The IoT movement

IoT is a movement where any system is able to leverage the Internet and its ecosystem.

Nodes
- Smart Things (With intelligence)
- Sensors (Send raw data)

Gateways
- Gateway

Cloud
- Network infrastructure (Switch / Router)
- Servers (Big data & cloud)

Sense – Process – Connect – Power - Secure

Process – Connect – Power - Secure

Process – Power - Secure
Connected objects in the 2.4 GHz band

- Insulin pump
- Earing aids
- Watches
- Glasses
- Tag locator
- Fitness
- Alarm
- Heating / cooling
- Door lock
- White goods
- Smoke detectors
- Lighting

**Bluetooth Smart**
Point-to-point communication with smartphones and other wireless devices

**BLE Mesh / 802.15.4**
Home automation with Mesh network need
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
- 1MB Flash
- 256KB Flash
- 3.6 V
- 1.7 V
- 129-pin
- 48-pin
- Advanced RF tool, Energy control with C code generation
- No matter what!
About the STM32WB

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

Security
PCROP, PKA, TRNG
AES 256-bit, CKS

Arm® Cortex®-M4
MPU + FPU
+ DSP Inst. @ 64 MHz

ART Accelerator™
Up to 1MB Flash
Up to 256KB SRAM

Arm Cortex-M0+ Core
@ 32 MHz
2.4 GHz Radio
Bluetooth 5.0
802.15.4
Concurrent mode

Independent Sub-system RF 2.4GHz

USB 2.0 FS
Crystal-less
SPI, I²C
LP-UART
SAI, Quad-SPI

ADC 12-bit
2x Comp
Temp sensor
Cap. Touch

LCD 8x40
### Power efficiency

#### FlexPowerControl
- Efficient running
- 8 low-power modes, several sub-modes
- High flexibility

#### Application benefits

- **High performance**
  - CoreMark score = 219
- **Outstanding power efficiency**
  - ULPBbench score = 303
- With RF and SMPS on
  - 53µA/MHz from M4

<table>
<thead>
<tr>
<th>Mode</th>
<th>Current @ 64 MHz</th>
<th>Current @ 2 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUN (Range1)</td>
<td>117 (73) µA / MHz**</td>
<td>103 µA / MHz**</td>
</tr>
<tr>
<td>RUN (Range2)</td>
<td>109 µA / MHz**</td>
<td>41 µA / MHz</td>
</tr>
<tr>
<td>LPRUN at 2 MHz</td>
<td>103 µA / MHz**</td>
<td>45 µA / MHz</td>
</tr>
<tr>
<td>LPSLEEP at 2 MHz</td>
<td>100 µA</td>
<td>320 nA / 650 nA*</td>
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<tr>
<td>STOP 0 (full retention)</td>
<td>100 µA</td>
<td>30 nA / 315 nA*</td>
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<tr>
<td>STOP 1 (full retention)</td>
<td>9.2 µA / 9.6 µA*</td>
<td>30 nA / 315 nA*</td>
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<tr>
<td>STOP 2 (full retention)</td>
<td>1.8 µA / 2.2 µA*</td>
<td>30 nA / 315 nA*</td>
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<tr>
<td>STANDBY + 32 KB RAM</td>
<td>110 nA / 440 nA**</td>
<td>110 nA / 440 nA**</td>
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<tr>
<td>STANDBY</td>
<td>110 nA / 440 nA**</td>
<td>110 nA / 440 nA**</td>
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<tr>
<td>SHUTDOWN</td>
<td>30 nA / 315 nA*</td>
<td>30 nA / 315 nA*</td>
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<tr>
<td>VBAT</td>
<td>2 nA / 300 nA*</td>
<td>2 nA / 300 nA*</td>
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</table>

Typ @ VDD = 1.8 V @ 25 °C

* with RTC
** from SRAM1
Easy to integrate, small form factor

Already certified for customer

Architecture

- WLCSP100 package integrated, 1MB Flash
- IPD integrated
- Crystals integrated
- Maximum of features & GPIOs exposed
- Low cost PCB for the mother board

Production: Q4 2020
Multiprotocol and open radio

- Fully certified Bluetooth® 5.0 radio
- 2x faster speed with 2Mbps capable mode
- Extend network coverage with BLE Mesh

- Last IEEE 802.15.4 standard ready
- OpenThread, Zigbee PRO / 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

STM32WB

2.4 GHz
Open

Bluetooth

Open

STM32

IEEE

BLE Mesh

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2.4 GHz
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IEEE

BL
Profiles

IEEE 802.15.4 MAC

2.4 GHz Radio
+6 dBm output / -100 dBm sensitivity (802.15.4)
-96 dBm sensitivity (BLE 1 Mbps)

Antenna

Make it yours
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
   Authentication signature matches preprogrammed key
   Case not, the process is aborted and device resets
4. New FW package is decrypted with proprietary Key. Device upload on going.
## IoT protection ready (2/2)

**STM32WB countermeasure against attacks**

<table>
<thead>
<tr>
<th>Attacks</th>
<th>Attacks description</th>
<th>STM32WB Countermeasures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non Invasive</td>
<td>• Environment modification</td>
<td>• Temperature sensor</td>
</tr>
<tr>
<td></td>
<td>• Temperature</td>
<td>• Power supply integrity monitor</td>
</tr>
<tr>
<td></td>
<td>• Voltage</td>
<td>• Clock security system</td>
</tr>
<tr>
<td></td>
<td>• Clock ....</td>
<td>• Tamper pads</td>
</tr>
<tr>
<td></td>
<td>• Fault injection (glitches....)</td>
<td>• Memory ECC, Parity check</td>
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<tr>
<td></td>
<td>• Exploit debug features</td>
<td>• RTC alarm, registers, SRAM mass erase</td>
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<tr>
<td></td>
<td>• Side channel, power Analysis, ...</td>
<td>• JTAG Read out protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• BOOT from Flash only</td>
</tr>
<tr>
<td>Software</td>
<td>• Low Authentication / Encryption</td>
<td>• Customer Key Storage (CKS)</td>
</tr>
<tr>
<td>Attacks</td>
<td>• Extract keys</td>
<td>• RNG, Crypto accelerator, CRC</td>
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<tr>
<td></td>
<td>• Exploitation of applicative test features</td>
<td>• Write memory protection</td>
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<tr>
<td></td>
<td>• Malware / Virus</td>
<td>• Read Out memory protection</td>
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<tr>
<td></td>
<td>• Replay, privilege escalation</td>
<td>• Memory Protection Unit (MPU)</td>
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<td></td>
<td></td>
<td>• Firmware Upgrade Service (FUS)</td>
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<tr>
<td></td>
<td></td>
<td>• Secure Firmware Update (SFU)</td>
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<tr>
<td></td>
<td></td>
<td>• Proprietary Code Read-Out Protection (PCROP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 96-bit ID</td>
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</tbody>
</table>
Prototyping made as easy as 1,2,3

Hardware Evaluation Pack

STM32CubeMX
STM32CubeWB
Code generation
Power calculation
STM32CubeMonRF
Software development tools

A complete flow, from configuration up to monitoring

STM32CubeMX
Configure & Generate Code

Partners IDEs
Compile and Debug

STM32CubeMonRF
STM32CubeProg

More to come after mass market launch
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• Also works offline!

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End-to-End Ecosystem

Software Tools

1. Configuration
- STM32CubeMX
- STM32CubeIDE

2. Development
- STM32CubeIDE
- IAR Systems
- arm KEIL

3. Programming
- STM32CubeMonitor
- STM32CubeMonitor-RF

4. Monitoring

Embedded Software

STM32Cube Expansions & Function Packs

STM32Cube MCU Package
Releasing your creativity

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community.st.com
www.st.com/STM32WB
Online Training
MOOC