Agenda (9:00 – 12:00)

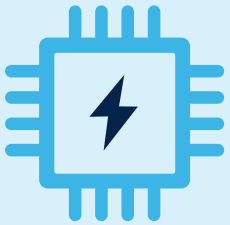
1 5 min	Session introduction & agenda	
2 30 min	Introduction of STM32WBA6 series	
3 45 min	How to start with STM32WBA6 ecosystem ?	
4 10 min	10:30 Break	
5 70 min	STM32WBA6 use cases and ecosystem • Demo1 : Performance • Demo2 : Energy efficiency • Demo3 : Unlocking OTA • Demo4 : Various 2.4GHz protocols • Demo5 : Running Matter	
6 15 min	ST RF Lab services and capabilities	
7 5 min	Takeaways, Q&A	

 Demo

STM32WBA6 in action

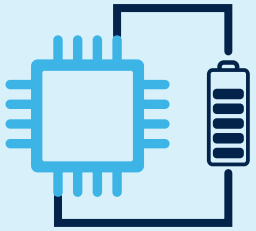
Use-cases and ecosystem demo lab tour

1



STM32WBA6 performance

2

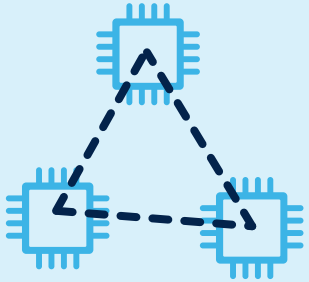


STM32WBA6 and its energy efficiency

3

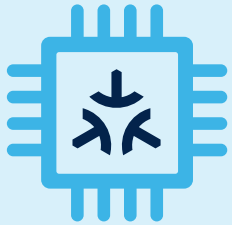
Unlocking OTA with STM32WBA6

4



STM32WBA6 and various 2.4GHz protocols

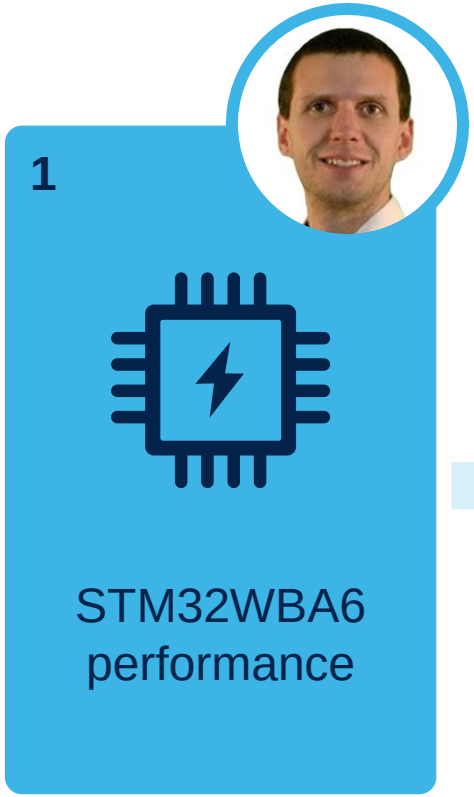
5

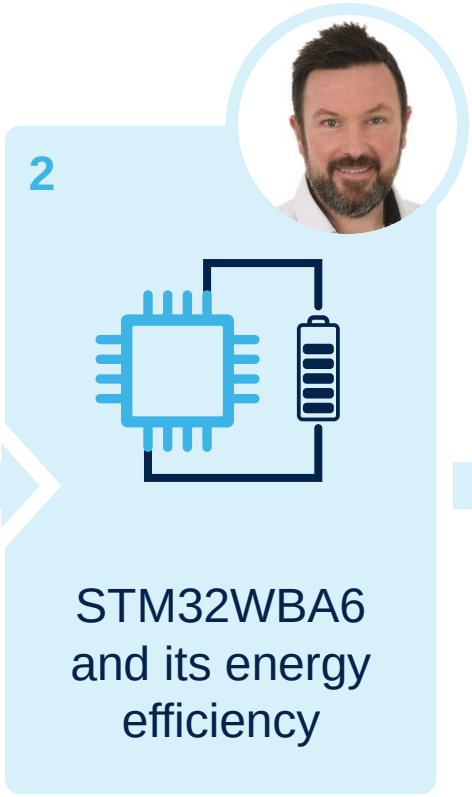


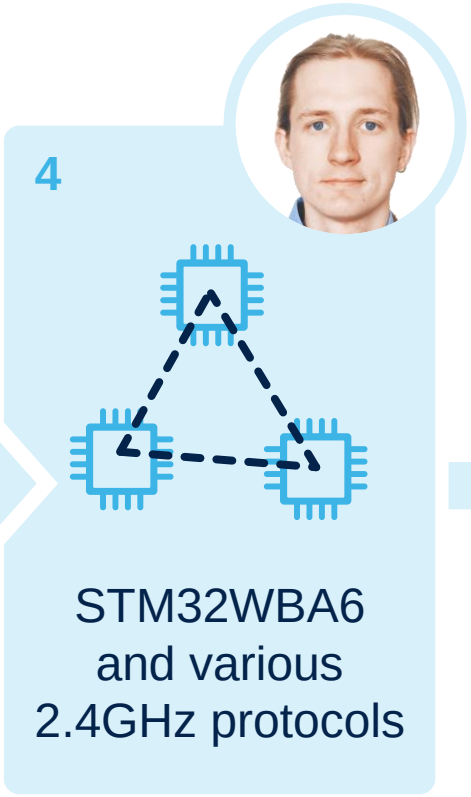
STM32WBA6 running Matter

STM32WBA6 in action

Use-cases and ecosystem demo lab tour

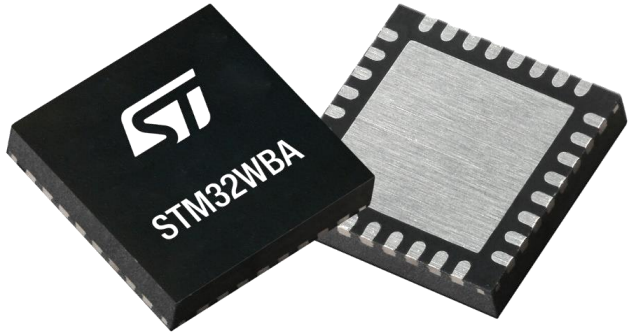






Demo 1: WBA6 performance
Introduction

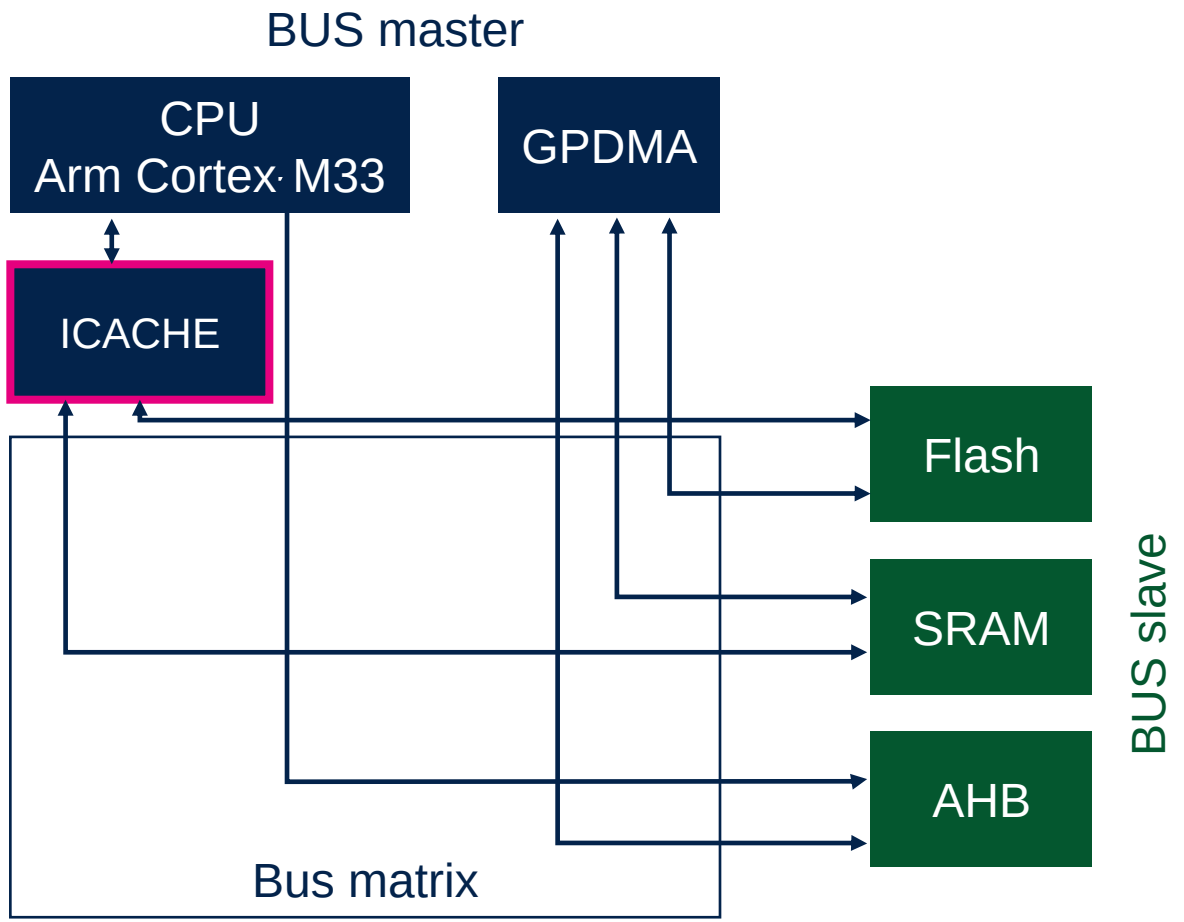
1. WBA6 system architecture overview
2. Low impact of BLE connectivity on MCU core performance for other application tasks
3. Flexible system priority setting



Demo 1: WBA6 performance
STM32 Architecture efficiency

- Flexible architecture supporting communication between peripherals without CPU involvement
  - Communication between peripheral using GPDMA
  - GPDMA linked list for memory task automatization
- ICACHE for performance increase

Even with active RF, plenty of performance is remaining for user application



*simplified illustration

Demo 1: WBA6 performance
Demo project description

- Coremark score of STM32WBAxx MCU = 410.03 ([1])
  - With IAR 9.60.4 coremark score 413.9 can be achieved
- Testing project base on BLE_HearRateFreeRTOS example
  - Coremark calculation demo available on stm32-hotspot

Task name	priority	description
Radio	HIGH	Radio handling
RNG		Used for advertising and generating HRS data
HRS app		Heartrate payload simulation
Statistic		FreeRTOS runtime statistic
Coremark	LOW	Idle task executing coremark

1 – https://www.eembc.org/coremark/scores.php

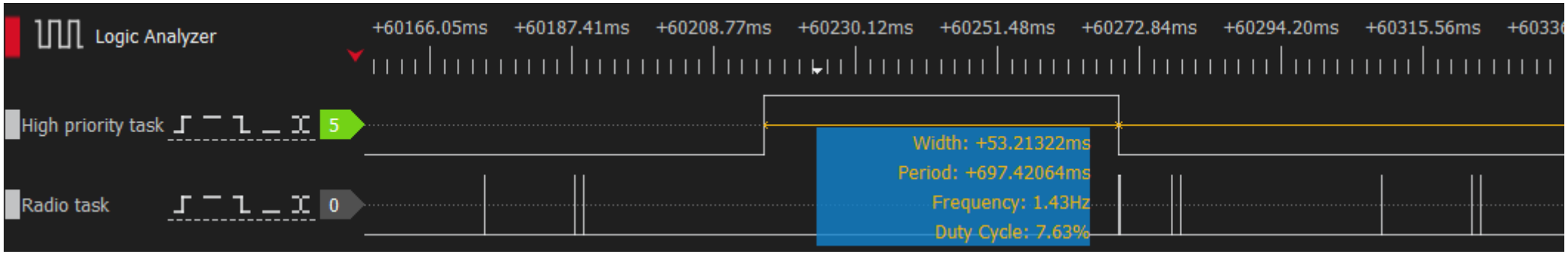
Demo 1: WBA6 performance
Results

	configuration	Coremark calculation duration [s]	Coremark result	Coremark [%]
	Without RTOS	24.16	413.9	**100**
	With RTOS (only coremark task)	24.3	409.8	**99**
Typical case	**100 ms advertising**	24.6	406.5	**98.2**
	20 ms advertising	25.2	396.8	**95.8**
Typical case	**Connected, HR notification enabled, 50 ms connection period**	24.9	401.6	**97.0**
	Connected, HR notification enabled, 11.25 ms connection period	26.8	373.1	**90.1**

Demo 1: WBA6 performance
System interrupts setting

- Single core RF MCUs usually demands RF to be the highest priority in the system
  - Needed on STM32WBA as well to ensure best RF performance ([1])
- Other task/peripheral may need to have higher priority

Task name	priority	description
High priority task	HIGH	Demo blocking delay
Radio		Radio handling
Other tasks	LOW	



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

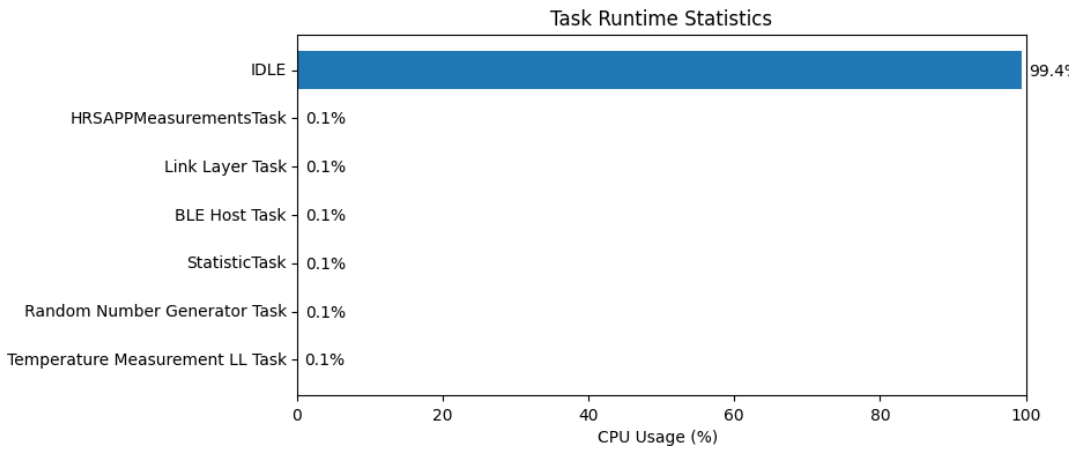
Demo 1: WBA6 performance
Takeaways

1 <3% impact on CPU performance by BLE radio activity in typical, yet demanding use-case

2 Autonomous peripherals to perform tasks without the need of CPU activity

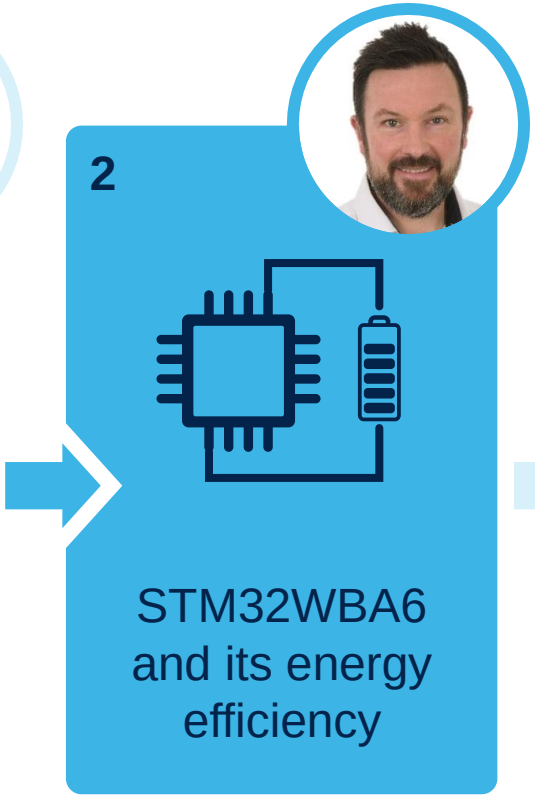
3 Flexible MCU priority setting options

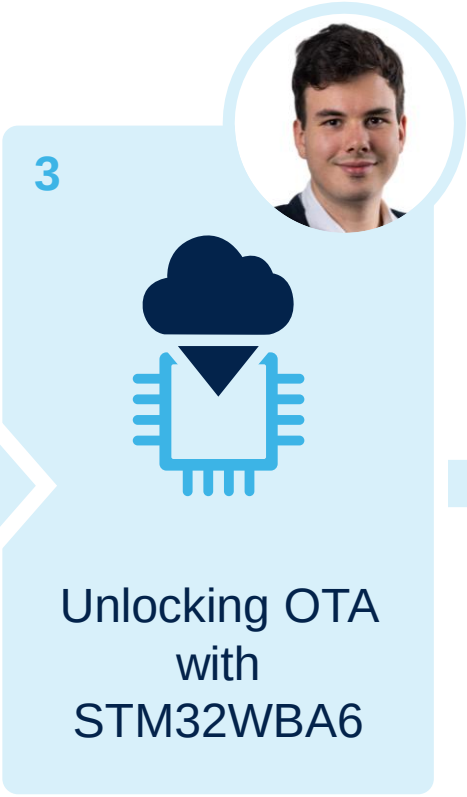
4 **Try WBA6 performance in your own use case**
Find complete project on stm32-hotspot

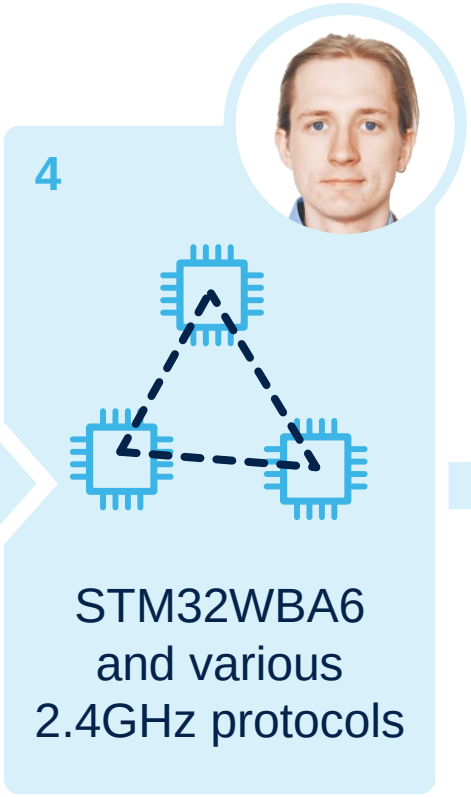


STM32WBA6 in action

Use-cases and ecosystem demo lab tour



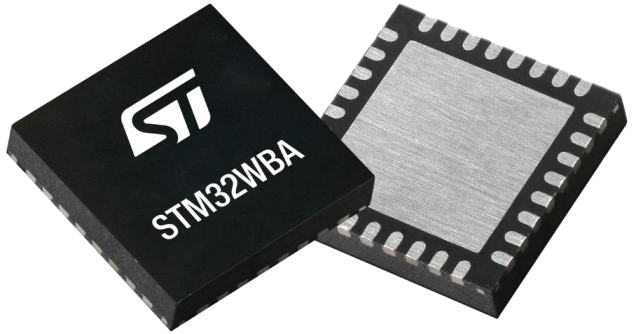




Demo 2: WBA6 and its energy efficiency

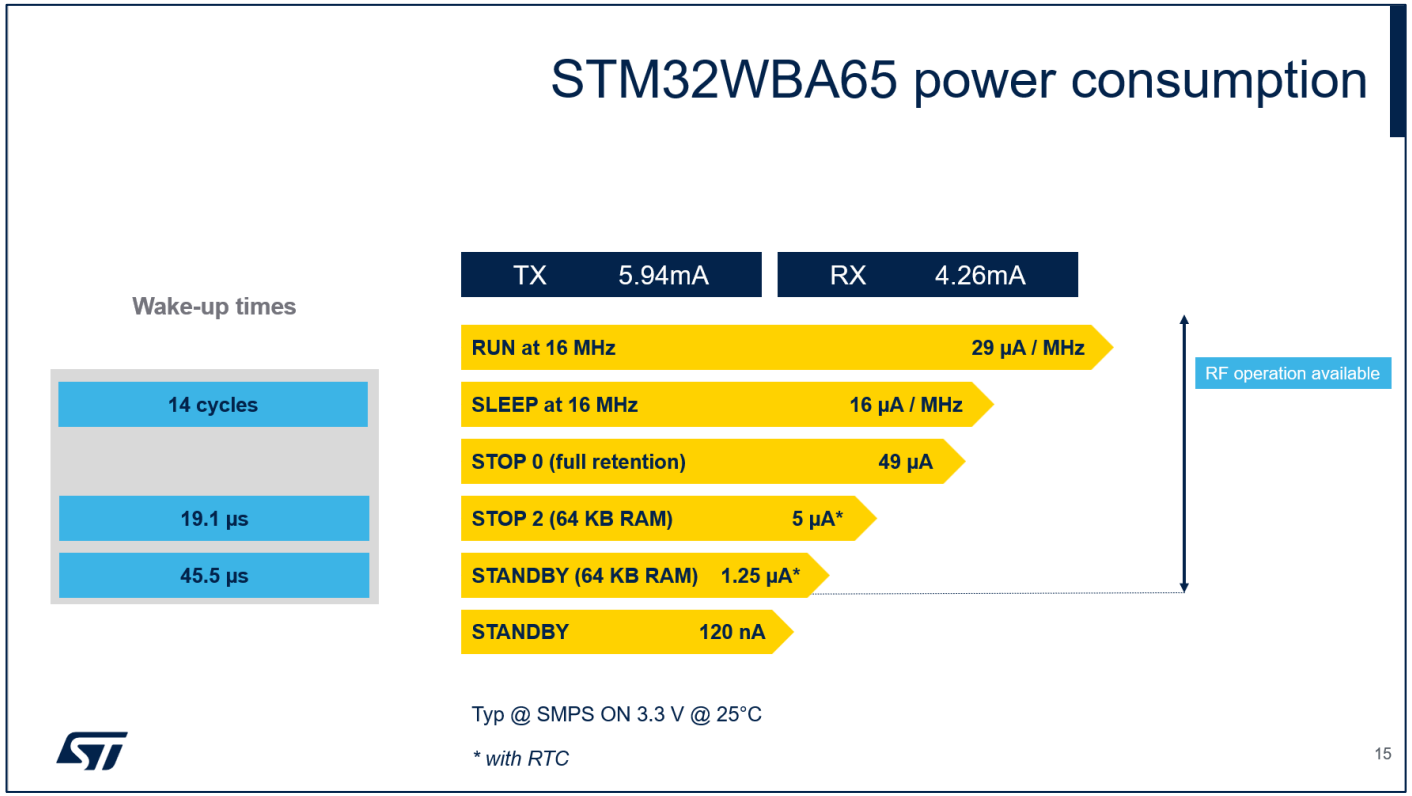
Introduction

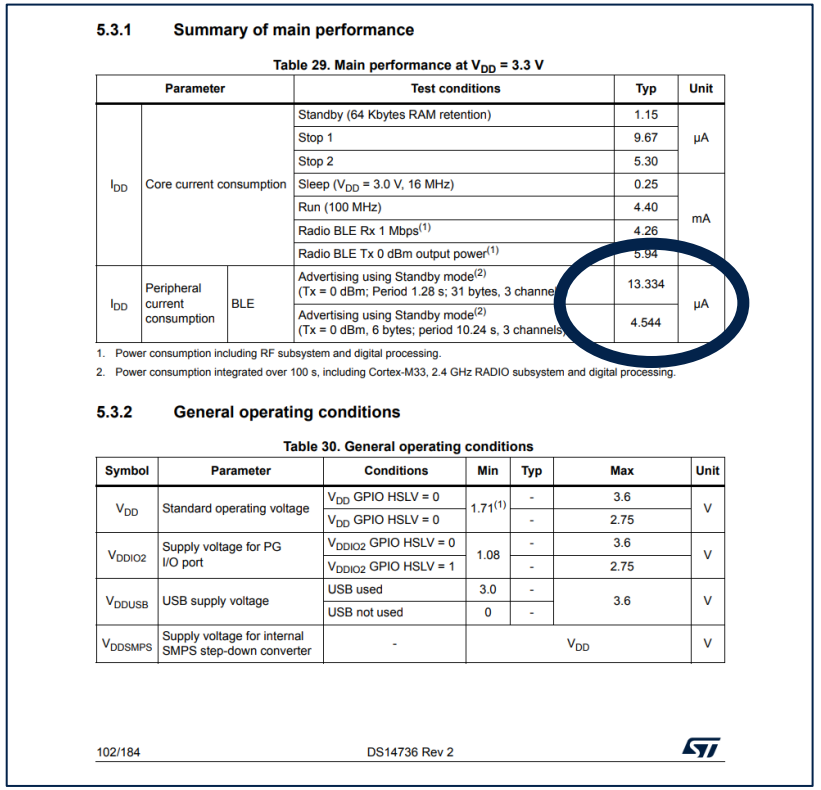
1. Demonstrate STM32WBA6 is tailored for battery powered applications
2. Highlight energy consumption figures in different modes
3. How the ST ecosystem helps to achieve good energy consumption and how to measure it



Demo 2: WBA6 and its energy efficiency

From documentation figures





5.3.1 Summary of main performance

Table 29. Main performance at V_{DD} = 3.3 V

Parameter			Test conditions	Typ	Unit
I_{DD}	Core current consumption		Standby (64 Kbytes RAM retention)	1.15	µA
			Stop 1	9.67	
			Stop 2	5.30	
			Sleep (V_{DD} = 3.0 V, 16 MHz)	0.25	mA
			Run (100 MHz)	4.40	
			Radio BLE Rx 1 Mbps(1)	4.26	
			Radio BLE Tx 0 dBm output power(1)	5.94	
I_{DD}	Peripheral current consumption	BLE	Advertising using Standby mode(2) (Tx = 0 dBm; Period 1.28 s; 31 bytes, 3 channe	13.334	µA
			Advertising using Standby mode(2) (Tx = 0 dBm, 6 bytes; period 10.24 s, 3 channels	4.544	

1. Power consumption including RF subsystem and digital processing.
2. Power consumption integrated over 100 s, including Cortex-M33, 2.4 GHz RADIO subsystem and digital processing.

5.3.2 General operating conditions

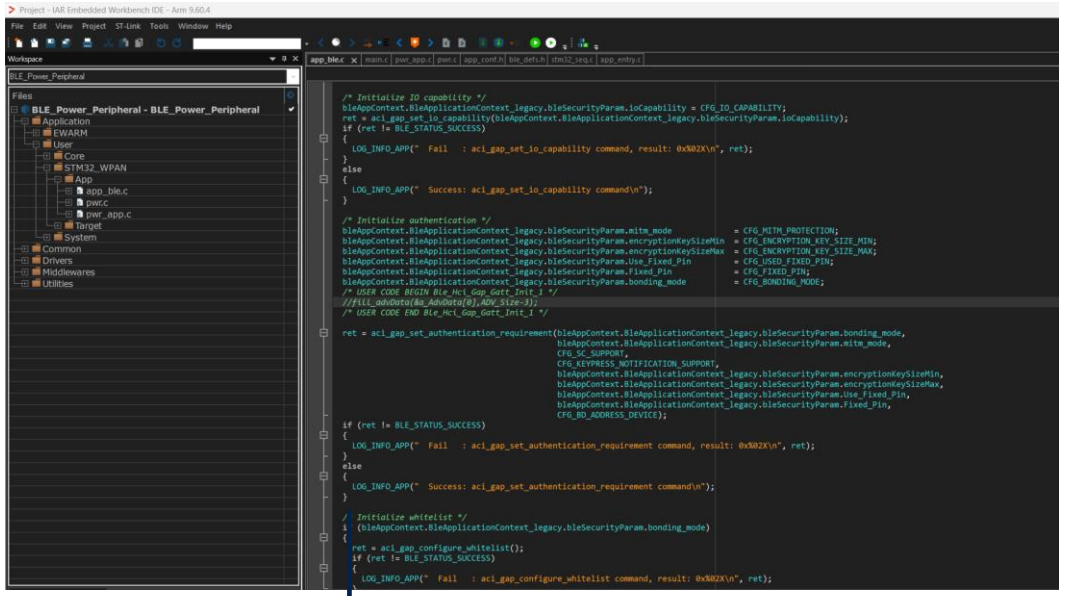
Table 30. General operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DD}	Standard operating voltage	V_{DD} GPIO HSLV = 0	1.71(1)	-	3.6	V
		V_{DD} GPIO HSLV = 0		-	2.75	
V_{DDIO2}	Supply voltage for PG I/O port	V_{DDIO2} GPIO HSLV = 0	1.08	-	3.6	V
		V_{DDIO2} GPIO HSLV = 1		-	2.75	
V_{DDUSB}	USB supply voltage	USB used	3.0	-	3.6	V
		USB not used	0	-		
V_{DDSMPS}	Supply voltage for internal SMPS step-down converter	-	V_{DD}			V

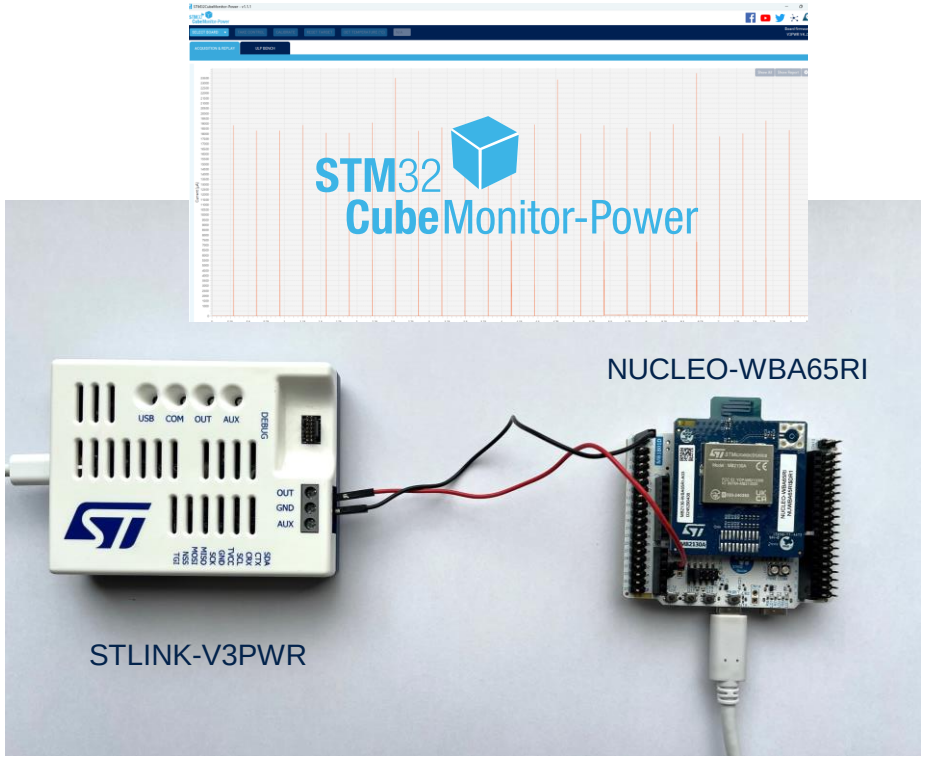
Demo 2: WBA6 and its energy efficiency

To real power consumption measurement

STM32 CubeIDE BLE_Power_Peripheral



Welcome to the ST WIKI



Demo 2: WBA6 and its energy efficiency
To real power consumption measurements

5.3.1 Summary of main performance

Table 29. Main performance at V_{DD} = 3.3 V

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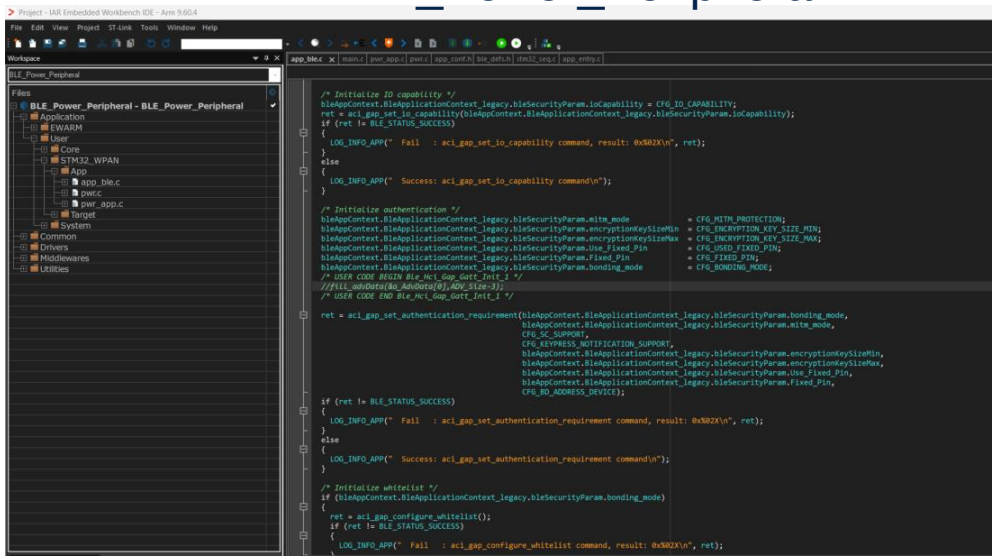
			Stop 2	5.30	
			Sleep (V_{DD} = 3.0 V, 16 MHz)	0.25	mA
			Run (100 MHz)	4.40	
			Radio BLE Rx 1 Mbps(1)	4.26	
			[illegible]	5.94	
I_{DD}	Peripheral current consumption	BLE	Advertising using Standby mode(2) (Tx = 0 dBm; Period 1.28 s; 31 bytes, 3 channels)	13.334	µA
			Advertising using Standby mode(2) (Tx = 0 dBm, 6 bytes; period 10.24 s, 3 channels)	4.544	

1. Power consumption including RF subsystem and digital processing.
2. Power consumption integrated over 100 s, including Cortex-M33, 2.4 GHz RADIO subsystem and digital processing.

BLE_Power_Peripheral



1. Update Adv interval to 1.28 secs
2. Update Adv payload to 31 bytes
3. Enable Full RAM retention (RAM1 + 2 + Radio)

Demo 2: WBA6 and its energy efficiency
Takeaways

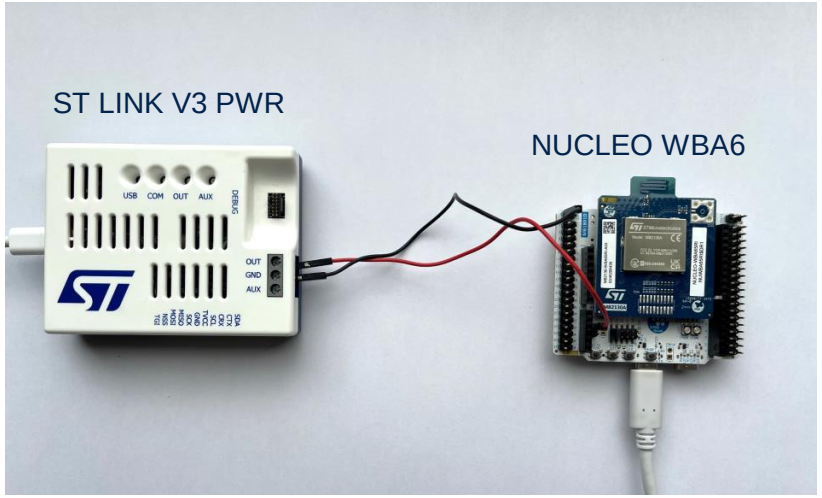
1 Thanks to turnkey BLE_Power_Peripheral sample code replicate and measure

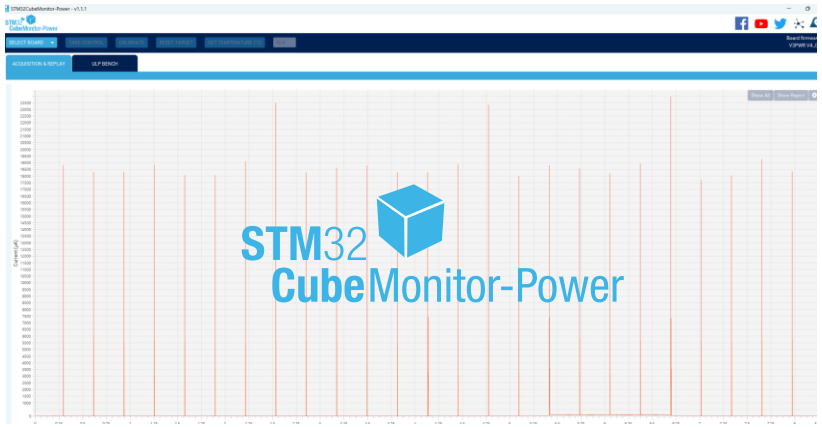
2 Refer to our wiki page* to understand procedure and how to replicate and correlate DS numbers

*https://wiki.st.com/stm32mcu/wiki/Connectivity:STM32WBA_Power_Consumption_Measurement

3 Use efficient and affordable ST LINK V3PWR and associated STM32CubeMonitor-Pwr tool

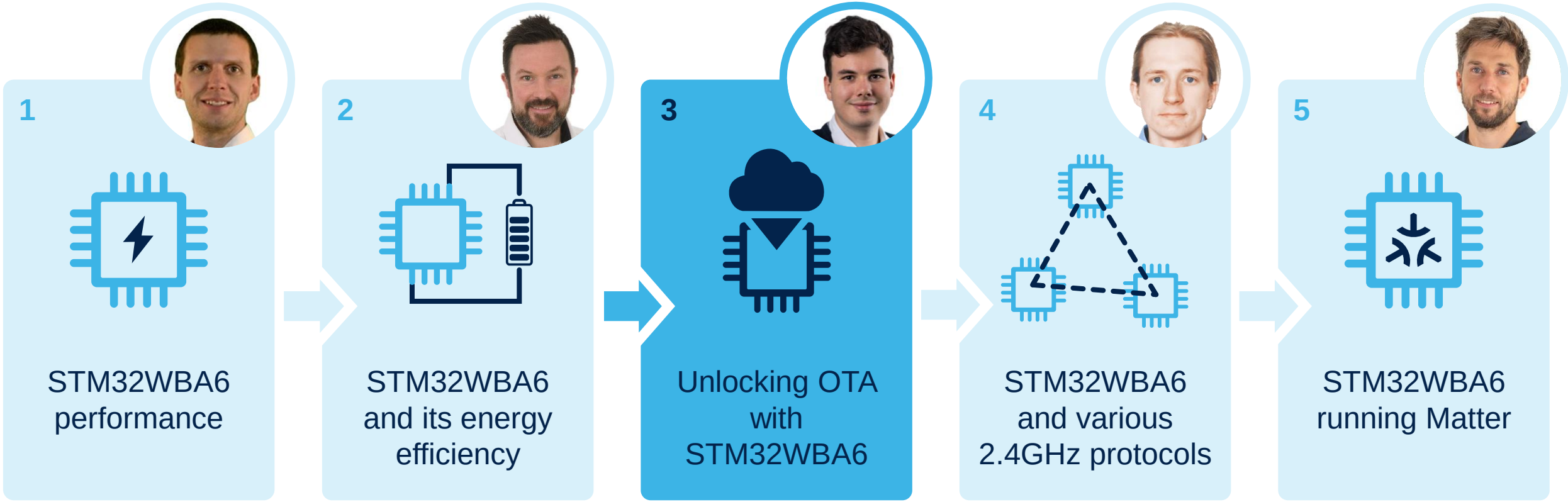
4 **Make your own measurements & evaluation**





STM32WBA6 in action

Use-cases and ecosystem demo lab tour



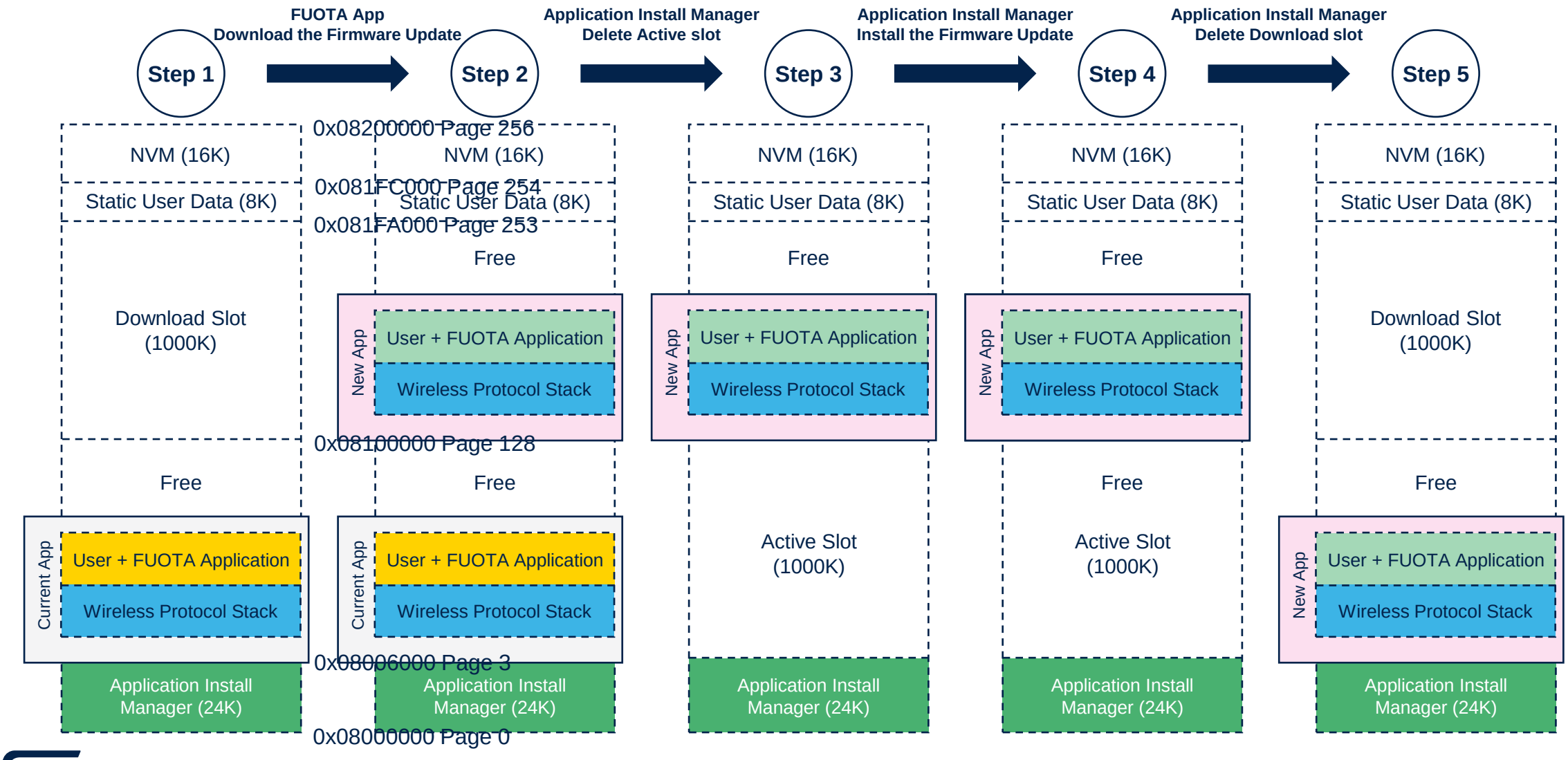
Demo 3: Unlocking OTA with STM32WBA6

Introduction

1	OTA Concept Overview and Quick Start Example
2	Complete FUOTA Development Toolkit
3	Overcoming firmware update OTA challenges with a collection of Practical Examples

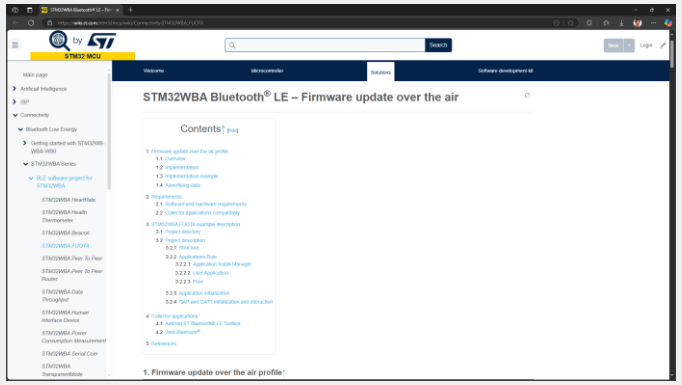
Demo 3: Unlocking OTA with STM32WBA6

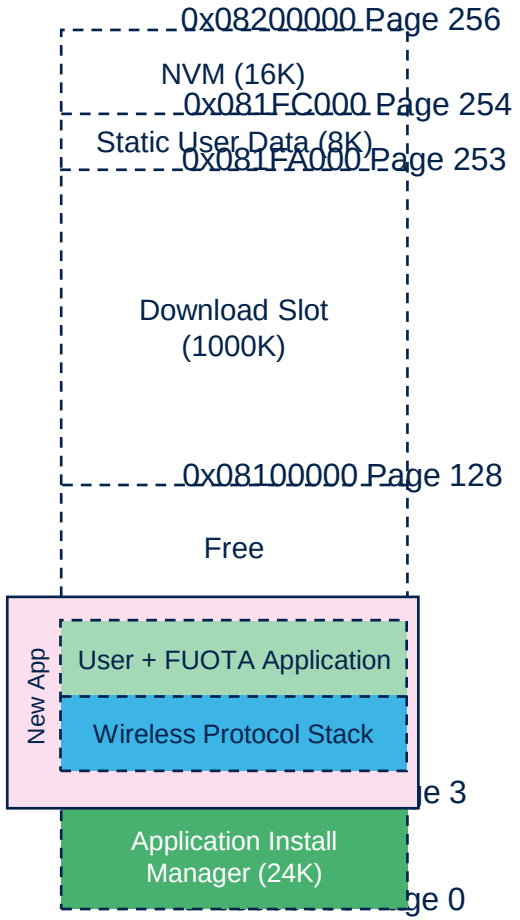
FUOTA Principle



Demo 3: Unlocking OTA with STM32WBA6
FUOTA examples

STM32WBA Bluetooth® LE Firmware update over the air

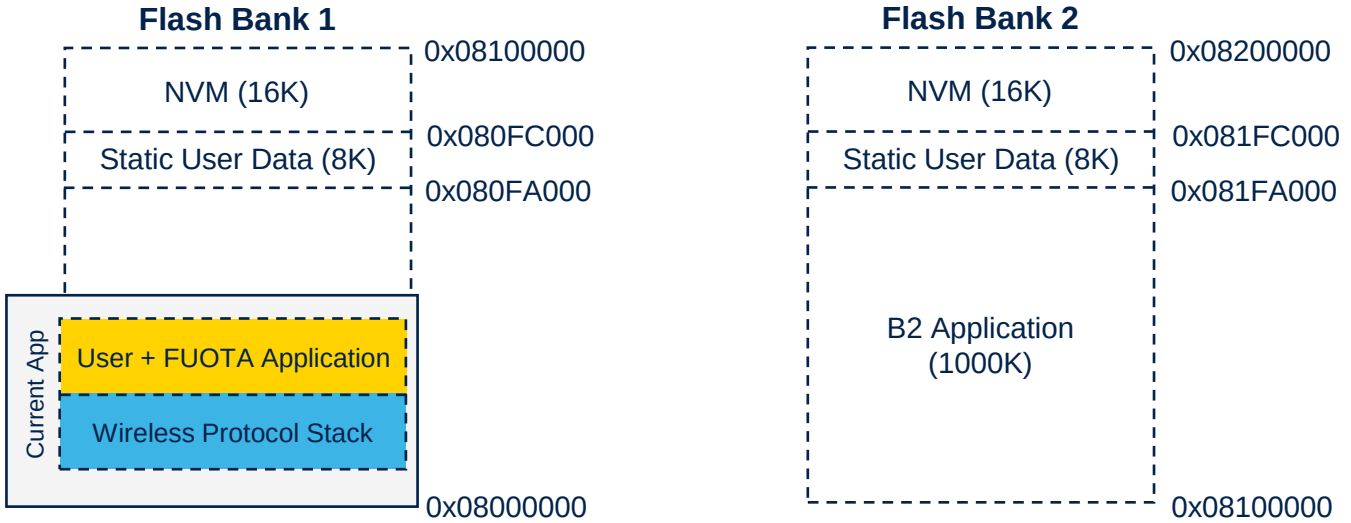




Demo 3: Unlocking OTA with STM32WBA6
FUOTA Dual Bank

Dual Bank specificities

- BLE FUOTA service will, into opposite bank:
  - Make a full erase
  - Write FW app received over BLE
  - Reboot MCU on opposite bank
- No Application Install Manager needed
- Always a functional App installed (N-1)
- Allows read-while-write operations
- Boot address is selected with option byte OB_USER_SWAP_BANK

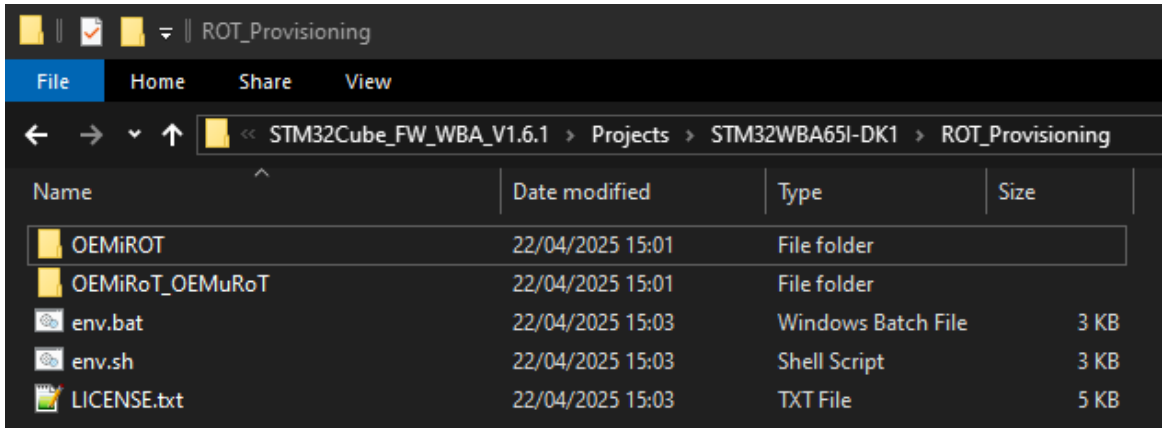


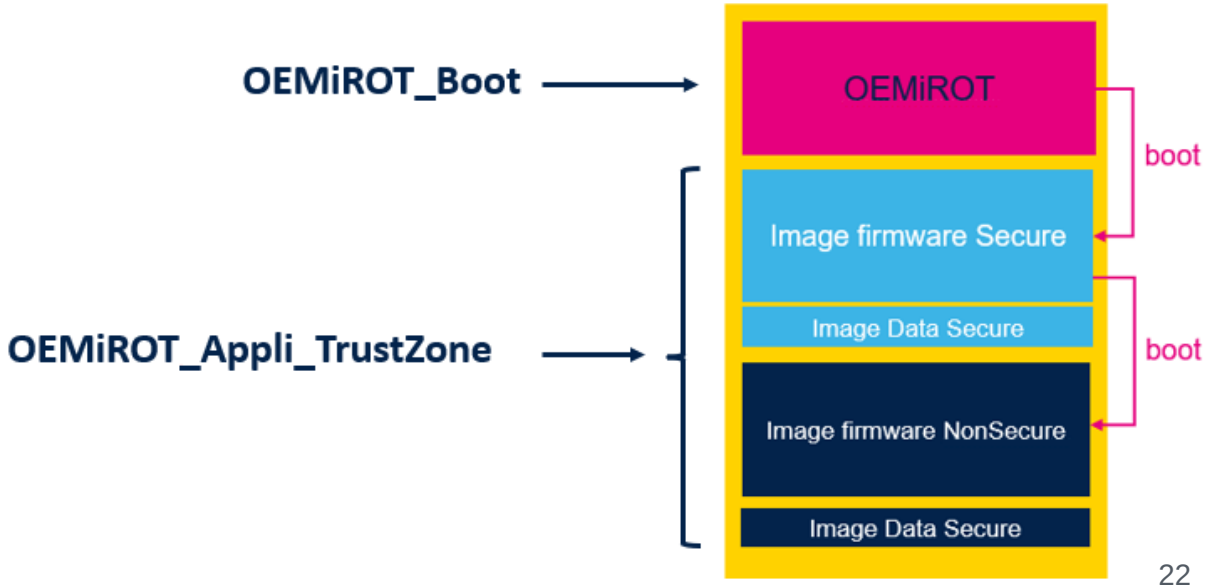
Delivered on our GitHub HotSpot!
For STM32WBA65RI-DK board

Demo 3: Unlocking OTA with STM32WBA6
FUOTA with OEMiROT

New example OEMiROT & FUOTA for discovery board:

- **OEMiROT** stands for **OEM i**mmutable (unchangeable) **R**oot **o**f **T**rust
  - Secure Boot
  - Secure Firmware Update
- Available soon on [GitHub HotSpot]
- [ST Wiki page] to guide you for the implementation

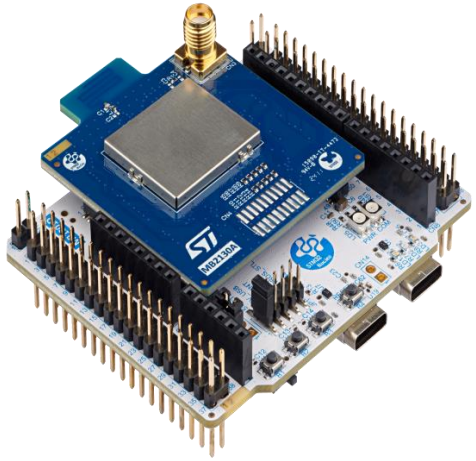


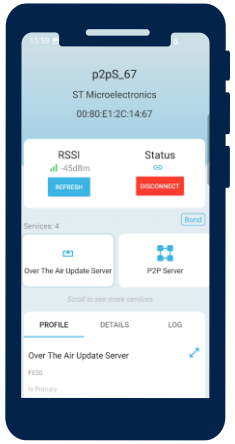


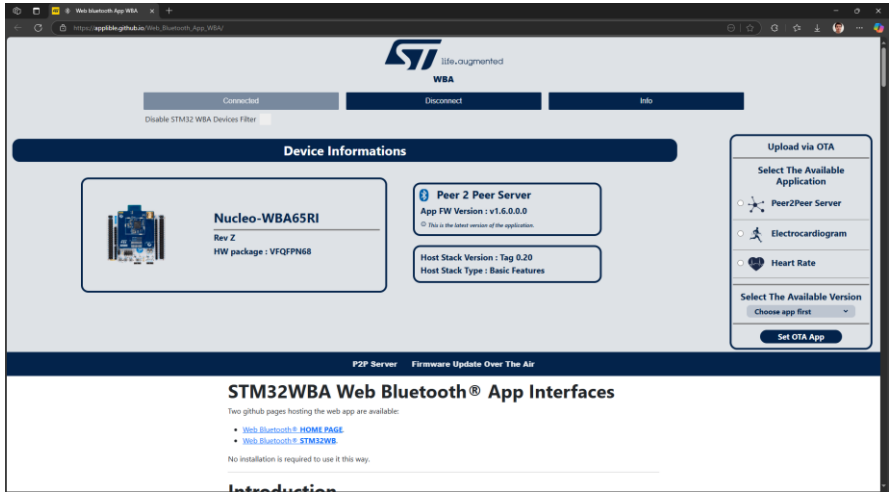
Demo 3: Unlocking OTA with STM32WBA6

Takeaways

1. FUOTA solution is part of the SDK package including all related tools
2. Full ecosystem: Android/iOS app, Web app, etc.
3. Overcoming FUOTA Challenges with large memory with dual-bank implementation and OEMiROT for security



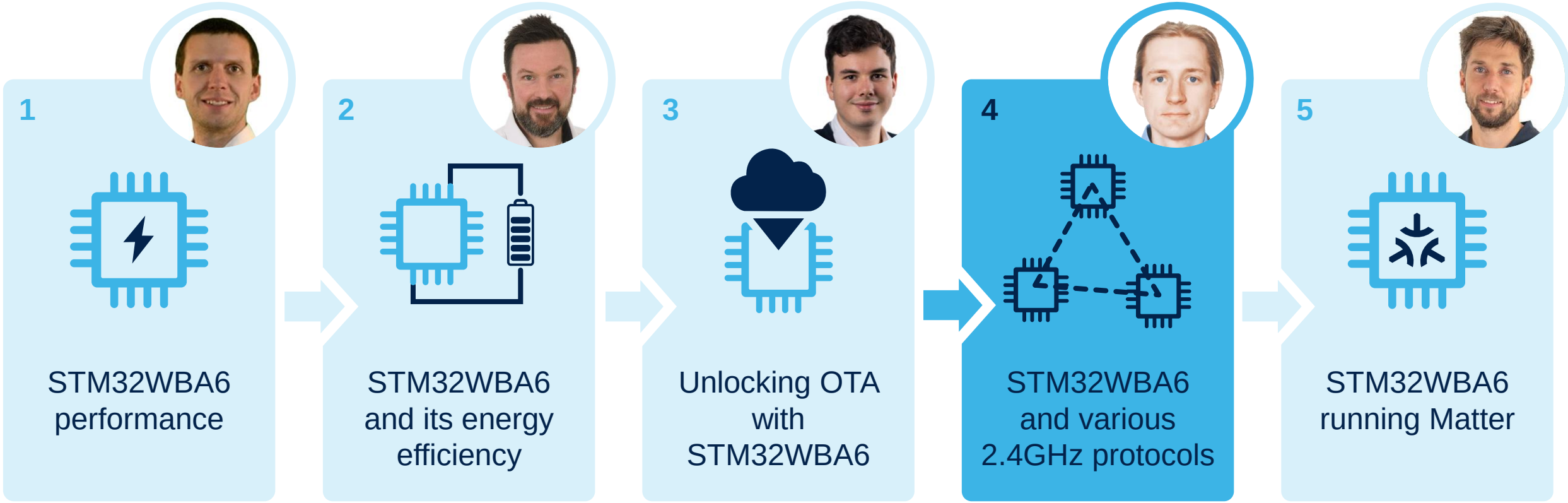




[STM32WBA Bluetooth® LE Firmware update over the air]

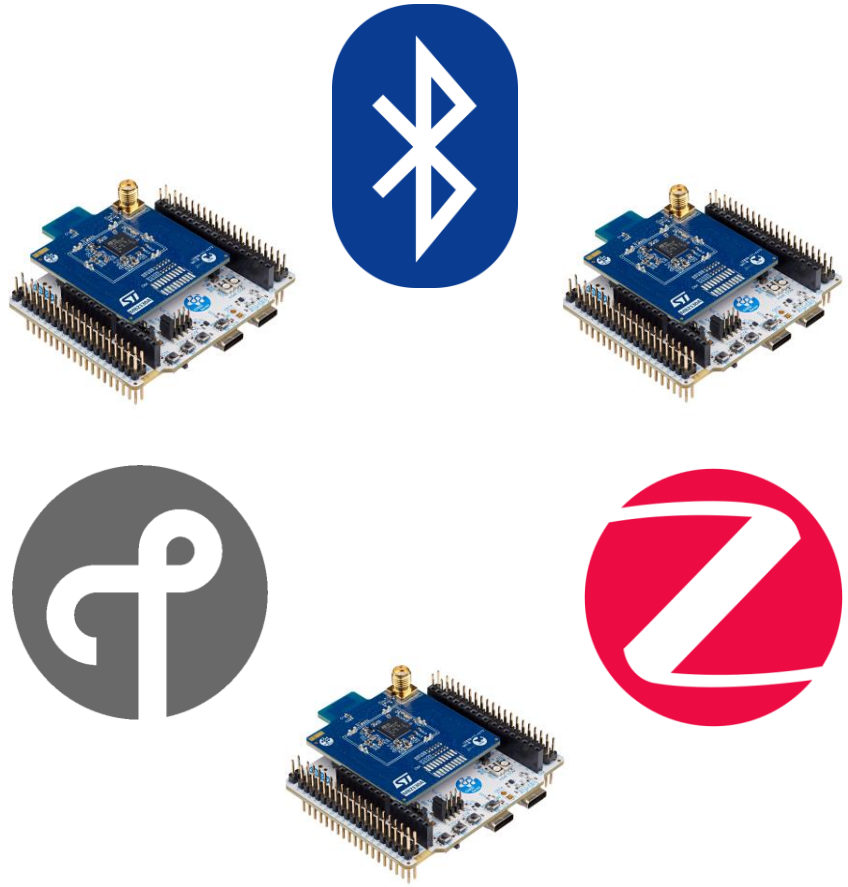
STM32WBA6 in action

Use-cases and ecosystem demo lab tour



Demo 4: STM32WBA6 running various 2.4GHz protocols
Introduction

1. Overview of available protocol stacks using 2.4GHz radio peripheral
2. Walkthrough of 2.4GHz examples available in STM32Cube SDK
3. Zigbee Pro and Zigbee Direct demonstration

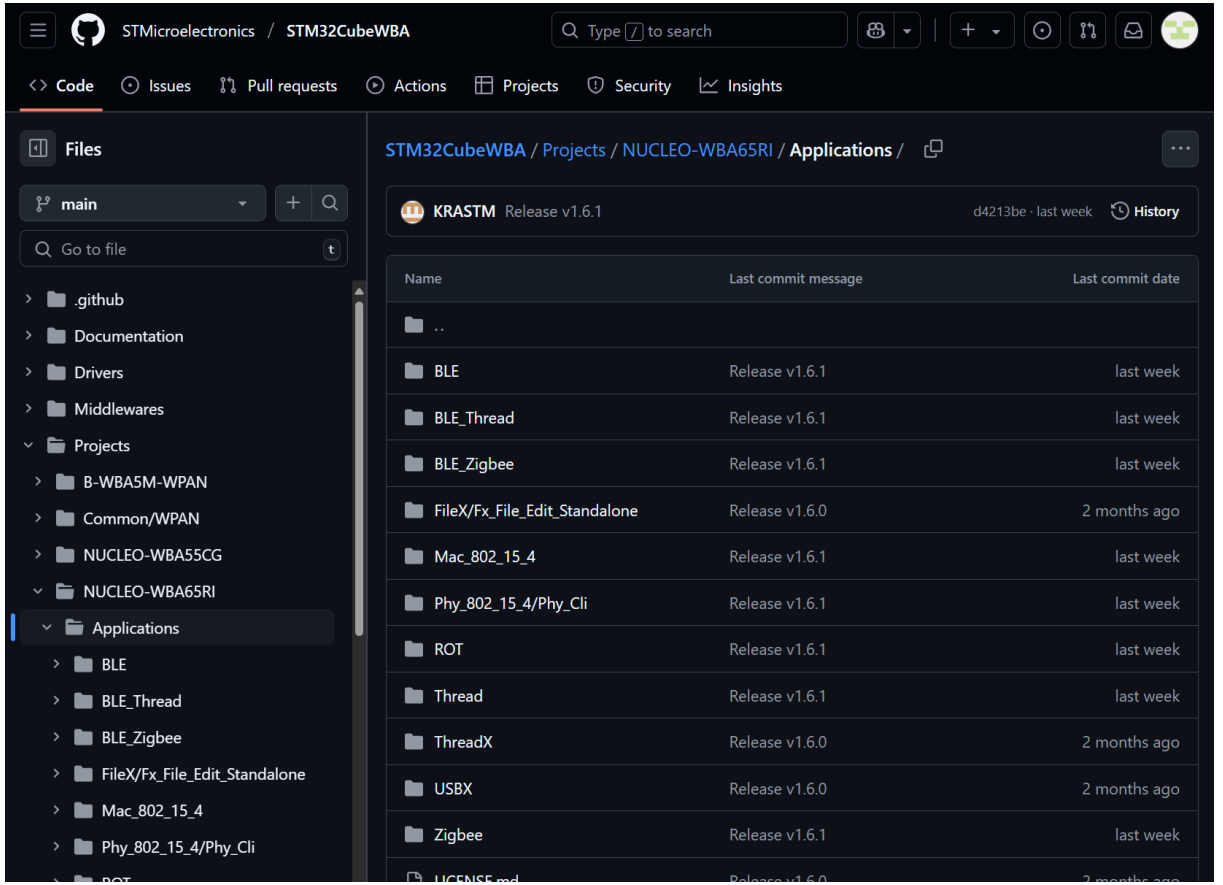


Demo 4: STM32WBA6 running various 2.4GHz protocols
Protocols stacks variants overview

- 6 variants of Bluetooth Low Energy stack
  - Bluetooth Low Energy 5.4
- 5 variants of Zigbee stack
  - Zigbee Pro 2017 (R22) and 2023 (R23)
- 2 variants for Thread
  - Compliant with Thread 1.3
- Other solutions
  - 802.15. 4 MAC layer only
    - for proprietary or 3rd party upper layers protocol stack integration
  - Concurrent mode stacks
    - Zigbee Direct
    - MATTER

Demo 4: STM32WBA6 running various 2.4GHz protocols **STM32CubeWBA package**

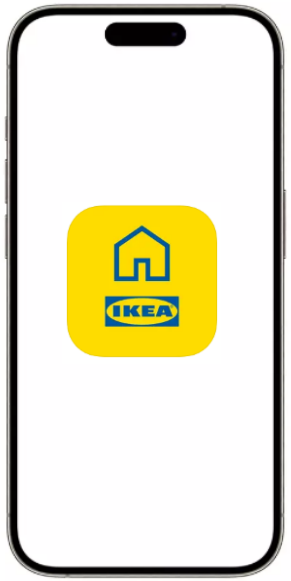
- SDK available also on [GitHub STM32CubeWBA](https://github.com/STMicroelectronics/STM32CubeWBA)*
- Examples covering the mostly common use-cases.
- Baremetal / OS versions available



*https://github.com/STMicroelectronics/STM32CubeWBA/

Demo 4: STM32WBA6 running various 2.4GHz protocols
Setup A – STM32WBA6 as Zigbee OnOff server / client

Delivered on our GitHub HotSpot!
For STM32WBA65RI-Nucleo board



Smart phone with related apk

Wi Fi

Ethernet

AP / Router

Zigbee network

Off-the-shelf
Zigbee Light
(OnOff Server)

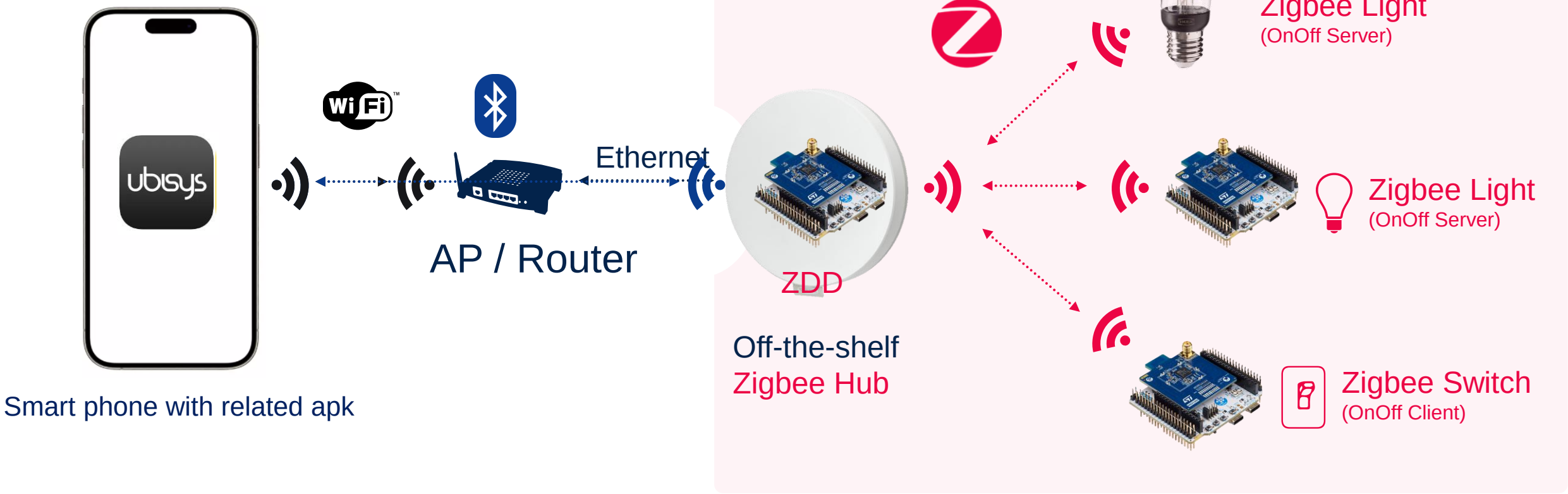
Off-the-shelf
Zigbee Hub

Zigbee Light
(OnOff Server)

Zigbee Switch
(OnOff Client)

Demo 4: STM32WBA6 running various 2.4GHz protocols
Setup B – STM32WBA6 as Zigbee Direct Device (ZDD)

More info on dedicated ST wiki page!

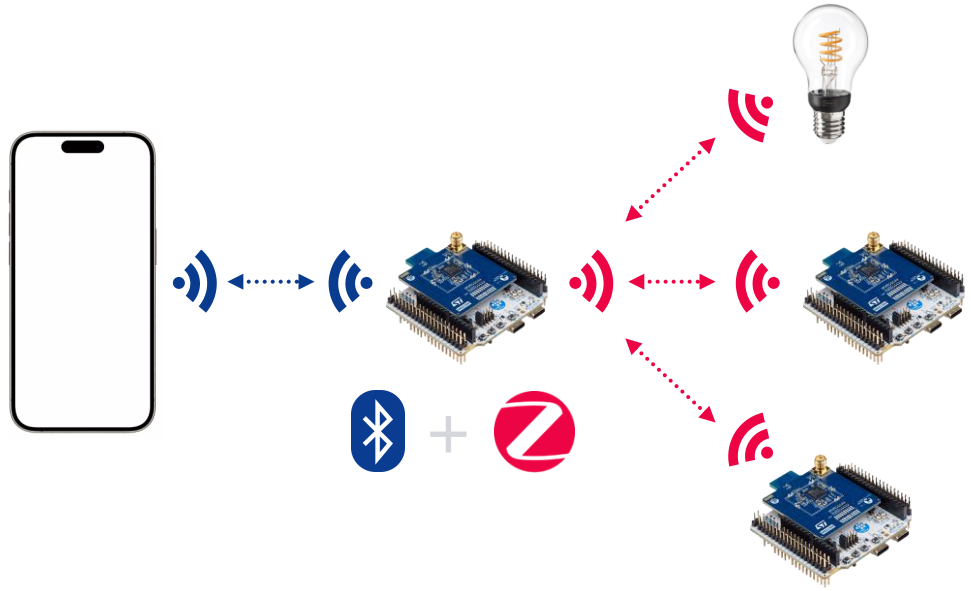


Demo 4: STM32WBA6 running various 2.4GHz protocols **Takeaways**

1	Various stack variants covering different use cases
2	Maturity and interoperability of our Zigbee solution
3	Zigbee Direct solution included in SDK and described on wiki*

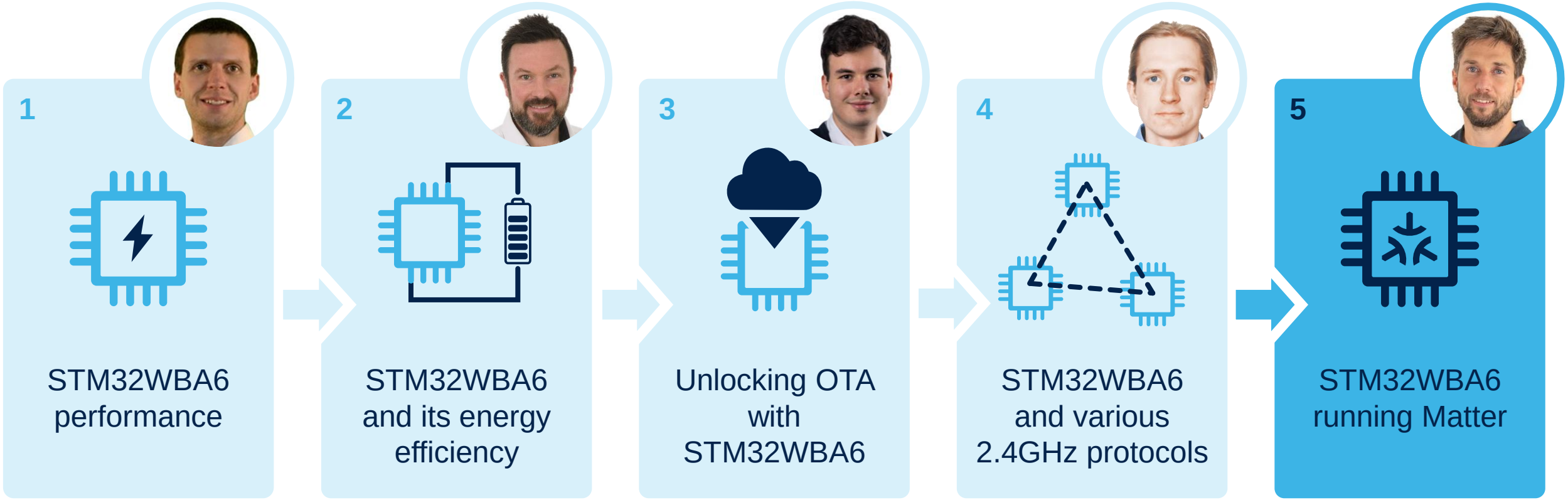
*https://wiki.st.com/stm32mcu/wiki/Connectivity:Ubisys_Smart_Home_Application_Zigbee_Direct_Setup

4	**Explore Zigbee Direct as interesting extension of Zigbee protocol standard**



STM32WBA6 in action

Use-cases and ecosystem demo lab tour

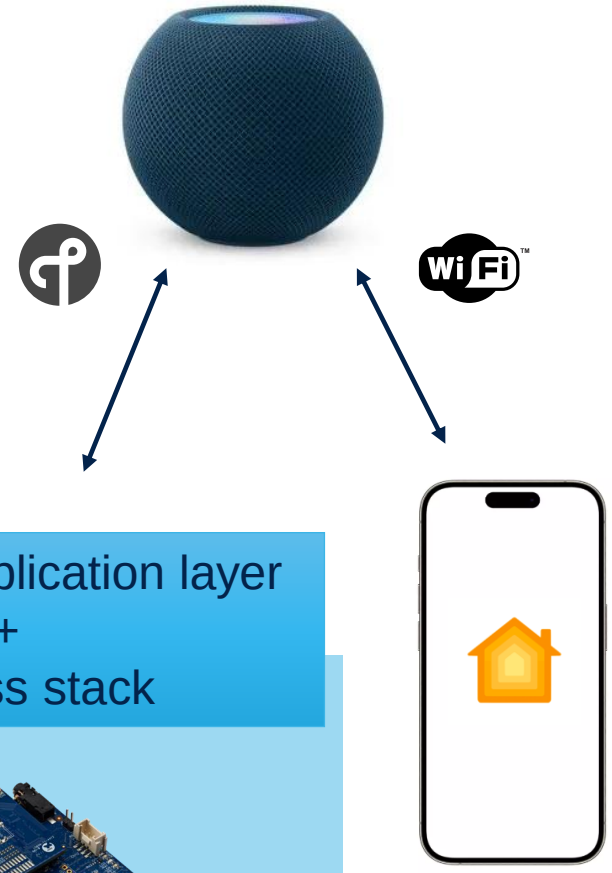


Demo 5: STM32WBA6 running Matter
Introduction

1 What is Matter protocol? matter

2 How can ST assist in supporting Matter?

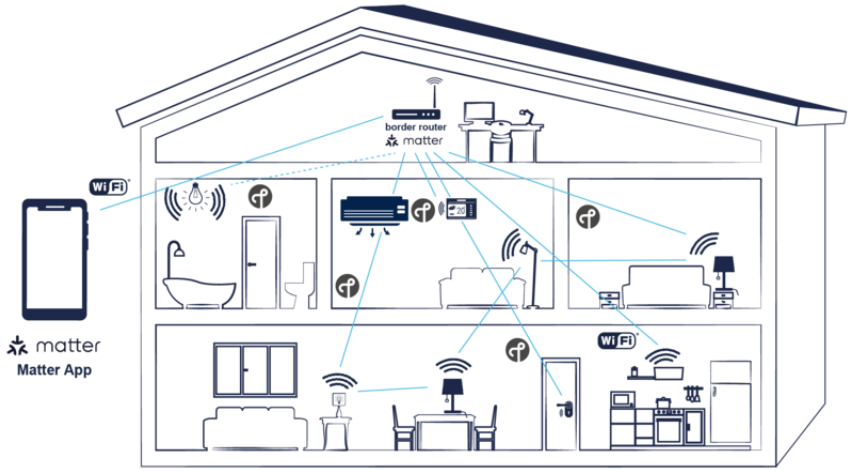
3 Adding STM32WBA6 Matter end device to Apple Ecosystem



Demo 5: STM32WBA6 running Matter

What is Matter protocol?

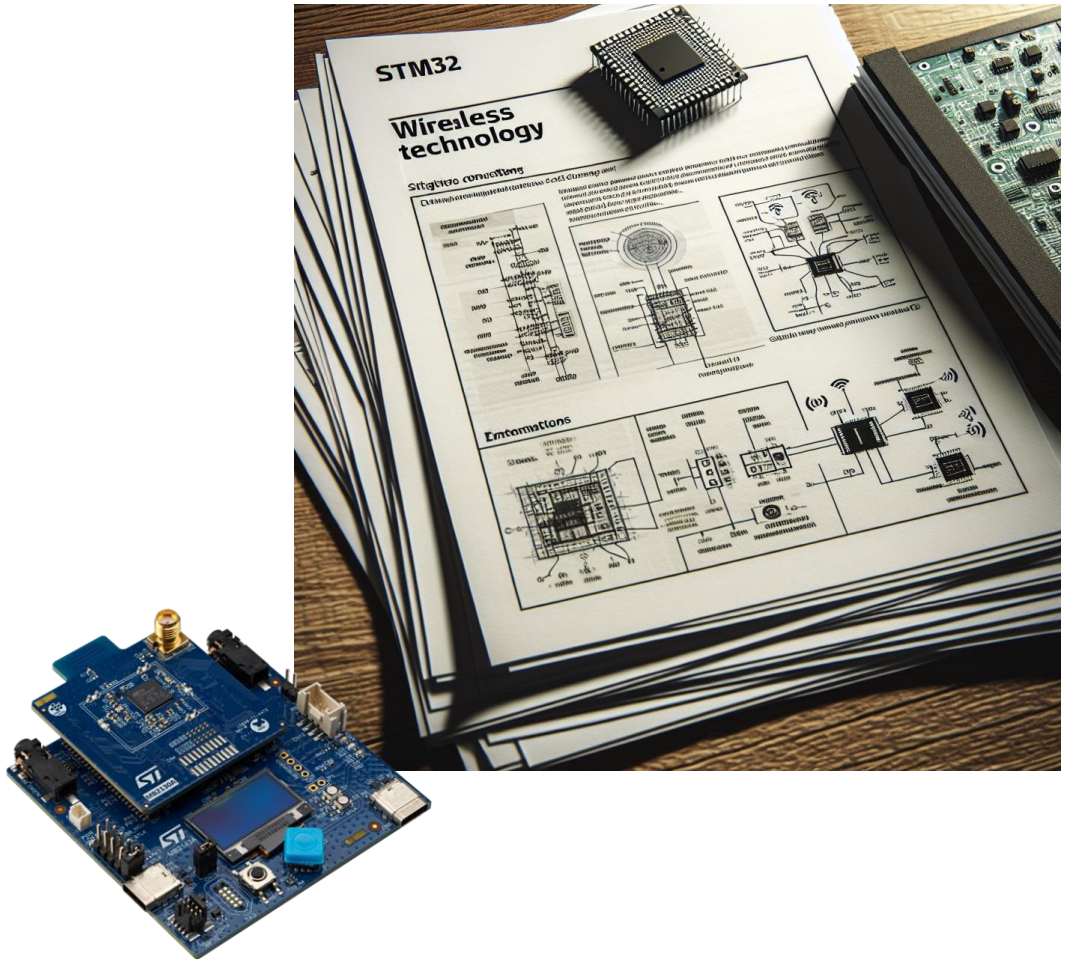
- MATTER is an open-source protocol maintained by CSA
  - Application layer
  - https://github.com/project-chip/connectedhomeip
- Ensure interoperability for consumers with a unified connectivity protocol
  - Using existing protocols – IPv6, UDP
  - Thread, Wifi, Ethernet
- Ensure security and data privacy for consumers
- Cross-platform support (Android, iOS)
- But Significant demand for memory resources



Demo 5: STM32WBA6 running Matter

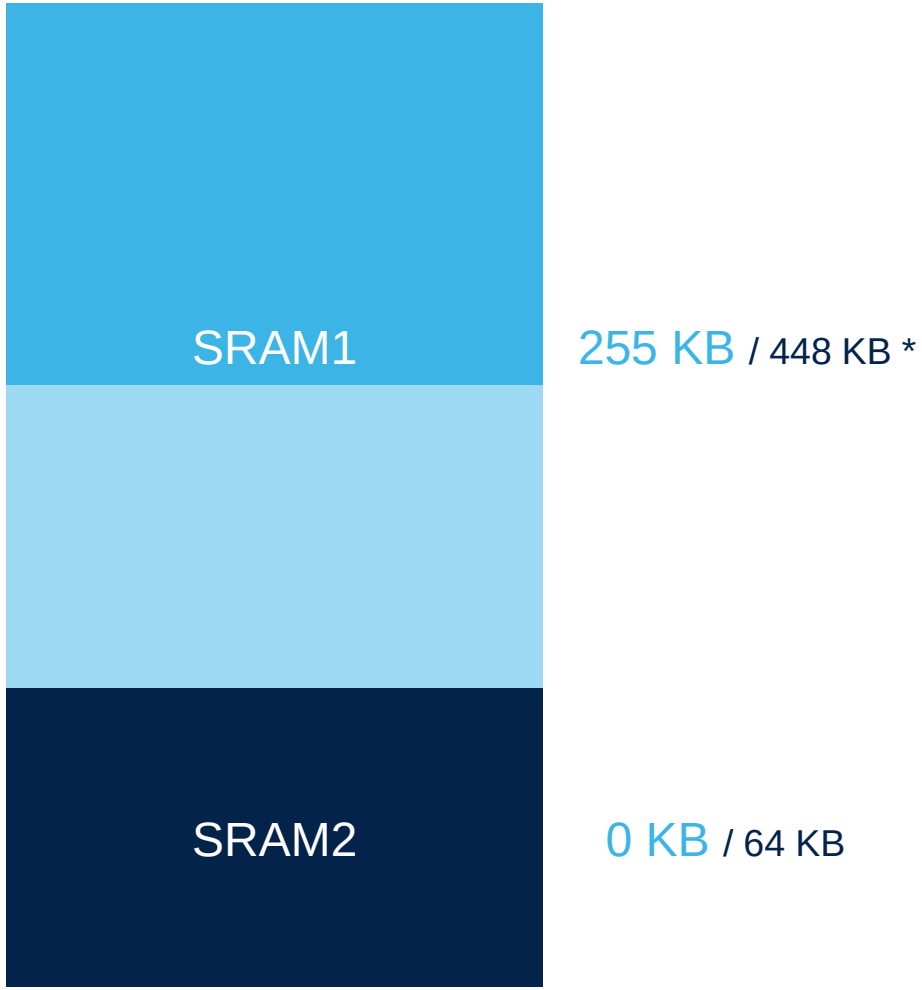
How can ST assist in supporting Matter?

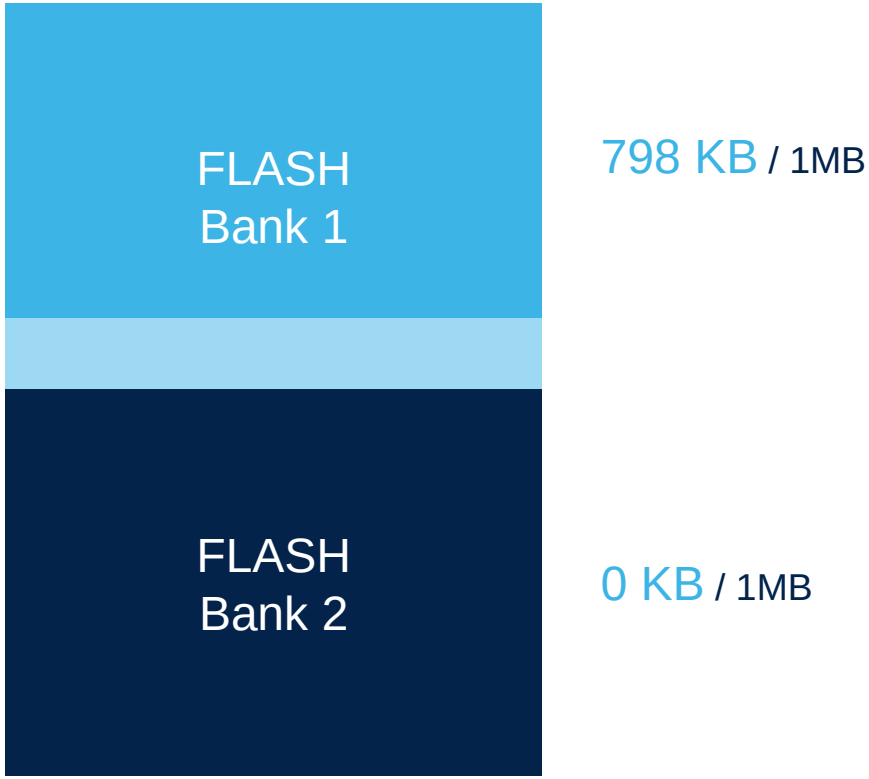
- X-CUBE-MATTER is package enables Matter protocol on STM32 – pre-certified
- ST wiki page can assist you in navigating through all the steps needed to build a MATTER device
- STM32Hotspot
  - GitHub repository
  - ST examples
- STM32 wireless portfolio



Demo 5: STM32WBA6 running Matter

Matter accessory application memory footprint



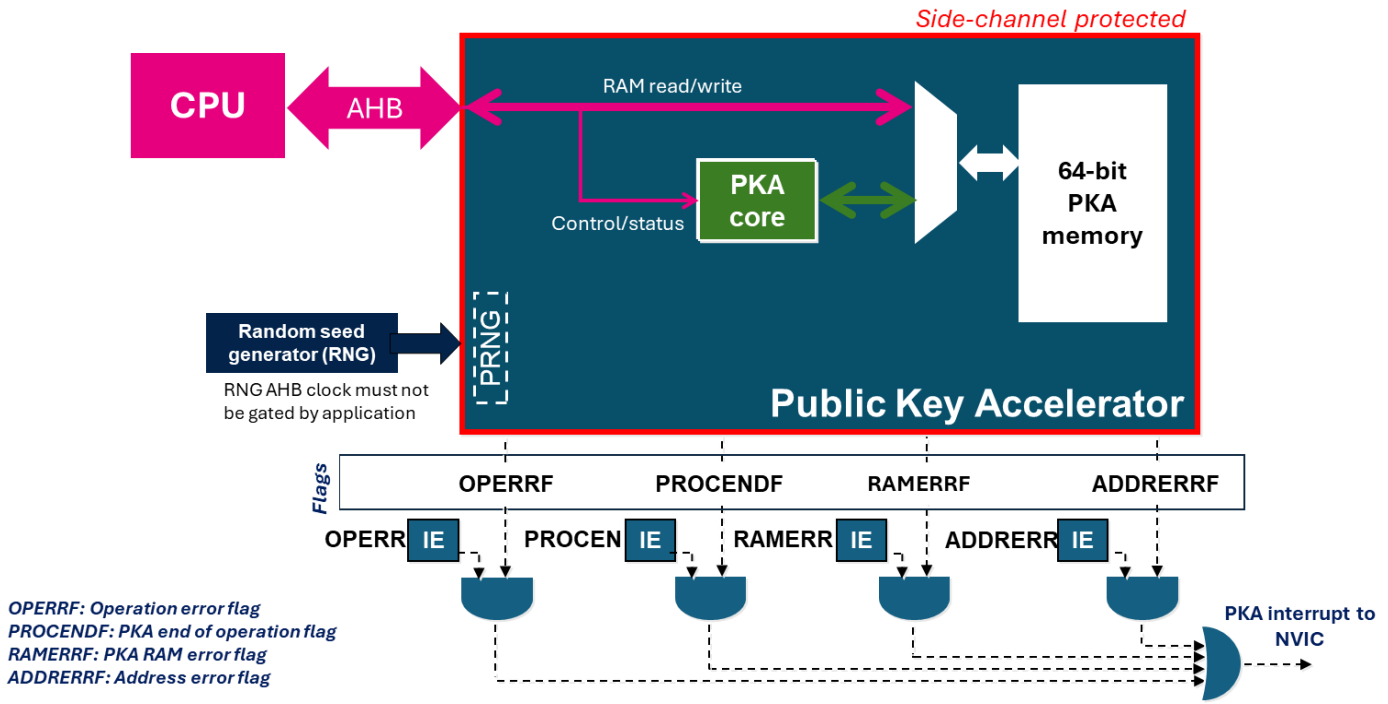


* consumed / available

Demo 5: STM32WBA6 running Matter
PKA (Public Key Accelerator) benefits

- Fast commissioning enabled by the PKA peripheral available on STM32WBA6
- 4x faster than without an accelerator

Measured approximately **15** seconds with PKA versus **60** seconds without PKA



Demo 5: STM32WBA6 running Matter
Takeaways

1 X-CUBE-MATTER for STM32 including Matter stack and application examples (pre-certified)

2 Several wiki* pages with all important information needed for evaluation and development

*https://wiki.st.com/stm32mcu/wiki/Connectivity:Introduction_to_Matter

3 STM32WBA6 tailored for Matter over Thread accessories

4 **Make it yours now and evaluate!**

X-CUBE-MATTER

matter

STM32WBA6

- Cortex-M33 w/ TrustZone
- 2 MB of Flash
- 512 KB of RAM
- 802.15.4 + BLE
- Low-Power consumption
- PKA (Public Key Accelerator)
- Up to +10 dBm

STM32WBA6 in action

Use-cases and ecosystem demo lab tour

1

STM32WBA6 performance

2

STM32WBA6 and its energy efficiency

3

Unlocking OTA with STM32WBA6

4

STM32WBA6 and various 2.4GHz protocols

5

STM32WBA6 running Matter

Agenda (9:00 – 12:00)

1 5 min	Session introduction & agenda	
2 30 min	Introduction of STM32WBA6 series	
3 45 min	How to start with STM32WBA6 ecosystem ?	
4 10 min	10:30 Break	
5 70 min	STM32WBA6 use cases and ecosystem • Demo1 : Performance • Demo2 : Energy efficiency • Demo3 : Unlocking OTA • Demo4 : Various 2.4GHz protocols • Demo5 : Running Matter	
6 15 min	ST RF Lab services and capabilities	
7 5 min	Takeaways, Q&A	

 Demo