

ST Mcus News

Avnet Memec Silica

March'16

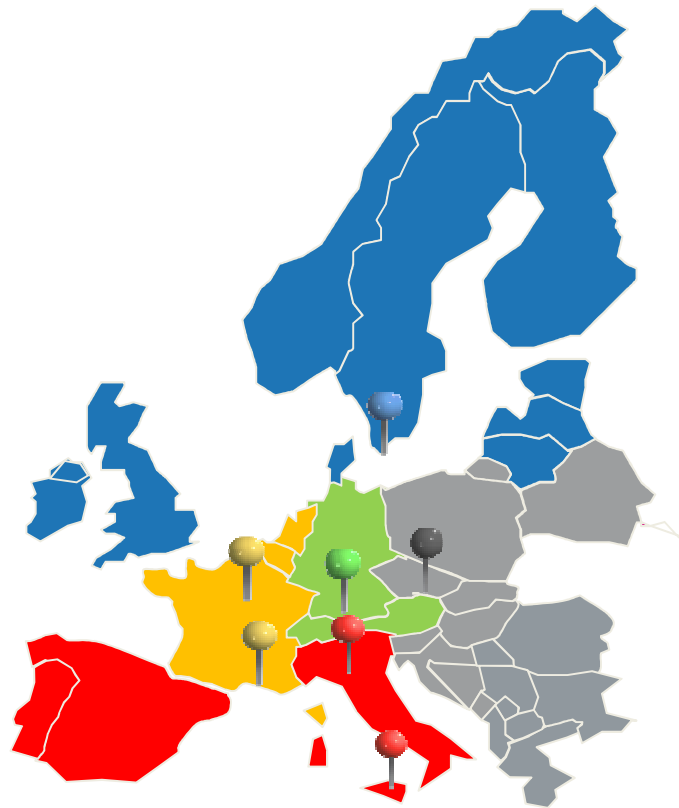


Agenda

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- STM32 F410
- STM32 F7 2MB
- STM32 L0 family completion
- STM32 L43x
- Agreement on LoRa
- New nucleos and Cube MX for Linux

EMEA MCD Marketing organization



Technical Marketing
Laurent Vera

Central Europe
Romain Ricci

Roland Hellstern

Carsten Sbick

Yvon Rannou

JM Broudic

Channel Management
JM Broudic

Promotion Program
S. Boube-Politano

South Europe
Francesco Di-Marco

Marco San Filippo

North Europe
Nordic
Marcus Woxulv

UK –
Laurent VERA acting

East Europe
Roman Ludin

West Europe

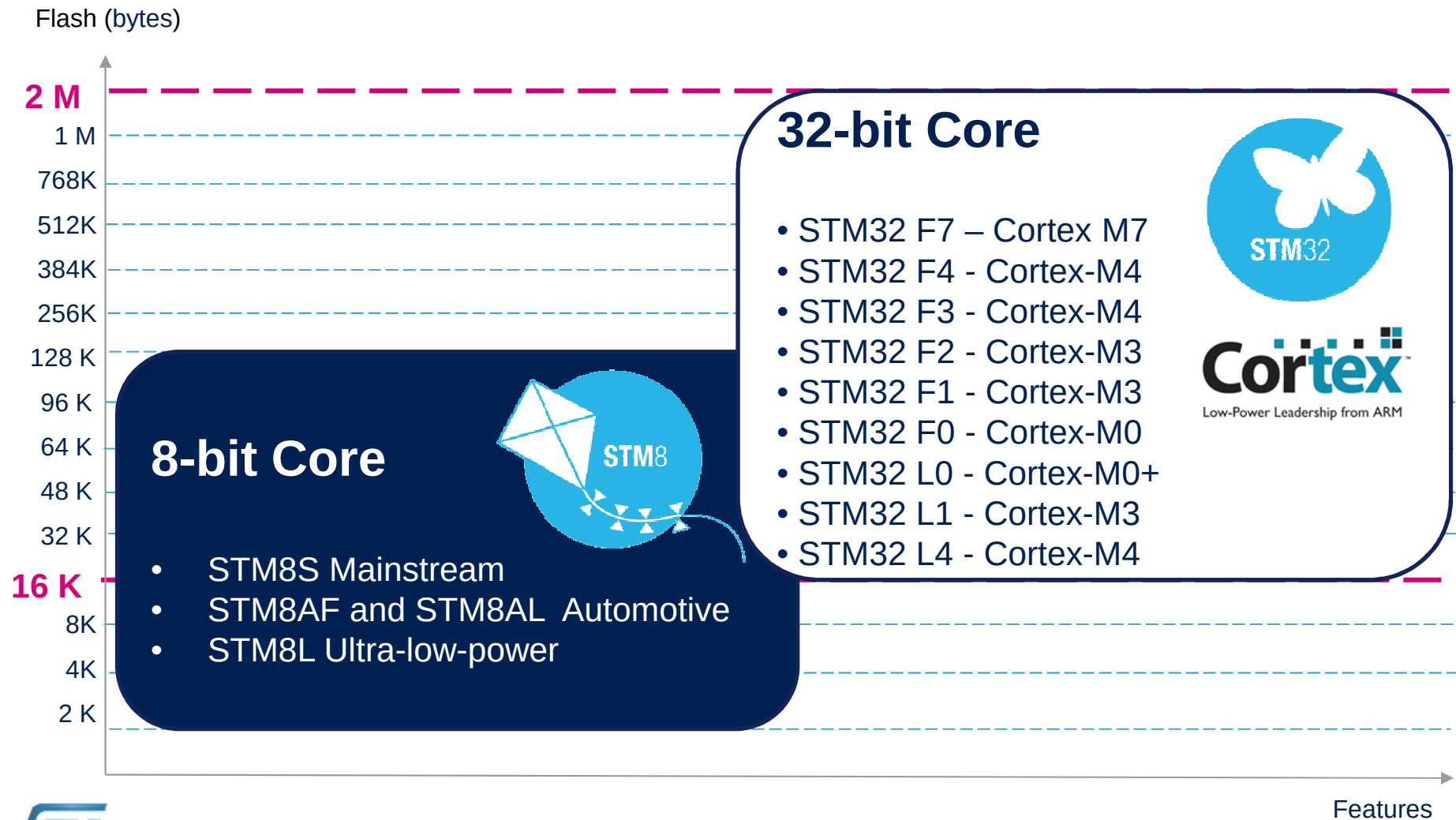
Salim Kandil

Vincent Leynaert

MCUs portfolio

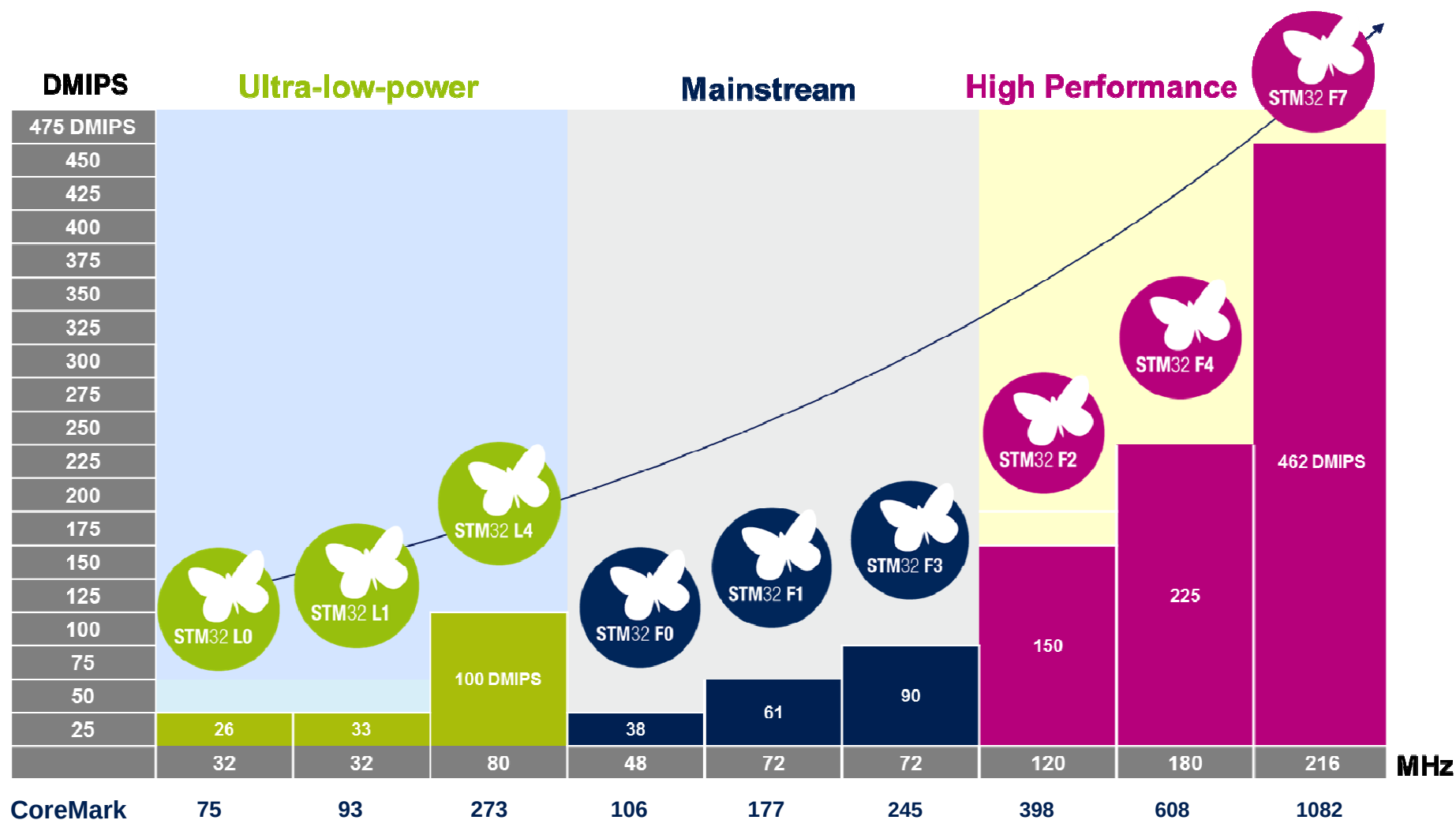
new families development focus

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Broadest 32-bit MCU product portfolio

5



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Enhanced Graphic
High memory density
Security

Extended Connectivity and Features

Security

Dynamic efficiency

Entry Level



Tiniest STM32 Dynamic Efficiency™
STM32F410 Cortex®-M4 MCU



100MHz / 125DMIPS from flash

Down to 88uA/MHz RUN and 10uA STOP

Batch Acquisition Mode (BAM),
DAC, TRNG

Packages

- WLSCP36 (2.553 x 2.579mm)
- UFQFN48
- LQFP64

Operating voltage

- 1.7 to 3.6V

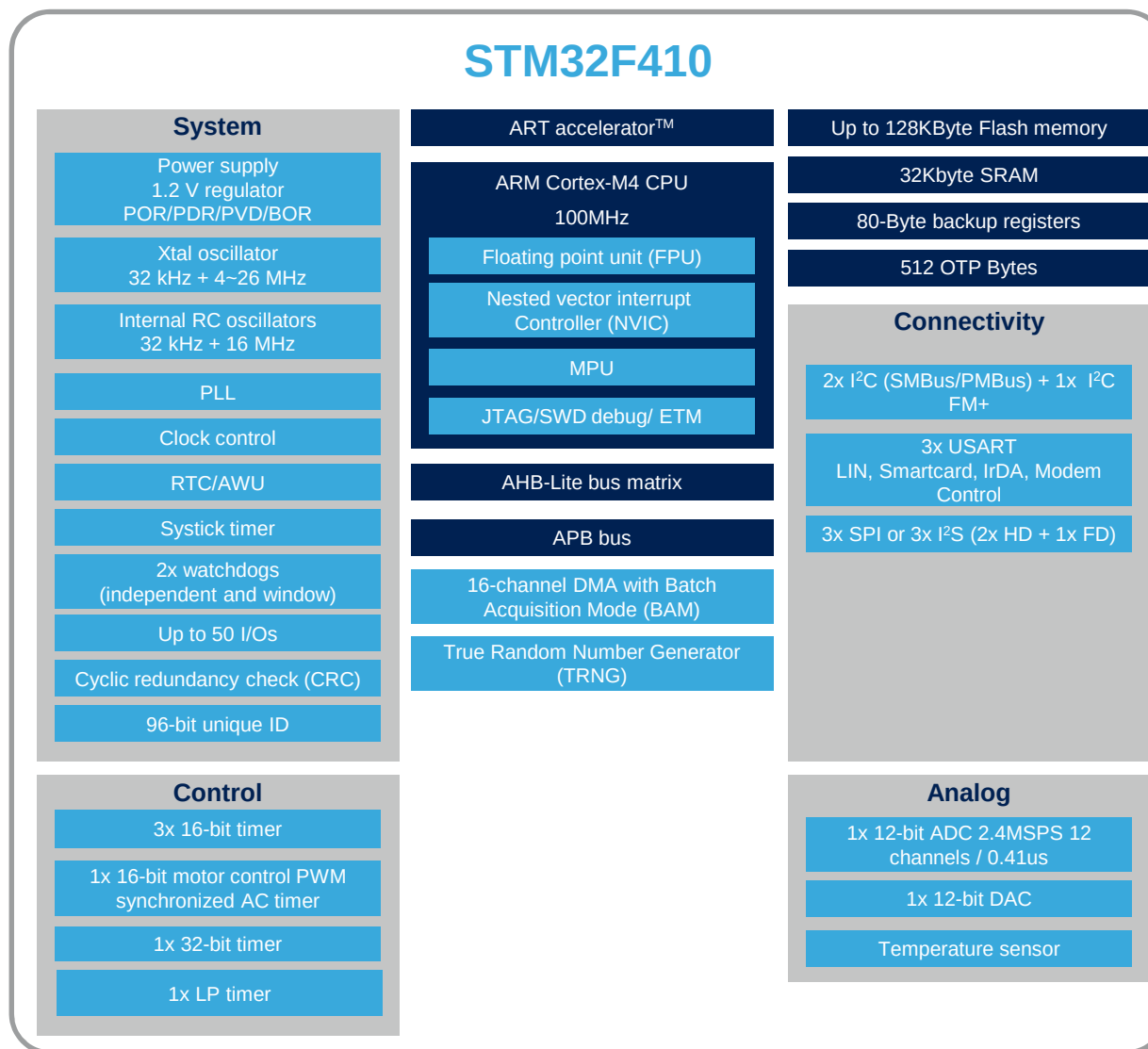
Operating temperature

- Industrial: -40 to 85 °C
- Extended: -40 to 105 °C



STM32F410 block diagram

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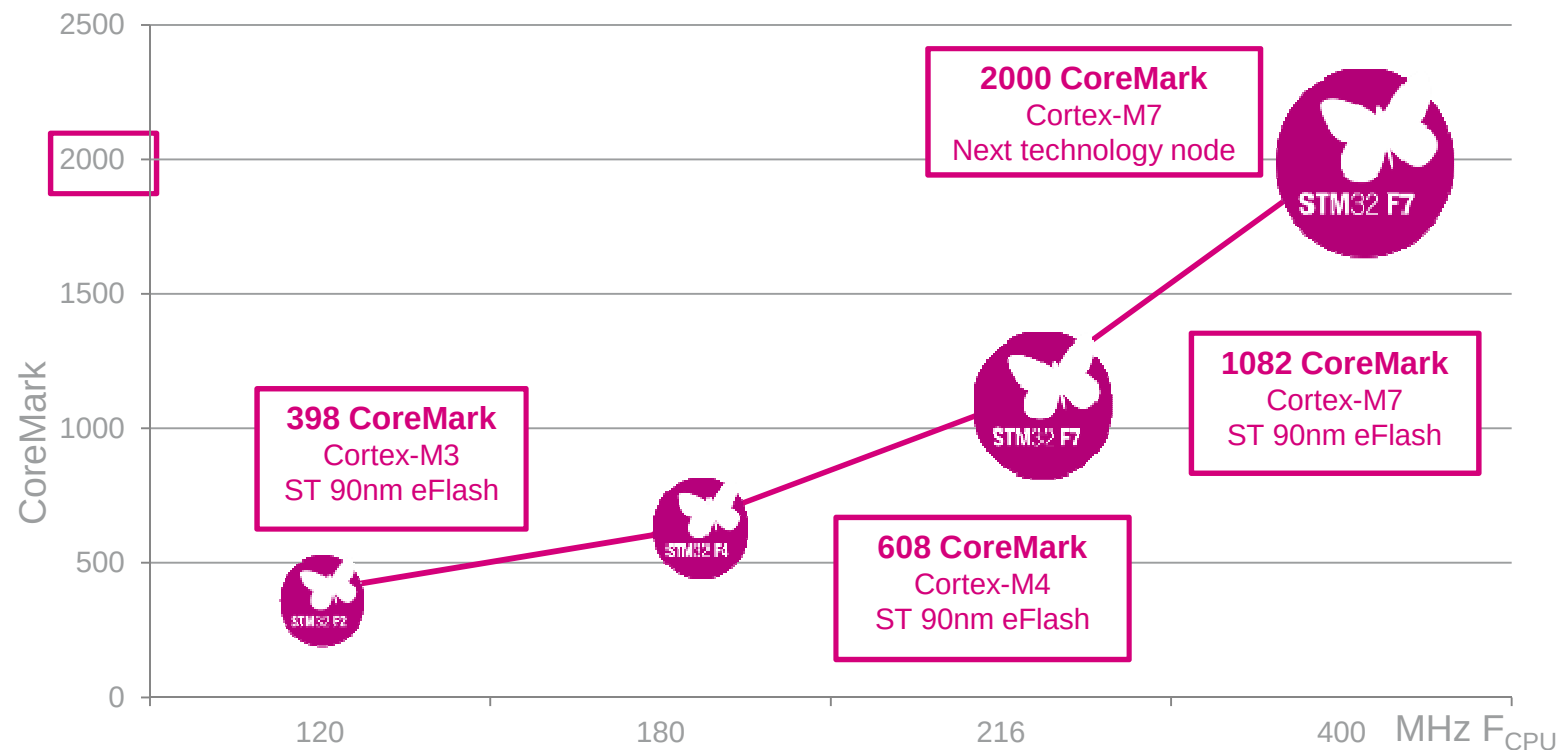


STM32 F7 Series

Smart-System Architecture for performance

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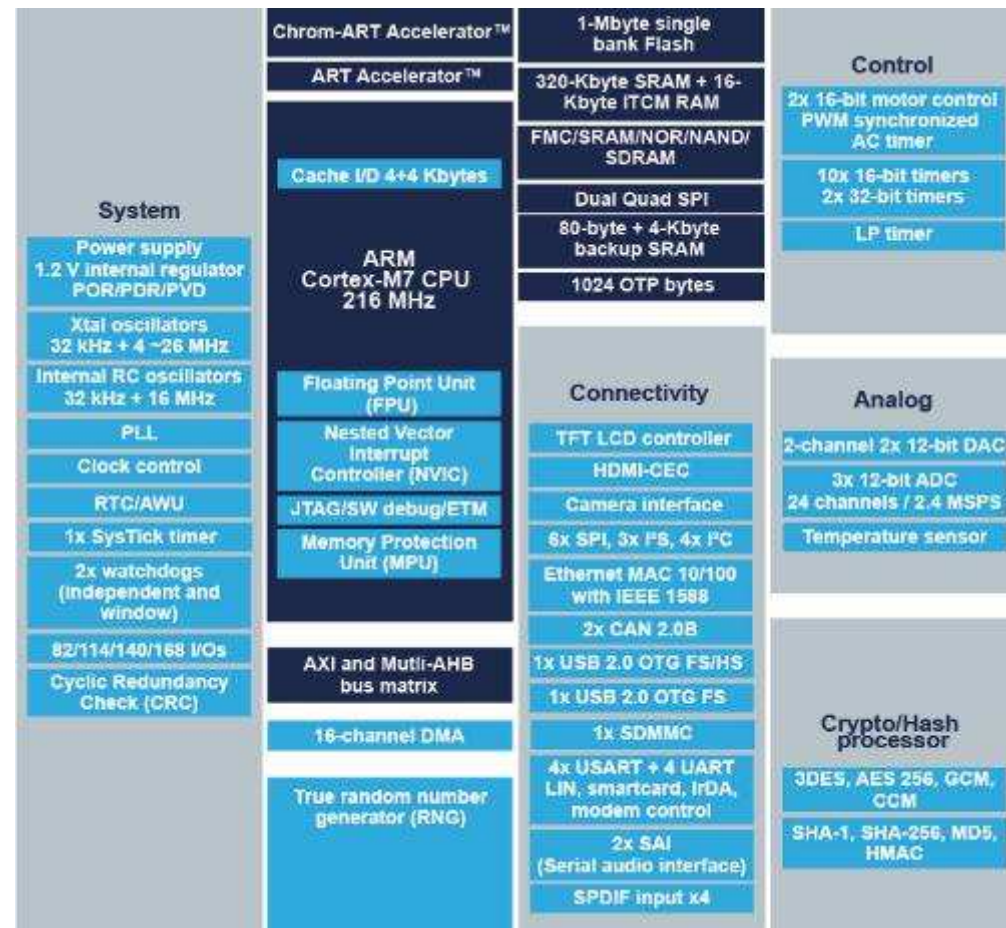
Fully compatible with the STM32 F4 and fully reuses STM32 Ecosystem
Our next step will go for the 2000 CoreMark on the next technology node



STM32 F756 block diagram

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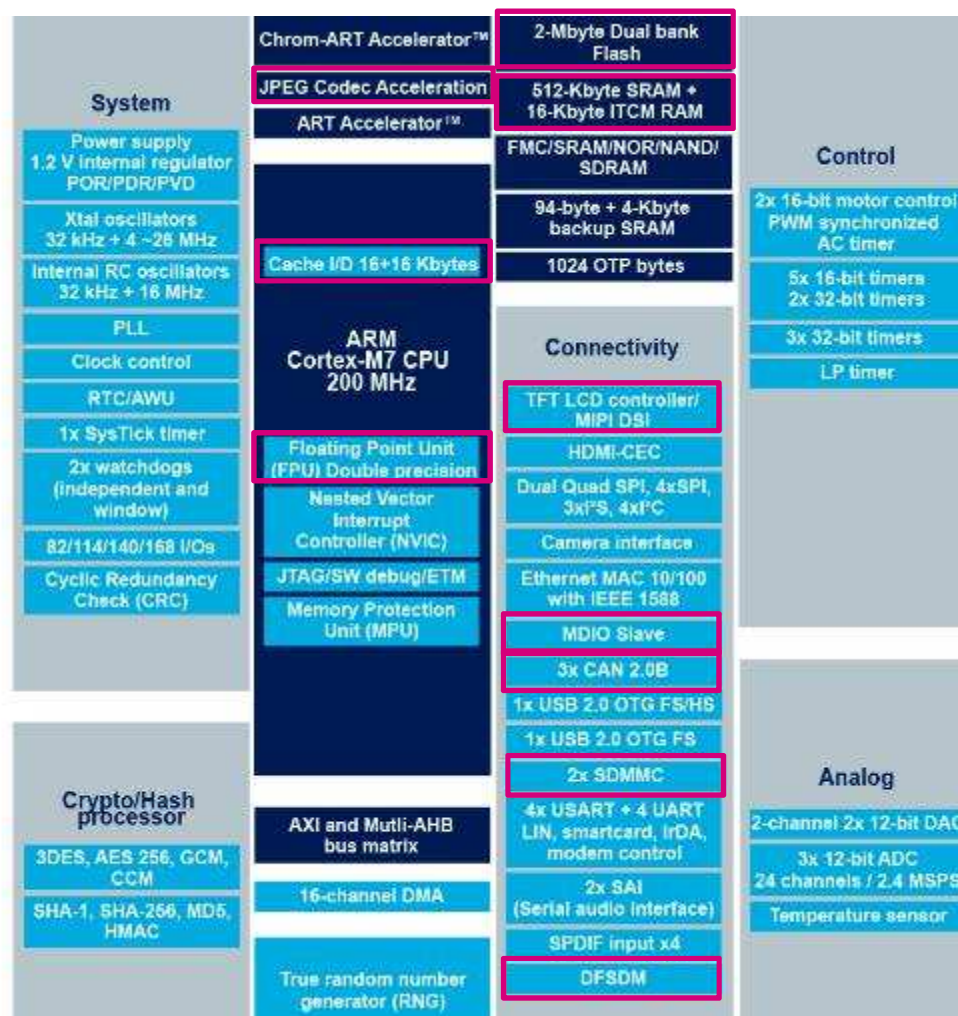
- NEW core: ARM Cortex-M7
- Up to 216 MHz, 462 DMIPS/1082 CoreMark
- Twice more DSP performance vs Cortex-M4 core
- New generation of Peripherals
- 2xSAI, 3xI2S half duplex, USB dedicated supply for 1.8 V operation, CEC, Quad SPI, SPDIF input, 4xI2C.
- Same packages as F429
 - WLCSP143
 - LQFP100,144,176,208
 - BGA 176, 216



STM32F76x - 2M block diagram

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- NEW core: ARM Cortex-M7 with double precision FPU
- 216 MHz, 462 DMIPS/
1082 CoreMark
- 2MB Flash / 512KB SRAM
- Twice more DSP performance vs Cortex-M4 core
- New generation of peripherals
- 2xSAI, 3xI2S half duplex, Dedicated supply for 1.8 V operation for USB and SDMMC, CEC, Dual mode Q-SPI, SPDIF input, 4xI2C, 2 SDIO I/F, 3 CAN, MIPI DSI, JPEG H/W codec, MDIO slave
- Same packages as F429
 - WLCSP180(168 active) pitch 0,4mm
 - LQFP100,144,176,208
 - BGA176, 216





STM32 F7 product lines

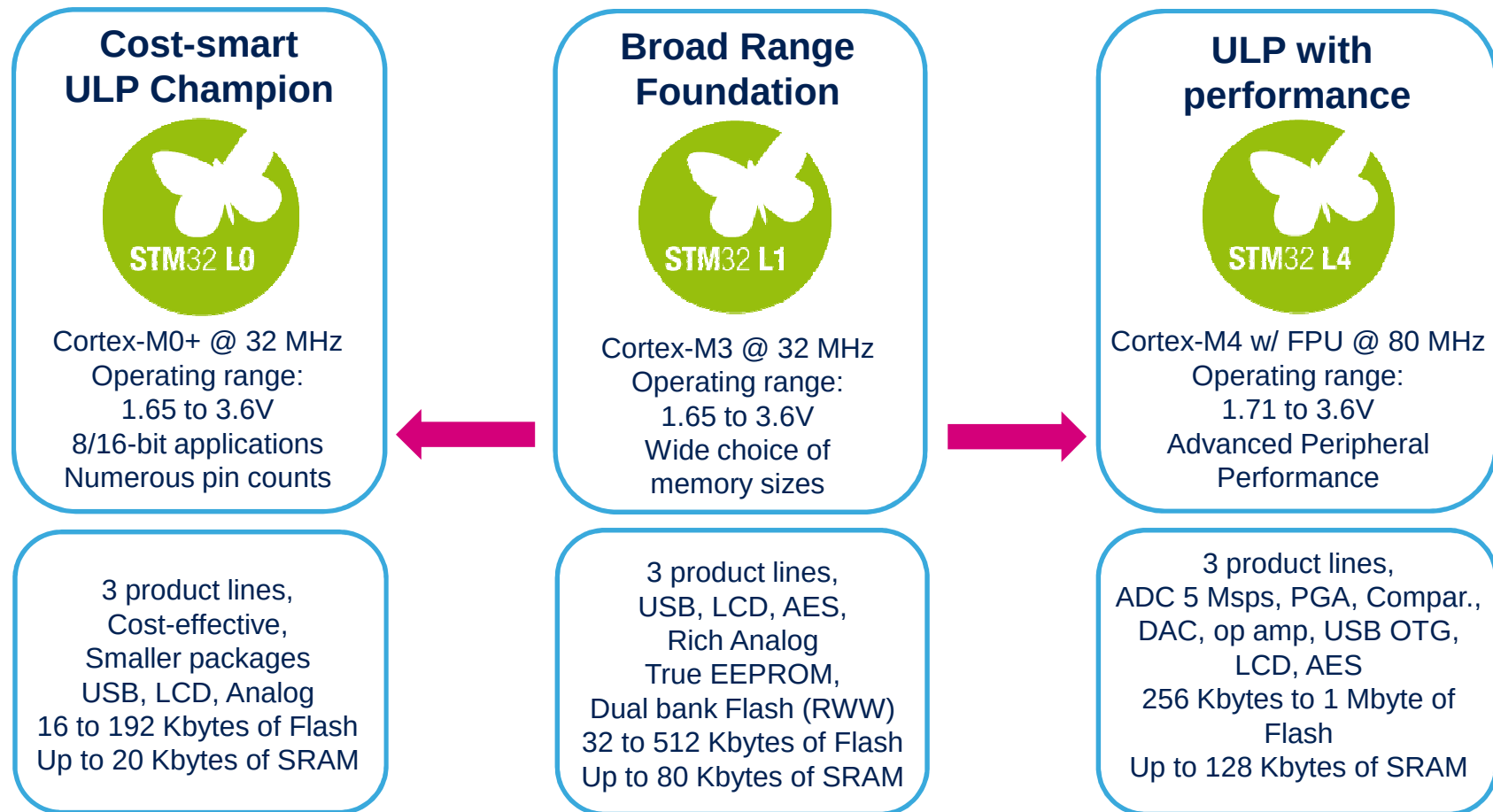
12

Cortex®-M7 – 216 MHz	Acceleration - ART Accelerator™ - L1 cache: data and instruction cache - Chrom-ART Accelerator™ - Floating Point Unit Connectivity 2 x USB2.0 OTG FS/HS - SDIO (x2 on F76x & F779) - USART, UART, SPI, I²C - CAN2.0 - HDMI-CEC - Ethernet IEEE 1588 - FMC - MDIO slave (on F76x and F77x) - Camera I/F - Dual mode Q-SPI Audio - I²S + audio PLL 2 x SAI 2 x 12-bit DAC - SPDIF-RX Others 16 and 32-bit timers 3 x 12-bit ADC (2.4Msps) - Low voltage 1.7 to 3.6V 85°C and 105°C range	Product line	FCPU (MHz)	L1 cache (I/D)	FPU	FLASH (bytes)	RAM (KB)	Hardware Crypto / hash	JPEG codec	CAN	DFSDM	TFT controller	MIPI® DSI
		STM32F779	216	16K+16K	Double Precision	1M to 2M (RWW)	512K (incl.128K DTCM) + 16K ITCM + 4K backup	•	•	3	•	•	•
		STM32F769	216	16K+16K	Double Precision	1M to 2M (RWW)	512K (incl.128K DTCM) + 16K ITCM + 4K backup		•	3	•	•	•
		STM32F777	216	16K+16K	Double Precision	1M to 2M (RWW)	512K (incl.128K DTCM) + 16K ITCM + 4K backup	•	•	3	•	•	
		STM32F767	216	16K+16K	Double Precision	1M to 2M (RWW)	512K (incl.128K DTCM) + 16K ITCM + 4K backup		•	3	•	•	
		STM32F765	216	16K+16K	Double Precision	1M to 2M (RWW)	512K (incl.128K DTCM) + 16K ITCM + 4K backup			3	•		
		STM32F756	216	4K+4K	Single Precision	512K to 1M	320K (incl.64K DTCM) + 16K ITCM + 4K backup	•		2		•	
		STM32F746	216	4K+4K	Single Precision	512K to 1M	320K (incl.64K DTCM) + 16K ITCM + 4K backup			2		•	
		STM32F745	216	4K+4K	Single Precision	512K to 1M	320K (incl.64K DTCM) + 16K ITCM + 4K backup			2			

STM32L ULP offer

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STM32L4 completes the ultra-low-power family





STM32L0 Ultra-Low-power Series

*From 16KB up to 192KB of Flash
ARM Cortex™-M0+ Based*





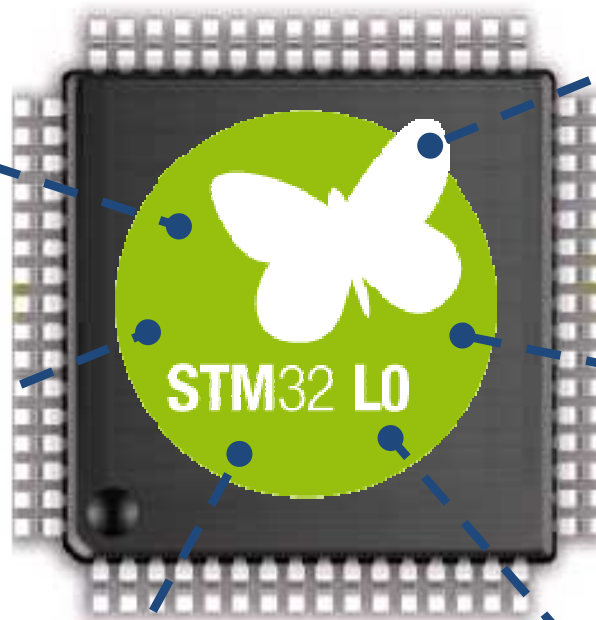
Meet the STM32L0x Series

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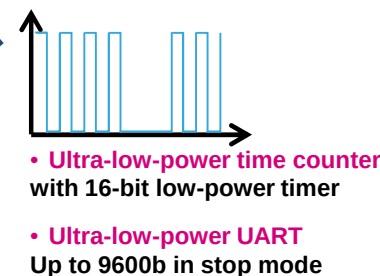
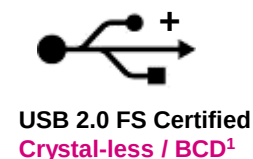
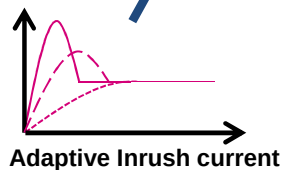
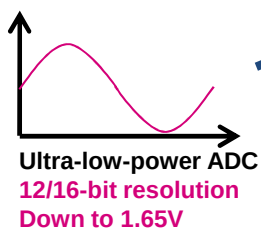
- **STM32® ultra-low-power DNA** built with **ARM Cortex-M0+**



- 1.71V to 3.6V 32MHz operation
- 139µA/MHz (Run 32MHz)
- 87µA/MHz (Run Optimized)
- 400nA Stop mode + Full Ram
- 3.5 µs wakeup to Run
- -40°C to +125°C range



- Full Flash Protection
- Sector Flash Protection
- Hardware encryption - AES
- True RNG²
- Unique ID (96-bit)
- Class B
- Built-in ECC



1. Battery Charger Detection
2. True Random Number Generator

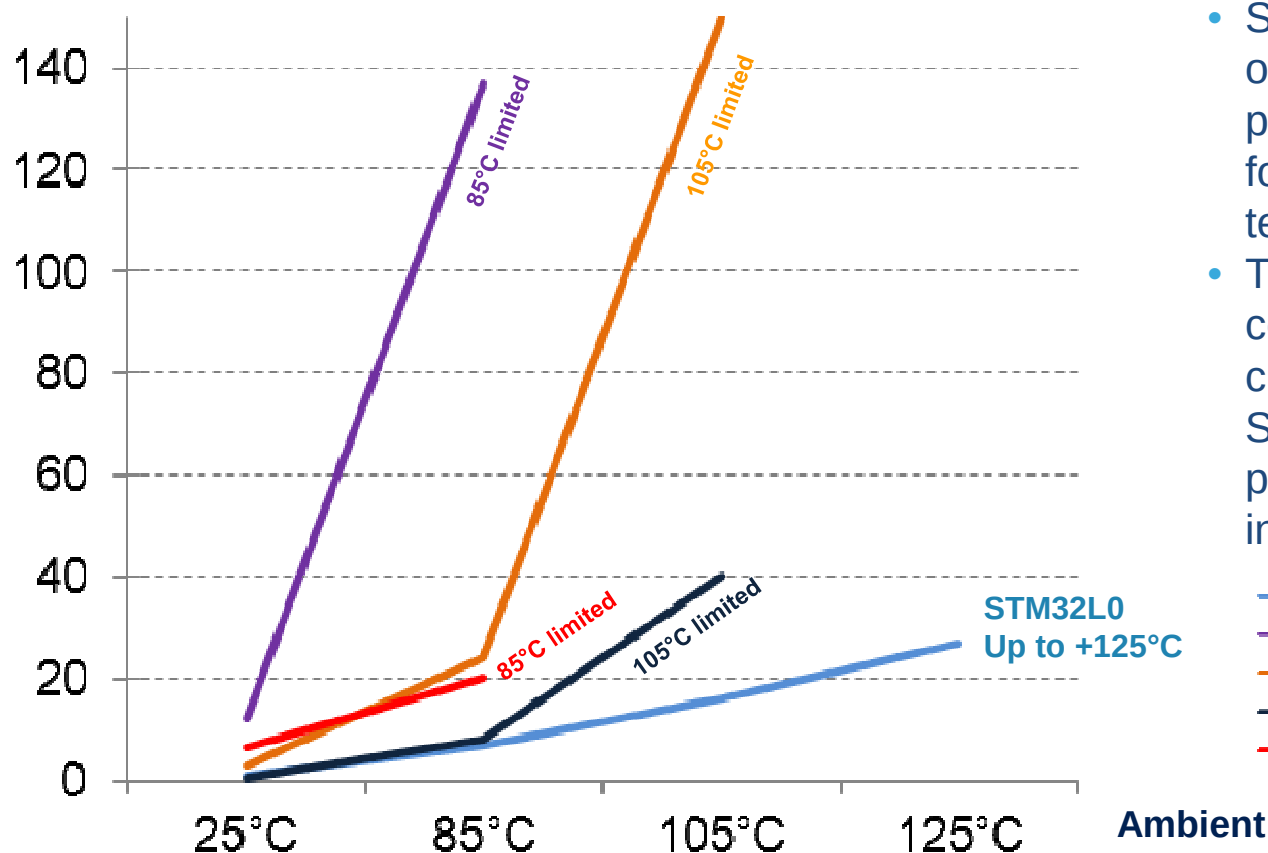


Leader at high temperature

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- Max. current value at lowest power mode vs. temperature capability

IDD (μA)



- STM32L0 platform offers the lowest power consumption for the highest temperature range.
- This capability to control leakage current makes STM32L0 the premium choice for industrial application,

— STM32L0
— Competitor A
— Competitor B
— Competitor C
— Competitor D

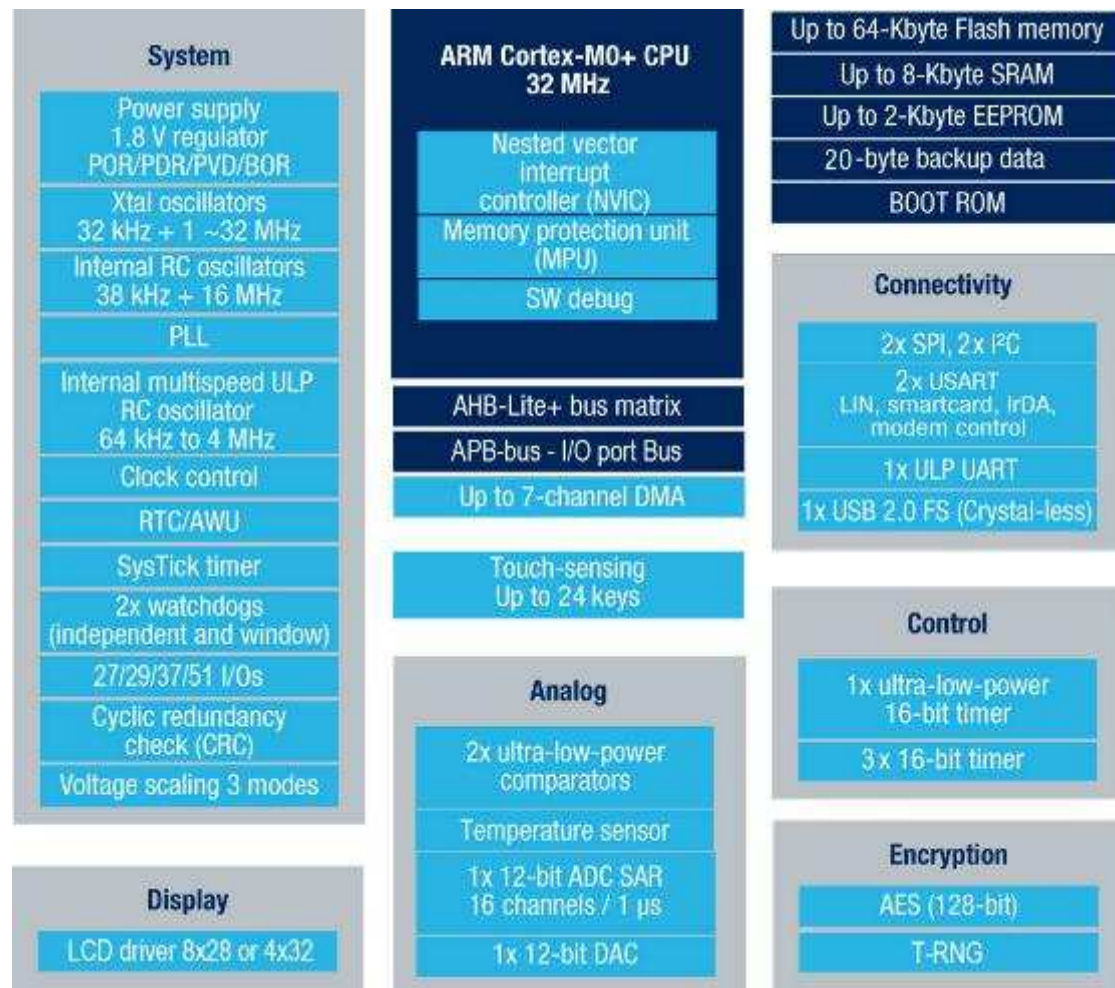


STM32L05x block diagram

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- Key features

- ARM Cortex-M0+ at 32MHz
 - Single-cycle I/O access
 - Single-cycle multiplier (MUL)
 - 0.97 DMIPS/MHz
- 1.71V to 3.6V, 32MHz full functional
- Digital down to 1.65V
- -40°C to +125°C temperature range
- ADC with build-in HW oversampling
 - Down to 1.65V
- Flash + Ram code sector lock
- USB 2.0 FS certified
 - Build-in 48MHz oscillator
 - Battery Charger Detection
 - Link Power Management
- Independent clock domain
 - I2C, USART/UART
 - USB
- 3x timers
 - 1x 16-bit (4ch)
 - 2x 16-bit(2ch)
 - 1x 16-bit LP¹ available in stop



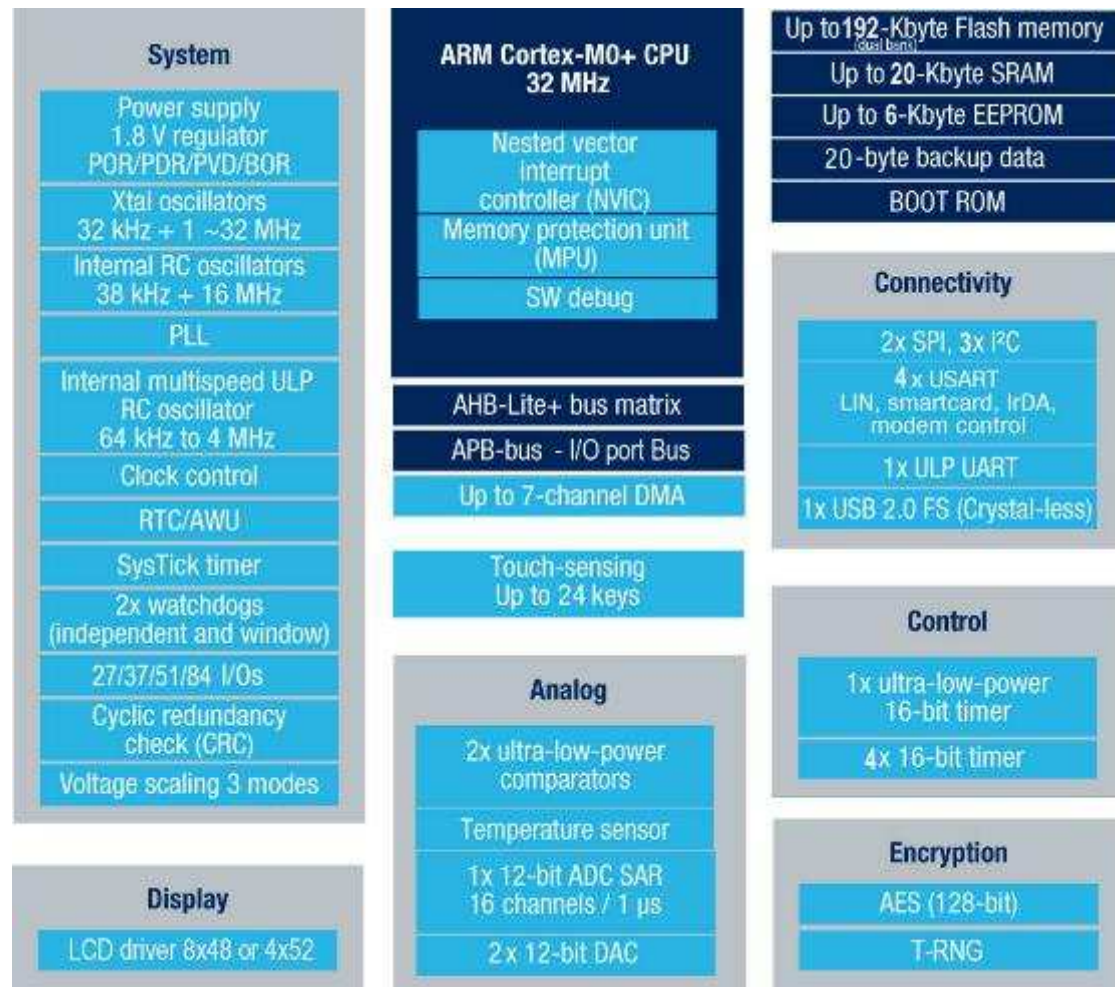


STM32L07x block diagram

18

- Key features

- ARM Cortex-M0+ at 32MHz
 - Single-cycle I/O access
 - Single-cycle multiplier (MUL)
 - 0.95 DMIPS/MHz
- 1.71V to 3.6V, 32MHz full functional
- Digital down to 1.65V
- -40°C to +125°C temperature range
- ADC with build-in HW oversampling
 - Down to 1.65V
- Flash + Ram code sector lock
- USB 2,0 FS certified
 - Build-in 48MHz oscillator
 - Battery Charger Detection
 - Link Power Management
- Independent clock domain
 - I2C, USART/UART
 - USB
- 5x timers
 - 1x 16-bit (4ch)
 - 3x 16-bit(2ch)
 - 1x 16-bit LP¹ available in stop





STM32L03x block diagram

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New: 8KB of SRAM

- Key features

- ARM Cortex-M0+ at 32MHz
 - Single-cycle I/O access
 - Single-cycle multiplier (MUL)
 - 0.95 DMIPS/MHz
- 1.71V to 3.6V, 32MHz full functional
- Digital down to 1.65V
- -40°C to +125°C temperature range
- ADC with build-in HW oversampling
 - Down to 1.65V
- Flash + Ram code sector lock
- Independent clock domain
 - I2C, USART/UART
- 4x timers
 - 1x 16-bit (4ch)
 - 2x 16-bit (2ch)
 - 1x 16-bit LP¹ available in stop



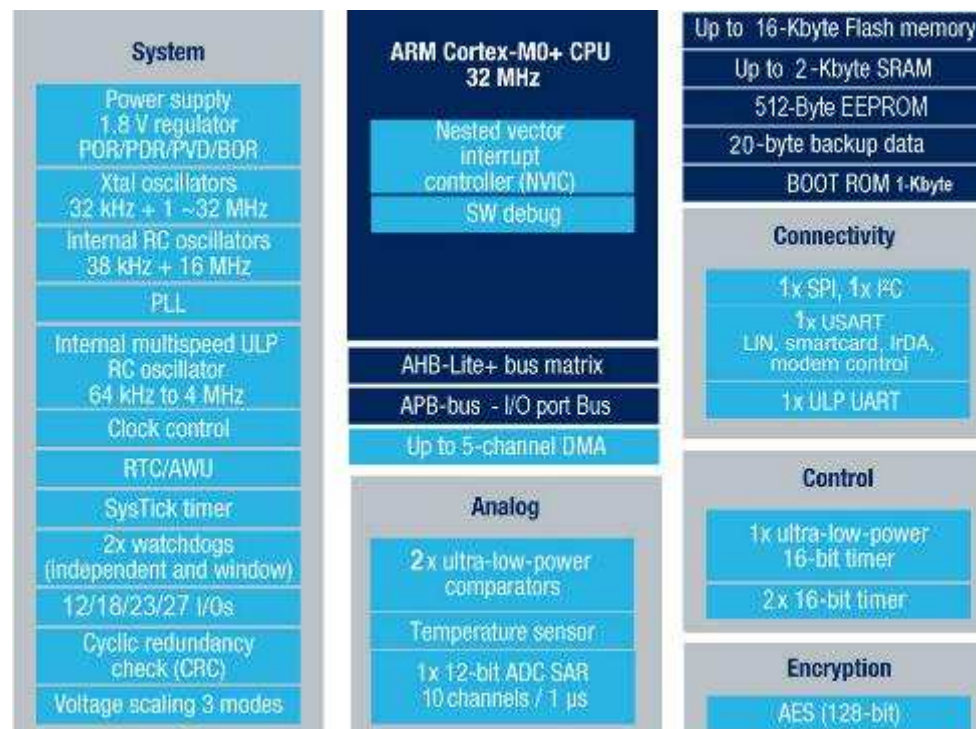


STM32L01x block diagram

20

- Key features

- ARM Cortex-M0+ at 32MHz
 - Single-cycle I/O access
 - Single-cycle multiplier (MUL)
 - 0.97 DMIPS/MHz
- 1.71V to 3.6V, 32MHz full functional
- Digital + ADC down to 1.65V
- -40°C to +125°C temperature range
- ADC with build-in HW oversampling
 - Down to 1.65V
- Independent clock domain
 - I2C, USART/UART
- 2x timers
 - 2x 16-bit(2ch)
 - 1x 16-bit LP¹ available in stop





STM32L0x – portfolio

Cortex™-M0+ @ 32MHz – H2-2015

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STM32L4 Ultra-Low-power Series

*From 256KB up to 1MB of Flash
ARM Cortex™-M4 Based*



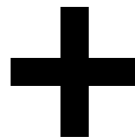


Merging 2 Market Mega trends

23



Performance



Low Power



EEMBC ULP score

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Clear	Device	Compiler	Active Mode Clock Config	Inactive Power Mode	Wakeup Timer Freq [Hz]	ULPMark™ -CP (1)		Date Sent 	Prod. Silicon
	Ambiq Micro APOLLO512-KBR Rev A3	ARM GCC 4.8.3 20140228	CPU: 24 MHz, RTC: 32.768 kHz	Deep Sleep	32768 Hz	377.50	✓	11/07/15	✓
	STMicroelectronics STM32L476RG	IAR C/C++ compiler for ARM v6.60.1.5097	CPU: 24MHz (MSI), RTC: 32.768kHz (LSE)	Standby with SRAM2 retention	32768 Hz	187.70	✓	11/02/15	✓
	Texas Instruments MSP430FR5969 Rev F	IAR Embedded Workbench 6.30.3	CPU: 8 MHz, RTC: 32 kHz	Low Power Mode 3	32768	123.70	✓	10/29/15	✓
	Texas Instruments MSP430FR6972 Rev A	IAR Embedded Workbench 6.30.3	CPU: 8 MHz, RTC: 32 kHz	Low Power Mode 3	32768	123.80	✓	10/29/15	✓
	Atmel Atmel SAML21J18A-UES RevA - DC1506	IAR EWARM 7.30.3.802	CPU : 12MHz, RTC 32,768kHz	STANDBY, PD0,PD1,PD2 in retention state	32768	185.50	✓	07/31/15	
	STMicroelectronics STM32L476RG	IAR C/C++ compiler for ARM v6.60.1.5097	CPU: 24MHz (MSI), RTC: 32.768kHz (LSE)	Standby with SRAM2 retention	32768 Hz	153.00	✓	05/26/15	✓
	Texas Instruments MSP430FR6972 Rev A	IAR Embedded Workbench 6.30.0	CPU: 8Mhz, RTC: 32kHz	Low Power Mode 3	32768 Hz	117.50		04/01/15	✓
	Texas Instruments CC2650F128RGZ, silicon version 2.2	IAR 7.30.4.8186	CPU: 48MHz, RTC: 32768Hz	Standby	32768 Hz	143.60		02/19/15	✓
	Texas Instruments MSP432P401R Rev. B	IAR Embedded Workbench for ARM version 7.30.1.7768	CPU: 24MHz, RTC: 32kHz	LPM3	32768	167.40	✓	02/19/15	
	STMicroelectronics STM32L476 Rev 3	ARMCC v5.04.0.49	CPU: 24MHz (MSI), RTC: 32.768kHz (LSE)	Standby with RTC and SRAM2	32768 Hz	130.80	✓	02/03/15	

187.70

STM32L476 + External DC/DC (supplying internal LDO @ 1.8v)



153.00

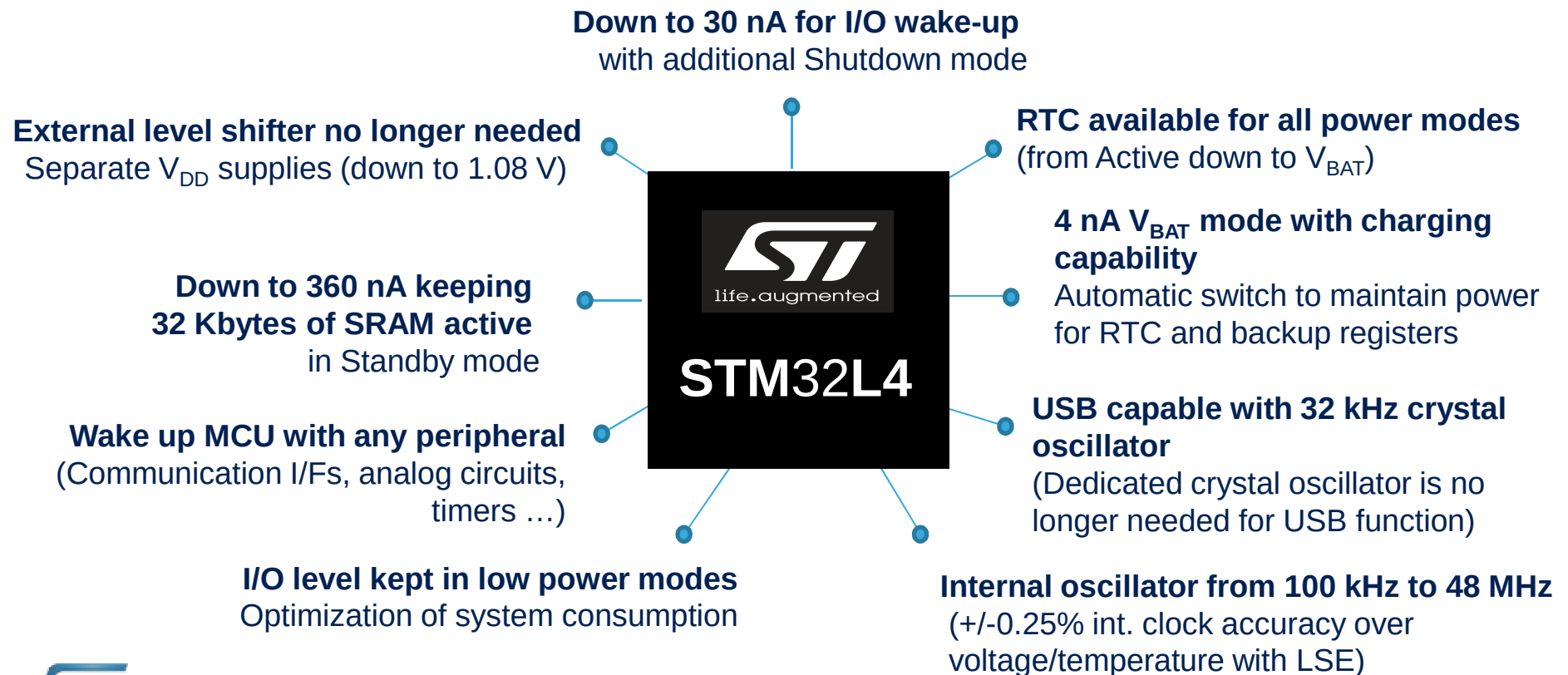
STM32L476 (with internal LDO @ 3.0v)

Ultra-Low-Power and Flexibility

FlexPowerControl

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STM32L4 is based on a new platform optimized to reduce power consumption and increase flexibility





Efficient run and fast wake-up

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Ready for Launch Control ? From 0 to 48 MHz in less than 5 μ s

- Thanks to our internal oscillator (MSI) used at start-up (programmable from 100 kHz to 48 MHz)
- PLL wake-up time < 15 μ s (needed to reach f_{MAX})

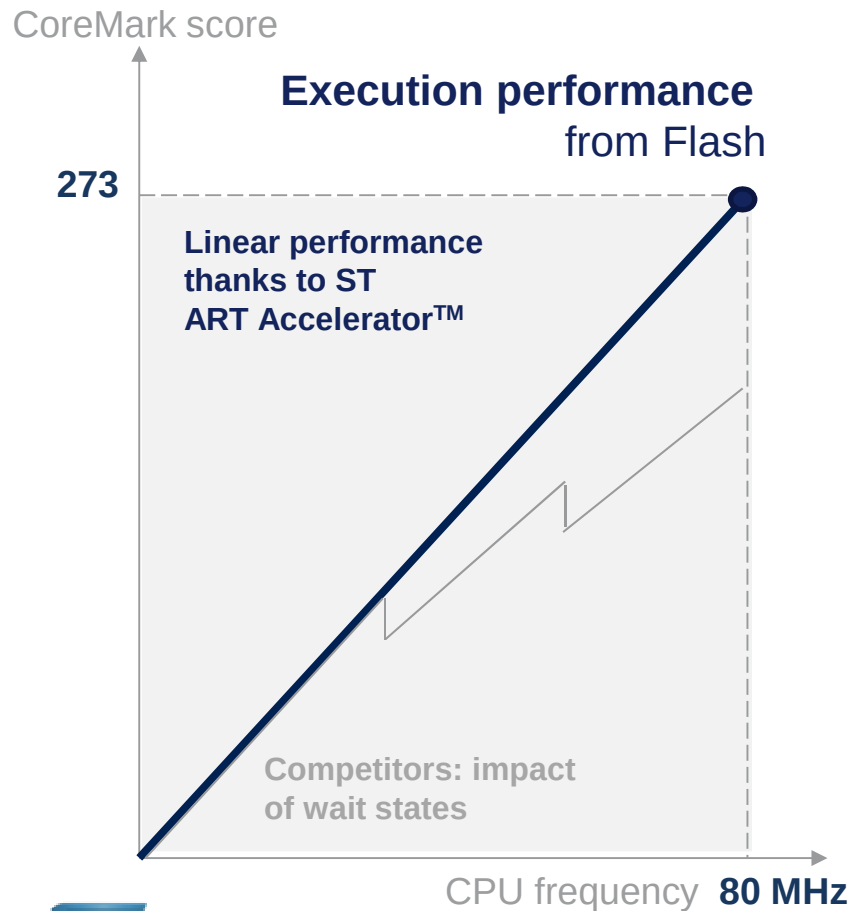




Providing more performance

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Do not compromise on performance with STM32L4



- **Up to 80 MHz/ 100 DMIPS** with ART Accelerator™
- **Up to 273** CoreMark Result
- ARM Cortex-M4 with DSP instructions and floating-point unit (FPU)
- Optimized DMA (14 channels)
- SPI up to 40 Mbit/s, USART 10 Mbit/s

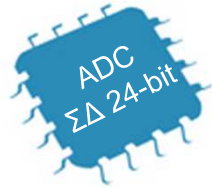
Smart peripherals

Metering

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Digital Filter for Sigma Delta Modulators

8 x parallel inputs
with up to 24-bit data
output resolution



V_{BAT} with RTC for battery backup

240 nA in V_{BAT} mode
for RTC and
32x 32-bit backup registers



TNRG & AES for Security

128-/256-bit AES
key encryption hardware
accelerator



FSMC

External memory interface
for static memories supporting SRAM,
PSRAM, NOR and NAND



STM32L4

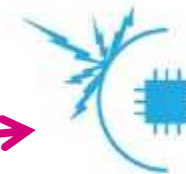


**Electricity/Gas
/Water
Smart Meter**



LCD Display

8x40 or 4x44
with step-up converter



Anti Tamper pin

3 x tamper pins
for battery domain



SPI / UART/ SDIO for Wireless

3x SPIs (4x SPIs with the Quad SPI)
6x UARTs (ISO 7816, LIN, IrDA, modem)
1 x SDIO



I/Os Up to 114 fast I/Os for buttons & relays

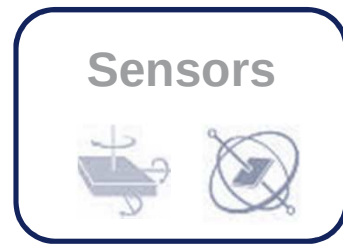
Smart peripherals

Fitness tracker - Wristband

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Digital Filter for Sigma Delta Modulators

with PDM (Pulse Density Modulation)
microphone input support



Batch Acquisition Mode (BAM)

I²C
3x I²C FM+(1 Mbit/s),
SMBus/PMBus

STM32L4



TFT Display

FSMC
Parallel interface to TFT
SPI
Up to 40 MHz speed



USB

USB OTG 2.0
full-speed,
LPM and BCD



SAI

2x serial audio interfaces

OPAMP

2x op amp with
built-in PGA

DAC

2x 12-bit DAC,
low-power sample and hold

ADC

3x 12-bit ADC 5 MSPS,
up to 16-bit with hardware
oversampling, 200 μ A/MSPS



SPI / UART

3x SPIs (4x SPIs with the
Quad SPI)
6x USARTs (ISO 7816, LIN,
IrDA, modem)



SWP

Single wire protocol
master interface (SWPMI)

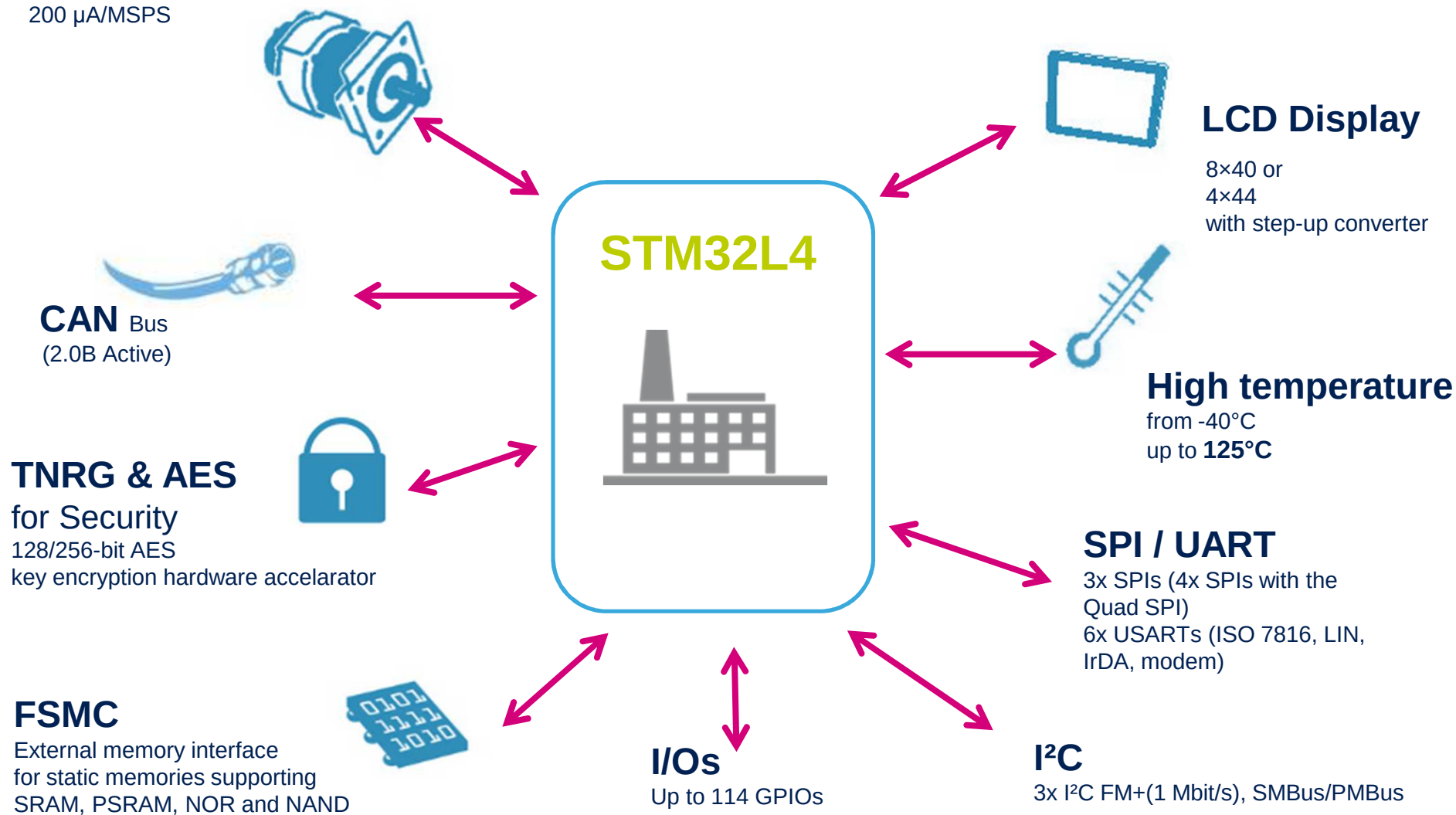


Motor Control :

2x 16-bit advanced motor-control timers
3x 12-bit ADCs: 5 MSPS, with up to 16-bit with hardware oversampling, 200 μ A/MSPS

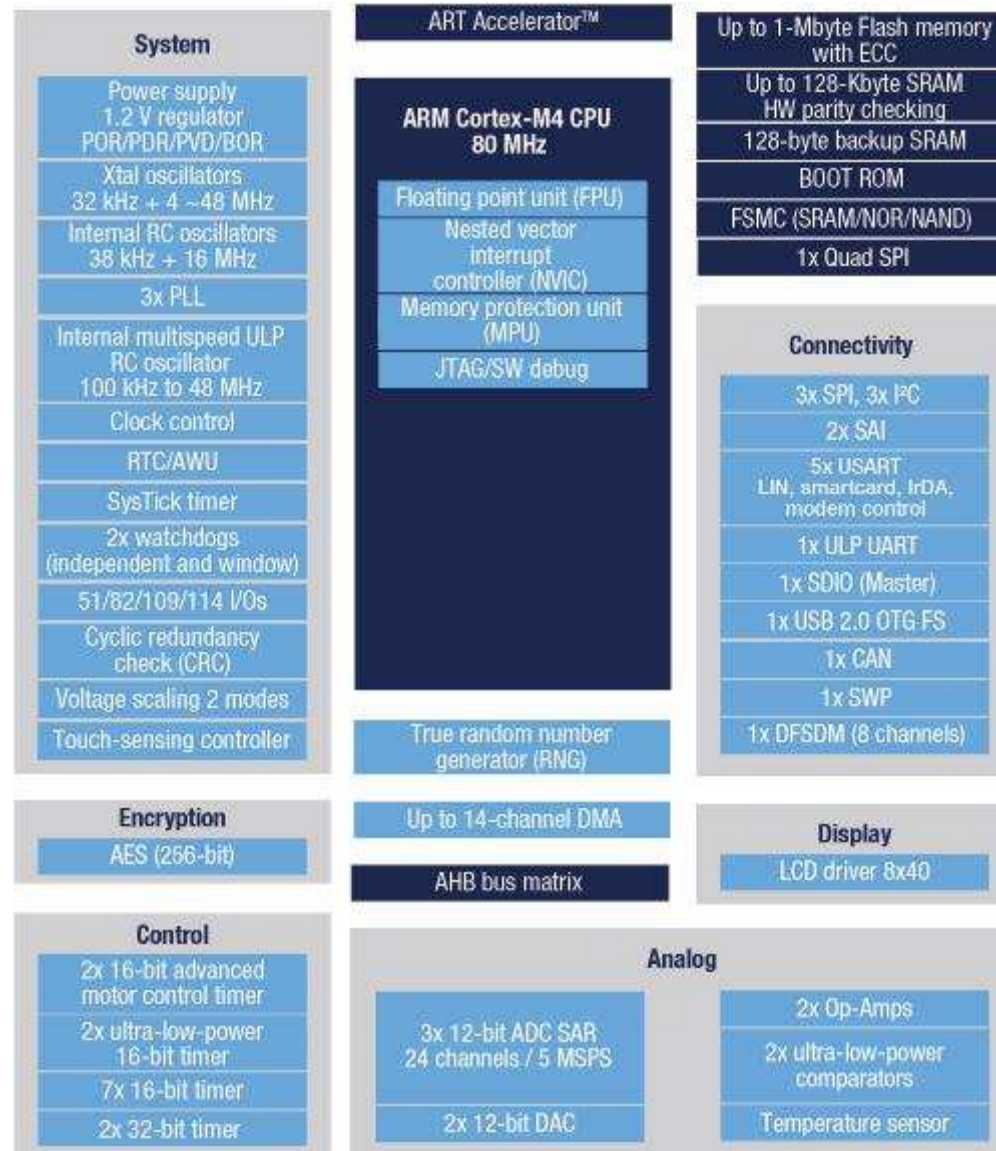
Smart Peripherals Industrial Sensors

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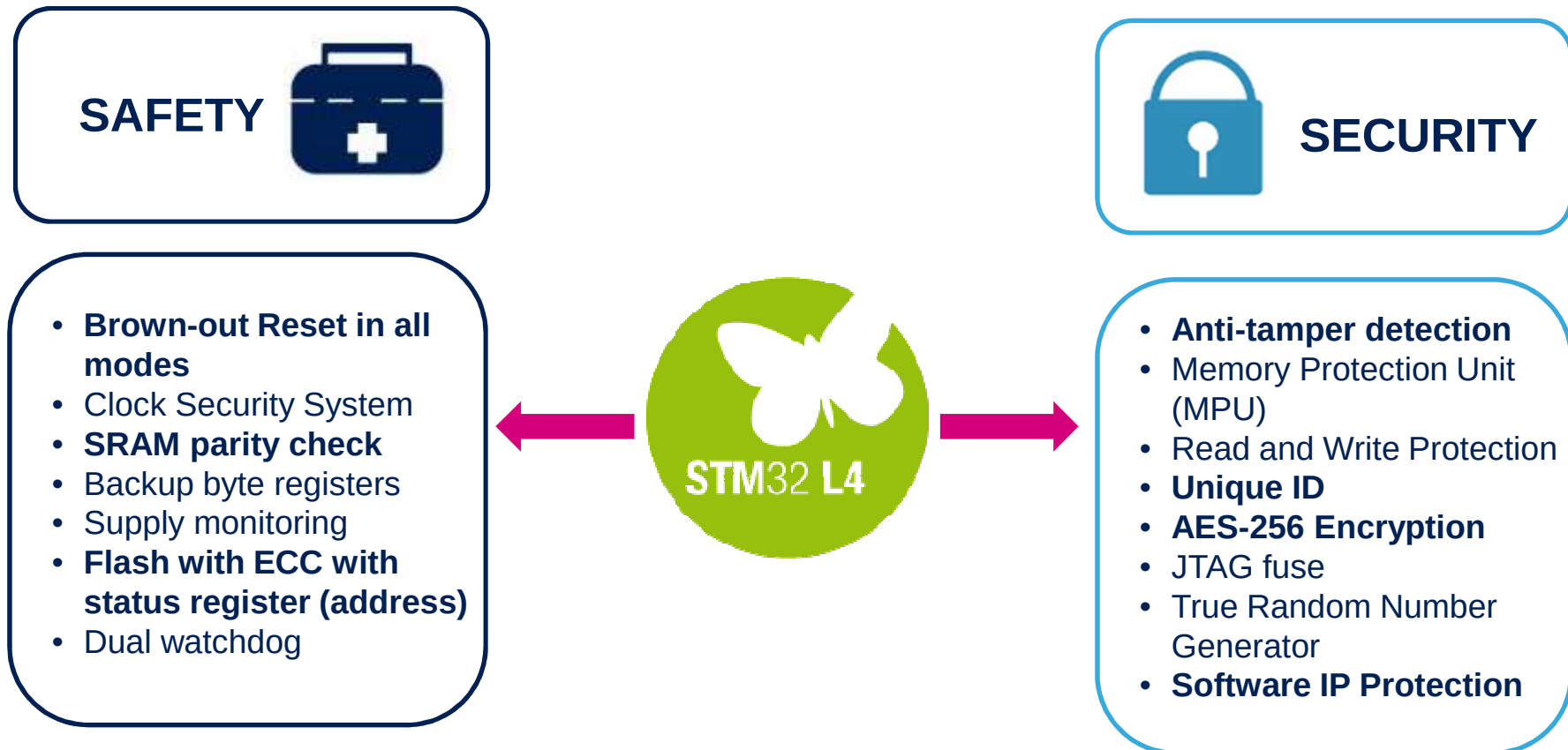


STM32 L47 block diagram – 1 MB

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Integrated safety and security features





STM32L4 series

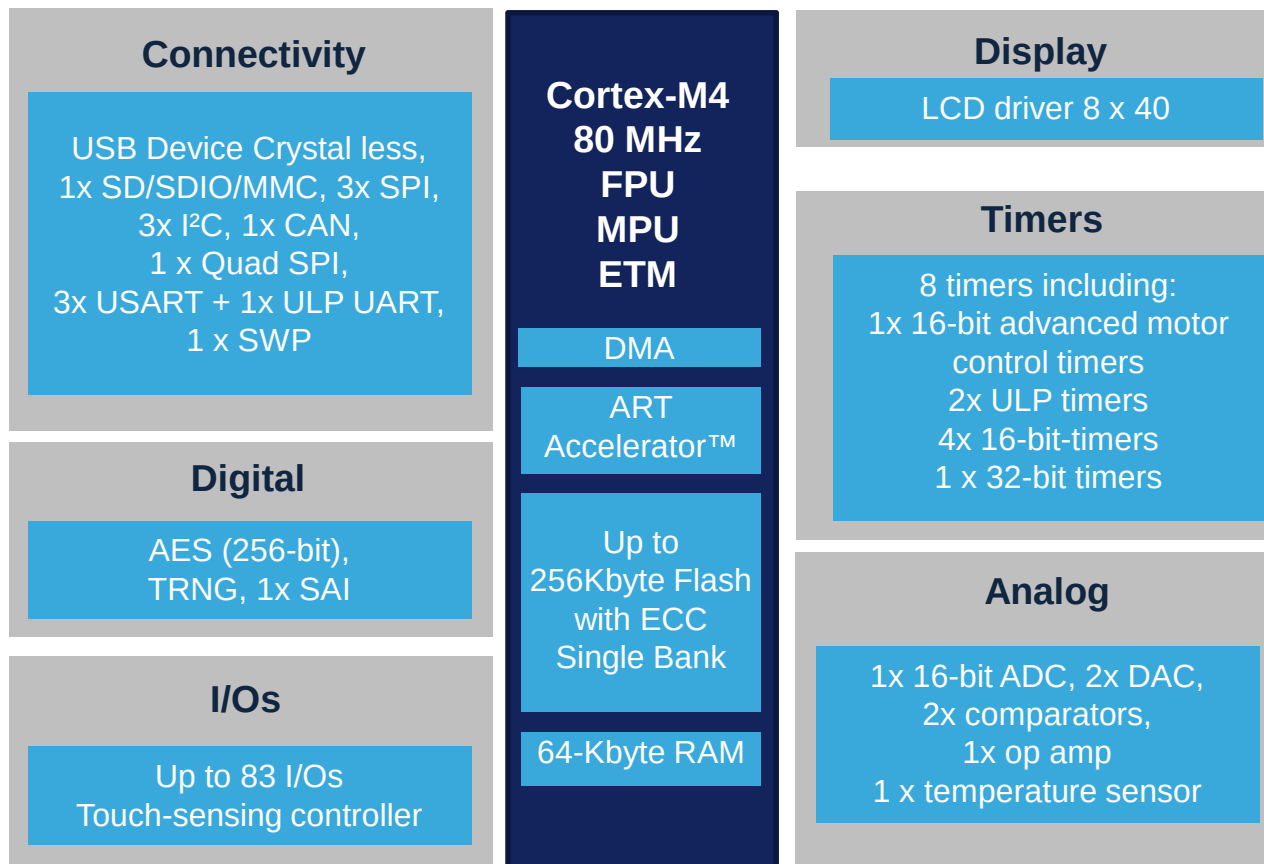
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Cortex®-M4 (DSP + FPU) – 80 MHz	• ART Accelerator™ • USART, SPI, I²C • QuadSPI • 16 and 32-bit timers • SAI + audio PLL • SWP • 1x CAN	Product line	FLASH (KB)	RAM (KB)	Memory I/F	2 x Op-Amp	2 x Comp.	8ch / 4x Sigma Delta Interface	12- bit ADC 5 Msp/s 16 bit HW oversampling	USB2.0 OTG FS	Segment LCD Driver	AES 128/256-bit
	• 2x 12-bit DAC • Temperature sensor	STM32L471 Access	512 to 1024	128	SDIO FSMC	•	•	•	3			
	• Low voltage 1.71V to 3.6V • Vbat Mode • Unique ID • Capacitive Touch sensing	STM32L475 USB OTG	256 to 1024	128	SDIO FSMC	•	•	•	3	•		
		STM32L476 USB OTG & LCD	256 to 1024	128	SDIO FSMC	•	•	•	3	•	Up to 8x40	
		STM32L486 USB OTG & LCD & AES	1024	128	SDIO FSMC	•	•	•	3	•	Up to 8x40	•



STM32L43x

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**Package size down
to 3.1 x 3.1 mm**





STM32L43x series

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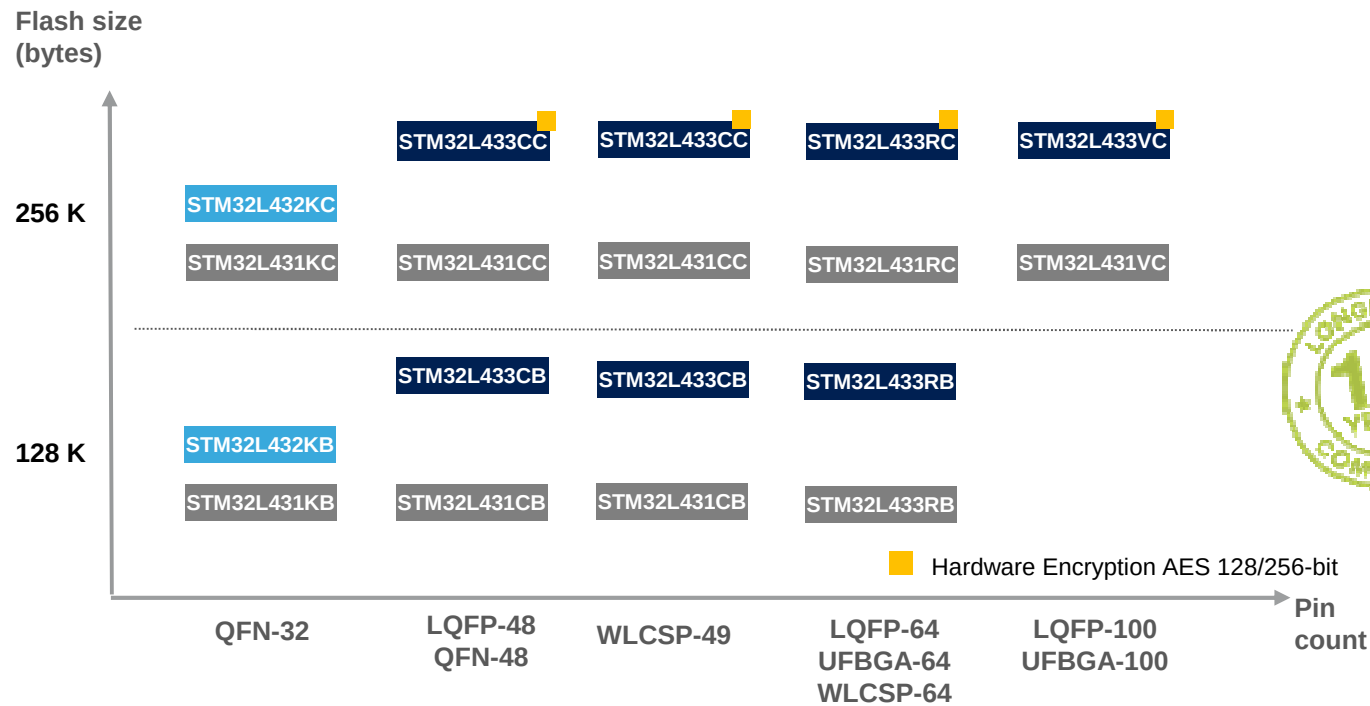
Cortex®-M4 (DSP + FPU) – 80 MHz	• ART Accelerator™ • USART, SPI, I²C • Quad SPI • 16 and 32-bit timers • SAI + audio PLL • SWP • 1x CAN • 1x 12-bit DAC • Temperature sensor • Low voltage 1.71 to 3.6 V • V_{BAT} Mode • Unique ID • Capacitive Touch sensing	Product line	Flash (KB)	RAM (KB)	Memory I/F	1 x Op amp	2 x Comp	16- bit ADC (5 Msps)	USB2.0 Device	Segment LCD Driver	AES 128/256-bit
		STM32L431 Access	128 to 256	64	SDIO	•	•	1			
		STM32L432 USB	128 to 256	64	SDIO	•	•	1	•		
		STM32L433 USB Device & LCD	128 to 256	64	SDIO	•	•	1	•	Up to 8x40	
		STM32L443 USB OTG & LCD & AES	256	64	SDIO	•	•	1	•	Up to 8x40	•

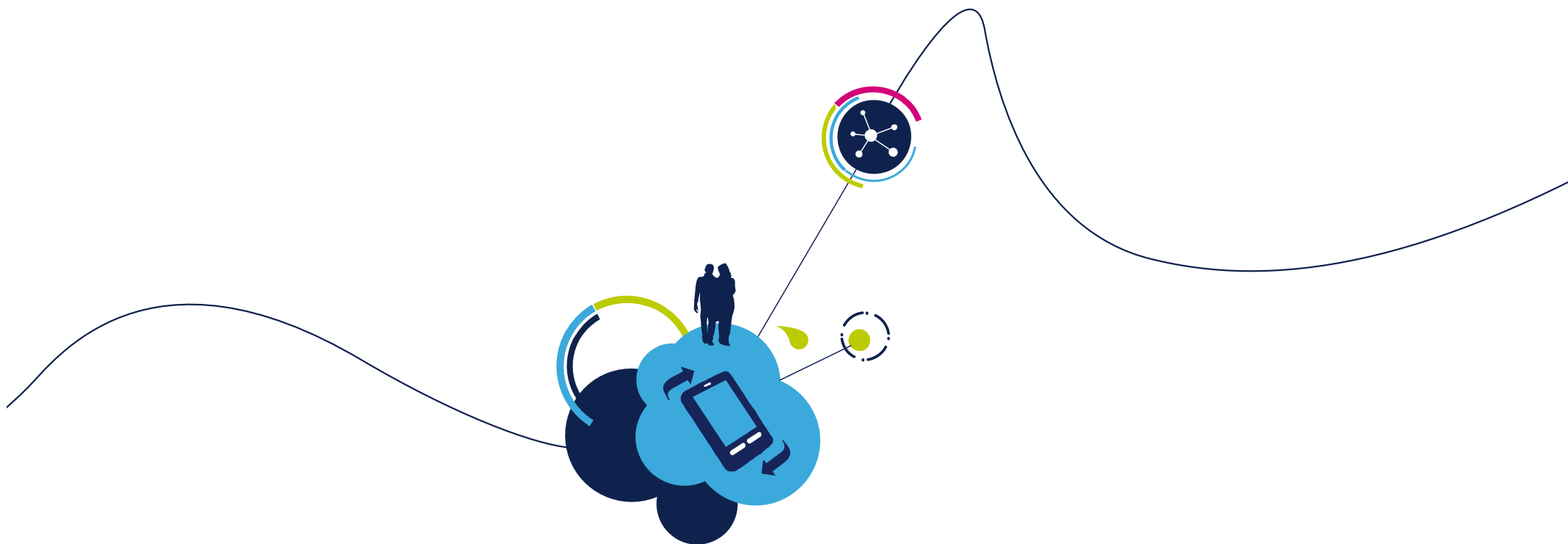


STM32L43x – portfolio

Cortex™-M4 @ 80MHz

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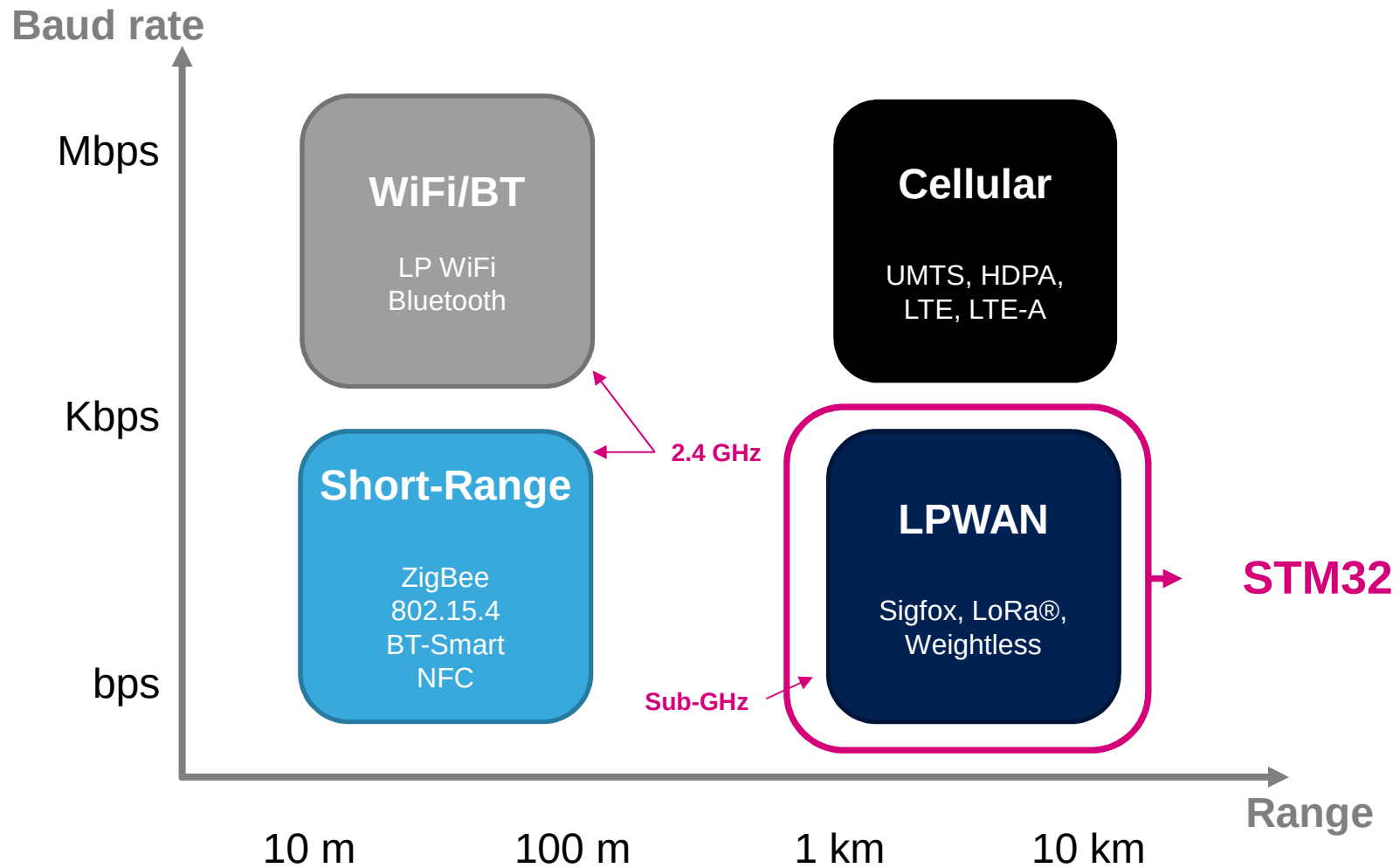


STM32WSx-SubGig Series



Communication Technologies - Overview

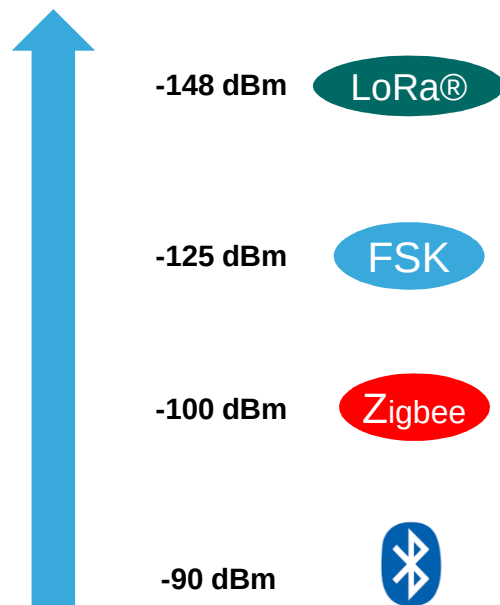
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What is LoRa®?

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- **LoRa® is a wireless technology that has been developed to enable low data rate communications to be made over long distances by sensors and actuators for M2M and Internet of Things, IoT applications. LoRa® technology is a global solution to provide a wide area network capability, using a MAC protocol named LoRaWAN**



- Long Range, Low Power & Small form factor
At +14dBm output power, 868MHz
 - In Sub-GHz: > 2km dense urban, > 15km suburban, > km VLOS
 - More than 10 years in operation without changing battery
- Concentrator with Network Capacity & Security
 - Star Network / Link rate Adaptation / Fully Scalable Network
 - More than 4M transaction per day per GTW
- Fully bidirectional
 - Acknowledge / Request from user or from sensor
 - High Security Network Level
 - Easy Network Management
 - Fast Channel Activity
 - Allow broadcasting
- Robust Communication
 - Robust to interferer / coexistence with other ISM
 - Robust to Jamming
 - Suitable for Mobile, Nomadic & fixed nodes
 - Indoor / Outdoor coverage
- High accuracy localization and ranging
 - Modulation format permits high accuracy localization
 - Not RSSI based and accounts for multi-path and fading

LoRaWAN Differentiation and Benefits

40



True Location

- ❑ In/out door
- ❑ Accurate



Bidirectional

- ❑ Bidirectional
- ❑ Scalable Capacity
- ❑ Broadcast



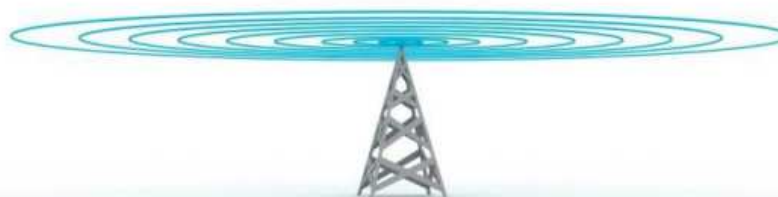
Global Mobility

- ❑ True Mobility
- ❑ Seamless
- ❑ Roaming



Security

- ❑ Unique ID
- ❑ Application
- ❑ Network



The LoRa® Alliance

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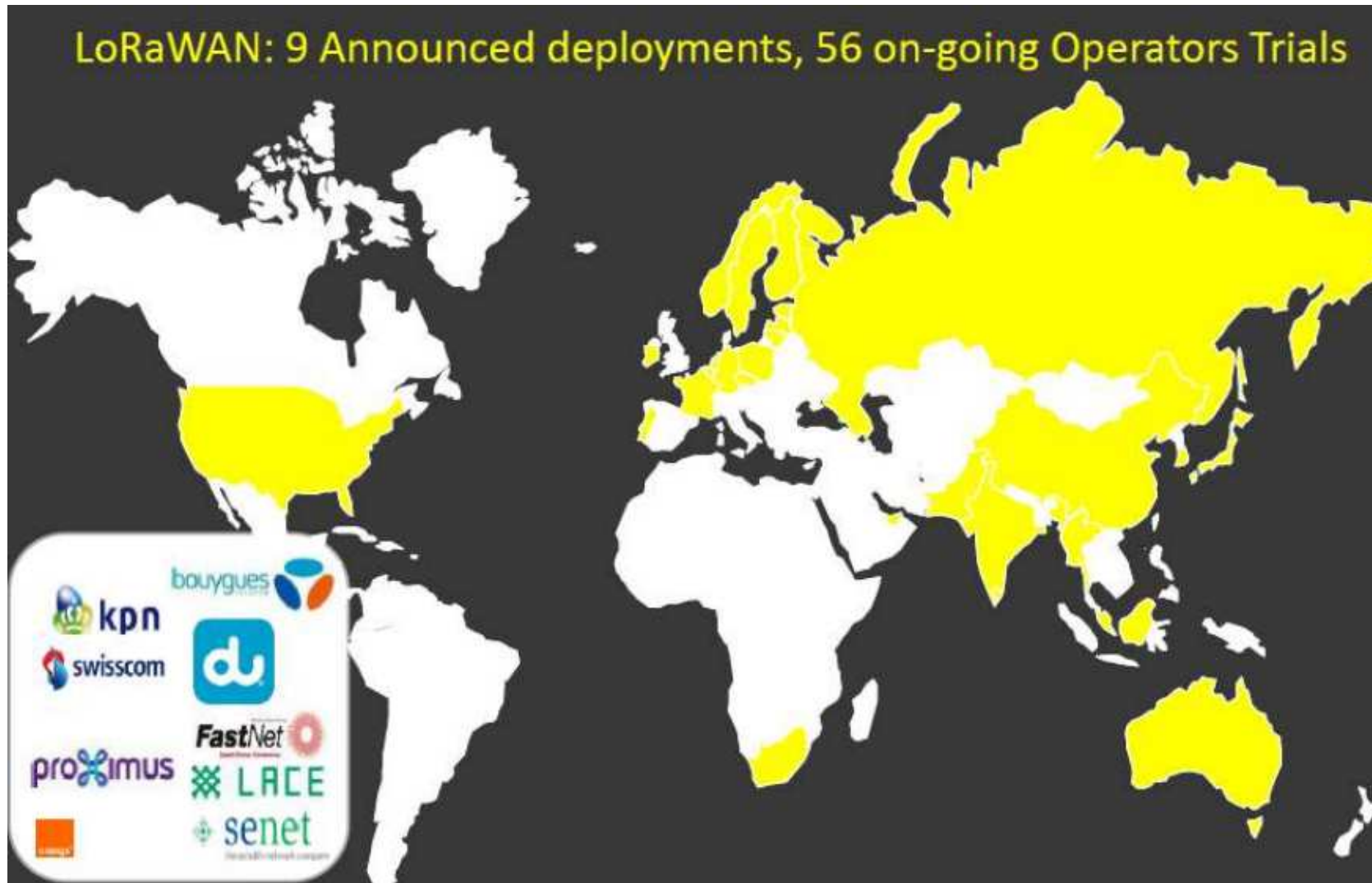
LoRa™ Alliance: Status

- Open & Non-Profit
- Founded: March-2015
- Board
 - IBM, Cisco, Bouygues Telecom, KPN, Proximus, Semtech, Sagemcom, Actility, Kerlink, Augtek, Homerider
- Chairman: Geoff Mulligan
- Committees
 - Technical: Nicolas Sornin, Semtech
 - Marketing: Tracy Hopkins, Stream Technologies
 - Strategy: Stephen Caldwell, Microchip
 - Certification: Derek Hunt, Semtech
- Specification: LoRaWAN R1.0
- Members: >127



The LoRa® Alliance

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ST and Semtech LoRa® agreement

43

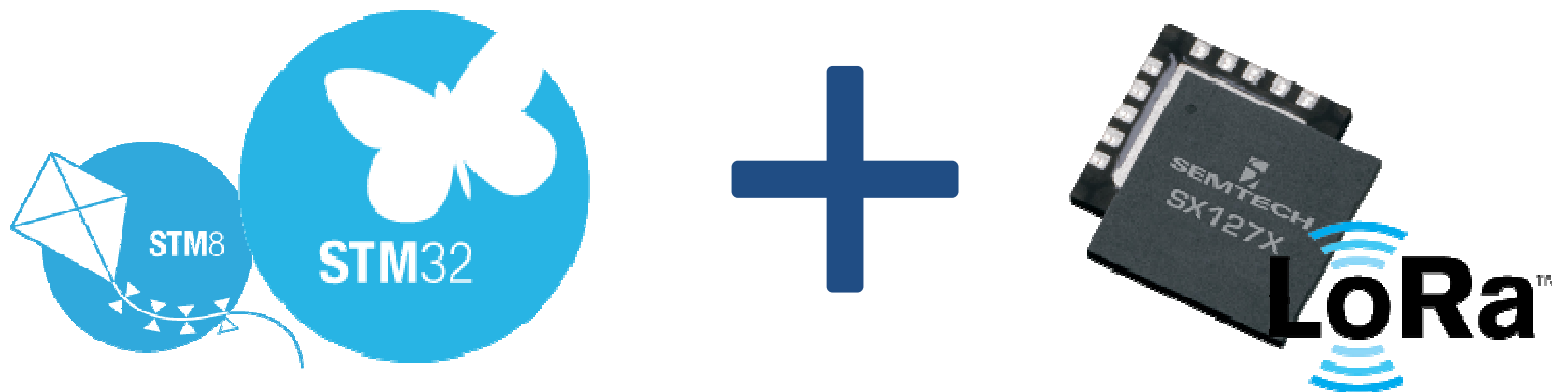
- Semtech Corporation and STMicroelectronics announce agreement on Semtech's LoRa® long-range wireless RF technology
- Intends to boost STM32 MCUs with LoRa® technology to target internet of things deployments by mobile network operators and large-scale private networks



<http://www.st.com/web/en/press/c2790>

The perfect match: STM32/8 + LoRa®

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STM32 portfolio is **800+** part numbers, from ARM Cortex-M0+ core to M7 available
From **8KB up to 2MB** of Flash, connectivity, **strong Analog** and **large choice of package**

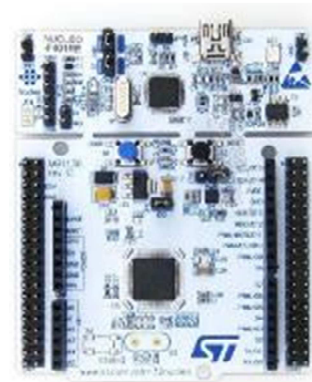
STM8 portfolio is 350+ part numbers offering **an undisputable** entry level 8-bit solution

LoRa® Long Range wireless solution offers **4 different** line in QFN packages

Let's get started!

45

- HW Tools are **already available**



STM32 Nucleo



Semtech LoRa® Shield

- Enjoy a quick **plug'n play example** (point-to-point demo) on ARM mbed

SX1276MB1xAS

The SX1276MB1MAS and SX1276LB1LAS are both fitted with the SX1276 transceiver which, added to a high-performance FSK / OOK RF transceiver modem, features the LoRa™ long range modem.

Hello World



Let's get started!

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- Libraries and stacks **already available**

- GitHub: Lora-net / LoRaMac/WAN-node [here](#)

GitHub

- IBM: LoRaWAN in C by IBM [here](#)

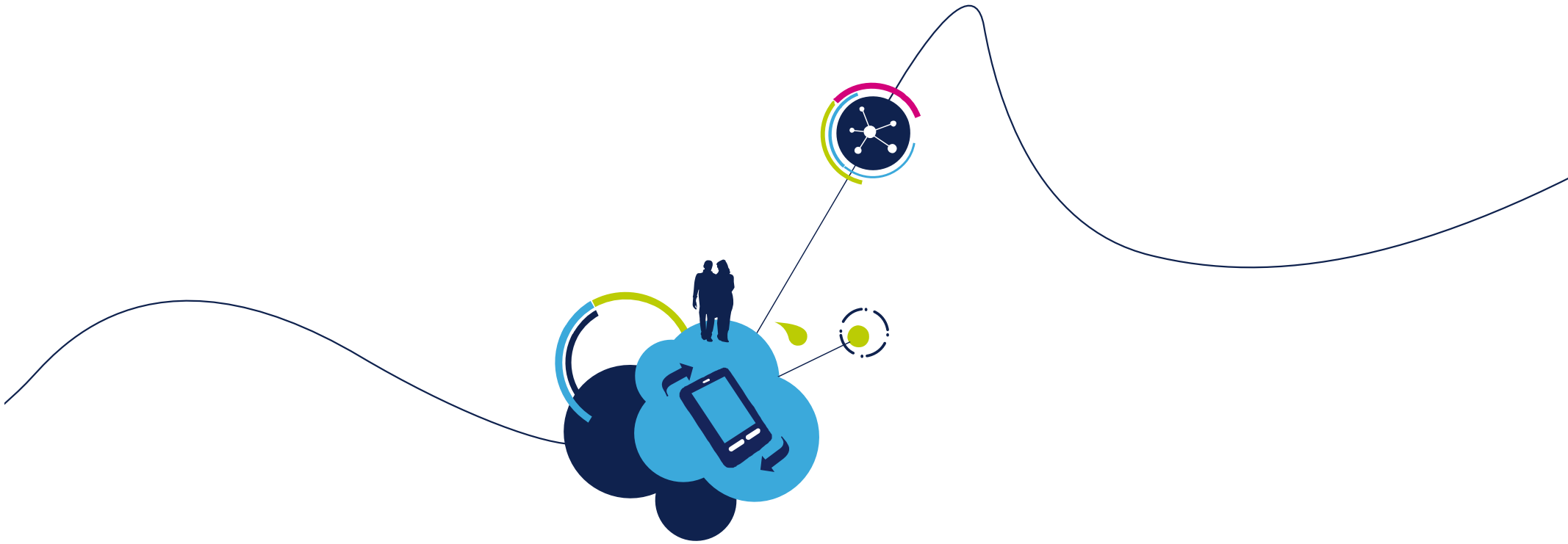


- ARM mbed: LoRaWAN-mic-app [here](#)

ARM[®]mbed[™]

- STM32Cube: LoRaWAN (coming soon)





Tools

STM32 embedded software offer

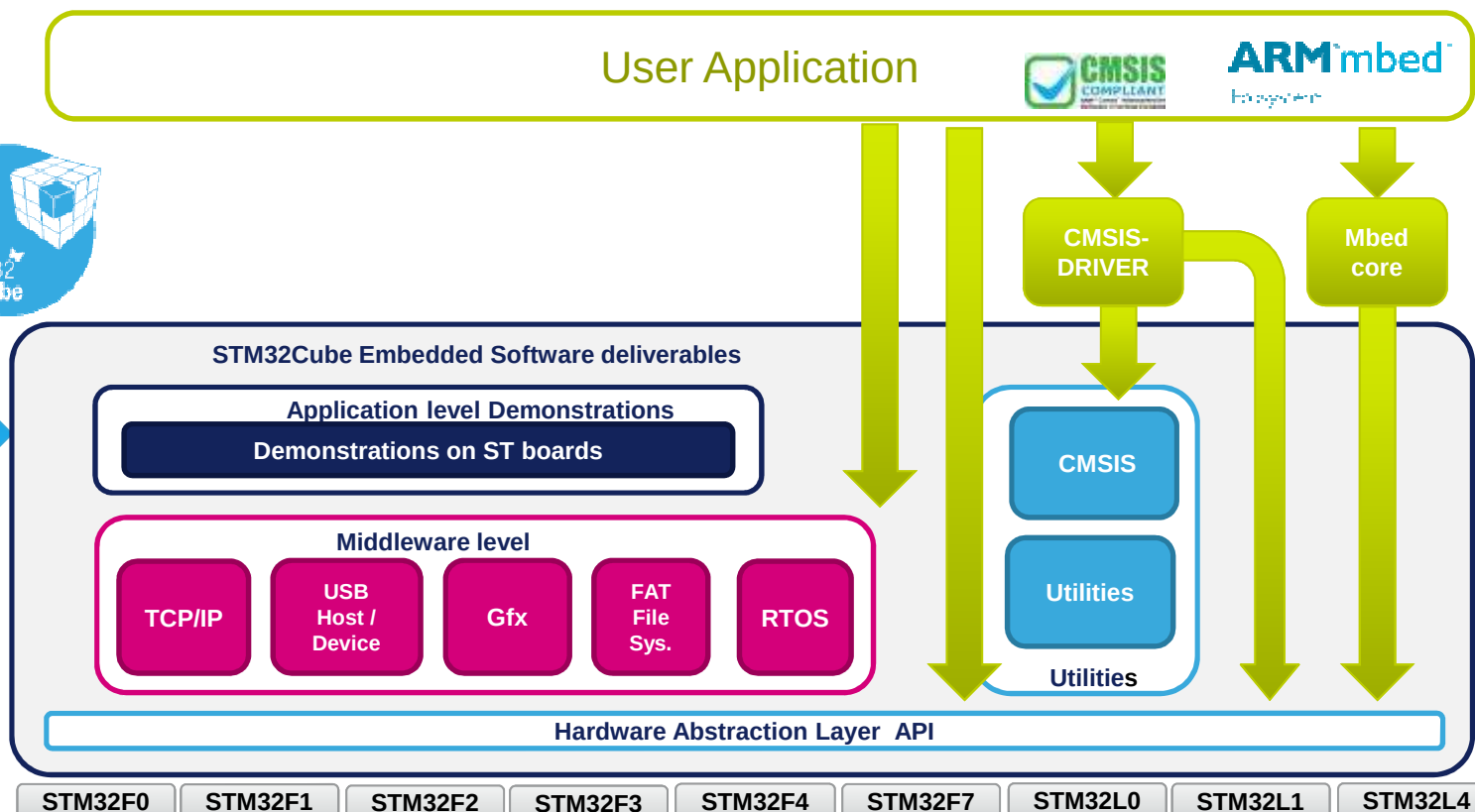
48

STM32 Cube

STM32CubeMX
Configuration tool on PC

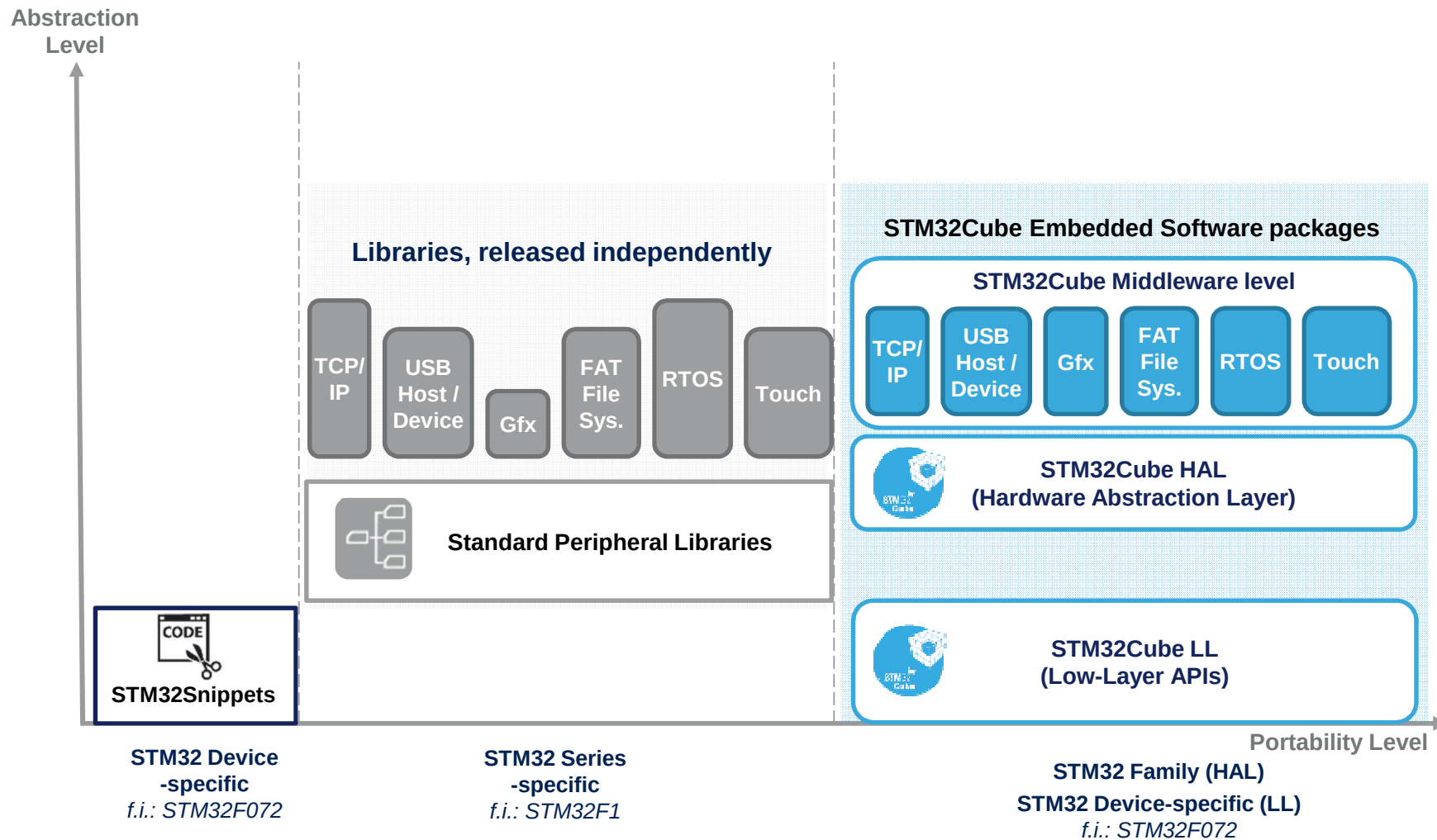


C code generation
for initialization,
depending on user
choices



ST Embedded software offer - Positioning

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new STM32 Nucleos

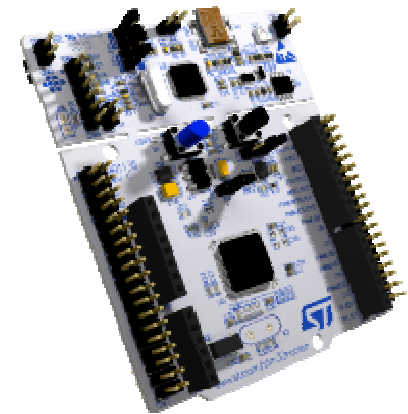
50



Nucleo-32
STM32 with
32 pins



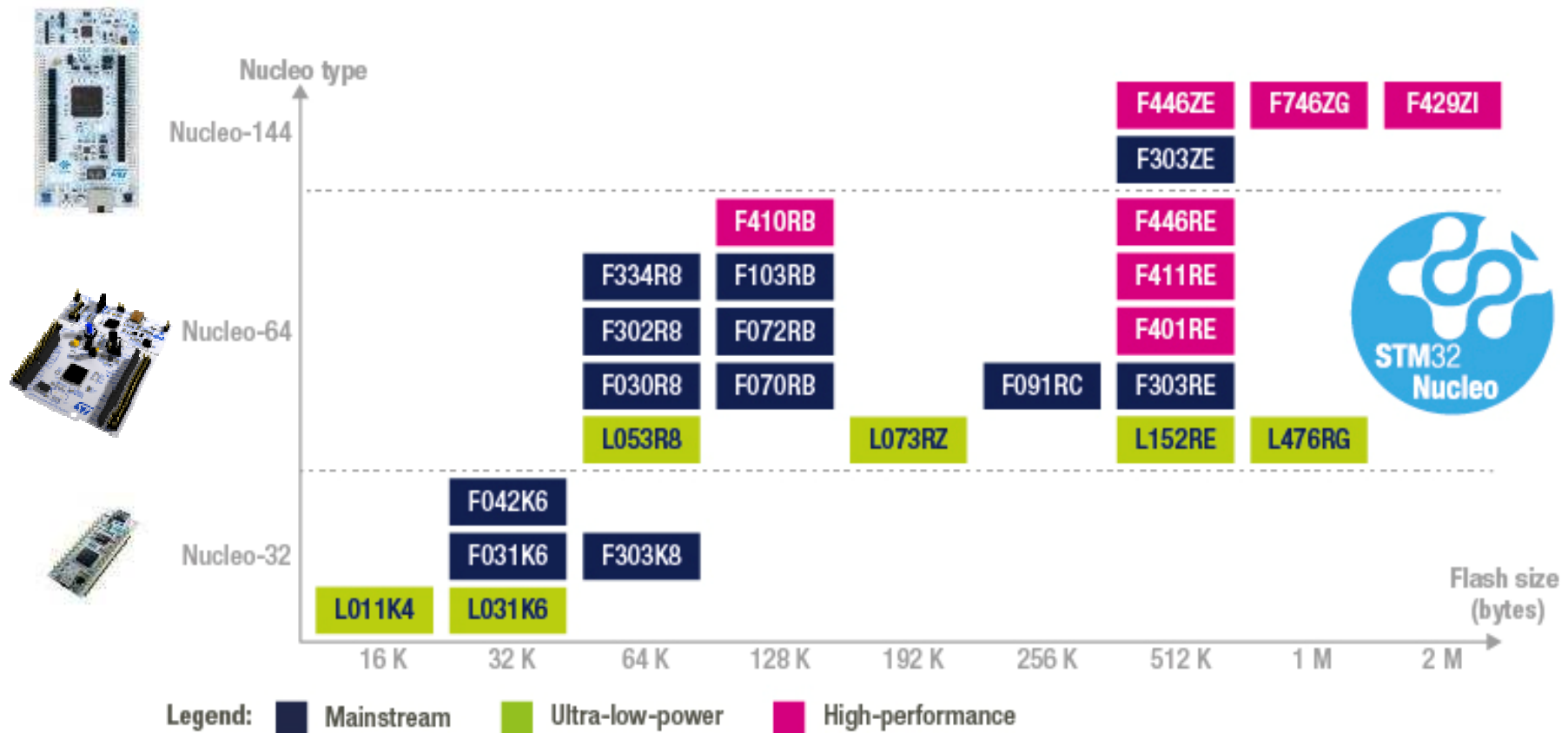
Nucleo-144
STM32 with
144 pins



Nucleo-64
STM32 with
64 pins

STM32 Nucleo portfolio

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STM32 Nucleo exposes the whole family of STM32 microcontrollers

STM32Nucleo open development platform

HW



STM32
Nucleo
development
boards

SW



STM32
Cube
SW library

Expansion

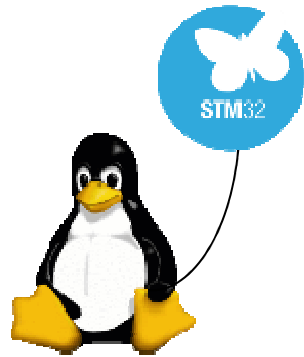


STM32 Nucleo expansion boards
(Nucleo shields)

STM32 Cube expansion SW

Multi-IDE support





Develop under Linux for STM32

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Developers can now use tools under Linux to develop for STM32, with all software from ST **FREE** of charge

STM32CubeMX



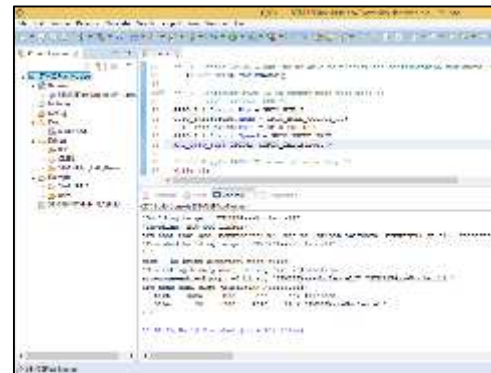
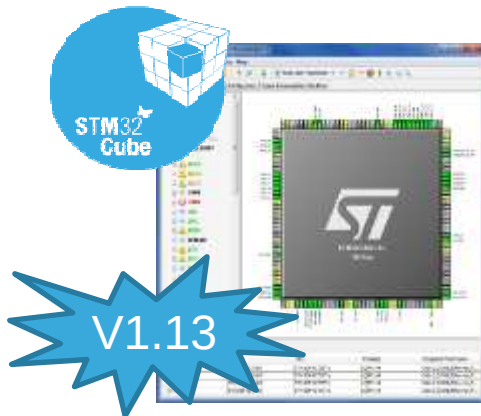
AC6 SW4STM32 Free IDE
(System Workbench for STM32)



ST-LINK/V2 probe
(Standalone, or on PCB)



Via OpenOCD open source project



Configure & Generate Code

Compile and Link

Program and Debug

Free software development tools



Eclipse-based toolset SW4STM32
www.openSTM32.org



Premium toolset TrueSTUDIO-Lite
www.atollic.com



Online development & community
www.mbed.com



Premium toolset MDK-ARM
www.keil.com/st



Free licenses for
STM32F0 / L0
(no code size limit)



Thank you

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