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STM32WB series MCU
with built-in Bluetooth[®] LE 5
and IEEE 802.15.4



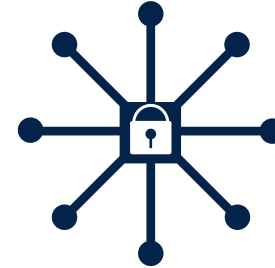
Make the choice of STM32WB series the 7 keys points to make the difference



Open 2.4 GHz radio
Multi-protocol



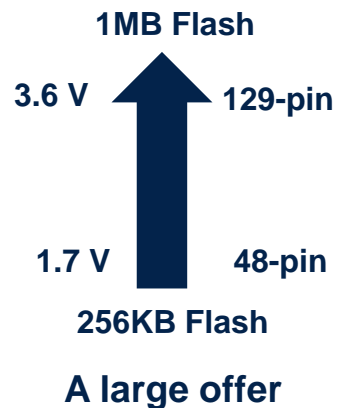
Dual-core / Full control
Ultra-low-power



IoT Protection ready



Massive integration
Cost saving



Advanced RF tool, Energy control
with C code generation

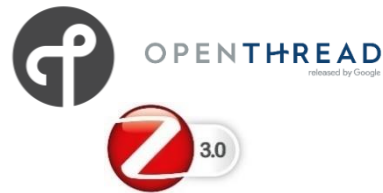


No matter what!

Multiprotocol and open radio



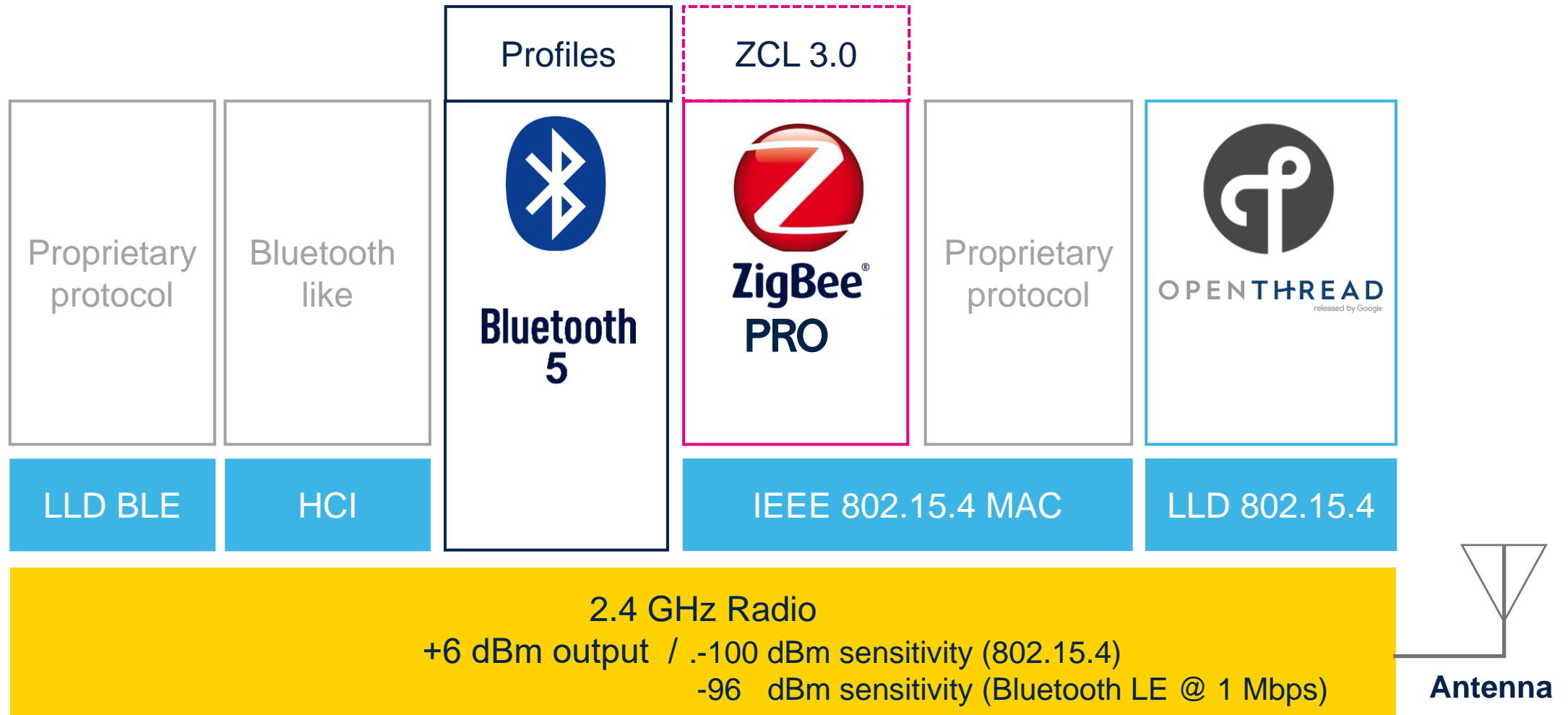
 **Bluetooth® 5**



2.4 GHz
Open

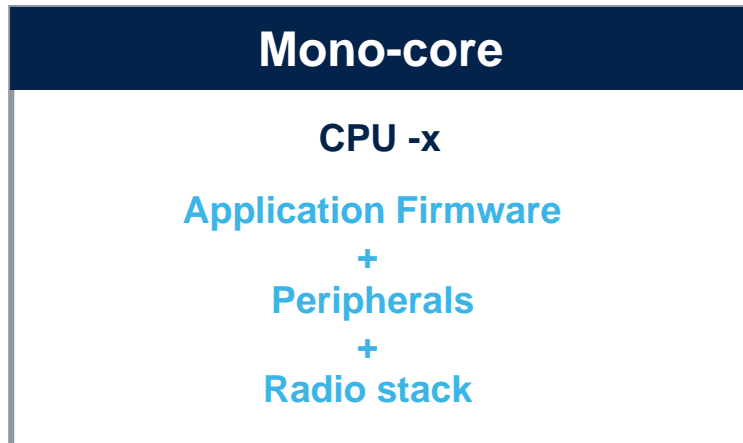
- Fully certified Bluetooth® LE 5 radio
- 2x faster speed with 2 Mbps capable mode
- Extend network coverage with Bluetooth Mesh
- Last IEEE 802.15.4 standard ready
- OpenThread, Zigbee 3.0
- Bluetooth 5.0 and 802.15.4 protocols in Static and Dynamic concurrent mode
- Proprietary protocol capable (Bluetooth Low Energy like or 802.15.4)
- Best-in-class RF with up to +6dBm output power and 102 dB link budget
- Energy sensitive application with only 4.5mA in RX and 5.2mA in TX (@ 0dBm)
- BOM cost reduction thanks to Integrated balun

Make it yours



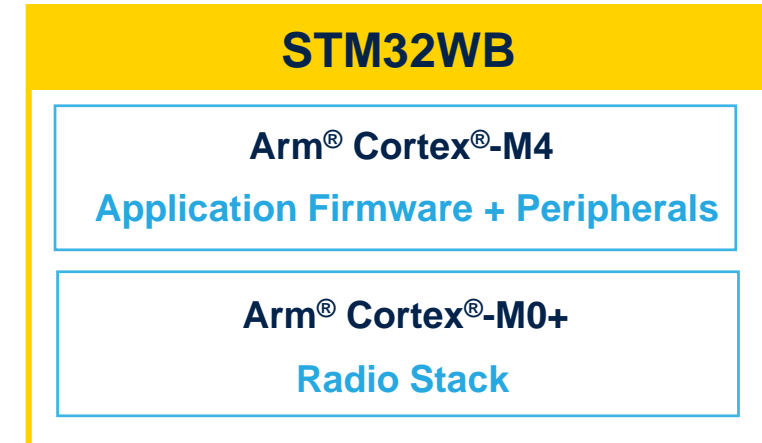
Simplicity of development

2 independent cores for real-time execution



• Drawbacks

- Time sharing
- Longer processing time – Greedy current consumption
- Need companion MCU (increased cost)



• Benefits

- SOC solution (1 single die)
- Full flexibility - Easy development – User experience
- Increase battery life
- All-in-1 solution - cost saving
- Speed up time to market
- Easy certification process

Rich feature set

KEY FEATURES

2 independent cores for real time execution

Ultra-low-power consumption

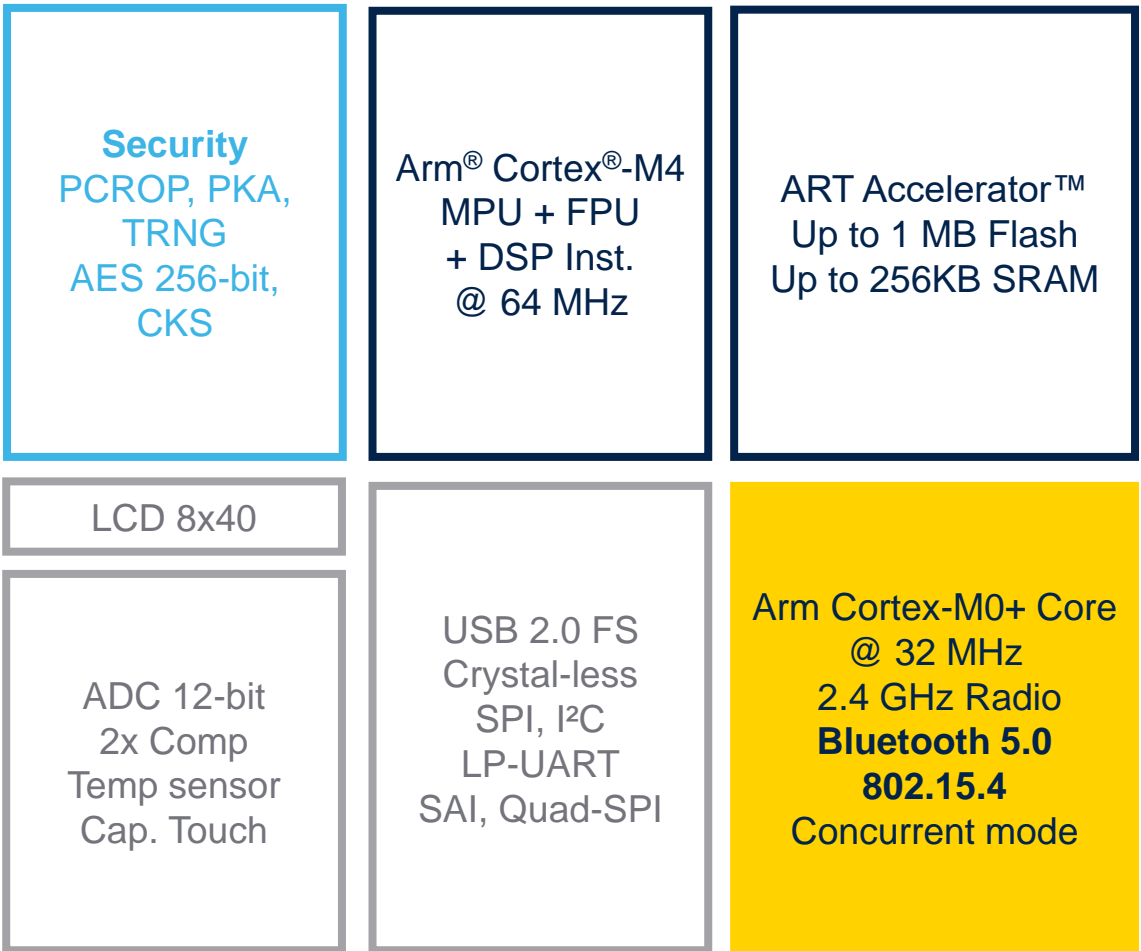
- 50 µA/MHz Active mode (at 3.0V)
- 2.1 µA Stop mode (Radio in standby + 256KB RAM)
- < 50 nA Shutdown mode

Peripherals

- 2xI²C, 1xUSART, 1xLP-UART, 2xSPI, 1x USB 2.0 FS device supporting Battery Charging Detection, 1xSAI, Quad-SPI (XIP), 6x 16-bit timer (including LPWM and low-power one)

1.7 to 3.6V voltage range (DC/DC, LDO)

-40°C to +105°C temperature range



Benefit of dual cores processing

1 Independent Radio activity

- Uploading data to mesh network or smartphone
- OTA of Radio protocol stack or application FW
- Running on Arm Cortex-M0+

2 Energy saving mode

- RAM + RTC running @ 2.1 μ A
- Fast wake up @ 5 μ s

3 Main application activity

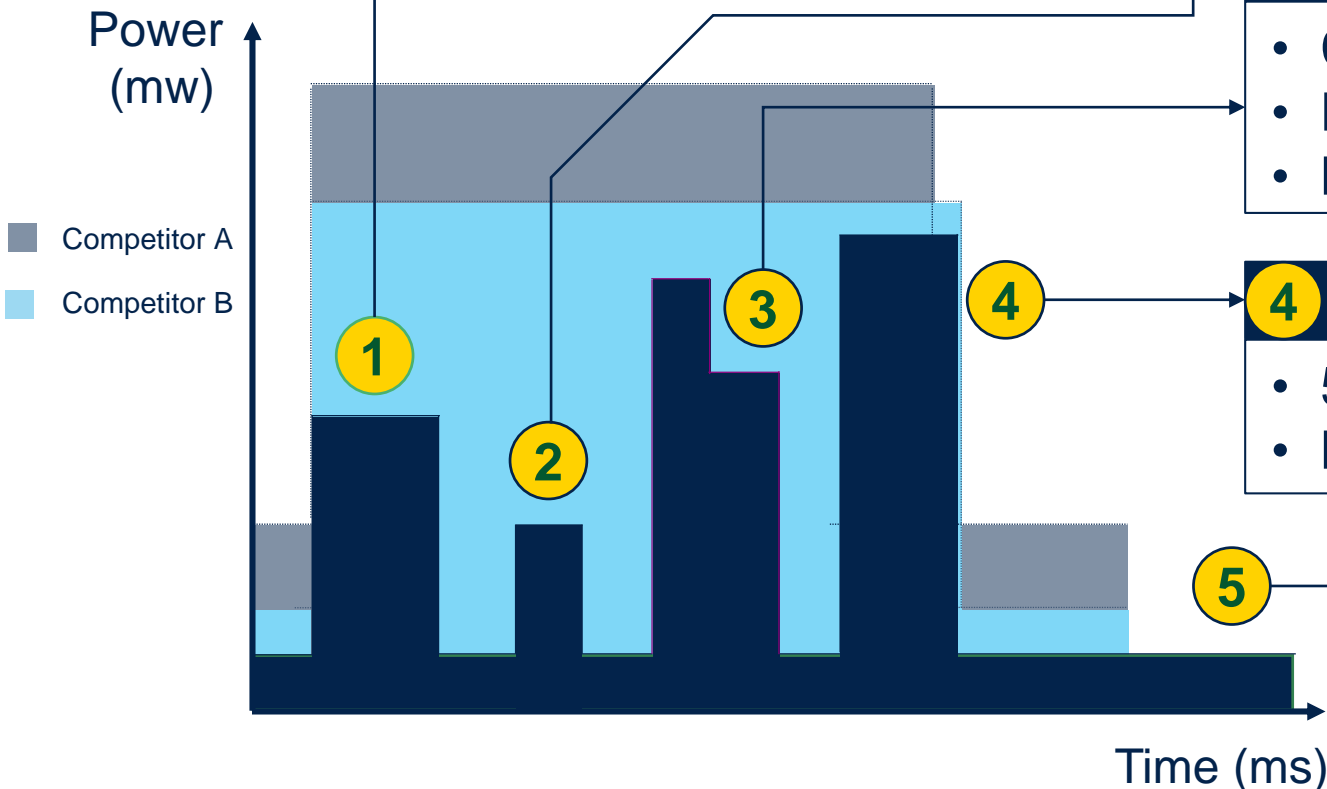
- Computing data (sensor fusion ...)
- Flexible Arm Cortex-M4 CPU speed up to 64 MHz
- Batch Acquisition Mode (BAM) with CPU & Flash turned off

4 Dual CPU activity

- 50 μ A/MHz only!
- Both Radio and Application running independently

5 Super saving mode

- Shutdown < 50 nA
- Battery energy saving



All in one MCU full flexibility control

- Robust RF link **-100dBm** sensitivity with IEEE 802.15.4 and **+6 dBm** output power
- Upgrade legacy 802.15.4 device to **Bluetooth LE 5.0**
- **Update** securely Radio and stack firmware with build-in FUS
- Bluetooth 5 and 802.15.4 protocols **Mesh capable** to extend network range



Lighting



Fleet maintenance

- Retrofit legacy product to **Bluetooth LE 5.0** and concurrency mode
- Remotely upgrade device with **OTA capability**
- **Brand protection** with Authenticated FW upgrade system

- **Up to 105°C** radio capable
- **External PA** support to get ultra wide communication distance
- Down to **600 nA mode** with RTC and 32KB of RAM
- Only **5µs wakeup** time over 16 wakeup lines
- PCROP, ECC, TRNG, PKA, for best design robustness
- Reduce BOM cost with **built-in LCD booster**



Industrial devices



Fitness/Healthcare

- **Multipoint** Bluetooth LE 5.0 connections
- Small form factor design with **CSP100 pins**
- Battery lifetime care with **< 50 nA** Shutdown mode
- Dynamic Efficient **50 µA/MHz**
- Extend memory storage with **Quad-SPI**
- Handle advanced algorithm with **1 Mbyte** of Flash
- Cost optimized product with USB 2.0 **crystal-less** device

- **Beacon** profile available among a huge list
- **Embedded balun** to minimize design cost
- Only **5.2mA Radio TX** current to extend beacon lifetime
- **Up to +6 dBm** output power to get best beacon range
- **< 2.1 µA** Stop mode with full RAM for **battery life** optimization
- Down to 1.71 full feature capable



Beaconing



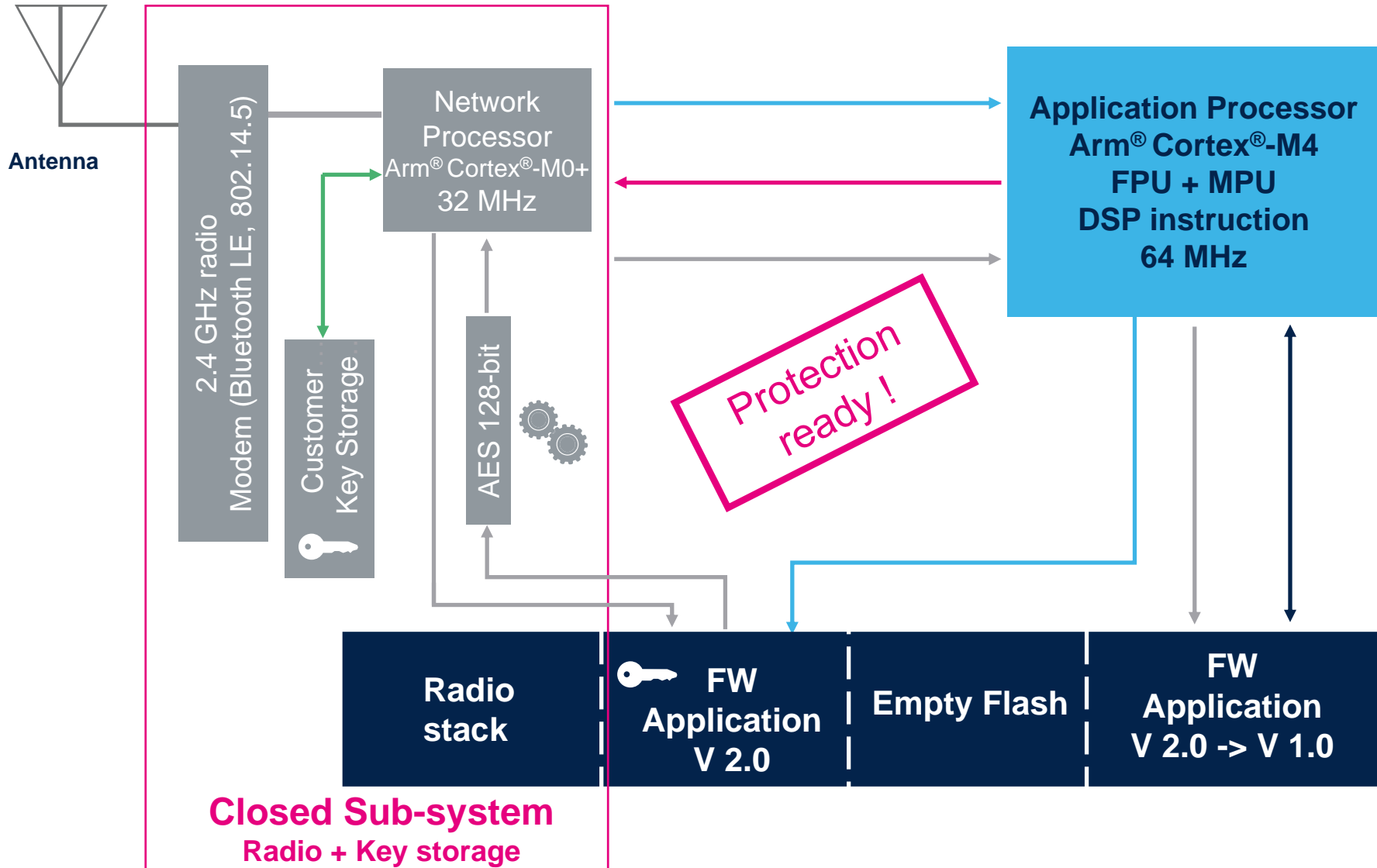
Home security and Audio

- **-100 dBm** sensitivity to increase area coverage
- **Customer Key Storage (CKS)** for trustable Application update
- Manage full duplex **audio** with embedded SAI
- USB FS 2.0 with Battery **Charging Detection** for remote device



IoT protection ready (1/2)

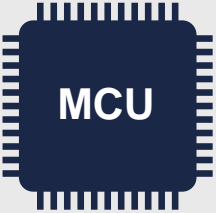

radio stack and/or application FW update



- 1 New FW package received
- 2 New FW detected Update is launched
- 3 App Processor send New FW package signature and encryption key for authentication
- 4 Authentication signature matches preprogrammed key Case not, the process is aborted and device resets
- 5 New FW package is decrypted with proprietary Key. Device upload on going.

IoT protection ready (2/2)

STM32WB counter measure against attacks

Attacks	Attacks description	STM32WB Countermeasures
<p>Advanced</p> <p>Non Invasive Attacks</p> 	<ul style="list-style-type: none"> • Environment modification <ul style="list-style-type: none"> • Temperature • Voltage • Clock • Fault injection (glitches....) • Exploit debug features • Side channel, power Analysis, ... 	<ul style="list-style-type: none"> • Temperature sensor • Power supply integrity monitor • Clock security system • Tamper pads • Memory ECC, Parity check • RTC alarm, registers, SRAM mass erase • JTAG Read out protection • BOOT from Flash only
<p>Basic</p> <p>Software Attacks</p> 	<ul style="list-style-type: none"> • Low Authentication / Encryption • Extract keys • Exploitation of applicative test features • Malware / Virus • Replay, privilege escalation 	<ul style="list-style-type: none"> • Customer Key Storage (CKS) • RNG, Crypto accelerator, CRC • Write memory protection • Read Out memory protection • Memory Protection Unit (MPU) • Firmware Upgrade Service (FUS) • Secure Firmware Update (SFU) • Proprietary Code Read-Out Protection (PCROP) • 96-bit ID

Massive cost saving

The more feature integration, the more the BOM drops down !

Silicon cost

- RF balun cost: Embedded
- External components: 7
- 32 kHz Master clock output available
- Crystal for USB 2.0 FS operation: embedded
- LCD display booster: embedded (only single glass)
- Capacitive touch controller: embedded
- PCB cost: 2 layers PCB only

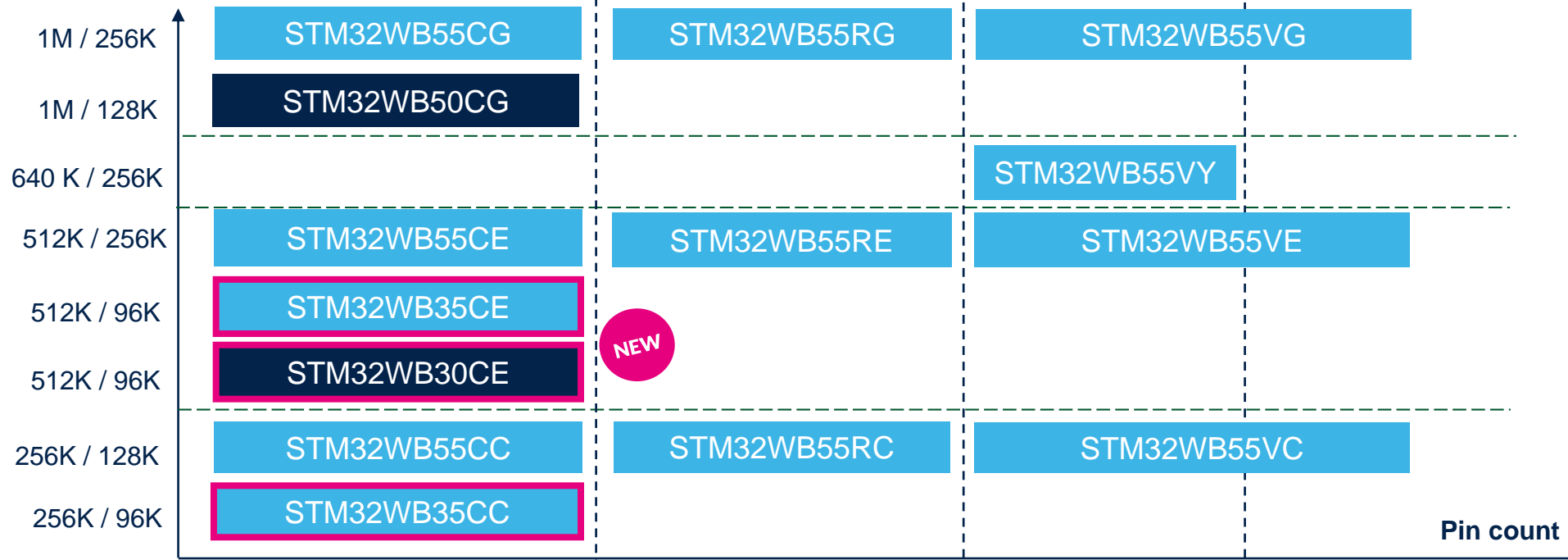
Free of charge Ecosystem

- Bluetooth LE™ 5.0 stack
- Zigbee 3.0 stack
- OpenThread stack
- Generic 802.15.4 MAC
- Generic HCI drivers
- STM32CubeMX
- STM32CubeMonRF
- IDEs (AC6: SW4STM32; ST: STM32CubeIDE)
- Bluetooth LE and 802.15.4 concurrency avoids to use a second radio MCU

STM32WB - a large offer

Bluetooth LE 5.0, OpenThread, Zigbee 3.0 and proprietary protocol capable

Flash / RAM Size (bytes)



48-pin UQFN
7x7mm, 0.5mm pitch
Pin-to-pin compatible



68-pin VQFN
8x8mm, 0.4mm pitch



100-pin WLCSP
4.39x4.37mm



129-pin UFBGA
7x7mm, 0.5mm pitch

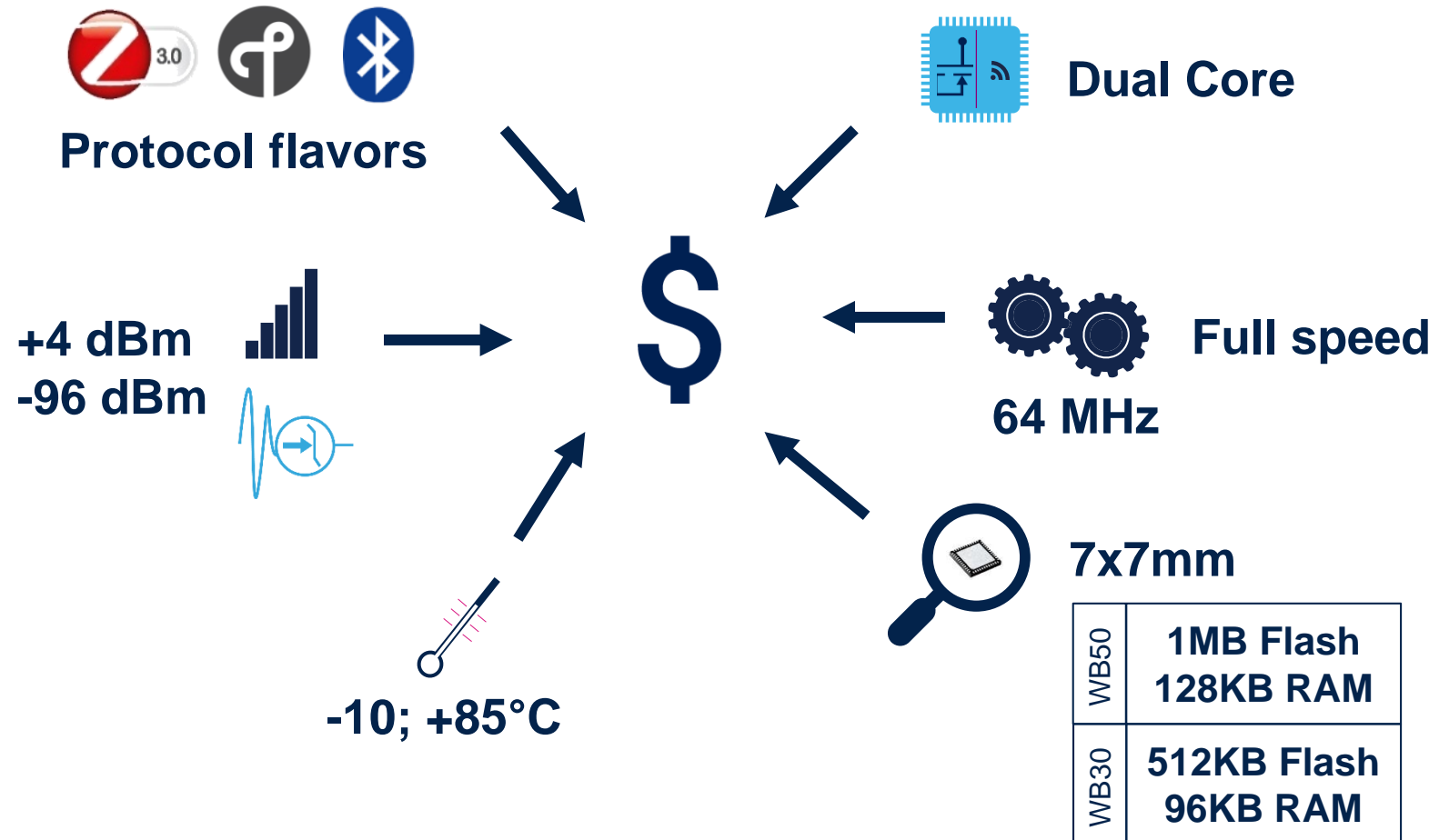


Standard line
Value line

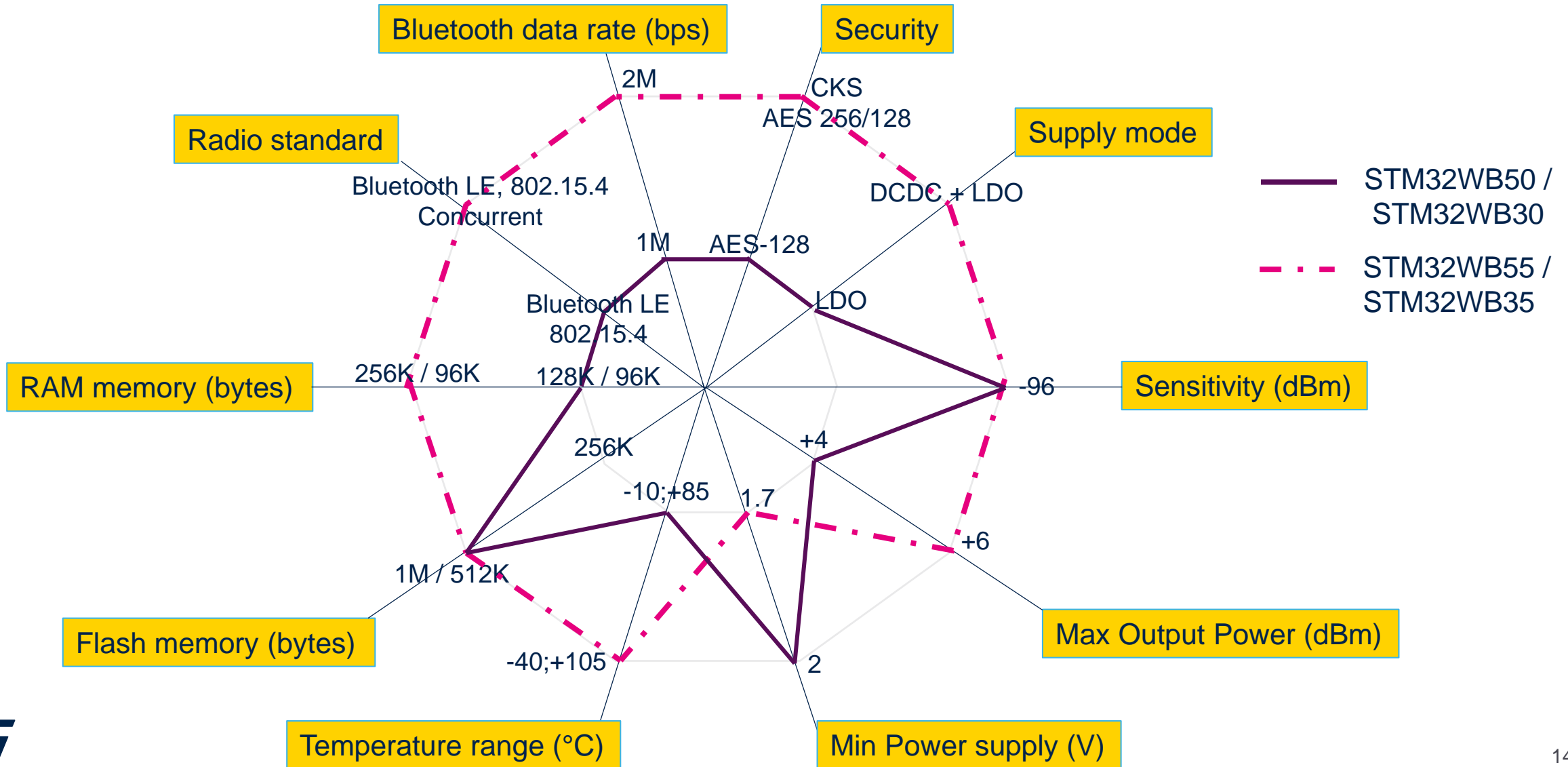
from 1.7 to 3.6 V
from -40 to +105°C

STM32WB value lines

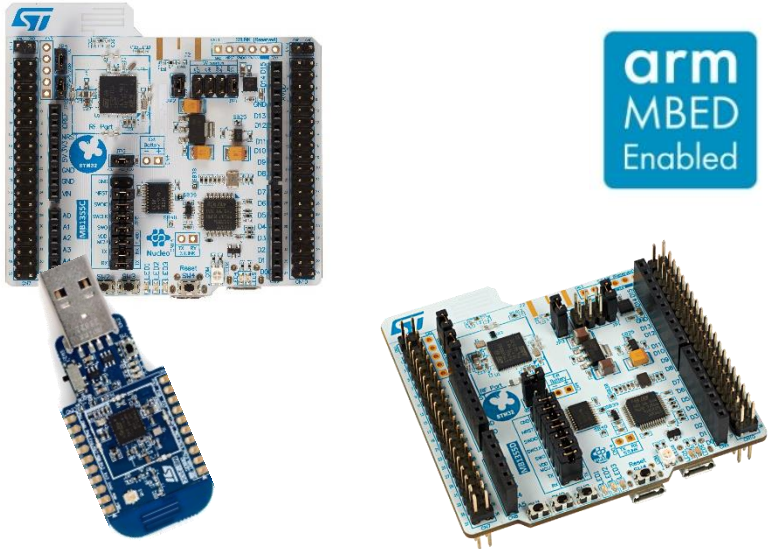
Essentials features product targeting
entry-level Bluetooth™ LE 5.0 and Mesh applications



STM32WB50 / STM32WB30 positioning



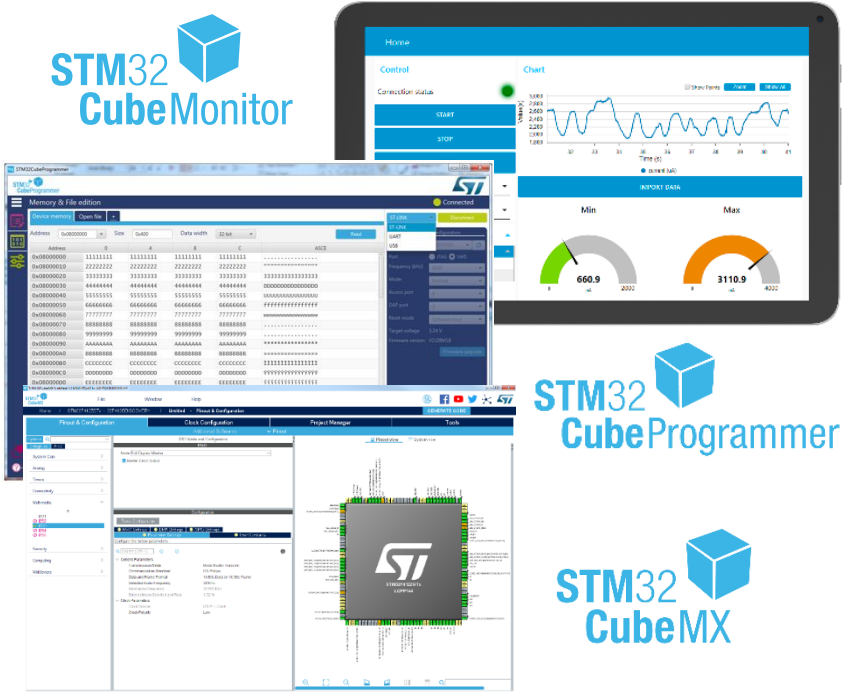
Prototyping made as easy as 1,2,3



arm
MBED
Enabled

P-NUCLEO-WB55 NUCLEO-WB55RG*

**Hardware
Evaluation Pack**



STM32
CubeMonitor

STM32
CubeProgrammer

STM32
CubeMX

**STM32CubeMX/STM32CubeWB/
STM32CubeProg & STM32CubeMonitor**

Code generation
Power calculation

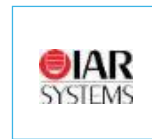
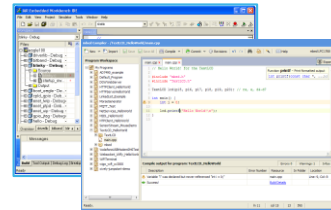
Software development tools

A complete flow, from configuration up to monitoring



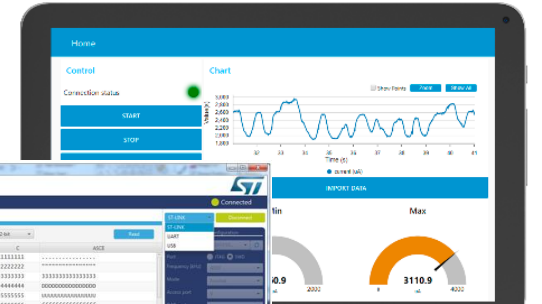
STM32
CubeMX

FREE
IDE's



More to come after mass market launch

STM32
CubeMonitor



STM32
CubeProgrammer

STM32CubeMX, GUI Builders
Configure & Generate Code

ST and Partner IDEs
Compile and Debug

STM32CubeProg/Monitor
Monitor, Program & Utilities

IPD - MLPF-WB55-01E3 harmonic filter with integrated impedance matching

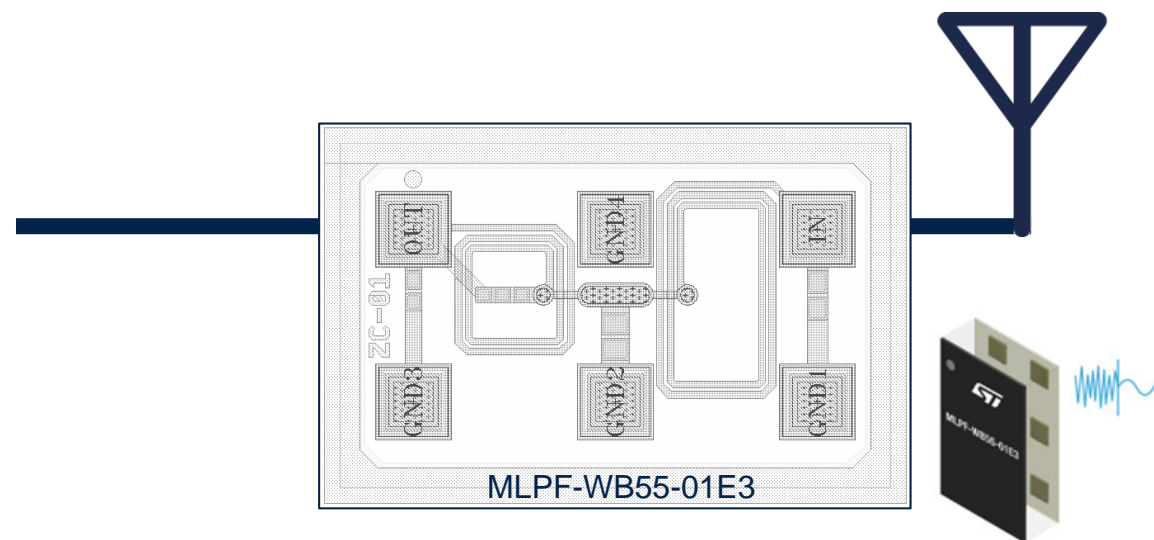


Integrated Balun

STM32WB

Arm Cortex-M4
Application firmware + Peripherals

Arm Cortex-M0+
Radio Stack



MLPF-WB55-01E3

Integrated STM32WB **impedance matching**

Deep rejection **harmonic filter**

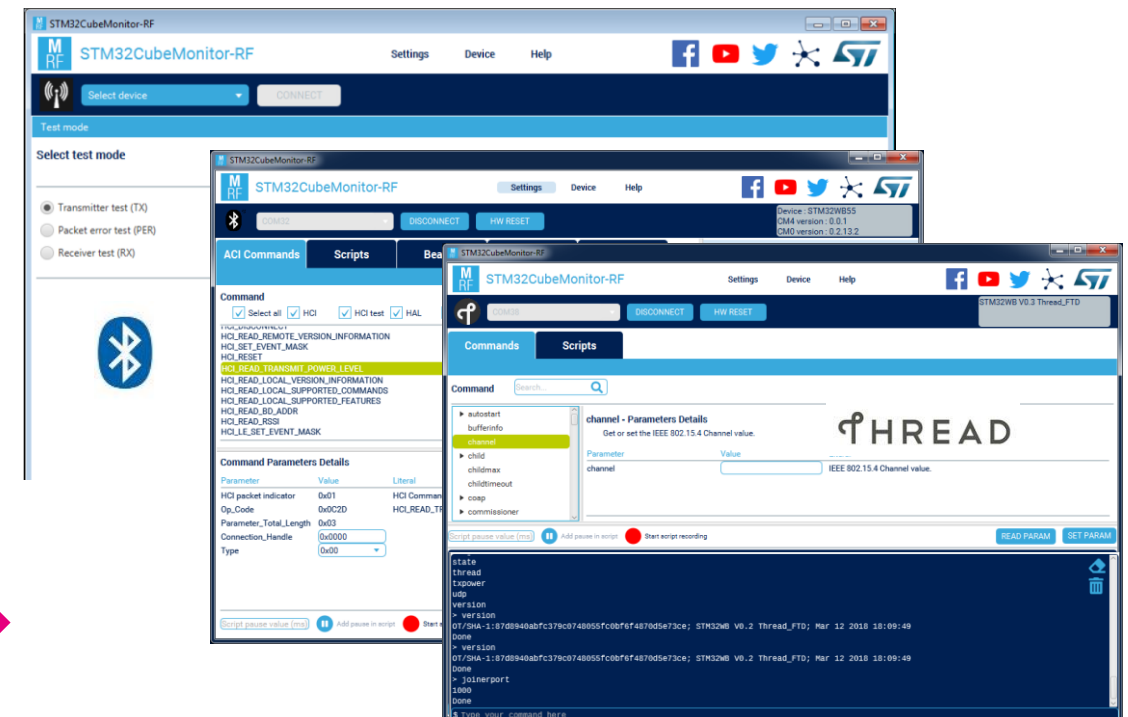
STM32CubeMonRF

- Exercise wireless features of STM32WB55
 - Bluetooth Low Energy commands
 - Bluetooth LE RF tests
 - send OpenThread commands
 - perform 802.15.4 RF tests

- DUT - Nucleo, USB dongle or customer boards.
- USB or UART to Virtual Com Port



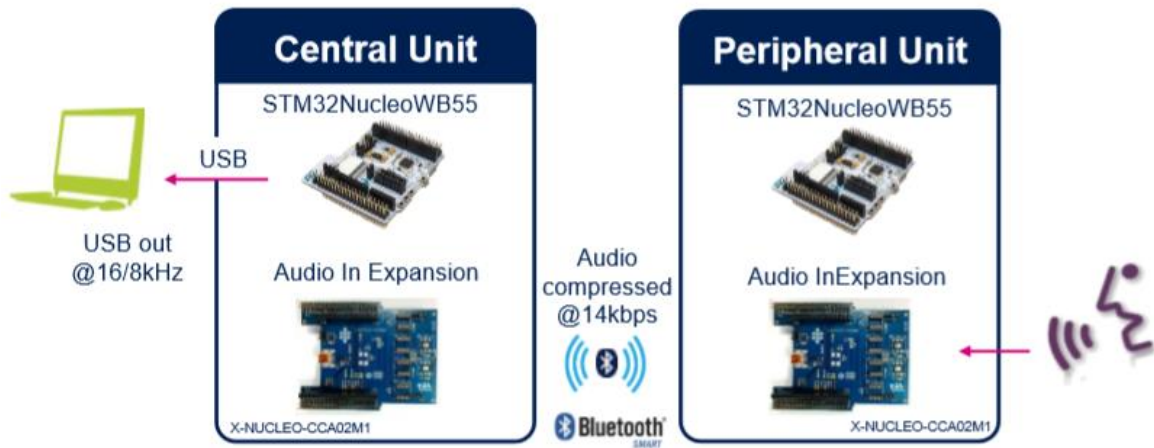
Mode selection



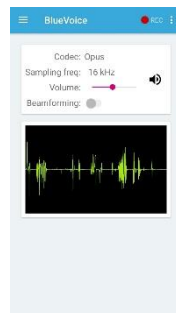
Advanced functionalities

Audio - Voice & streaming

Full-duplex audio streaming over Bluetooth LE 5.0 using Opus codec
 STM32Cube function pack for STM32WB MCU: [FP-AUD-BVLINKWB1](#)



STM32WB Nucleo development board
 +
 Digital MEMS microphones Expansion board



Sensor fusion & activity recognition

Bluetooth LE connectivity with environmental and motion sensors
 STM32Cube function pack for STM32WB MCU: [FP-SNS-MOTENVWB1](#)



STM32WB Nucleo-64 development board
 +
 Motion MEMS and Environmental Sensor Expansion board



Both packages are compatible with STBLESensor app for iOS and Android



STM32 MCU “Wireless” series

★ High Perf MCUs

STM32F2
398 CoreMark
120 MHz

STM32F4
608 CoreMark
180 MHz

STM32H7
Up to 3224 CoreMark
240 MHz Cortex -M4
Up to 550 MHz Cortex -M7

STM32F7
1082 CoreMark
216 MHz

» Mainstream MCUs

STM32F0
106 CoreMark
48 MHz

STM32G0
142 CoreMark
64 MHz

STM32F1
177 CoreMark
72 MHz

STM32F3
245 CoreMark
72 MHz

STM32G4
550 CoreMark
170 MHz

🔋 Ultra-low Power MCUs

STM32L0
75 CoreMark
32 MHz

STM32L1
93 CoreMark
32 MHz

STM32L5
443 CoreMark
110 MHz

STM32L4
273 CoreMark
80 MHz

STM32L4+
409 CoreMark
120 MHz

📶 Wireless MCUs

STM32WL
161 CoreMark
48 MHz

STM32WB
216 CoreMark
64 MHz



● Optimized for mixed-signal applications

● Cortex-M0+ Radio co-processor



Releasing your creativity



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[wiki.st.com/stm32mcu](#)



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[STM32WB online training](#)



[STM32WB blog article](#)



[MOOC – STM32WB workshop](#)



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