



life.augmented

开启STM32WB无线新市场

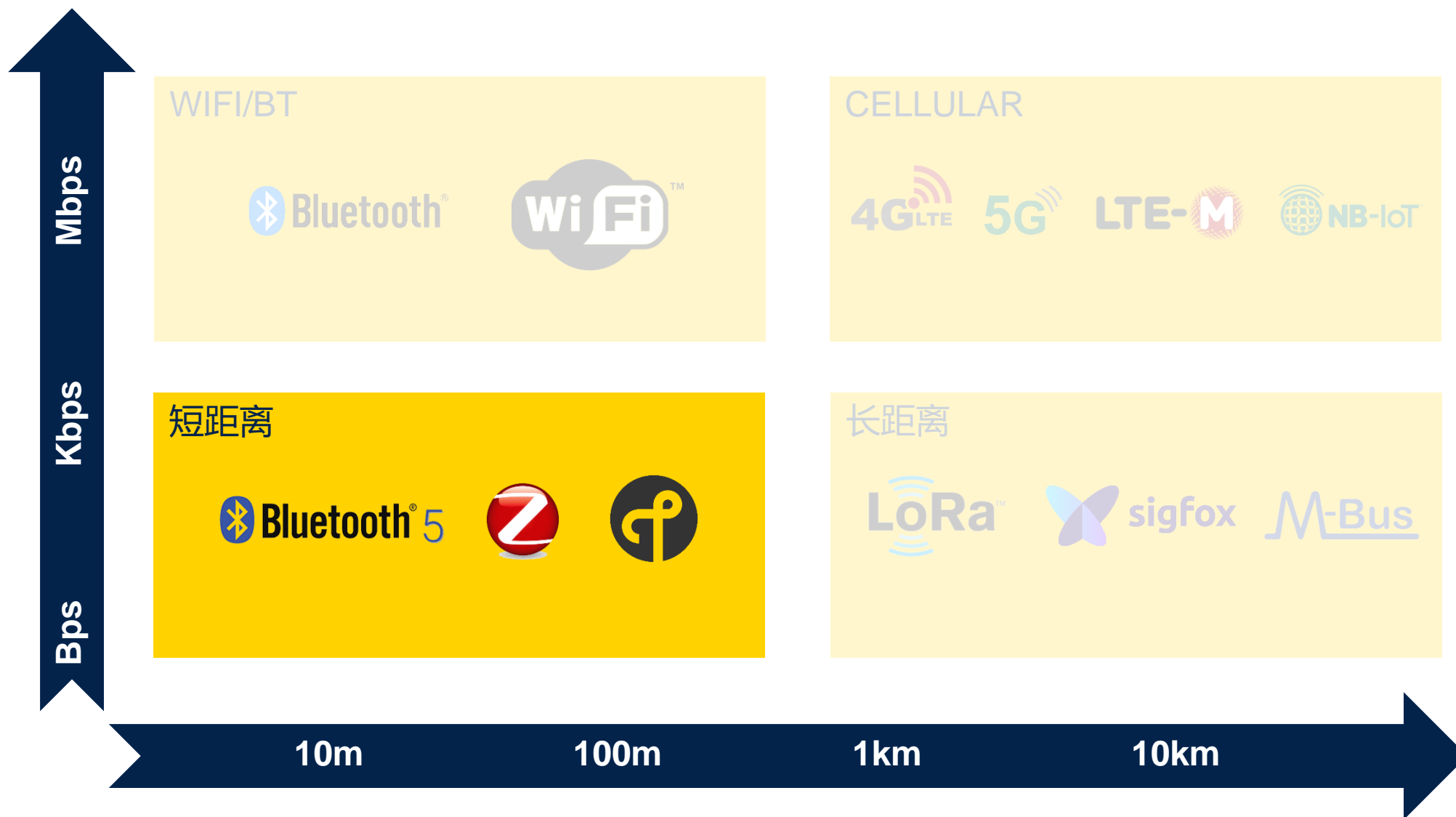
Terry Han

STM32无线技术产品市场经理



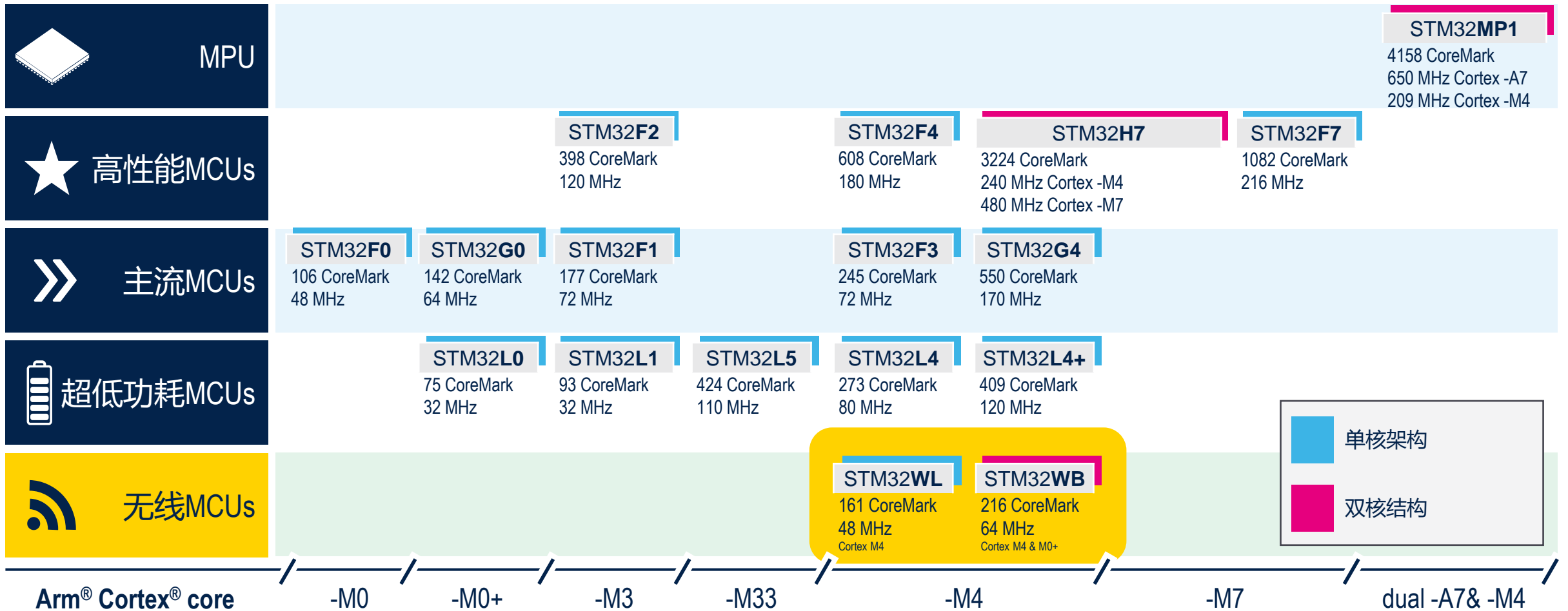
- 1 STM32WB无线产品概述
- 2 STM32WB架构和系列
- 3 STM32WB生态系统
- 4 STM32WB培训课程及市场应用
- 5 STM32WB市场应用及总结

无线通信技术



STM32家族

Arm® Cortex®-M 32-bit 通用MCU领导者



40,000+ 客户 / 自2007年至今已发货40亿 STM32

STM32WB



STM32WB 无线MCU

更高数据处理能力，多协议通信能力

更高性能

更强大的通信功能

STM32生态支持

STM32WB是一款

- **双核心Dual core design**
- **多种协议支持Multi-modulation**
- **超低功耗Ultra low power**
- **安全性高Security**

- 双核心设计
- 更高的实时性



—代码生成
inRF – 射频

CubeMonitor-RF

2.4GHz无线多协议双核MCU

双核无线MCU

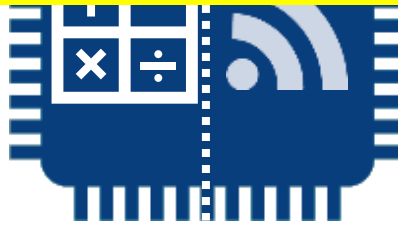


STM32WB

STM32WB是一款 M4 + M0 双核
BLE/ Zigbee Wireless SoC



STM32L4

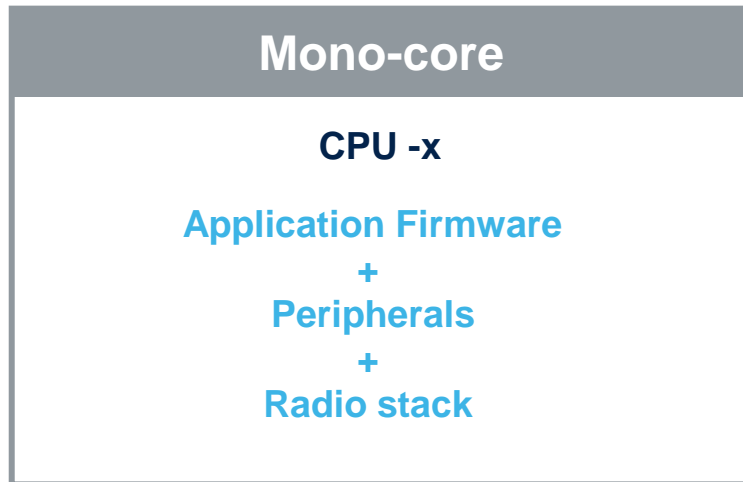


Bluetooth LE
802.15.4



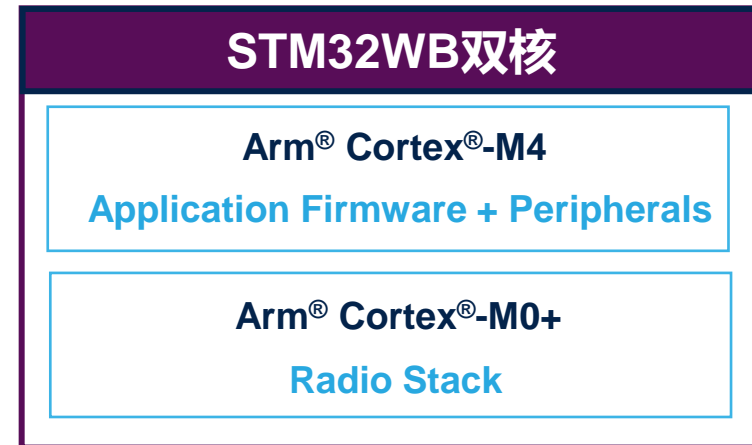
双核-更加简单的设计

两个独立内核有更强实时性



• 缺点

- CPU的占用
- 更长处理时间 – 功耗增加
- 隐私数据安全性



• 优点

- SOC 单芯片设计
- 双核设计更加灵活
- 增加电池使用时间
- 增强安全性

STM32WB55-框图

主要特征

- CM4 DSP/FPU 高达 64MHz
- 高达1MB Flash 和256KB SRAM

▪ 射频

- 射频集成平衡不平衡器(Balun)
- 低功耗蓝牙5.0 和802.15.4
- 输出功率: +6.0 dBm (支持外部PA)
- BLE 接收灵敏度: -96 dBm @ 1Mbps (102dB链路预算)
- 802.15.4 接收灵敏度: -100 dBm @ 250kbps (106dB链路预算)
- 接收(RX): 4.5mA 和发送(TX): 5.2mA (0dBm)

▪ 外设

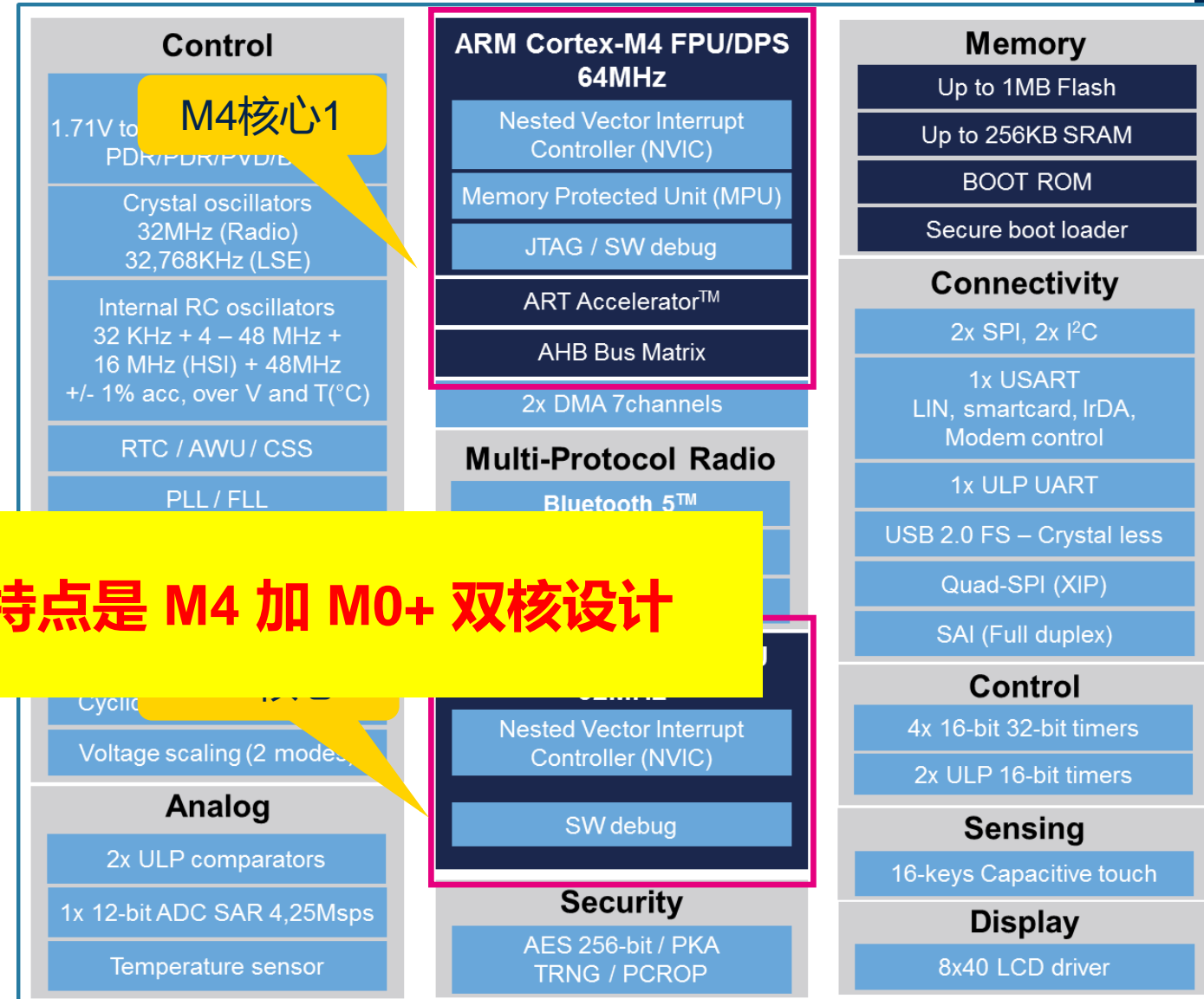
- 2x I2C, 1x USART, 1x LPUART, 1x SAI, Q-SPI (XIP)
- 6x 定时器: 包括2x LP-1
- 2x 超低功耗比较器

- 工作电压1.71V 至3.6V (DC/DC, LDO)

- 工作温度-40°C 至+105°C

▪ 功耗

- 运行模式 < 53µA/MHz (3V - RF ON)
- 停止模式 2.1 µA (射频待机+ 256KB RAM)
- 待机模式 0.6 µA (射频待机+ 32KB SRAM2a)
- 关闭模式 < 13nA

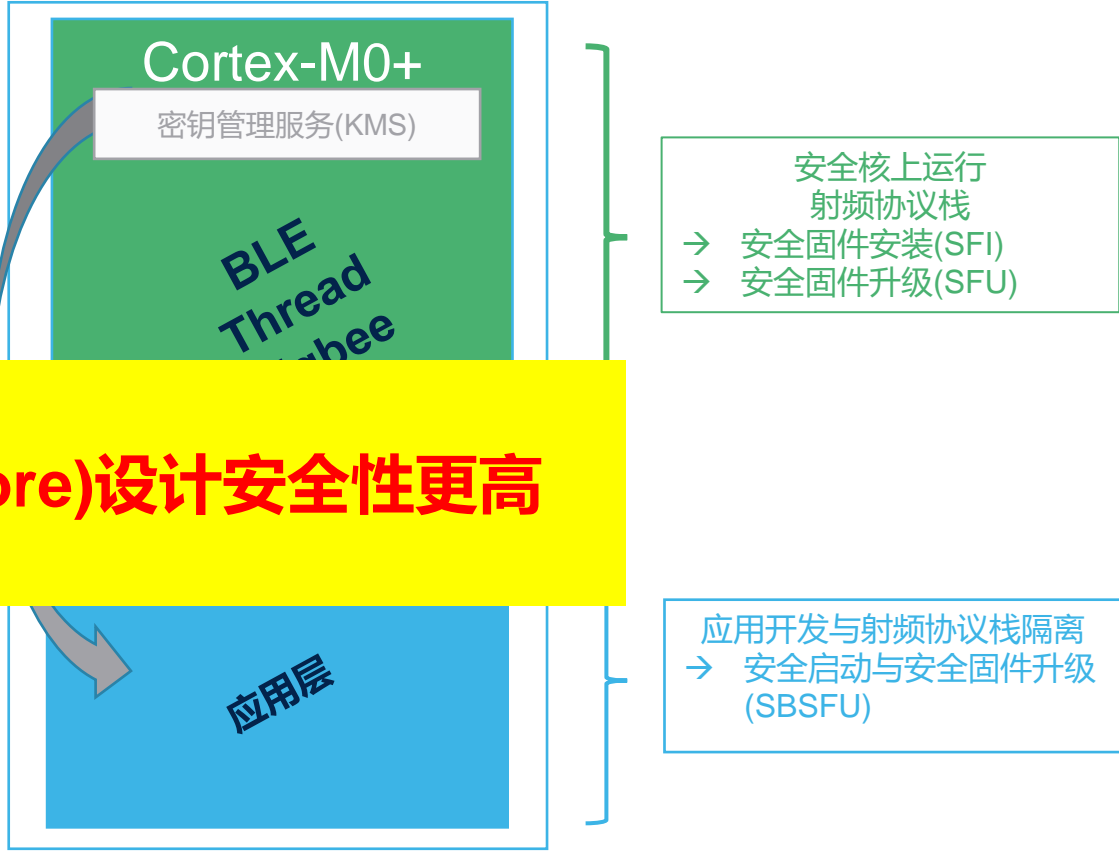


- 封装: QFN48, QFN68, WLCSP100, BGA129

双核架构 – 固件隔离

- Cortex-M4
 - 开放调试功能
 - 运行用户应用程序
- Cortex-M0+ (安全)
 - 安全区域代码和数据 / 禁止调试
 - 射频协议栈与应用程序
 - 安全固件升级功能 (STFU)
 - 为运行在CM4的应用程序
- KMS(密钥管理服务)
 - 密钥长度:长达256位
 - 1 主密钥+100 简单密钥 (可由主密钥加密或明文)

STM32WB双核心(Dual Core)设计安全性更高



双核架构 – 安全分区

SBSFU

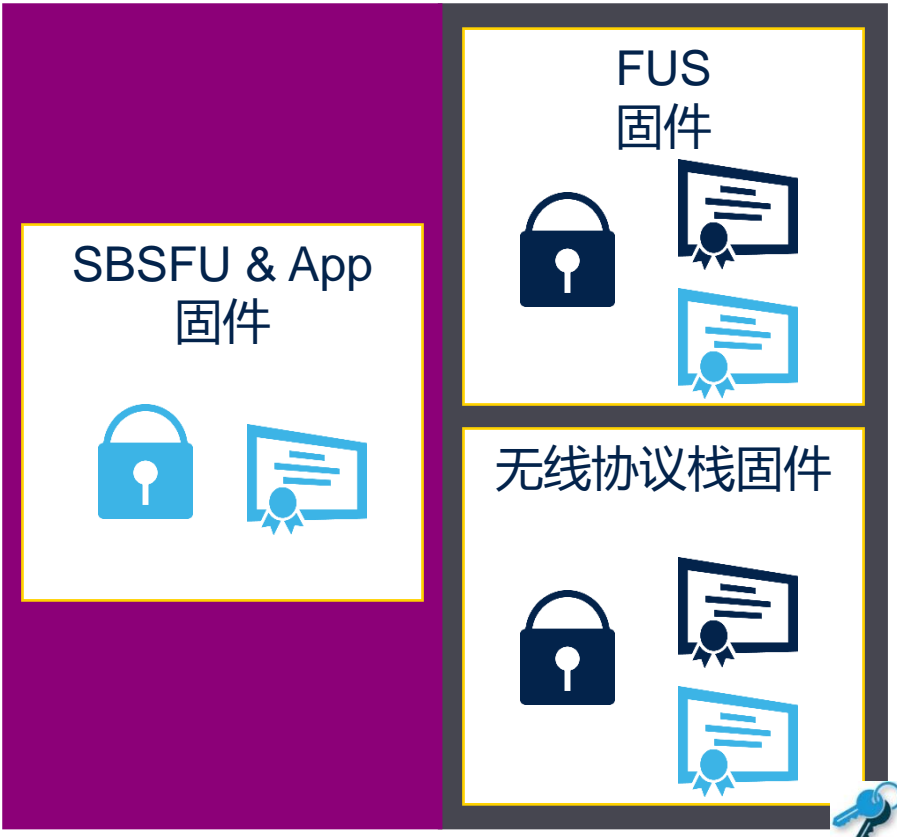
- ✓ 信任链
 - 代码运行时执行
- ✓ 信任根
 - 用户固件的真实性和完整性

App 固件

- ✓ 有开发者管理
- ✓ 通常由客户通过SBSFU加密和签名



 加密固件
 签名固件



APP 子系统
由Cortex M4
Core FPU/DSP
驱动

RF子系统
由Cortex M0+
Core & RF
独立驱动

FUS 固件

- ✓ 由ST加密和签名
- ✓ 还可由客户进行二次签名(可选)

无线协议栈固件

- ✓ 由ST加密和签名
- ✓ 还可由客户进行二次签名(可选)



BLE Certification

Profile / Product Type	Low Energy RF_PHY	Host Stack Subsystem	Profile Subsystem	
STM32WB Available QDID	QDID 123250 -STM32WB55Cx_RF_PHY (QFN 48) BLE5.2 - 2Mbit/s	QDID 160726 - STM32Cube_WB_BLE_HCI (4.0 HCI – Low Energy LL) BLE 5.2 - 2Mbit/s – TCRL 2019-2	QDID 122688 – STM32Cube_FW_WB (Multiprofiles HTP, HTS, DIS, PXP, FMP, IAS, LLS, TPS, HRP, HRS, TIP, CTS, NDCS, RTUS, PASP, PASS, ANS, ANP, BLS, HOGP, HIDS, BAS, SCPS, GLS, RSCS, CSCS, CPS, LNP, LNS, WSS, WSP, BMS, ESS, IPS, AIOS, HPS, OTS) BLE5.2 TCRL2018-1	
	QDID 131652 - STM32WB50Cx_RF_PHY (QFN 48) BLE5.2 - 1Mbit/s		QDID 160724 – STM32Cube_WB_BLE_FULL_STACK (4.0 HCI – Low Energy LL – ATT –GAP – GATT – L2CAP - SMP) BLE 5.2 - 2Mbit/s – TCRL 2019-2	QDID 146387 – ST_BLE_MESH MESH Profile - TCRL 2019-1
	QDID 160192 - STM32WB35Cx_RF_PHY (QFN 48) BLE5.2 - 2Mbit/s			QDID 151209 – ST_BLE_MESH MESH Model (Client & Server) - TCRL 2019-2
	QDID 160199 - STM32WB30Cx_RF_PHY (QFN 48) BLE5.2 - 1Mbit/s			
	QDID 127495 -STM32WB55Rx_RF_PHY (QFN 68) BLE5.2 - 2Mbit/s			
	QDID 134665 - STM32WB5xVxx_WLCSP100_RF_PHY (CSP 100) BLE5.2 - 2Mbit/s			
	QDID 147020 - STM32WB55Vxx_BGA129_RF_PHY (BGA 129) BLE5.1 - 2Mbit/s			

802.15.4 Certification

- 802.15.4 Overall certification status

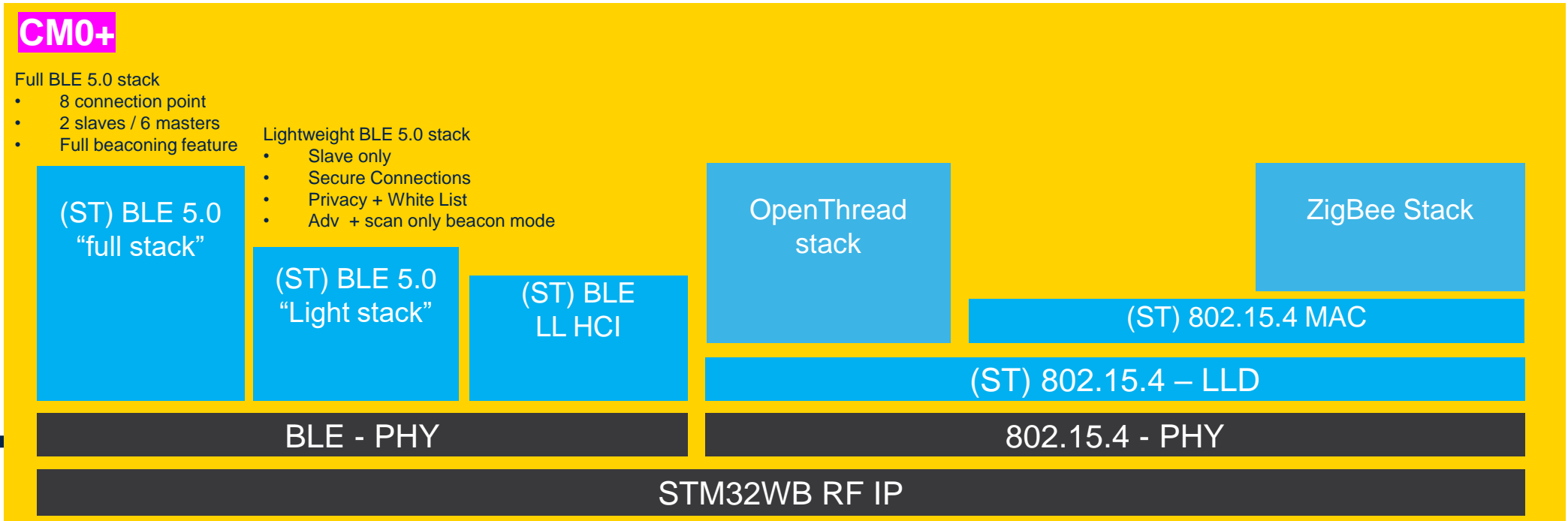
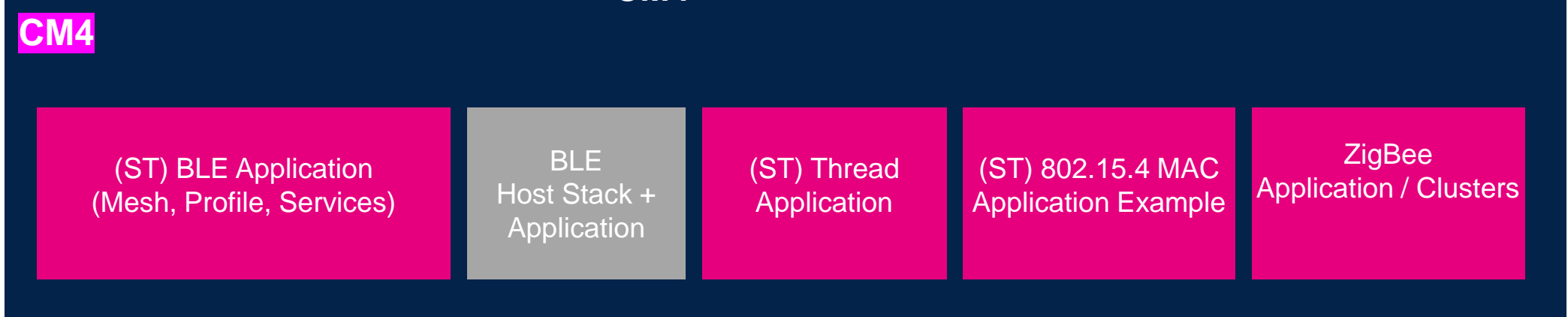
802.15.4 Certification	802.15.4 RF_PHY	Thread Stack Subsystem	Mac 802.15.4	Zigbee	
				Compliant Platform	Zigbee 3.0
Overall Certification	Zigbee Phy certification QFN48 Lab: "Elements"	Thread FTD Wireless Logo Verification Services, FTD (STM32WB Nucleo) Lab: "UL" Publication Link: Thread Group certified products https://openthread.io/platforms/stm32wb	Mac 802.15.4 R2011 Lab: "Elements"	Zigbee FFD feature Set: Zigbee Pro & Green Power Lab: "TUV" Certificat ID: ZIG20024ZCP27245-24 Publication link: https://zigbeealliance.org/fr/zigbee_des-produits/stm32wb-2/	Zigbee FFD lab: "TUV" Certificat ID: ZIG20210ZB330703-24 Publication Link: https://zigbeealliance.org/fr/zigbee_des-produits/stm32wb-4/
	Zigbee Phy certification QFN68 Lab: "Elements"				
	Zigbee Phy certification CSP100 Lab: "Elements"	Thread MTD Wireless Logo Verification Services, MTD (STM32WB Nucleo) Lab: "UL" Publication Link: Thread Group certified products https://openthread.io/platforms/stm32wb		Zigbee RFD feature set: Zigbee Pro Lab: "TUV" Certificat ID: ZIG20037ZCP27258-24 Publication Link: https://zigbeealliance.org/fr/zigbee_des-produits/stm32wb-3/	Zigbee RFD Lab: "TUV" Certificat ID: ZIG20246ZB330739-24 Publication link: https://zigbeealliance.org/fr/zigbee_des-produits/stm32wb-5/
	Zigbee Phy certification BGA129 Lab: "Elements"				

多协议

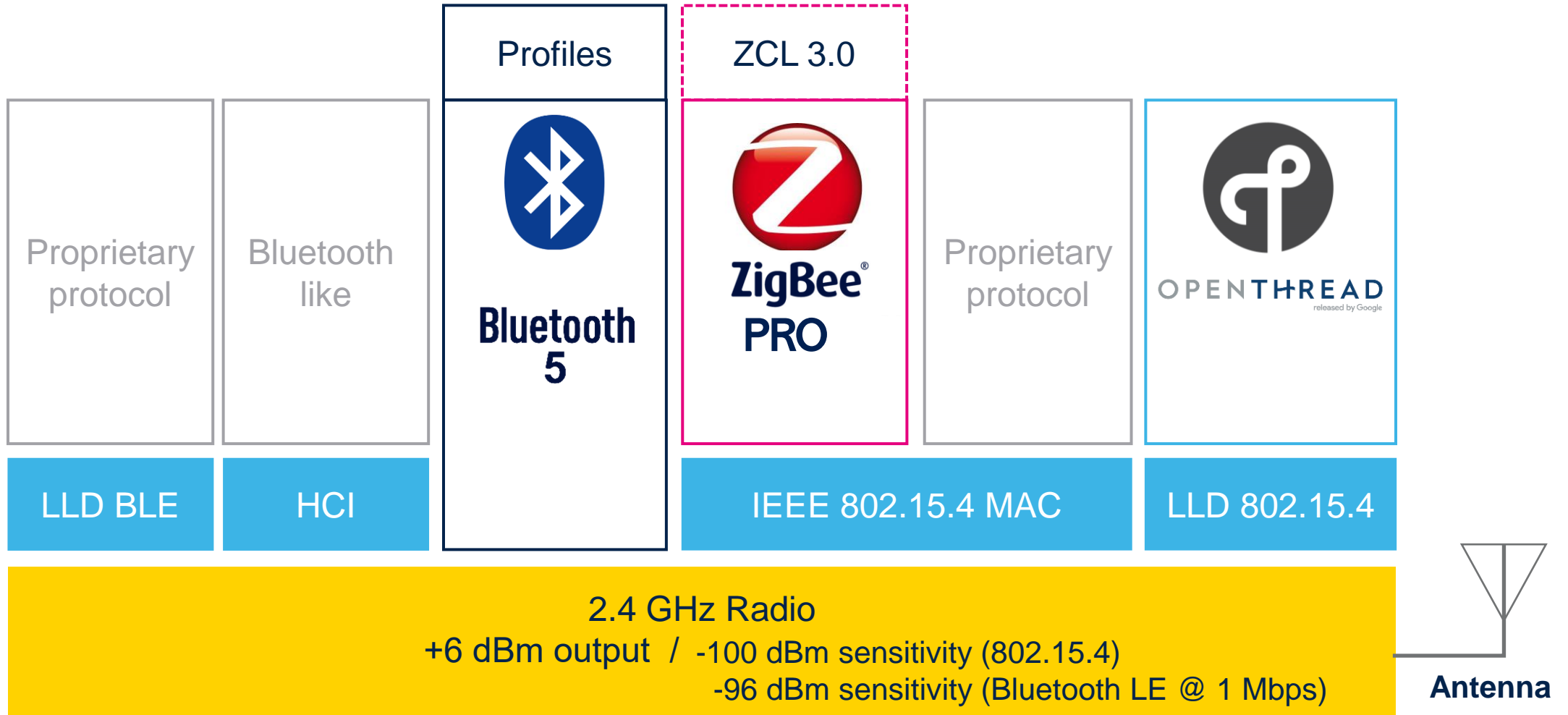
Concurrent modes



免费的各种协议栈和参考源码



选择需要的无线标准



多协议和开放射频



- 完全认证的BLE 5.0 协议栈
- 数据速率提高2倍，支持2Mbps高速模式
- 支持BLE Mesh网状网络技术，提高网络覆盖面

STM32WB55 可以支持

- BLE5.0
- Zigbee3.0
- Thread
- 802.15.4私有协议

无线通信标准
IEEE 802.15.4
支持 Zigbee 3.0 协议栈
支持 Thread 协议栈
支持自定义的动/静态并发模式

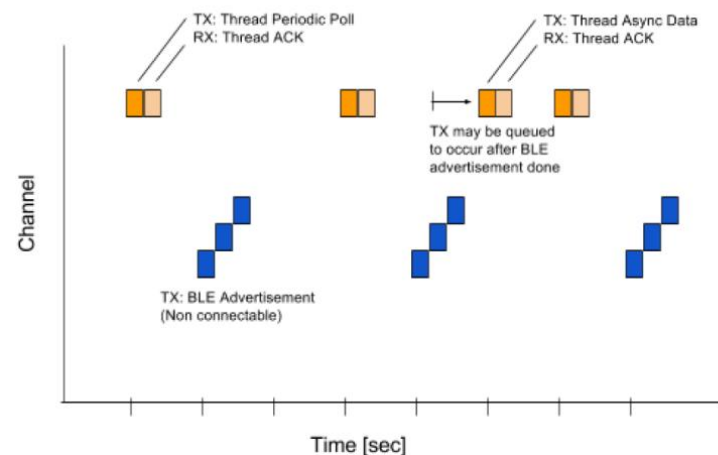
支持 IEEE 802.15.4
发射功率高达 +6dBm，接收灵敏

2.4 GHz
开放

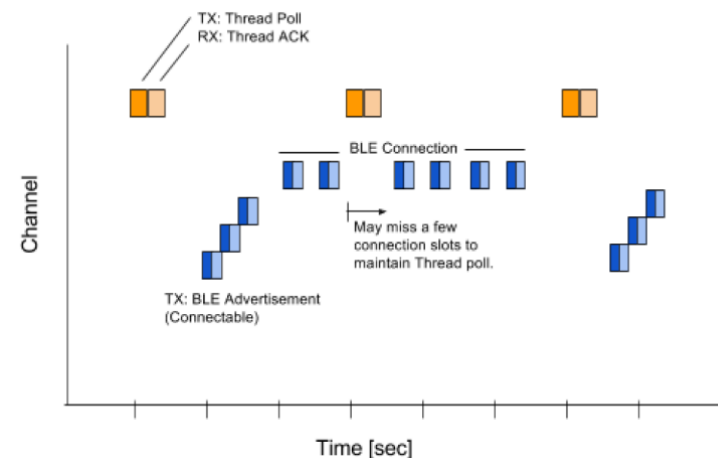
- 接收功耗仅为4.5mA，发射功耗5.2mA(@ 0dBm)，适合能耗敏感的应用
- 内部集成巴伦，降低物料清单成本

多协议并发

- 静态多协议并发 (切换)
 - 以独占方式从BLE模式切换到Thread模式
 - Thread可进行数据收/发
 - 但是BLE只能发广播
- 动态多协议并发 (并发)
 - 以轮询方式从BLE模式切换到Thread模式
 - Thread可进行数据收/发,
 - 但是BLE可保持连接, 可进行BLE数据收/发

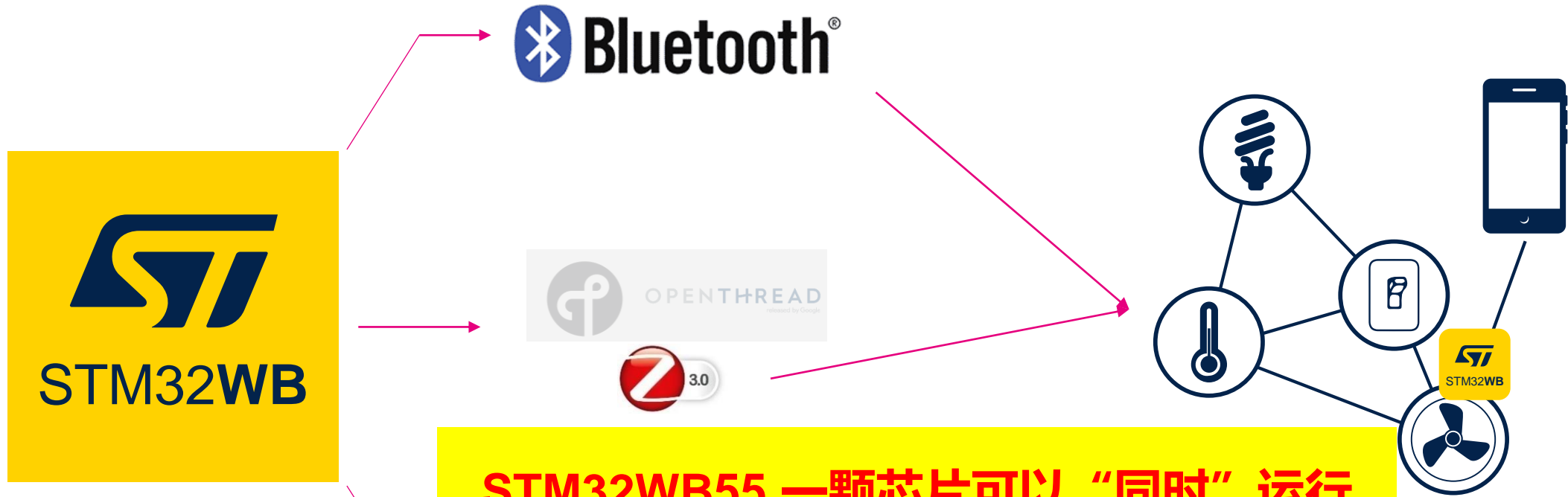


Thread 轮询 + BLE Beacon



Thread 轮询 + BLE 连接

灵活的 BLE 和 Zigbee 网状网络



STM32WB55 一颗芯片可以“同时”运行 BLE + Zigbee

用方案

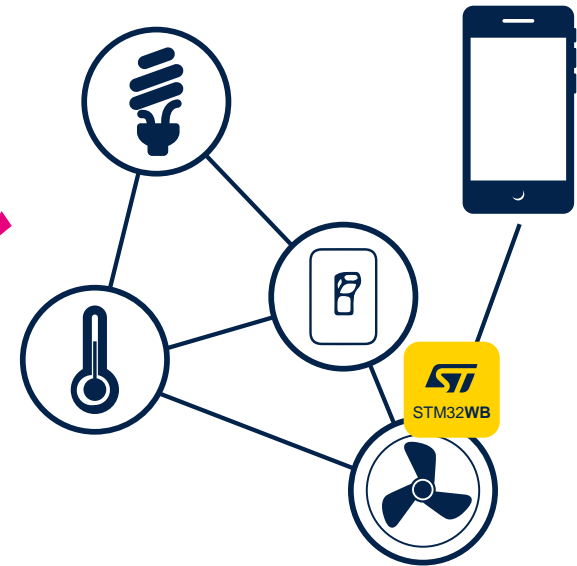
- WB同时赋能BLE和Zigbee 网状网络
- 通过智能手机享受BLE连接，同时接入Zigbee网络的好处
- 解决接入Zigbee网络的痛点

开放
Q4'2020

灵活的 BLE 和 Thread 网状网络



2.4 GHz
开放
Q4'2020

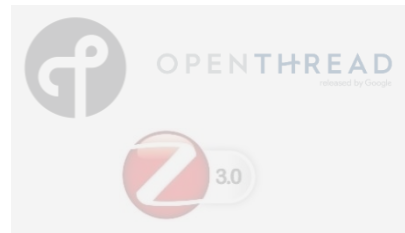


- ST首个允许BLE + Thread 应用方案
- WB同时赋能BLE和Thread 网状网络
- 通过智能手机享受BLE连接，同时接入Thread网络的好处

灵活的 BLE 和 802.15.4 网状网络



 **Bluetooth®**



2.4 GHz
开放
Q4'2020

- ST首个允许**BLE + 802.15.4** 应用方案
- WB同时赋能BLE和802.15.4 网状网络
- 通过智能手机享受BLE连接，同时接入802.15.4私有网络的好处

STM32WB

6 device flavors – and more to come



STM32WB55



STM32WB55 在1MB + 256k RAM 应用
STM32WB35 在512KB + 96k RAM 应用
STM32WB15 在320KB + 48k RAM 应用

15*



STM32WB50

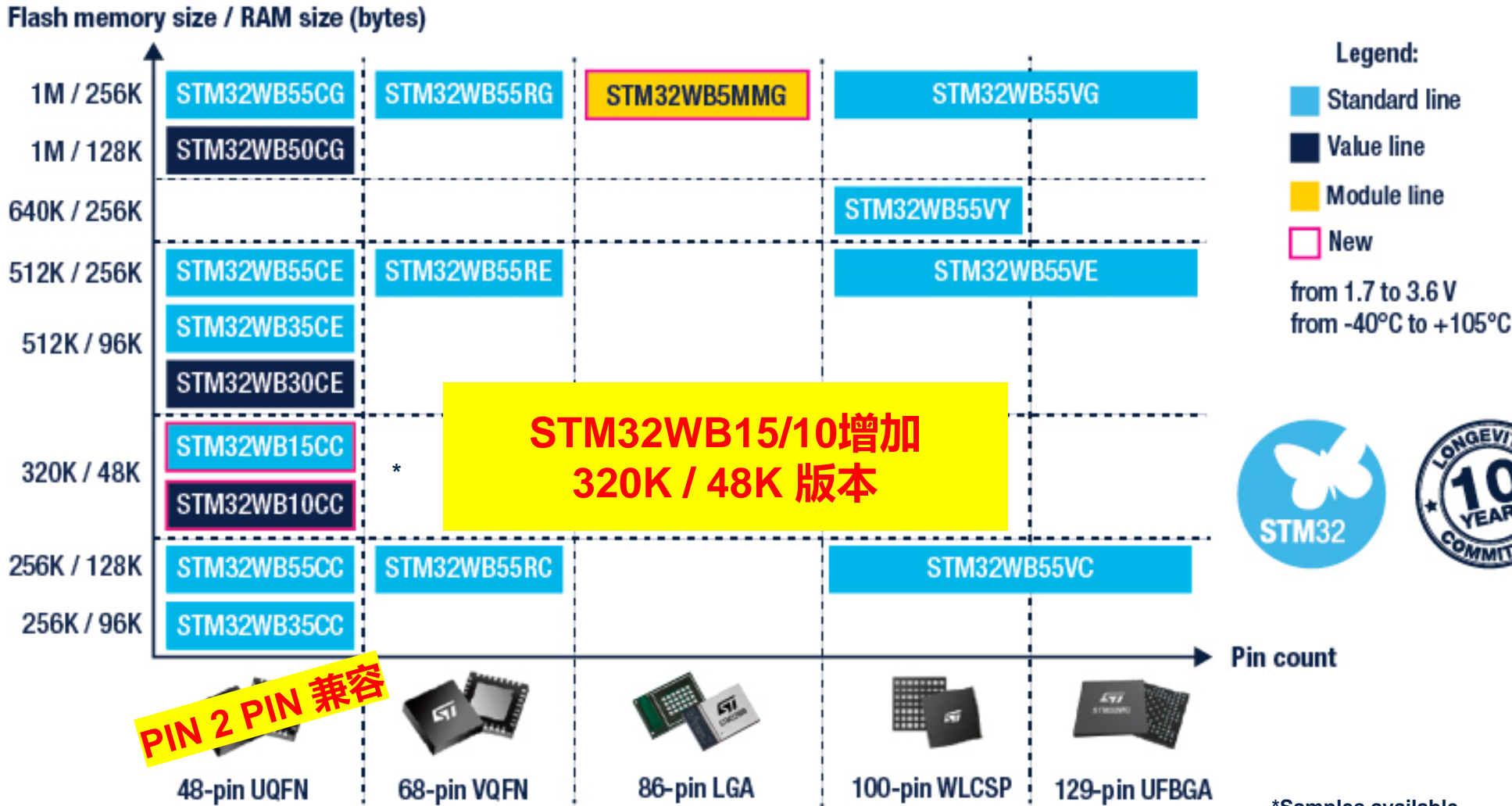
STM32WB30



STM32WB10*

STM32WB 产品系列

Bluetooth LE 5.2, OpenThread, Zigbee 3.0





STM32WB 超值系列

Flash memory / RAM size (bytes)



from 2 V to 3.6 V
from -10°C to +85°C



Legend: ■ STM32WB50 super set ■ STM32WB30 featured ■ STM32WB10 optimized

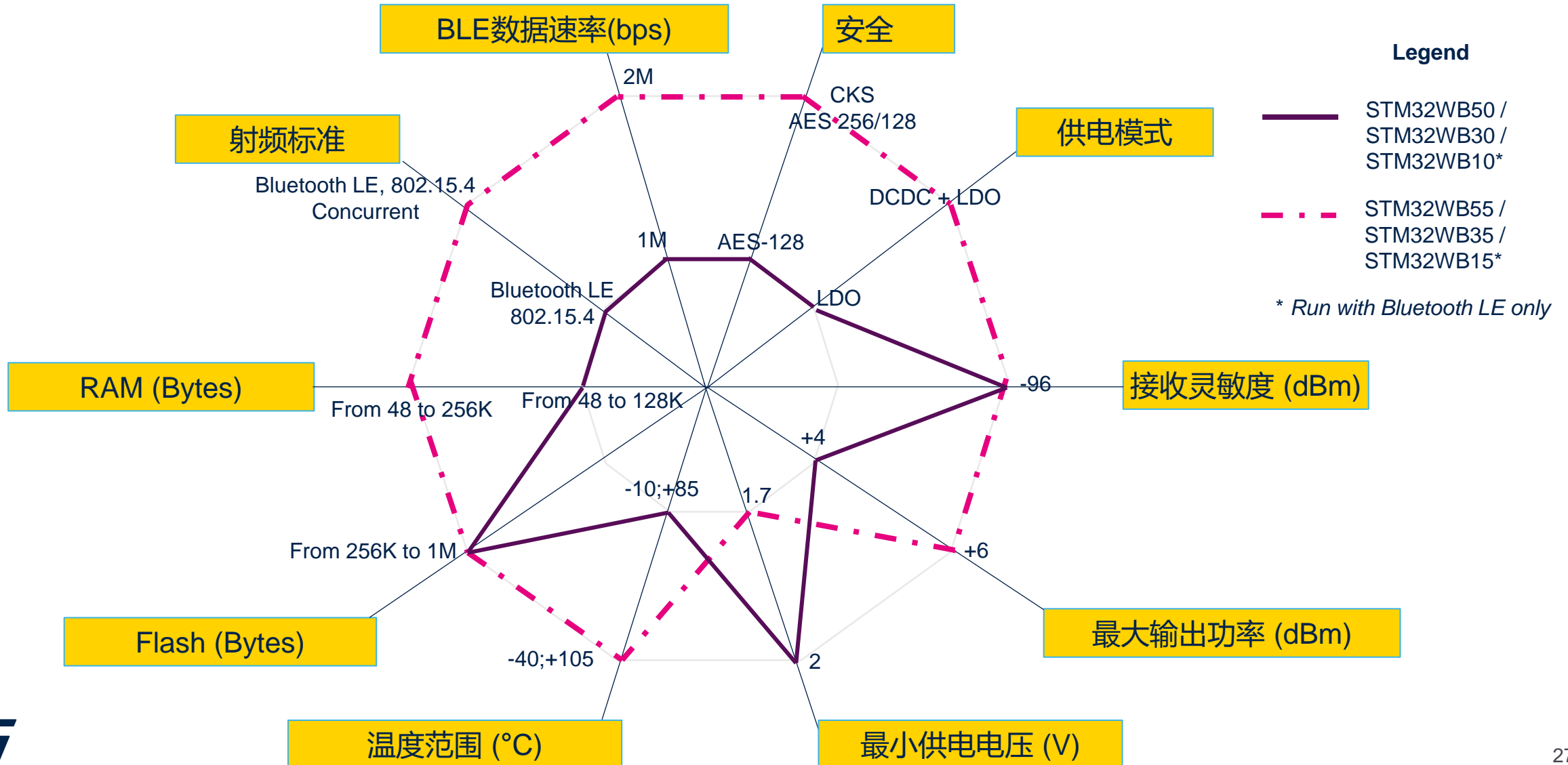
STM32WB55/ 35/ 15 系列比较

IPs	STM32WB55	STM32WB35	STM32WB15
Core	Dual core CM4/CM0+	Dual core CM4/CM0+	Dual core CM4/CM0+
Radio stacks	BLE 5.2 + 802.15.4 (Zigbee, Thread) + proprietary (HCI, MAC, LLD) + concurrent modes (BLE/Zigbee, BLE/Thread, BLE/MAC)	BLE 5.2 + 802.15.4 (Zigbee, Thread) + proprietary (HCI, MAC, LLD)	BLE 5.2 + proprietary (HCI, LLD)
Data rate	Up to 2Mbps	Up to 2Mbps	Up to 2Mbps
VDD range	1.71 – 3.6V	1.71 – 3.6V	1.71 – 3.6V
Temp range	-40 to +105°C	-40 to +105°C	-40 to +105°C
Flash	256KB up to 1MB	256KB up to 512KB	320KB
RAM	Up to 256KB	96KB	48KB
Max output power	+6 dBm	+6 dBm	+6 dBm
Sensitivity	-96dBm (BLE 1Mbps) -100 dBm (802.15.4)	-96dBm (BLE 1Mbps) -100 dBm (802.15.4)	-96dBm (BLE 1Mbps)
Peripherals	UP to 2x I2C, Up to 2x SPI, Up to 2x USART USB 2.0, SAI (2ch), LCD, Q-SPI, Cap-touch 12-bit ADC 4.1Msps, 2x COMP, 2x DMA (14ch) DC/DC and LDO	UP to 2x I2C, 1x SPI, 1x USART USB 2.0, SAI (2ch), Q-SPI, 12-bit ADC 4.1Msps, 2x COMP, 2x DMA (14ch) DC/DC and LDO	1x I2C, 1x SPI, 1x USART SAI (2ch), 12-bit ADC 2.5Msps, Cap-touch, 1x COMP, 1x DMA (14ch) DC/DC and LDO
Security feature	Full Security package(FUS, CKS, SBSFU, OTA) 3x AES block	Full Security package(FUS, CKS, SBSFU, OTA) 3x AES block	Full Security package(FUS, SBSFU, OTA) 2x AES block
Run mode range	2	2	1
Package	BGA129, WLCSP100, QFN68, QFN48, Module LGA86	QFN48	QFN48, QFN48 extended
Tools, services	Nucleo, Discovery, Die business, Fastrom		Nucleo

STM32WBx5 vs STM32WBx0

IPs	STM32WB55 / 35 / 15	STM32WB50 / 30
Core	Dual core CM4/CM0+	Dual core CM4/CM0+
Radio stacks	Up to BLE 5.2 + 802.15.4	BLE 5.2 or 802.15.4 No concurrency mode, or proprietary
Data rate	Up to 2Mbps	1Mbps
VDD range	1.71 – 3.6V	2 – 3.6V
Temp range	-40 to +105°C	-10 to +85°C
Flash (KB)	256 up to 1000	WB50=1000 WB30=512 WB10=320
RAM (KB)	WB55=256 WB35=96 WB15=48	WB50=128 WB30=96 WB10=48
Max output power	+6 dBm	+4 dBm
Sensitivity	-96dBm (BLE 1Mbps) -100 dBm (802.15.4)	-96dBm (BLE 1Mbps) -100 dBm (802.15.4)
Peripherals	UP to 2x I2C, Up to 2x SPI, Up to 2x USART USB 2.0, SAI (2ch) , LCD, Q-SPI, Cap-touch 12-bit ADC 4.1Mps, 2x COMP, 2x DMA (14ch) DC/DC and LDO	1x I2C, 1x SPI Cap-touch 12-bit ADC 2Mps, 1x DMA (7ch) LDO
Security feature	Full Security package(FUS, CKS, SBSFU, OTA) 3x AES block	FUS, RF stack update No AES for CM4
Run mode range	2	1
Package	BGA129, WLCSP100, QFN68, QFN48	QFN48
Others	Nucleo, Discovery, Die business, Fastrom	No dedicated HW tools

STM32WB不同产品定位



专用于STM32WB的集成滤波器

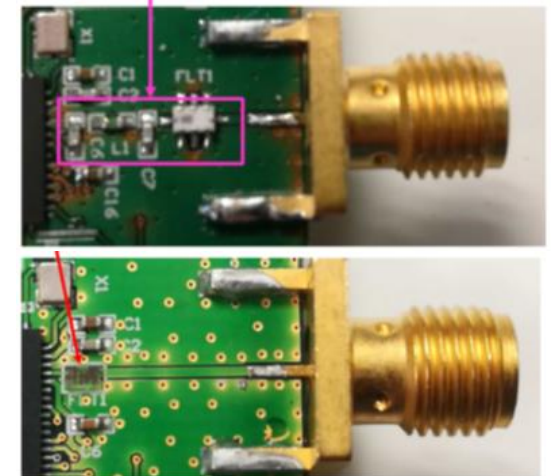
- 集成滤波器最大化了多协议射频性能，且占用PCB面积是分离方案的1/7
- 集成滤波器MLPF-WB55-0xE3 集成了：
 - 阻抗配网络 – 转换为50Ω阻抗
 - 谐波滤波器 – 减少带外TX谐波发射，提高RX灵敏度



MLPF-WB55-0xE3

天线 (50Ω)

**采用ST的集成方案
最大优点是不用调试复杂的RF射频电路**



MLPF-WB55-01E3 (QFN48,QFN68)
MLPF-WB55-02E3 (WLCSP100)

STM32WB5M - 模组

易集成，轻认证

Key advantages

- 尺寸: 7.3x11mm
- WLCSP100 package integrated
- Maximum of features exposed

Bottom view

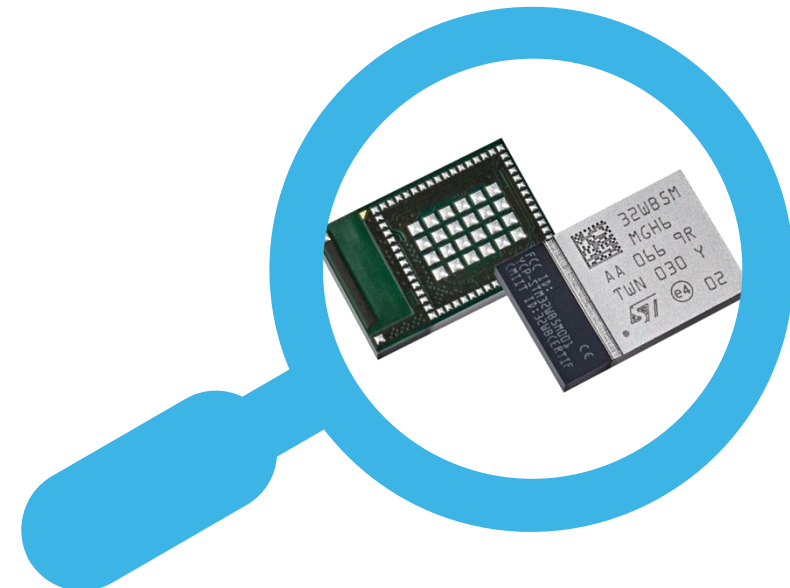
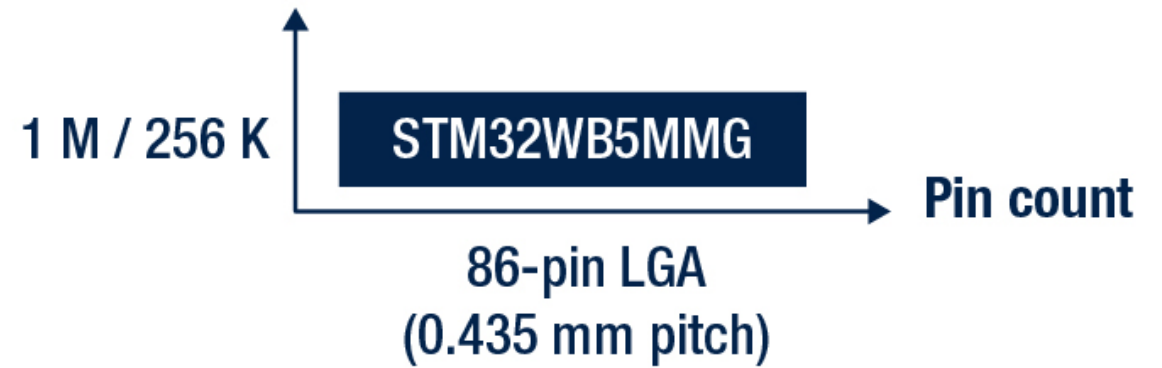


In production NOW!

STM32WB5M Module

Control		Memory	
Power supply 1.8 to 3.6 V w/ DC/DC + POR/PDR/PVD/BOR	Arm® Cortex®-M4 FPU/DSP 64 MHz	1-Mbyte Flash memory	
Xtal oscillators 32 MHz (RF) 32.769 kHz (LSE)		256-Kbyte SRAM	
Internal RC oscillators 32 kHz+ 4 ~ 48 MHz + 16 MHz (HSI) + 48 MHz ± 1% acc. over V and T(°C)		Boot ROM	
RTC/AWU/CSS		Secure boot loader	
PLL/FLL	ART Accelerator™	Connectivity	
SysTick timer		2 x SPI, 2 x I²C	
2 watchdogs (WWDG/IWDG)		1 x USART, LIN, Smartcard, IrDA Modem control	
Up to 68 GPIOs	AHB Bus matrix	1 x ULP UART	
Cyclic redundancy check	2 x DMA 7 channels	USB 2.0 FS - Xtal less	
Voltage scaling (2 modes)	Multi-protocol RF stack	Quad-SPI (XIP)	
	Bluetooth™ 5	SAI (full duplex)	
	IEEE 802.15.4	Timers	
	AES	4 x 16-bit 32-bit timers	
	Arm® Cortex®-M0+ 32 MHz	2 x ULP 16-bit timers	
		Nested vector interrupt controller (NVIC)	Sensing
			16-key capacitive touch
			Encryption/security
		256-bit AES/PKA	
		TRNG/PCROP	
		FUS/CKS	
		Display	
		8 x 40 LCD driver	

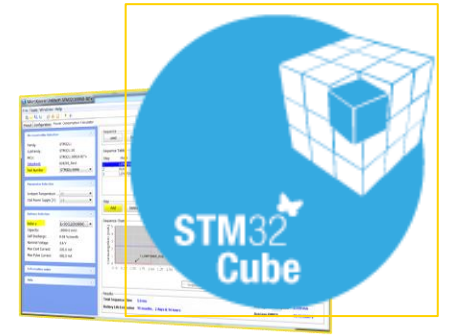
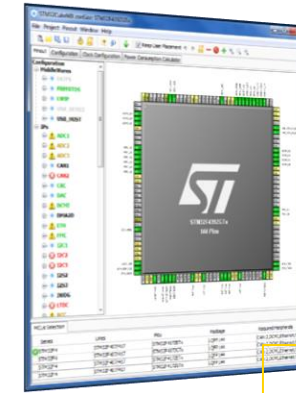
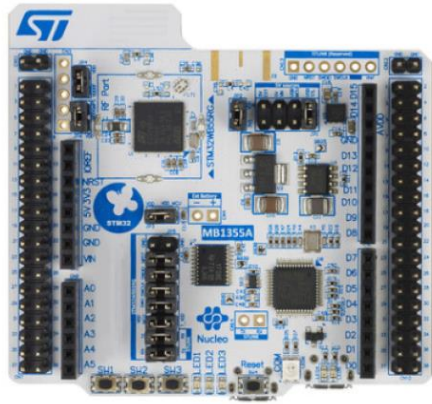
Flash memory / RAM size (bytes)



STM32WB Ecosystem



开发工具



WB55硬件
评估板套件
P-NUCLEO-WB55

STM32CubeMX - 代码生成
STM32CubeMonRF - 射频测试

生态系统不仅仅是**免费**的协议栈!

配置

开发

下载

监控



STM32CubeIDE
STM32CubeMX



STM32CubeWB



STM32CubeIDE
STM32CubeProgrammer

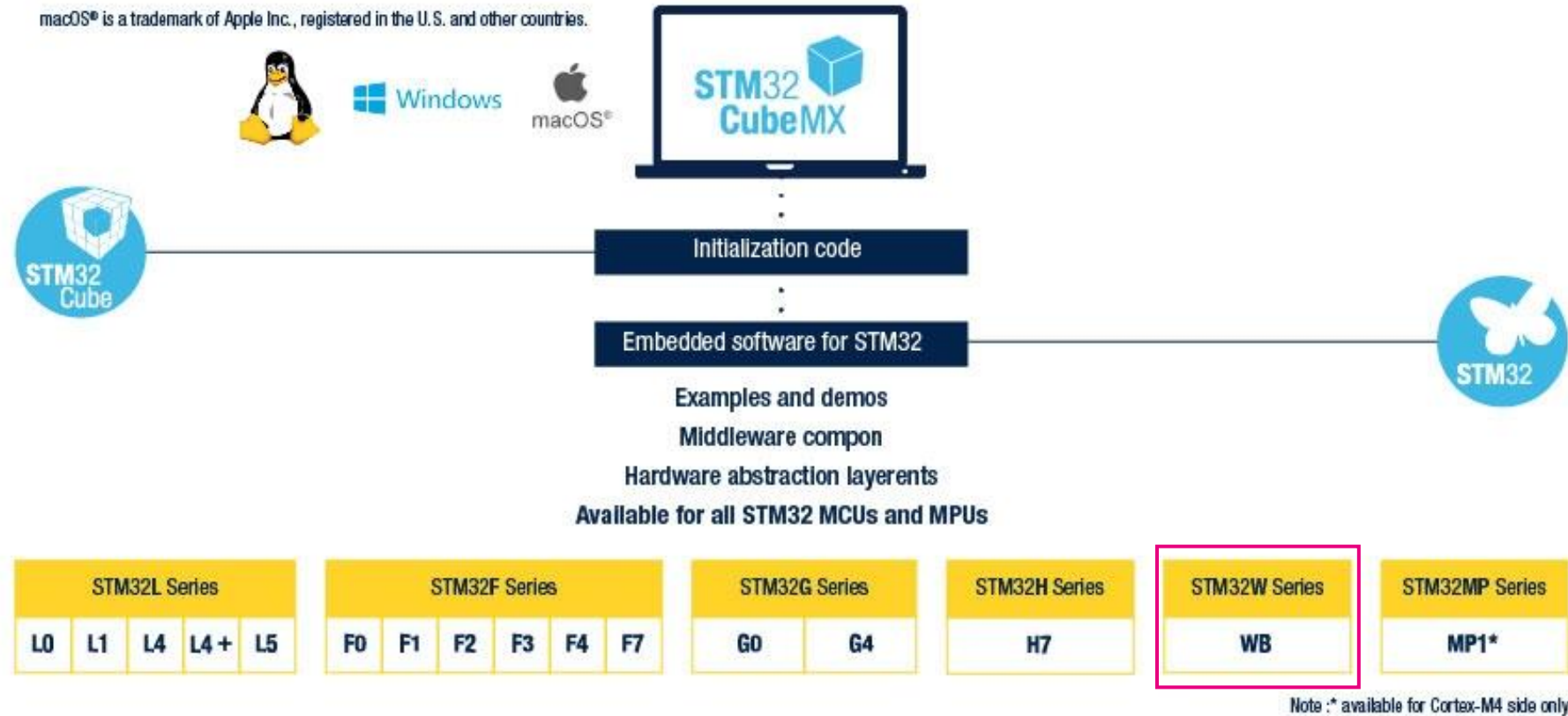


STM32CubeMonitor
STM32CubeMonitor-RF



STM32CubeMX

◆CubeMX配置硬件引脚，使HW开发更容易

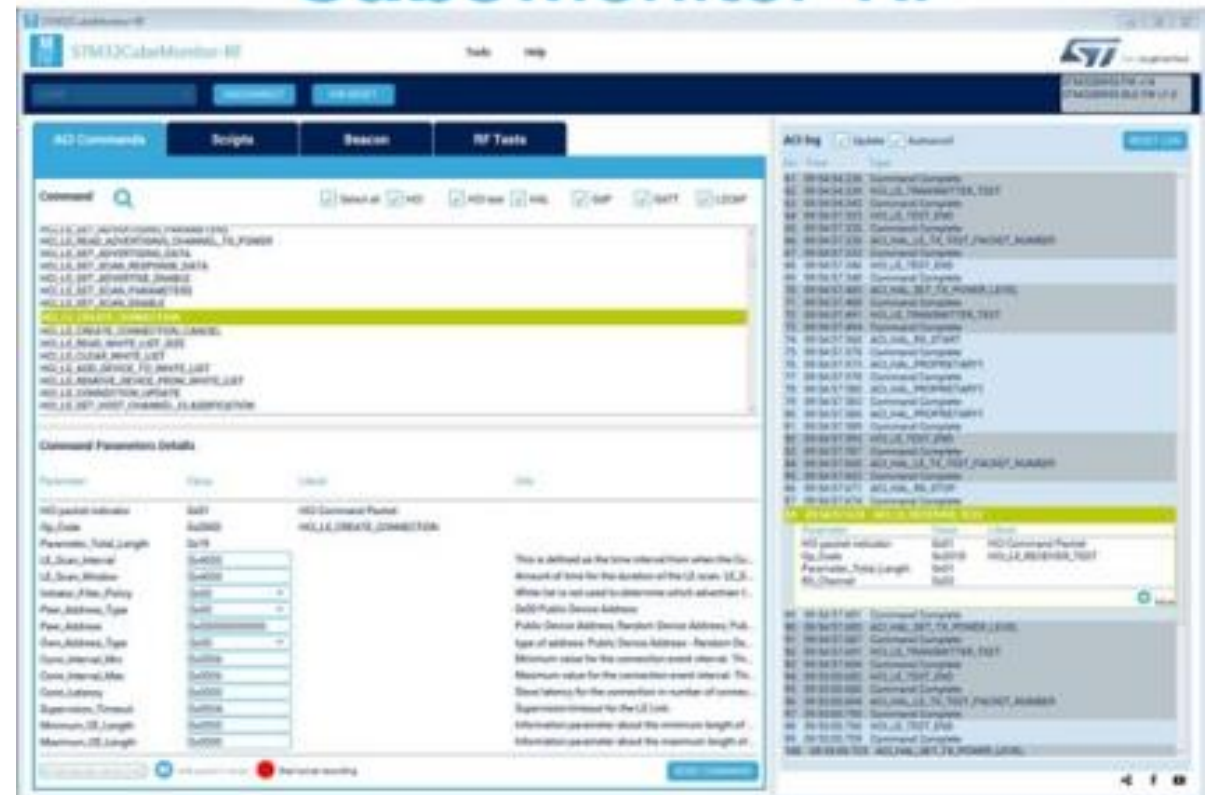


◆CubeMX配置BLE 广播，配对，Service服务，使SW 开发更容易

STM32CubeMonRF



- STM32WB 射频性能测试
- 支持STM32WB BLE及802.15.4
- BLE测试包括
 - HCI/ ACI 命令测试
 - Direct Test Mode 直接测试命令
 - 显示BLE 设备的profile
 - OTA文件传输以及安全升级



STM32WB中文视频培训

网址:

<https://c.51diantang.com/>



课程名:

STM32WB 新一代无线芯片BLE应用开发和设计

STM32WB设计资料汇总

<https://www.stmcu.com.cn/ecosystem/chip/chipfamily-stm32wb>

《STM32WB 新一代无线芯片BLE
应用开发和设计》课程大纲

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01. STM32WB 简介

02. STM32WB 硬件简介

03. STM32WB 软件简介

04. GATT 与服务介绍

05. 使用 STM32CubeMX创建BLE应用

06. 如何设计BLE应用

STM32WB应用案例分享

个人消费类



蓝牙手环



蓝牙压感笔

智能家居类



蓝牙门锁



温湿度/烟感等传感器

智能工业类



工业环境监测



工业测温仪



工业温控器

健康医疗类



家用胎监仪器

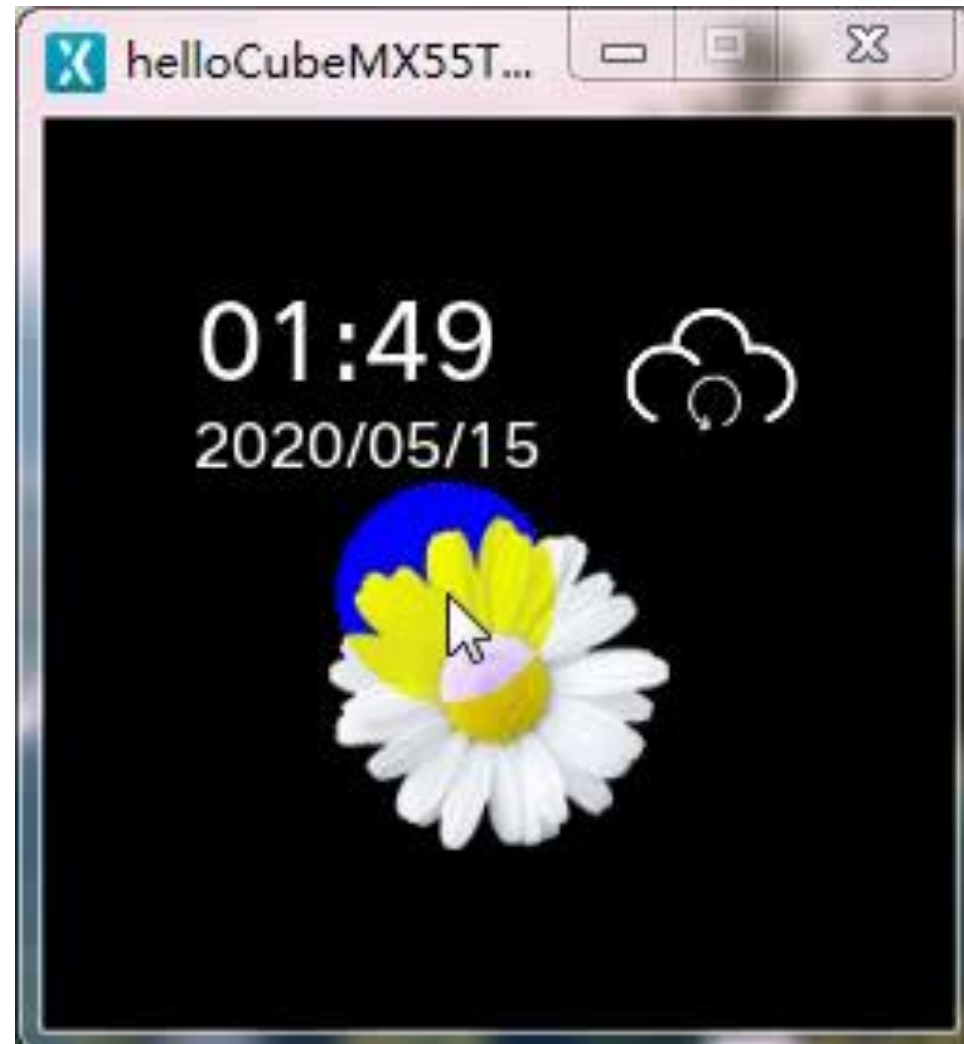


蓝牙智能血压计



便携心率血氧仪

WB55 on Smart Watch GUI



Pencil

Description:

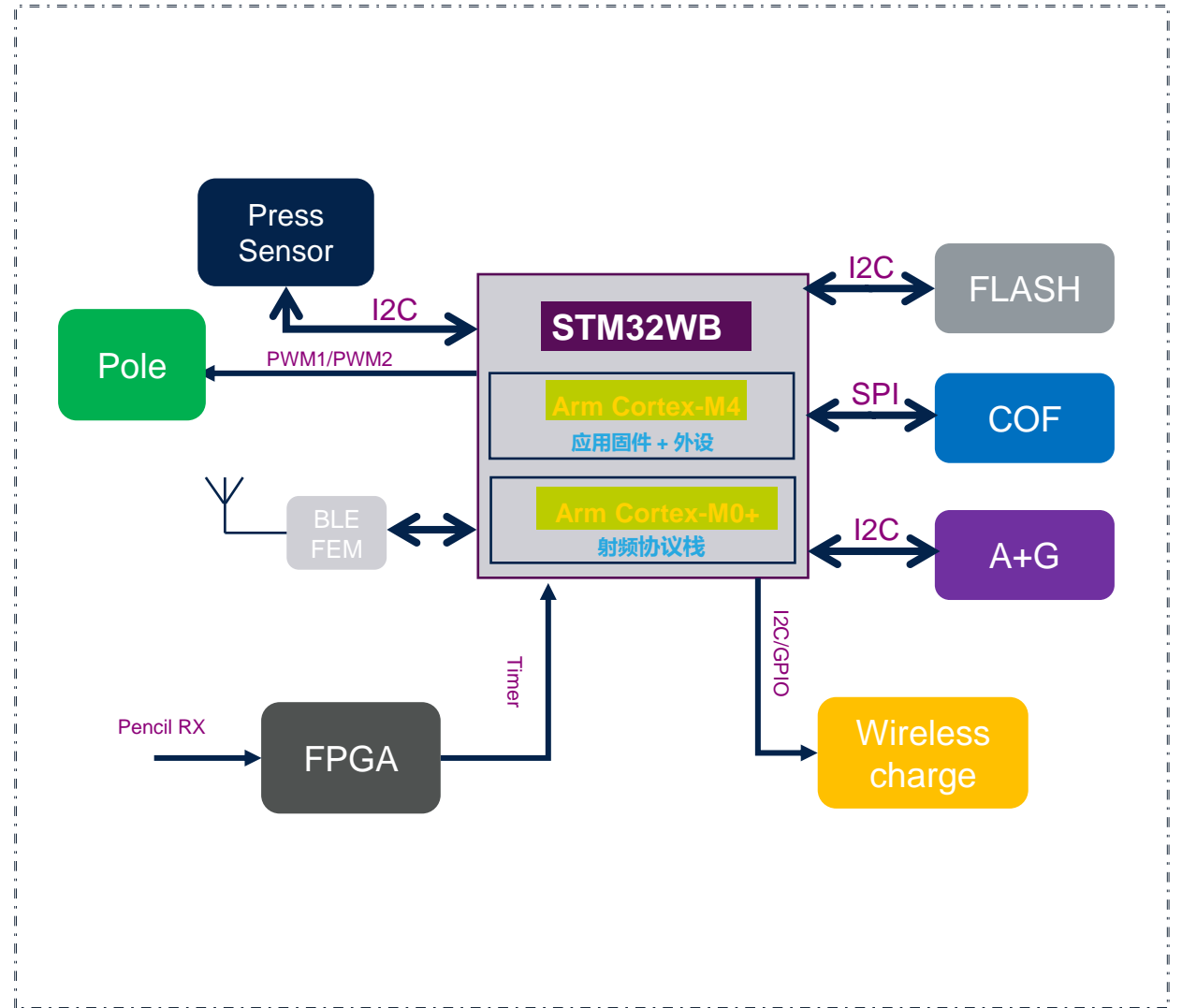
pencil used with Tablet PC, like Apple pencil. Size < 5*5 mm diameter.

STMCU Type : STM32WB55

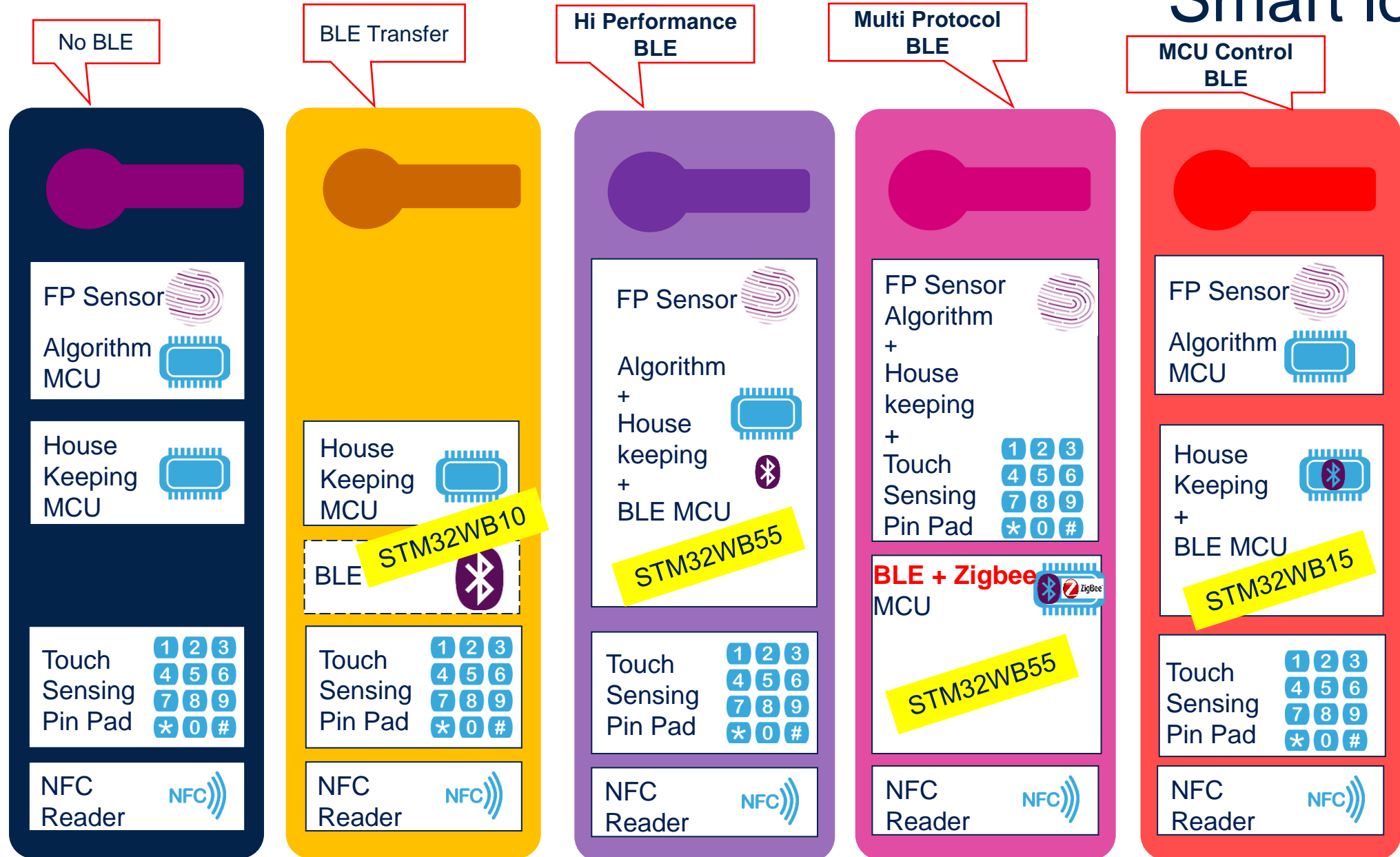
STMCU Role: Main processor

Reasons to get Design In:

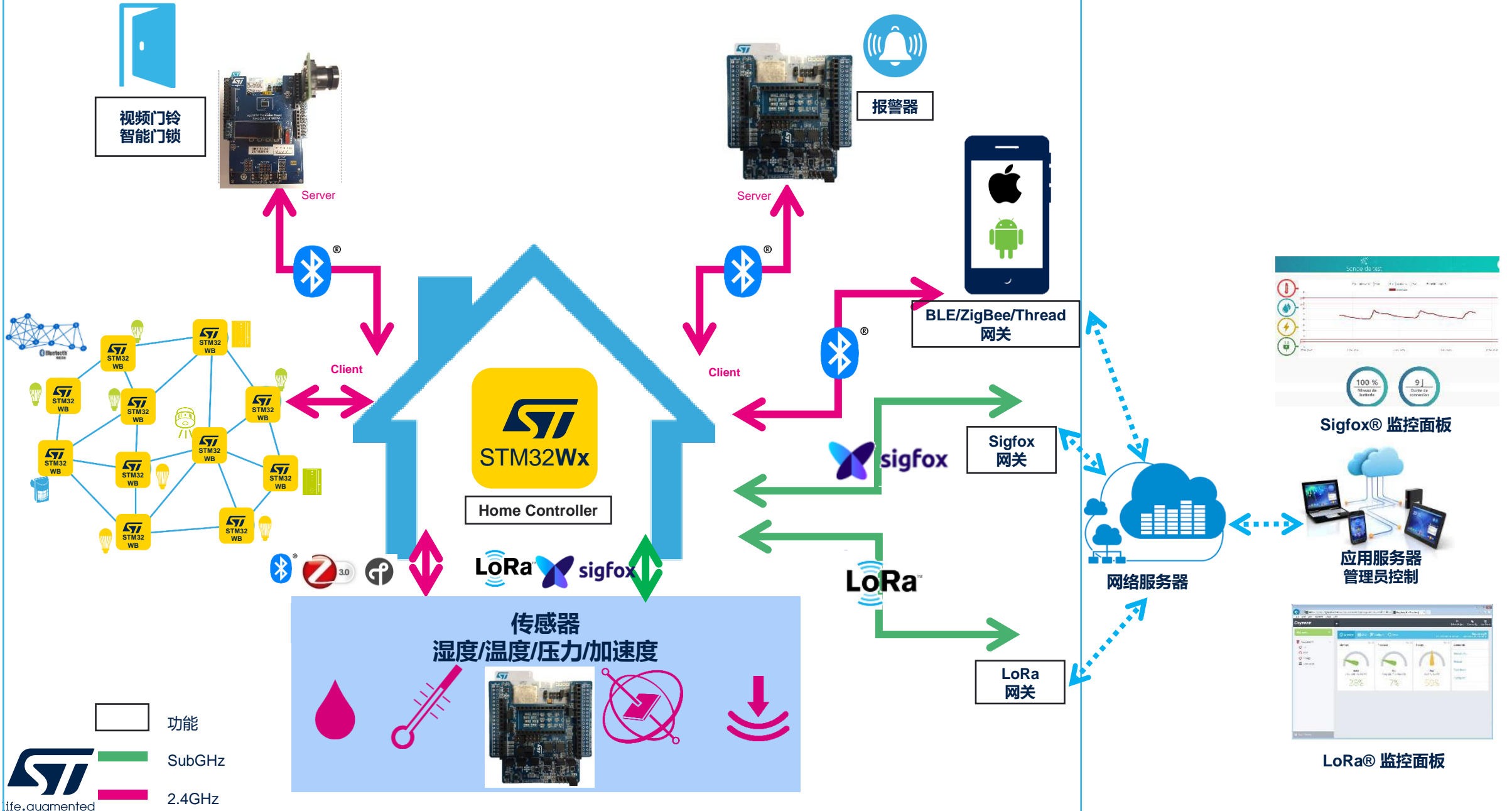
1. Integrated MCU and BLE
2. WLCSP100 4.39*4.37 mm could meet product volume.
3. Flash volume 1Mbyte , don't need external extension.



Smart lock



基于BLE+ZigBee+Thread+Mesh+LoRa+Sigfox的物联家居



- 1 STM32WB是支持BLE5.0/Zigbee3.0 双核无线MCU
- 2 STM32WB涵盖256K~1MB Flash多款不同配置
- 3 STM32WB支持多协议BLE + ZigBee同时运行
- 4 STM32WB具有完整STM32 MCU生态系统
- 5 STM32WB提供培训课程快速上手
- 6 STM32WB应用涵盖消费类、智能家居、工业监控及医疗健康

Thank you

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