
coming

- BlueNRG-MS DK coming **W15** with STEVAL-IDB005V1
- DK 1.7.0 BlueNRG & BlueNRG-MS now available on the web

New

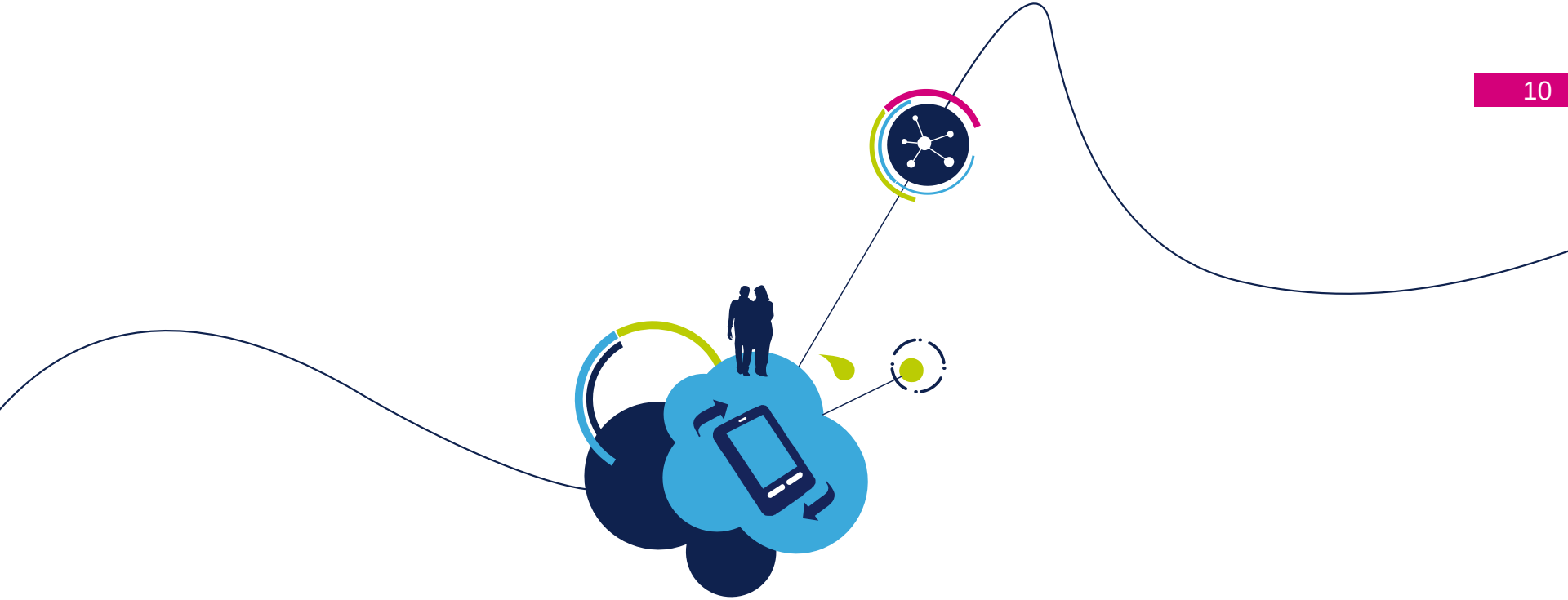
2 X-NUCLEO-IDB04A1 & X-CUBE-BLE1/OSXSmartConnPS

New



- New X-CUBE-BLE1 release available on the web
- New package aligned with BlueNRG/MS native DK 1.7.0
- HID standard profile part of OSXSmartConnPS

life.augmented



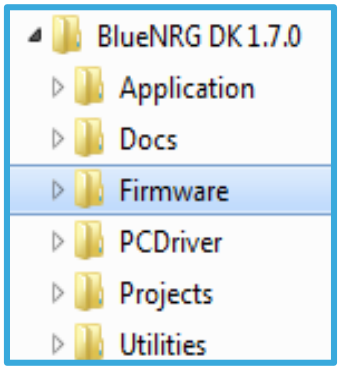
BlueNRG Evaluation

BlueNRG evaluation thanks to GUI (1/3)

The GUI part of STSW-BLUENRG-DK package allows to :

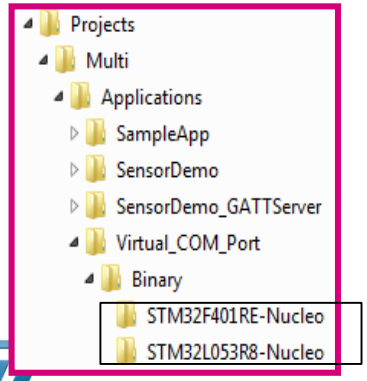
✓control BlueNRG device (access to stack interface)

✓enable connection from BlueNRG evaluation boards and smartphone apps

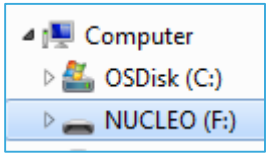


From STSW-BLUENRG-DK load BlueNRG_VCOM_1_x.hex (as per as UM1686) on IDB002V1

1

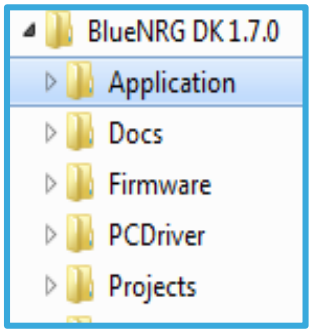


From X-CUBE-BLE1 SW resource package drag and drop Virtual_COM_Port.bin on Nucleo drive

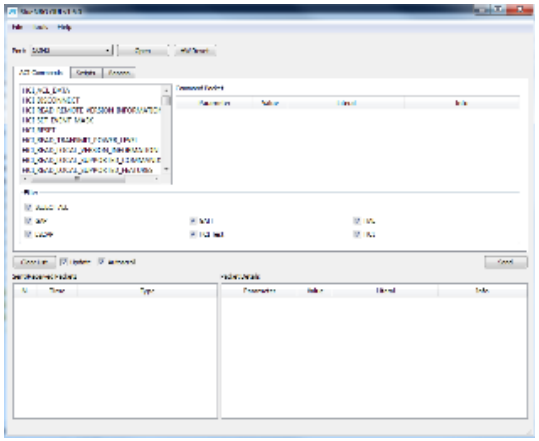


BlueNRG evaluation thanks to GUI (2/3)

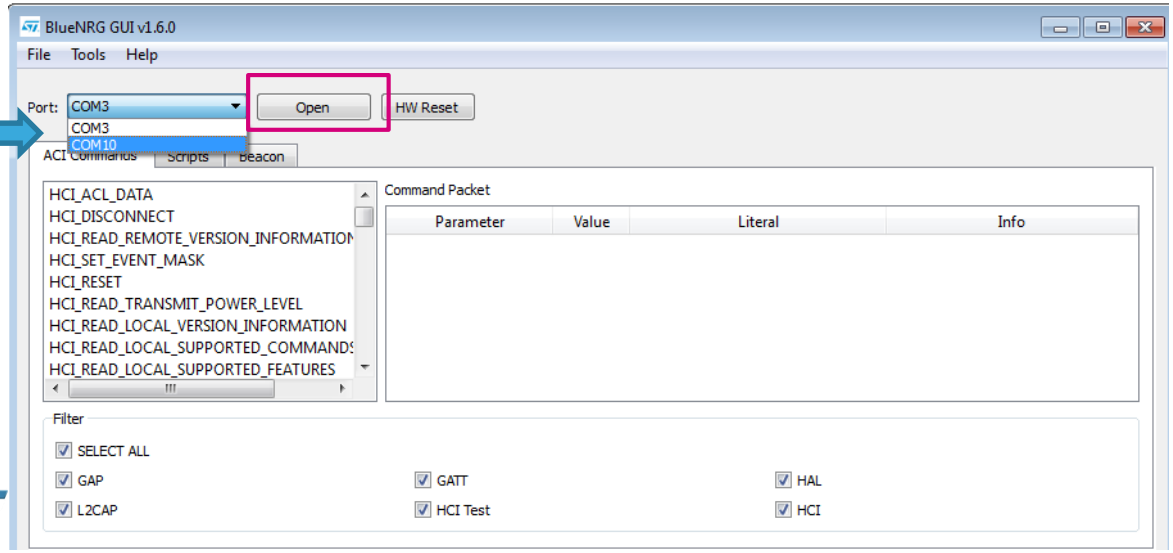
2



From STSW-BLUENRG-DK launch GUI application BLUENRG_GUI.exe



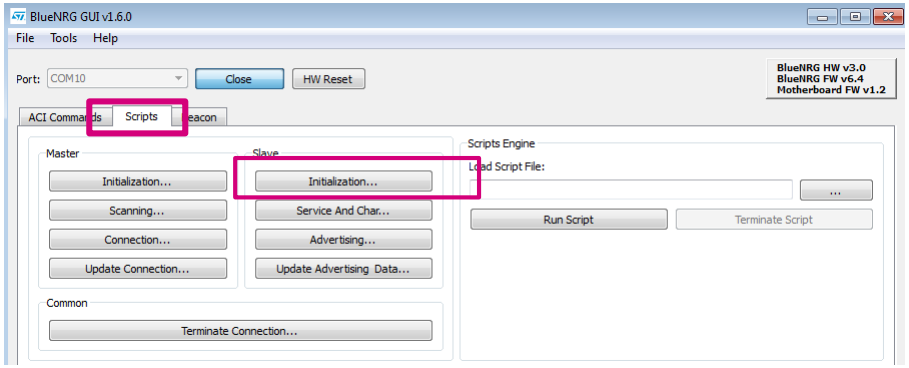
3



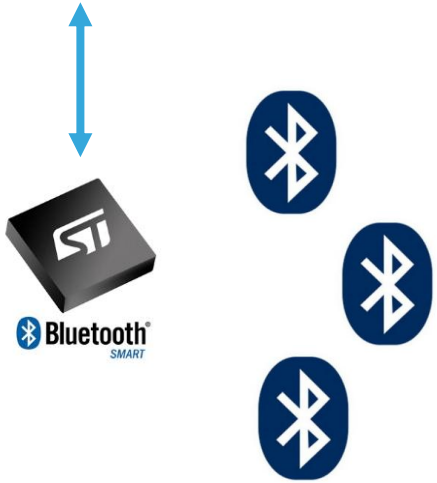
GUI now controlling BlueNRG stack

BlueNRG evaluation thanks to GUI (3/3)

4



GUI scripts to easily enable a connection between evaluation boards and smartphone apps*

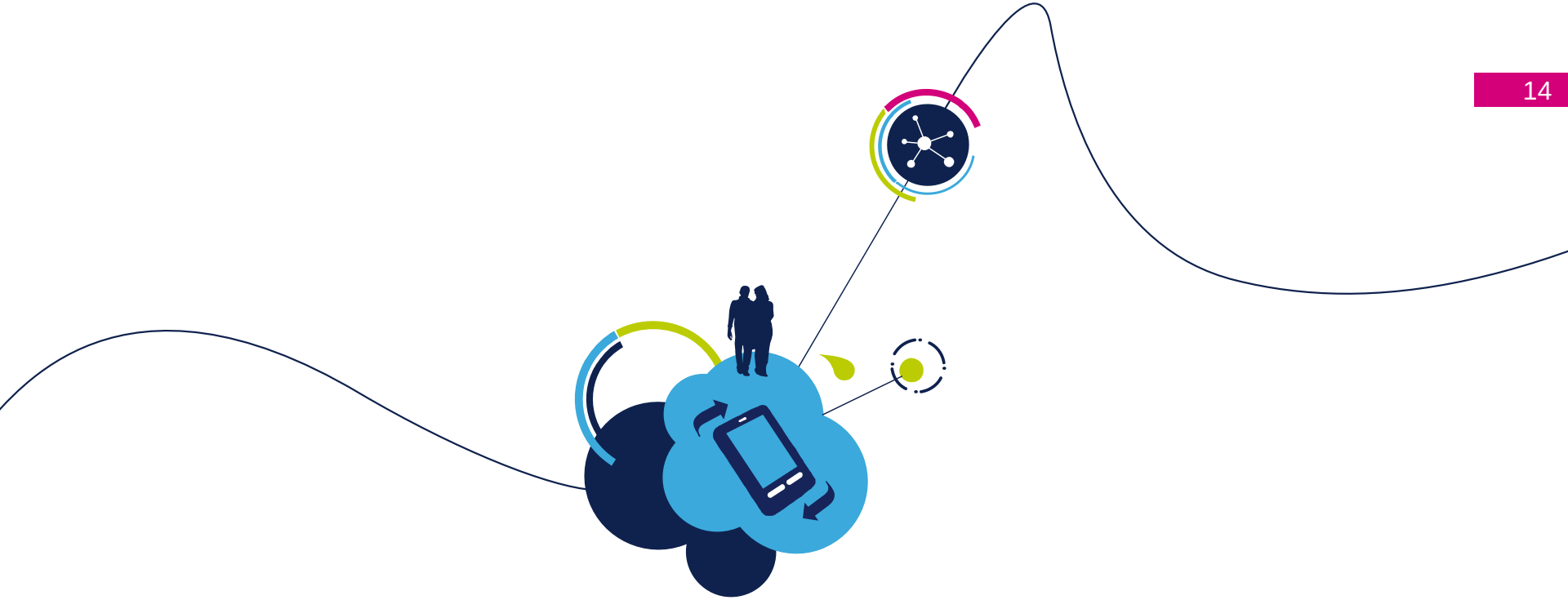


* Ios
Light Blue

* Android
BleScanner

Full BlueNRG Hands On available over BeST.com

BlueNRG Hands On with X-Nucleo V2.1



BlueNRG
From prototyping to production

BlueNRG prototyping to production
ST guideline

Application

SW Application

HW Application (PCB)
- PCB config/BlueNRG IFR*
- FW update

Validation & Production

debug *recommended*

test on production line *recommended*

certification

life.augmented

*** InFormation Register**

BlueNRG prototyping to production
ST guideline

Application

SW Application

HW Application (PCB)

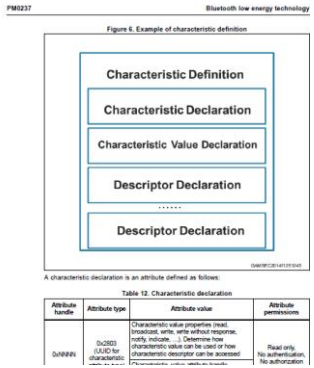
- PCB config/BlueNRG IFR*
- FW update

life.augmented

*** InFormation Register**

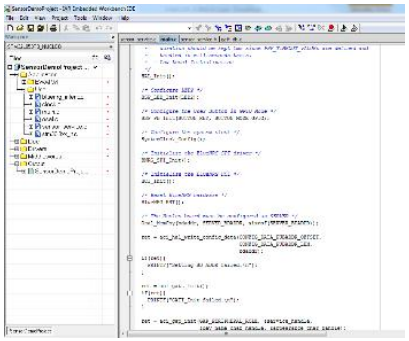
BlueNRG prototyping to production
SW prototyping

1 BLUENRG-DK Application notes



- **PM0237: BlueNRG stack programming guidelines**
  - BLE concept definition : security, MAC address, service & characteristic
  - BlueNRG examples describe and comments
- **UM1770: BlueNRG profile application interface**
  - Find Me, Glucose, ect…standard applications profile implementation

2 SW code examples in source over X-CUBE-BLE1 & STSW-BLUENRG DKs



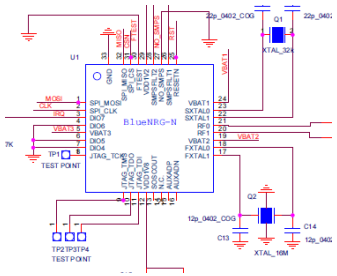
- **source codes examples based on STM32x integrating**
  - BlueNRG stack interface through SPI
  - BLE application profiles
- **sensor Apps in source code (BLUEMICROSYSTEM1 @ ST web)**

STM32 as host µC in customer application = strong SW workload leverage

life.augmented

BlueNRG prototyping to production
HW prototyping

1 BLUENRG-DK HW Application notes



- **PCB design based on ST guideline**
  - **AN4630** PCB design guidelines for the BlueNRG and BlueNRG-MS

Customer PCB to be compliant to ST guideline

2 InFormation Register management – What is IFR ?

- BlueNRG allowing flexibility to configure application **(BOM & SW)** according use case constraints : power efficiency, performances, number of data to be handled.

- The BlueNRG and BlueNRG-MS firmware use a table of configurable parameters (IFR) which allows such key parameters to be properly configured ie : high-speed crystal time, low-speed crystal type, stack mode.

BlueNRG IFR : flexibility on customer application

3 Product Bring Up : AN4494: Bringing up the BlueNRG and BlueNRG-MS

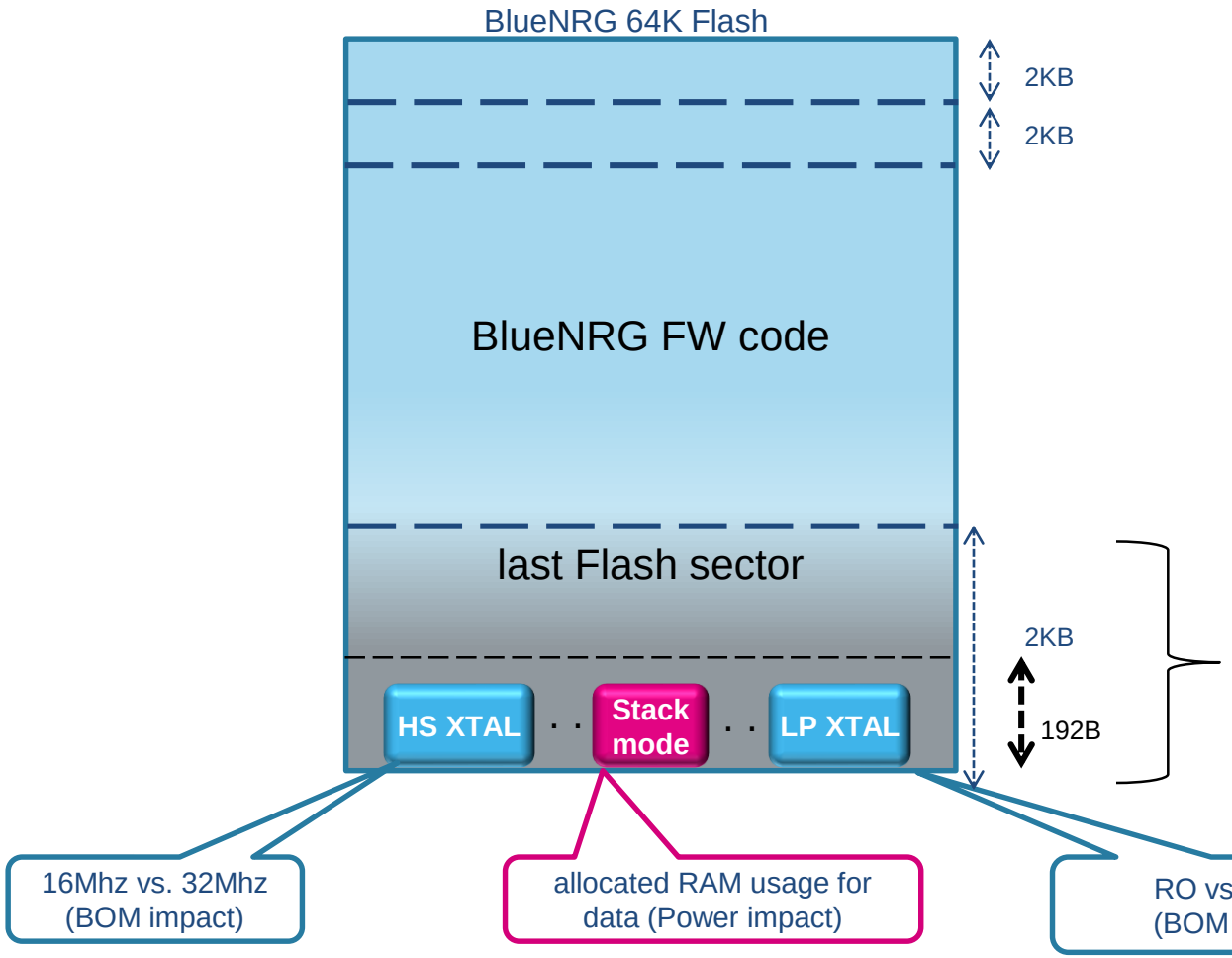
steps by steps check to secure PCB

life.augmented

BlueNRG prototyping to production
IFR Handling

IFR definition - What is IFR ?

- The configurable parameters table (IFR) resides in the last sector (2KB) of the Flash
- IFR definition & architecture ➔ UM1868 BlueNRG and BlueNRG-MS information register



1. The IFR table is stored in the last **192 bytes** of the sector
2. The first part of last sector is not used in BlueNRG-MS and is **storing part of FW code in BlueNRG**

BlueNRG prototyping to production
IFR Handling

IFR Handling

- BlueNRG and BlueNRG-MS part configured out of ST factory
  - 32KHz external Low Power XTAL
  - 16MHz High speed crystal
  - Stack in mode 2 (common main usage for slave device)

PCB and application defined IFR to be considered

IFR to be programmed once in product life, 2 main options :

Option 1: SW application update to integrate IFR process

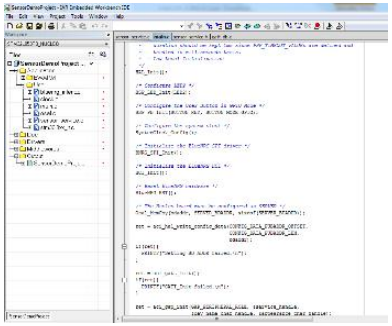
Option 2: Stand alone PC application: ST GUI

life.augmented

BlueNRG prototyping to production
IFR Handling

Option1: Handle IFR in SW application

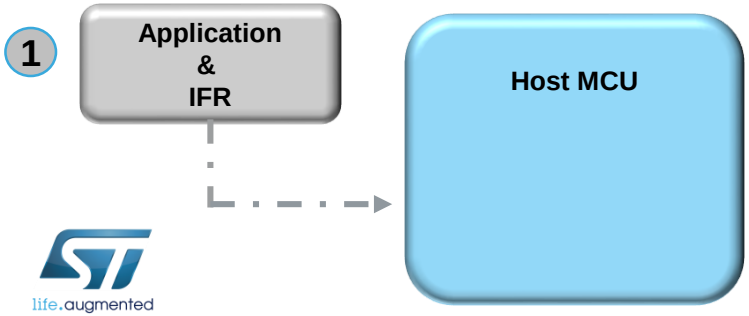
- ST providing source code examples



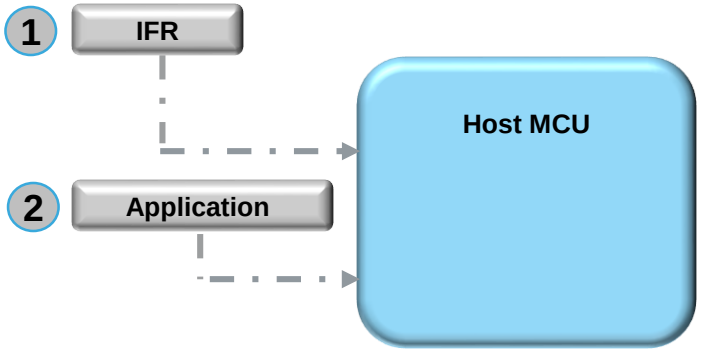
- BlueNRG_Stack_IFR_Updater project (STSW-BLUENRG DK)
- IFR architecture over BlueNRG (not BlueNRG- MS) implies 2K RAM allocation

pending to host RAM constraints 2 strategies

1. integrate IFR update in customer application



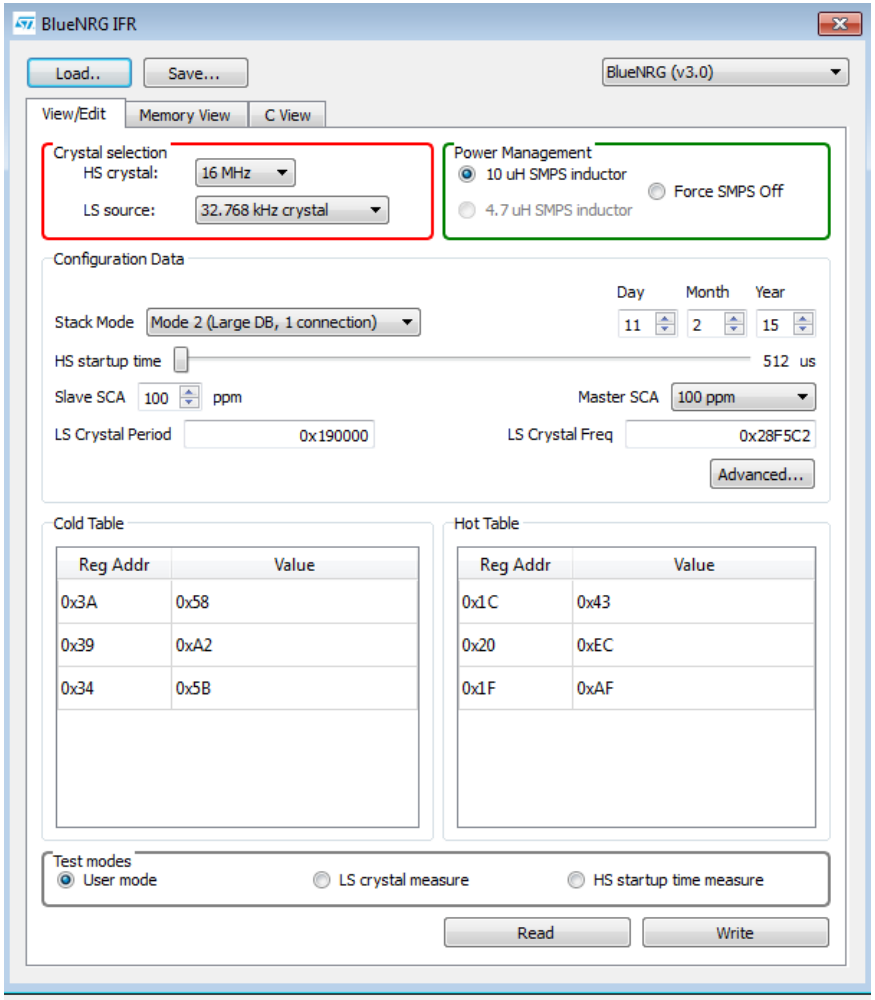
2. program IFR in a dedicated manufacturing SW application



life.augmented

BlueNRG prototyping to production
IFR Handling

Option2: Handle IFR thanks to ST GUI



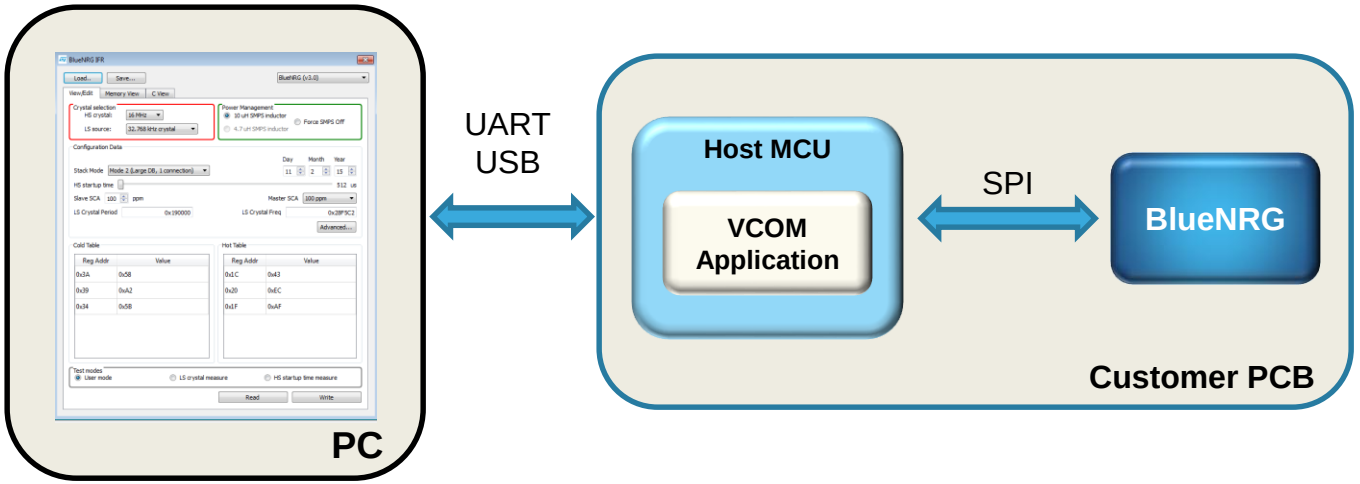
- ST GUI part of STSW-BLUENRG DK allows to easily configure and understand IFR
- UM1868 BlueNRG and BlueNRG-MS information register (IFR)

- Application board communication with ST GUI

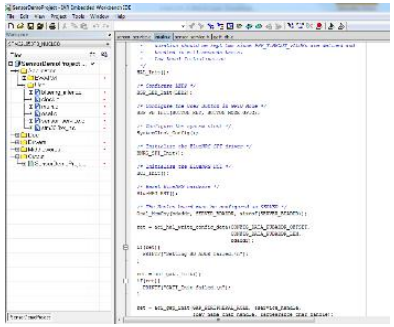
- Connecting GUI to BlueNRG requires specific SW in host µC : VCOM FW

BlueNRG prototyping to production
IFR Handling

Option2: What is VCOM ?



- VCOM source code part of STSW-BLUENRG DK & X-CUBE-BLE1
- Thanks to VCOM, dedicated application for IFR configuration can be easily handled from remote PC

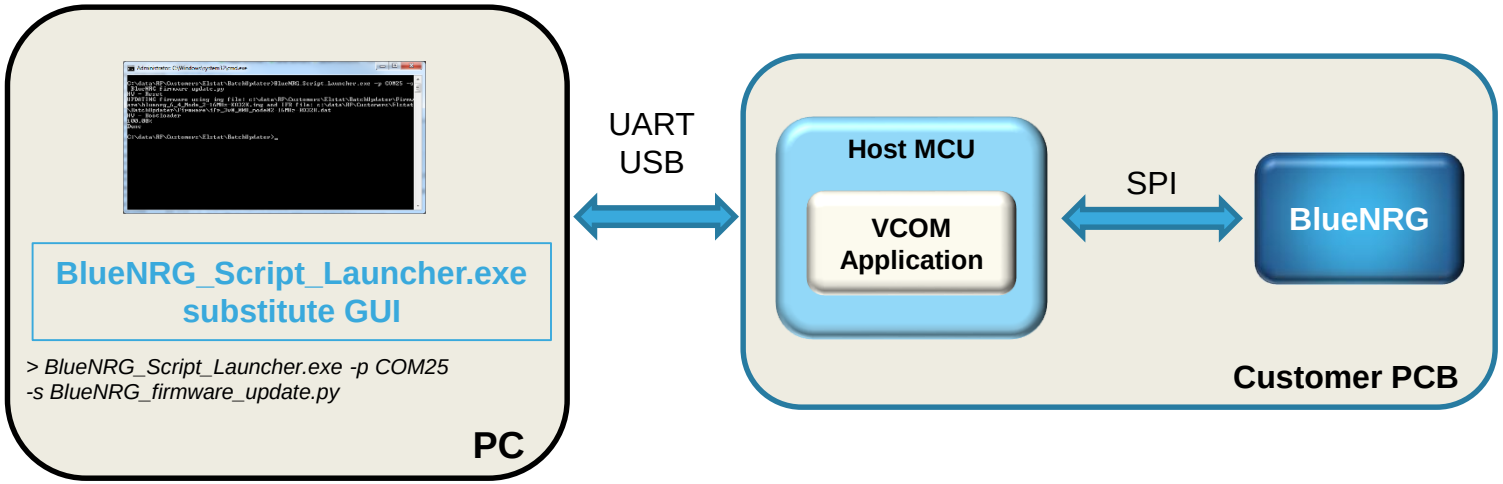


VCOM (few lines of code)
Host MCU acting as a bridge

life.augmented

BlueNRG prototyping to production
IFR Handling

Option2: IFR update from batch



- Thanks to GUI scripting capabilities, IFR process can be executed from batch

VCOM integration suitable for IFR batch programming

BlueNRG prototyping to production
FW UPDATE

FW Update Handling

- BlueNRG FW6.4 in production starting W1449
  - FW6.4 expected to be final MP FW
- FW6.3 parts potential stock in the field -> ST recommendation to move to FW6.4

FW6.3 parts

FW update to 6.4

FW update procedure : 2 options

Option1: SW application update

Option2: Stand alone PC application, ST GUI

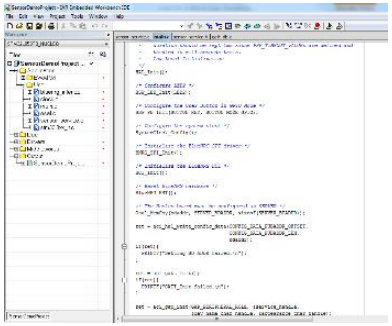
FW update procedures similar to IFR procedures

life.augmented

BlueNRG prototyping to production
FW UPDATE

Option1: Handle FW update in SW application

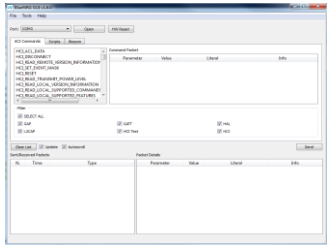
- ST providing source code examples



- BlueNRG_Stack_IFR_Updater project (STSW-BLUENRG DK)
- This process implies 64K Flash in external MCU to host new FW
- Aternative to receive FW from Ymodem application (PC application)

Option2: Handle FW update thanks to ST GUI

- Thanks to VCOM hosted over external MCU, BlueNRG FW update can be executed from GUI



- FW update process can be executed from batch (GUI scripts capabilities)

FW update through GUI : simple process thanks to VCOM SW integration

life.augmented

BlueNRG prototyping to production
ST guideline

Validation & Production

- **debug** *recommended*
- **test on production line** *recommended*
- **certification**

* **I**n**F**ormation **R**egister

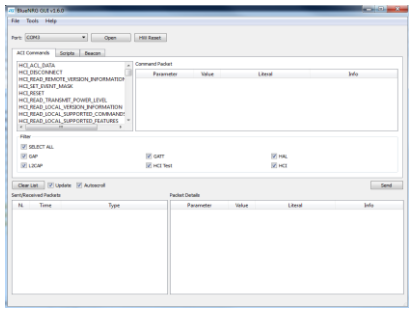
BlueNRG prototyping to production
Debug & Test

1 **Debug** capabilities to be anticipated before application validation

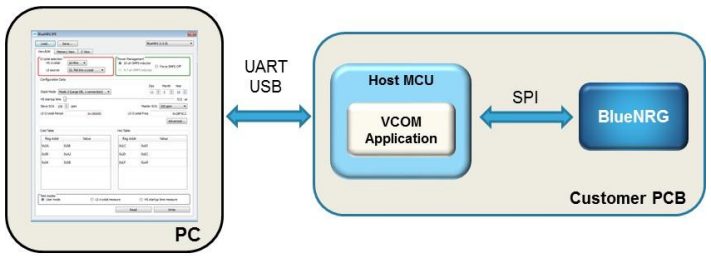
Access to BlueNRG stack interface through ST GUI allows to quickly sort integration issue : PCB, RF, SW

2 **Test** in production to validate customer PCB

Capability to send basic RF commands (TONE & HCI) from GUI allows to validate PCB RF functionalities



VCOM enables accessibility to device through GUI
➔ Reduce customer design efforts



life.augmented

BlueNRG prototyping to production Certification

- To ensure interoperability between devices, Bluetooth certification is required

Step 1 collect BlueNRG/MS QDID : The BlueNRG stack is already qualified

- Simple click on SIG website
  - 4000$ for associates
  - 8000$ for adopters
  - 1000$ for small companies

Step 2 execute BLE RF PHY Test Cases : HW design (antenna, layout) to be qualified

- The RF PHY tests are specified by SIG : 7 Transmitters tests, 7 receivers tests
- To be executed in Test House

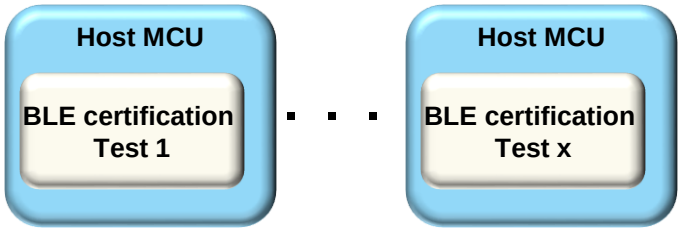
Process & requirements details over BeST.com

BlueNRG Certification Guideline.pdf

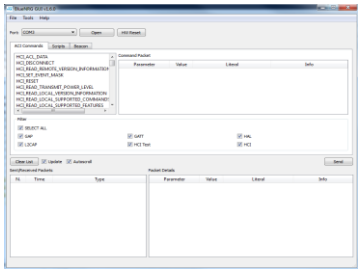
BlueNRG prototyping to production Certification

How to achieve step 2 : execute BLE RF PHY Test Cases

- **Option 1 :** Implement several application binaries

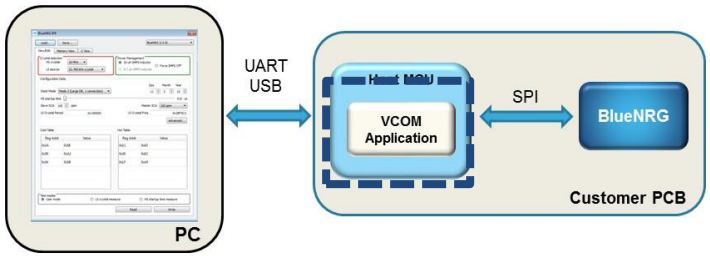


- **Option 2:** use ST GUI
- ST GUI integrating the required standard HCI commands to execute BLE RF tests cases

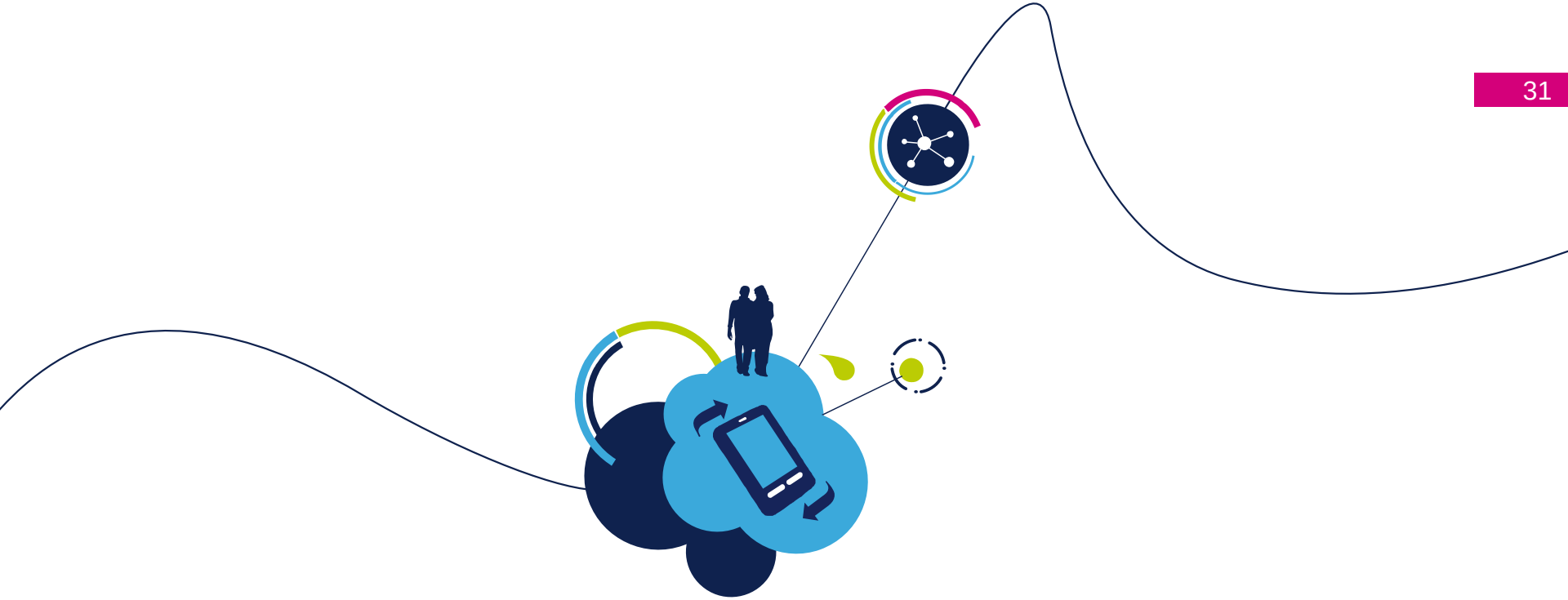


HCI_LE-RECEIVER_TEST
HCI_LE_TRANSMITTER_TEST
HCI_LE_TEST_END

VCOM SW integration over external MCU to ease certification



life.augmented



Key Messages

Key Messages

1. BlueNRG DKs integrating source code examples and ST AN guideline
   - Ease SW application prototyping and implementation
   - Secure PCB to insure performances

2. Handle IFR according customer PCB choices

IFR = Application flexibility

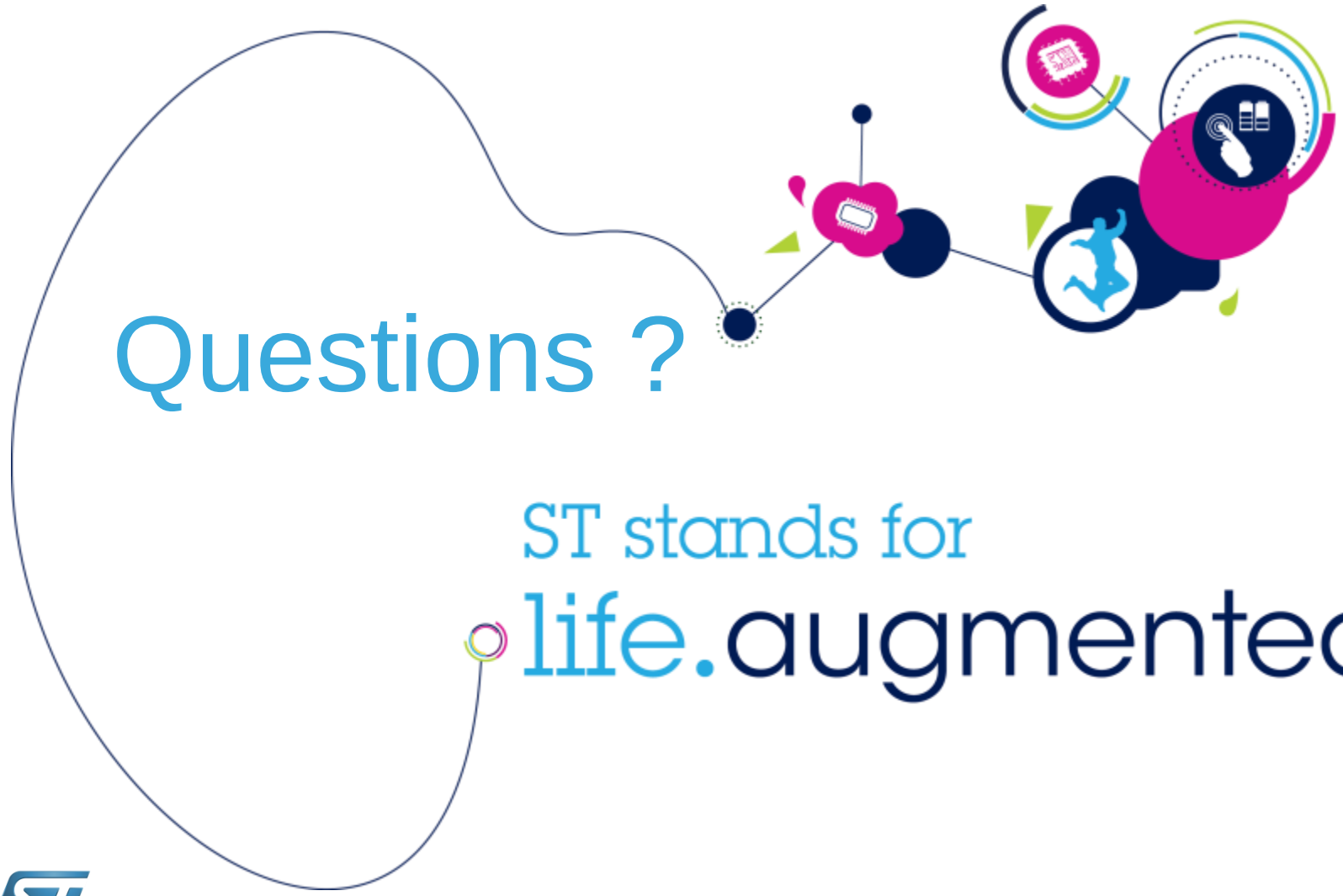
   - IFR implementation using ST SW examples and AN
   - IFR management thanks to ST GUI & associated VCOM SW application

3. To secure the complete application design, access to PCB through ST GUI
   - Ease debug during integration & validation test on production line
   - Ease certification process

VCOM SW application integration over external MCU to secure product design

life.augmented

Thank You



Questions ?

ST stands for

life.augmented