STM32MP1 series

Industrial-grade MPUs with rich ecosystem

> **If only**
> I could overcome MPU design complexity and leverage an extensive, user-friendly ecosystem.
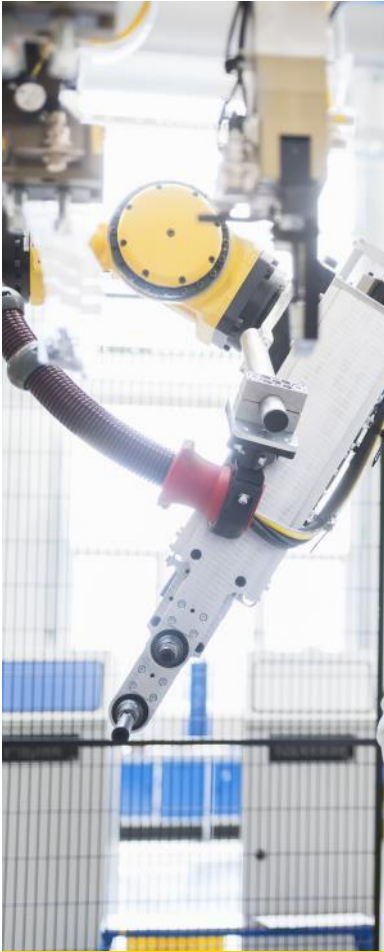
This is where we come in

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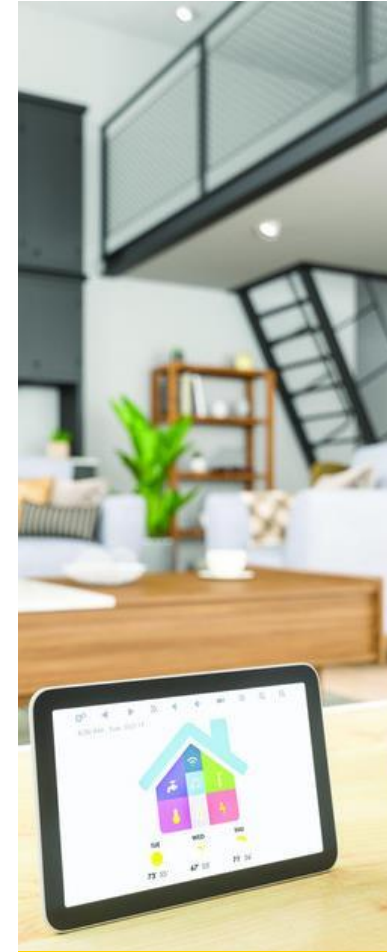# STM32MP1 MPUs for a wide range of applications

Industry 4.0

Factory automation

Health & wellness

Human machine interfaces
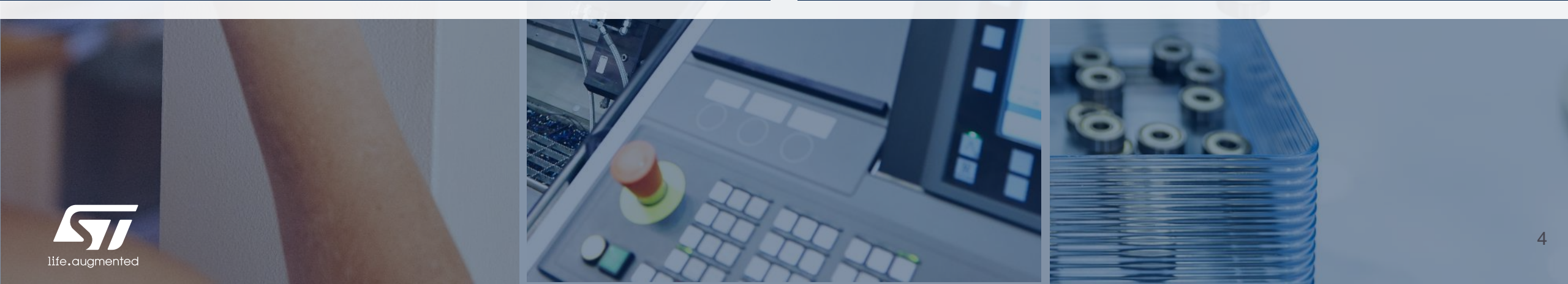
Smart homes

Smart metering

STM32MP1 microprocessor series

**Industrial-grade MPUs
for entry-level designs**

A **rich STM32 MPU ecosystem**
to reduce development time & cost

Industrial grade microprocessors

Industrial qualification combining both:
- 100% operation time during 10 years
- Junction temperature: - 40°C to 125°C

10 years longevity commitment renewed every year

LONGEVITY 10 YEARS COMMITMENT

Industrial connectivity, advanced analog and real time processing

Advanced security for Industry 4.0

STM32

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STM32MP1 MPU series for 32-bit applications

STM32MP15 lines

Dual Arm® Cortex®-A7
Arm® Cortex®-M4
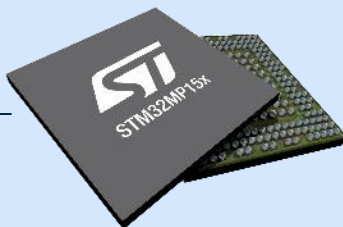
Arm® Cortex®-A7
Arm® Cortex®-M4

STM32MP153
- Dual Cortex-A7 from 650 to 800 MHz
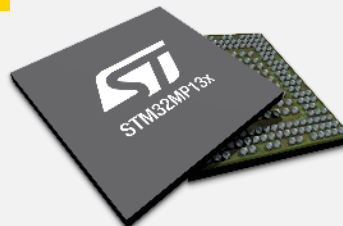- Cortex-M4 at 209 MHz
- CAN FD

STM32MP157
- Dual Cortex-A7 up to 800 MHz
- Cortex-M4 at 209 MHz
- CAN FD, 3D GPU, DSI display

STM32MP151
- Cortex-A7 from 650 to 800 MHz
- Cortex-M4 core at 209 MHz

STM32MP13 lines

Arm® Cortex®-A7

STM32MP131
- From 650 MHz to 1 GHz
- Ethernet

STM32MP133
- From 650 MHz to 1 GHz
- CAN FD, 2 x Ethernet

STM32MP135
- From 650 MHz to 1 GHz
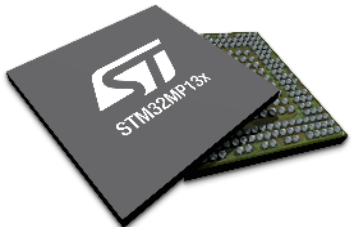- CAN FD, 2 x Ethernet
- Camera, parallel display

Security feature options available for all STM32MP1 MPUs

A scalable offering

Dual or Single Arm® Cortex®-A7 up to 800 MHz

Arm® Cortex®-M4 up to 209 MHz

STM32MP151	STM32MP153	STM32MP157

Pin-to-pin compatibility

- **TFBGA257** 10 x 10 mm p0.5mm (4 layers PTH PCB)
  - smallest package for dual Cortex-A GP MPU
- **TFBGA361** 12 x 12 mm p0.5mm (4 layers PTH + Laser via PCB)
- **LFBGA354** 16 x 16 mm p0.8mm (4 layers PTH PCB)
- **LFBGA448** 18 x 18 mm p0.8mm (6 layers PTH PCB)

Arm® Cortex®-A7 up to 1 GHz

STM32MP131	STM32MP133	STM32MP135

Pin-to-pin compatibility

- **LFBGA289** 14 x 14 mm p0.8mm (4-layer PTH PCB)
- **TFBGA320** 11 x 11 mm p0.5mm (4 layers PTH)
- **TFBGA289** 9 x 9 mm p0.5mm (6-layer HDI PCB)

STM32 Cube

One STM32 ecosystem

OpenSTLinux Distribution

STPMIC1 power management IC for STM32MP1 MPU series

DC/DCs & **LDOs** for
- STM32MP1
- Memories
- External devices

STPMIC1

Optimized power consumption

BOM savings for typical applications

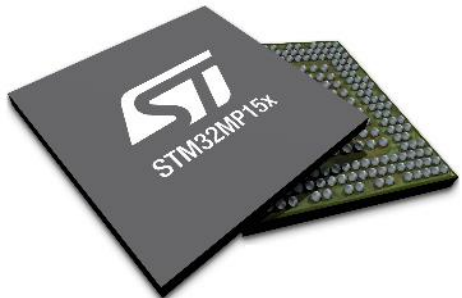Small PCB footprint vs. full discrete solution

STM32MP15 MPU lines

- **Dual or single Arm® Cortex® A7 up to 800 MHz**

- **Arm® Cortex® M4 up to 209 MHz**

Accessible

- Strong, user-friendly ecosystem for STM32 MPUs (OpenSTLinux, Linux-RT, OP-TEE)
- PCB layout reference designs

Enabling advanced HMI

- 3D GPU with OpenGL ES 2.0
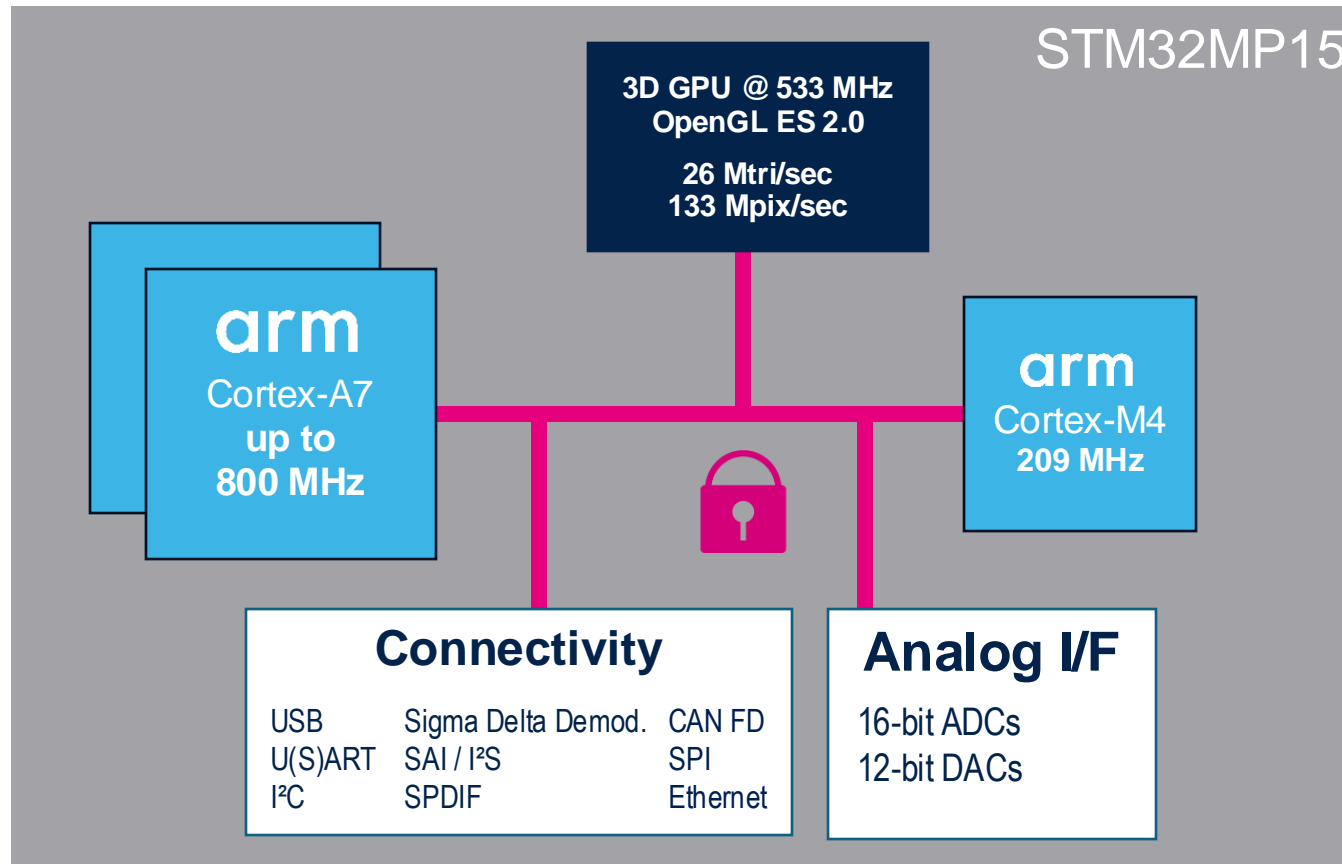- Parallel RGB 24b or DSI interfaces

Flexible architecture

- Flexible resource and peripheral mapping between cores to increase power savings
- Dual cores:
  - Arm® Cortex®-A for high-speed I/F and processing
  - Arm® Cortex®-M with 448 Kbytes of SRAM for real-time performance

STM32MP15 lines: efficient resource management

Flexible resource and peripheral mapping between Arm® Cortex-A and Cortex-M cores

STM32MP15

3D GPU @ 533 MHz
OpenGL ES 2.0

26 Mtri/sec
133 Mpix/sec

arm
Cortex-A7
up to
800 MHz

arm
Cortex-M4
209 MHz

Connectivity

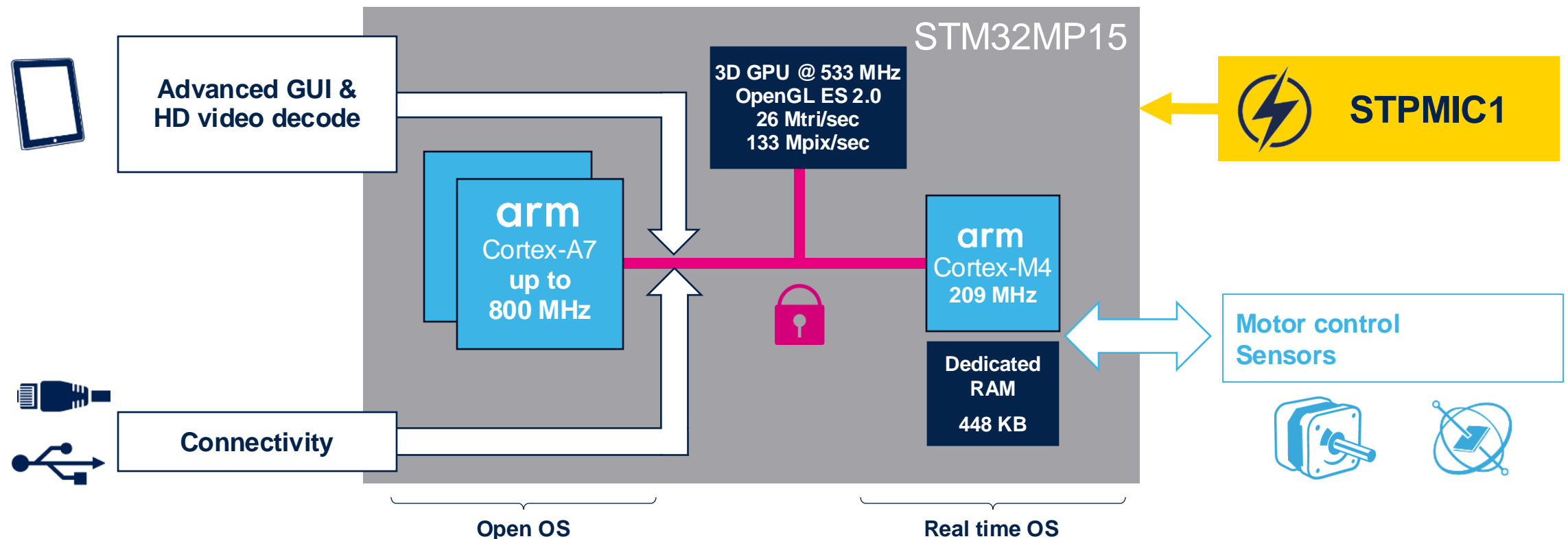|		
USB	Sigma Delta Demod.	CAN FD
U(S)ART	SAI / I²S	SPI
I²C	SPDIF	Ethernet

Analog I/F

16-bit ADCs
12-bit DACs

What this means for industrial applications

- The HMI and Ethernet connectivity can be handled by the Cortex®-A.

- The ADCs and the sensors can be controlled by the Cortex®-M.

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STM32MP15 lines enable many application possibilities

Graphics and communication **high** processing **up to 3040 DMIPS**	**Real-time** & **low power** applications 260 DMIPS

Advanced GUI & HD video decode

STM32MP15

3D GPU @ 533 MHz
OpenGL ES 2.0
26 Mtri/sec
133 Mpix/sec

STPMIC1

arm
Cortex-A7
up to 800 MHz

arm
Cortex-M4
209 MHz

Dedicated RAM 448 KB

Connectivity

Motor control Sensors

Open OS

Real time OS

STM32MP157 block diagram

STM32MP157C / STM32MP157F

System
- 5x LDOs
- Crystal & internal oscillators
- MDMA + 2x DMA
- Reset and Clock
- Watchdogs (2x I & W)
- 96-bit unique ID
- Up to 176 GPIOs

Security
- TrustZone®
- DES, TDES, AES-256
- SHA-256, MD5, HMAC
- 3x Tamper pins with 1 active
- T°, V, and 32 KHz detection
- Secure ROM and RAMs
- Secure peripherals
- Secure RTC
- Analog true RNG

Dual Cortex-A7 @ 650 MHz / up to 800 MHz
Core 1 @ 650 / 800 MHz L1 32KB I / 32KB D	Core 2 @ 650 / 800 MHz L1 32KB I / 32 KB D
NEON SIMD	NEON SIMD
256 KB L2 cache	

Cortex-M4 @ 209 MHz
FPU	MPU

DDR3/DDR3L 32-bit @ 533 MHz
LPDDR2/LPDDR3 32-bit @ 533 MHz

System RAM 256 KB	MCU system RAM 384 KB
Retention RAM 64 KB	Backup RAM 4 KB
Boot ROM 128 KB	OTP Fuse 3 Kb

Control
- 2x 16-bit motor control PWM synchronized AC timer
- 10x 16-bit timer
- 5x 16-bit LP timer
- 2x 32-bit timer

3D GPU OpenGL ES2.0 @ 533 MHz
26Mtri/sec, 133Mpix/sec

Connectivity
24-bit parallel RGB Display	MIPI DSI 2 lanes @ 1 Gbps
Camera interface	HDMI-CEC
1 Gbps Ethernet	2x FDCAN / TTCAN
2x USB2.0 host HS	USB2.0 OTG FS/HS
MDIO	DFSDM 8 channels / 6 filters
6x I²C	4x UART, 4x USART
6x SPI / 3x I²S	4x SAI
SPDIF Tx / Rx 4 inputs	Dual QUADSPI
3x SDIO3.0 / SD3 / eMMC 4.51	16-bit SLC NAND, 8-bit-ECC

Analog
- 2x 16-bit ADC
- 2x 12-bit DAC
- Temperature sensor

Arm® Cortex® -A7 @ 650 MHz only from -40°C < Tj < 125°C
Arm® Cortex® -A7 @ 800 MHz only from -20°C < Tj < 105°C

STM32MP15 security overview

Memory protections
against illegal access control

Cryptographic accelerator
for hardware robustness

Security ecosystem

Trusted execution with OP-TEE

Platform authentication
during product life cycle

Code isolation
for runtime protection

Secure secret provisioning (SSP)

psacertified™
level one

target certification

STM32Cube framework for MPU (Signing & key generation)

and more!

Security assurance level 1

Software robustness

STM32MP15 for advanced HMI
with graphics and video for smart gateways

Better user experience powered by 3D GPU 533 MHz OpenGL ES 2.0

Parallel RGB 24b & DSI interfaces up to WXGA 60 fps for simple GUI and SVGA for complex GUIs

Supported by market-leading GUI experts: Qt, Embedded Wizard, Crank

HD video decode
with dual Arm® Cortex® -A7 at 800 MHz

STM32MP13 MPU lines

Arm® Cortex®-A7 core running up to 1 GHz

System performances:
- DRAM interface at 533 MHz
- Optimized interconnect

Accessible

- Strong, user-friendly ecosystem for STM32 MPUs (OpenSTLinux, Linux-RT, OP-TEE, RTOS)
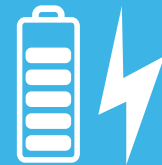- PCB layout reference designs

Secure
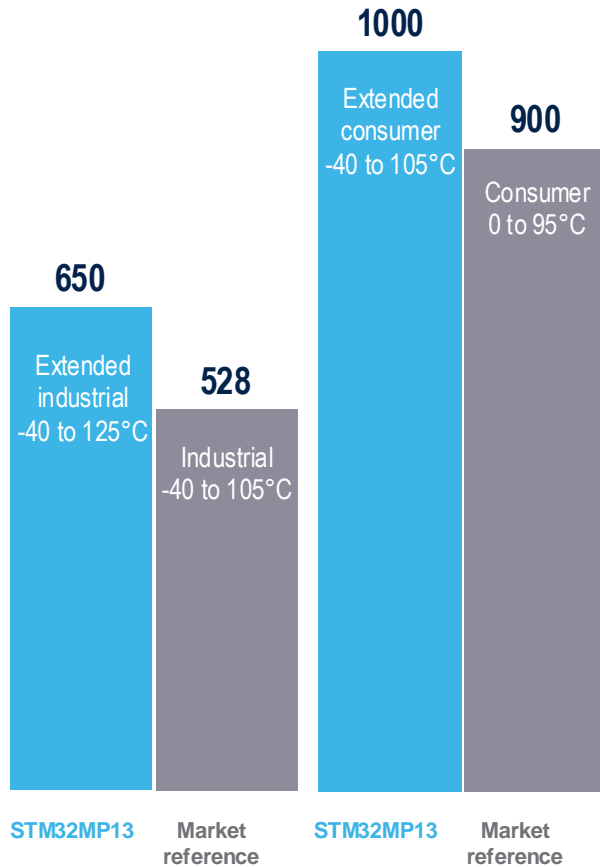
- Strong robustness
- Certified for faster time to market

Power efficient

- Best-in-class consumption in low power modes
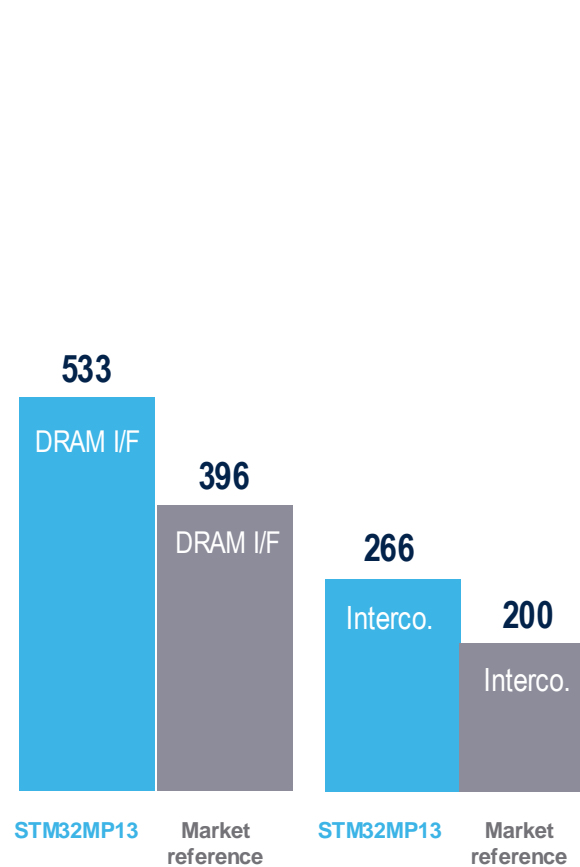- Over 90% energy savings in standby and V_{BAT} modes

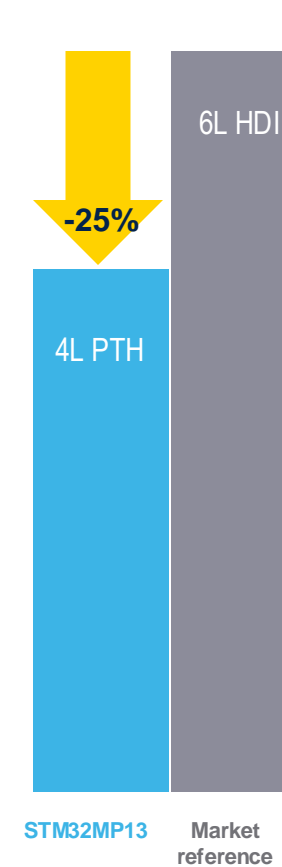# How the STM32MP13 lines compare to the market reference

650 — Extended industrial -40 to 125°C (STM32MP13)
528 — Industrial -40 to 105°C (Market reference)
1000 — Extended consumer -40 to 105°C (STM32MP13)
900 — Consumer 0 to 95°C (Market reference)

More CPU performance (MHz) over extended temperature range

533 — DRAM I/F (STM32MP13)
396 — DRAM I/F (Market reference)
266 — Interco. (STM32MP13)
200 — Interco. (Market reference)

Better system performance (MHz)

27 — STM32MP13
450 — Market reference
-94%

Lower power consumption (standby μW)

4L PTH — STM32MP13
6L HDI — Market reference
-25%

Lower PCB cost (BGA p0.5mm)

psacertified™ level one
SESIP™3
PCI 6.0
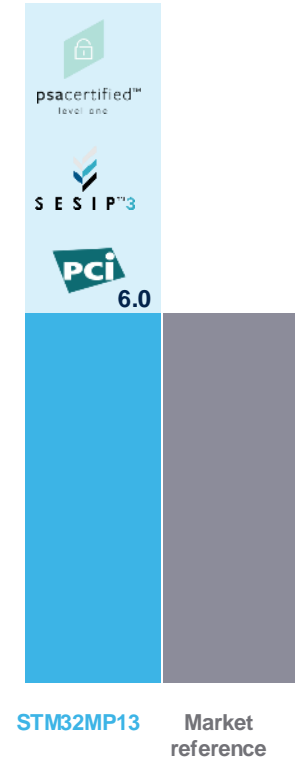
Enhanced security

STM32MP13 / Market reference

STM32MP13 power consumption

V_{BAT} * 30 nW

Standby *   12 μW

LPLV-Stop 2   1.64 mW

LPLV-Stop   2.86 mW

Stop   11 mW

Run Cortex-A7 @ 650 MHz   222 mW

Run Cortex-A7 @ 1 GHz   314 mW

Best-in-class energy consumption in low power modes **combined with STPMIC1 power management IC**
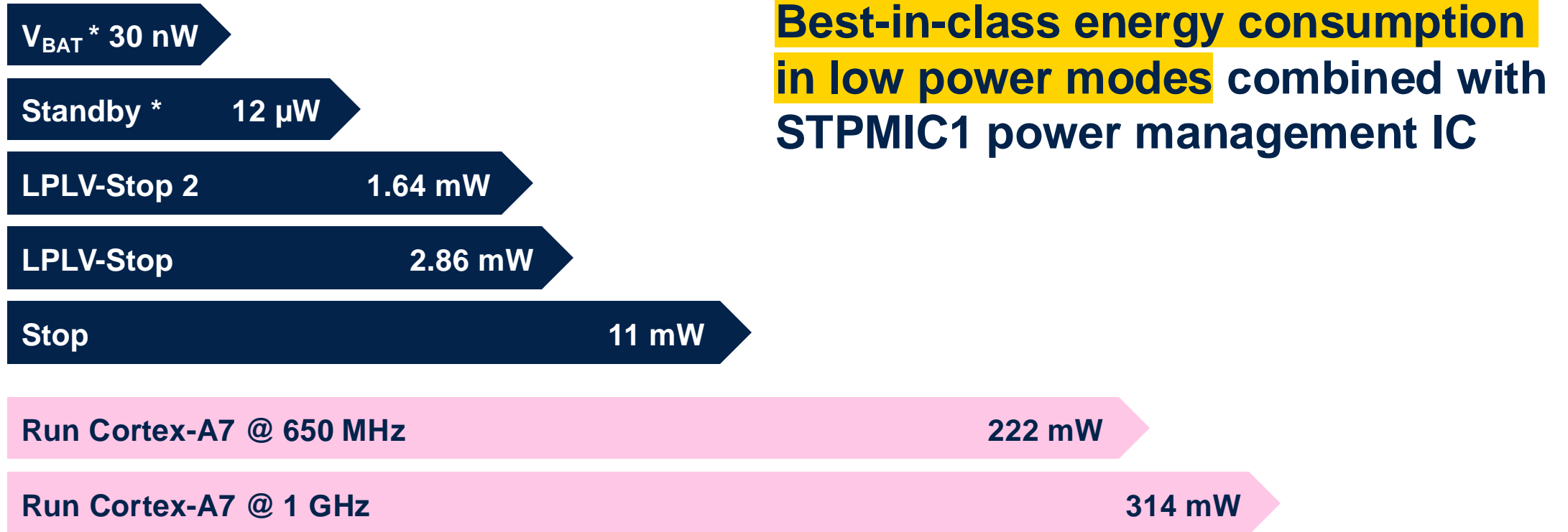
Typ @ V_{DDCORE} = 1.25 V, V_{DD} = 3.3 V @ 25 °C, peripherals OFF
* Backup SRAM, RTC, LSE/CSS, T° monitoring OFF

STM32MP135 Block Diagram

STM32MP135C / STM32MP135F

System
- Crystal & internal oscillators
- 2x watchdogs (Independent)
- 135 GPIOs

Security
- DRAM OTF Encode/Decode
- DES, TDES, AES-256 with SCA
- SHA-256/512, SHA-3, HMAC
- PKA ECC/RSA with SCA
- 12x Tamper Pins inc. 5x Active
- T°, V, F and 32 KHz monitoring
- Secure RTC
- Analog true RNG

Analog
- 2x 12-bit ADC
- Temperature sensor

Cortex-A7 @ 650 MHz / up to 1 GHz
- Core @ 650 MHz
  L1 32kB I / 32kB D
- NEON SIMD MPE
- 128 kB L2 cache
- TrustZone®

DDR3/DDR3L 16b @ 533 MHz
LPDDR2/LPDDR3 16b @ 533 MHz

- System RAM 160 kB
- Boot ROM 128 kB
- Backup RAM 8 kB
- OTP Fuse 3 kb

Control
- 2x 16-bit advanced PWM synchronized AC timer
- 10x 16-bit timer
- 5x 16-bit LP timer
- 2x 32-bit timer

Connectivity
- 24-bit parallel Display I/F RGB
- 16-bit parallel Camera I/F
- 2x Ethernet 1 Gbps
- USB2.0 host HS + HS PHY
- USB2 OTG/Host HS + HS PHY
- 2x CAN FD
- 4x UART + 4x USART
- 5x I²C FM+
- 5x SPI / 4x I²S
- DFSDM 4 channels / 2 filters
- 2x SAI
- SPDIF Tx / Rx 4 inputs
- 16-bit FMC (NAND 8-bit ECC)
- 2x SDIO3.0/SD3.01/eMMC4.51
- Dual Quad-SPI

Arm® Cortex® -A7 at 650 MHz only from -40°C < Tj < 125°C
Arm® Cortex® -A7 at 1 GHz only from -40°C < Tj < 105°C

STM32MP13: certified security services for faster time to market

STM32 Trust

Memory protections
against illegal access control

Cryptographic accelerator
for hardware robustness

Platform authentication
during product life cycle

Code isolation
for runtime protection

Security assurance level 3

Robustness to hardware attacks

Security ecosystem

Trusted execution with OP-TEE

Secure secret provisioning (SSP)

STM32Cube framework for MPU (Signing & key generation)

and more!

SESIP™3

PCi ready

psacertified™ level one

target certifications

STM32 **Trust**

A **certified SoC security offer** around secure boot chain & TrustZone®

Open-source solution with long-term support

Ready-to-use secure functions: code isolation, crypto functions, secure key & data storage, firmware update

Complete STM32 ecosystem tools integration & support

* Open Portable - Trusted Execution Environment

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STM32MP13: high security for payment terminals

PCI PTS POI 6.0 precertification

PCI-compliant security functions (crypto. accelerators + tamper + SoC)

Secure peripherals: display, RTC…

Energy-efficient VBAT at 7.6 µA for on-the-shelf storage

STM32

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STM32MP135 & Qt Graphics solution
Full color embedded GUIs on STM32MP135

Run full color GUIs on the STM32MP135 without a dedicated GPU, thanks to the fast DDR3 and 1 GHz CPU.

Two ways to get started:

1. QBSP available from Qt toolchain
2. OSTL + Qt open source available on demand
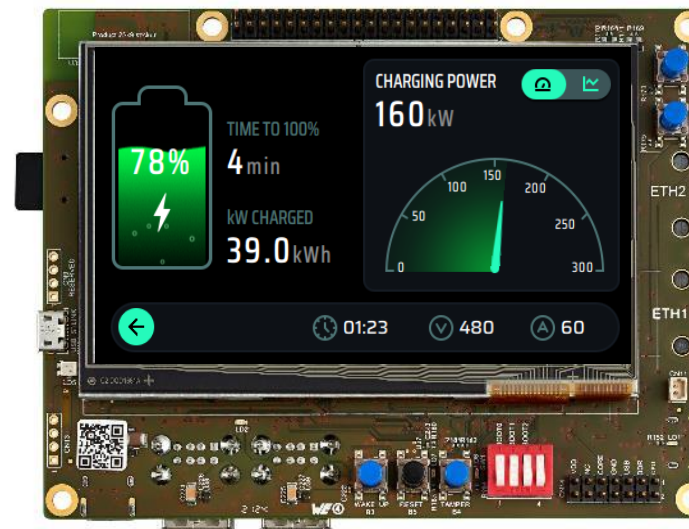
Qt support for STM32MP135F-DK

Reduce development time & cost with our STM32 ecosystem

Accelerate your time to market

Get STM32 MPU embedded software

Software development

Security management & board provisioning

- Keys generator
- Signing tool
- OTP programming
- Flash programming

STM32MP1

Your application

Development boards

PCB layout examples

Hardware configuration

- Pinout
- Clock tree
- DRAM Tuning tool

? Where to find help online
- wiki.st.com/stm32mpu
- Community

+ Partner tools & ecosystem
- System-on-modules
- Software services

Hardware tools and reference designs

Speed-up evaluation, prototyping, and design

More STM32-based dev tools
available with our partners

Evaluation boards

Discovery kits

STM32MP157D-EV1
STM32MP157F-EV1

STM32MP157F-DK2

STM32MP157D-DK1

STM32MP135F-DK

Quickly build your custom projects

PCB layout examples based on Altium projects provide you with a modular approach to build your designs

- All different BGAs packages, STPMIC1, Flash and different DRAM types (DDR3L, LPDDR2 & LPDDR3)

- Signal integrity and power integrity checks completed

- Developers can reuse the layouts and add their own interfaces linked to their end projects

Plug & play solution for STM32MP1 series enabling project reuse

ST's reference PCB layouts down to 4 layers PTH

Flash

STM32MP1x

DRAM

STPMIC1

Wi-Fi / BLE module

Ethernet application

Your application, built around ST's reference layout!

STM32MP13x examples

STM32MP15x examples
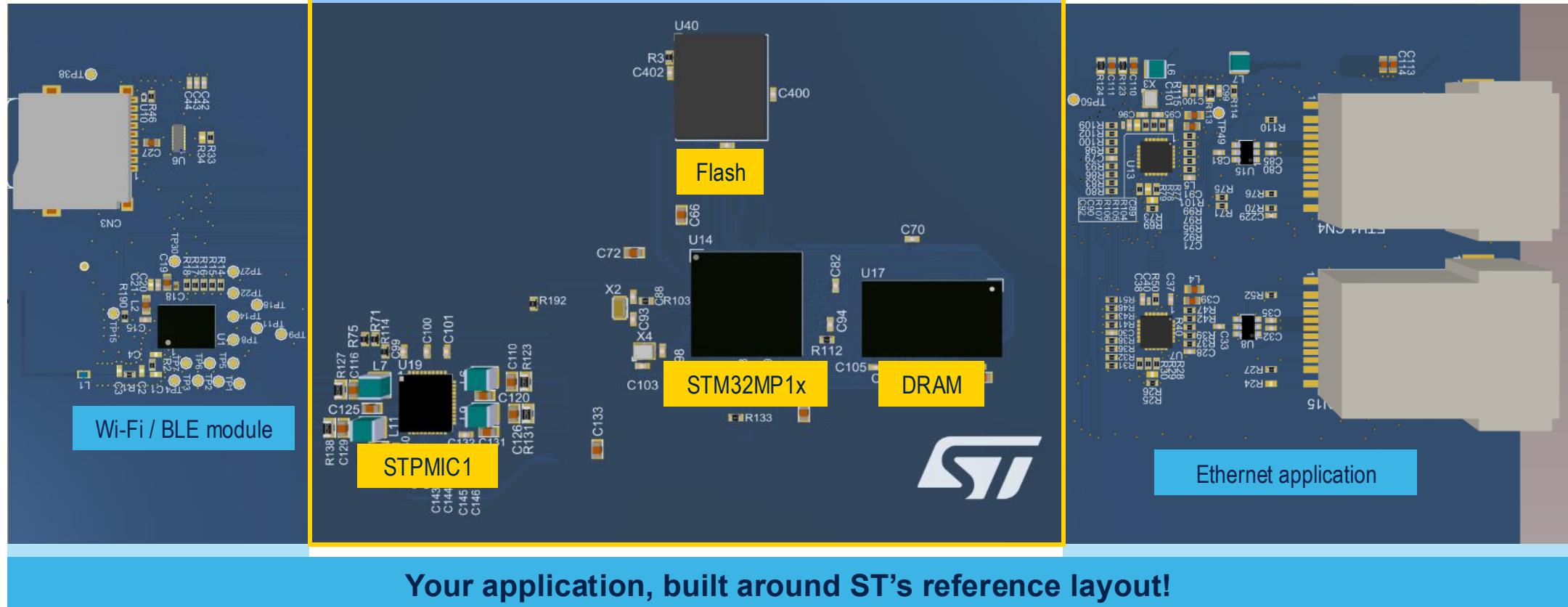
Accelerate your time to market using expansion packages

Scalable **Flexible**

OpenSTLinux
Expansion packages

Reliable

LoRa®

LoRaWAN® Server

Microsoft Azure IoT Platform

Microsoft Azure IoT Edge

aws qualified device

Amazon AWS

NFC

X-LINUX-NFC5

X-LINUX-AI

X-LINUX-RT

X-LINUX-GNSS

X-LINUX-Qt

X-LINUX-PREDMNT

Qt

Planned

Available
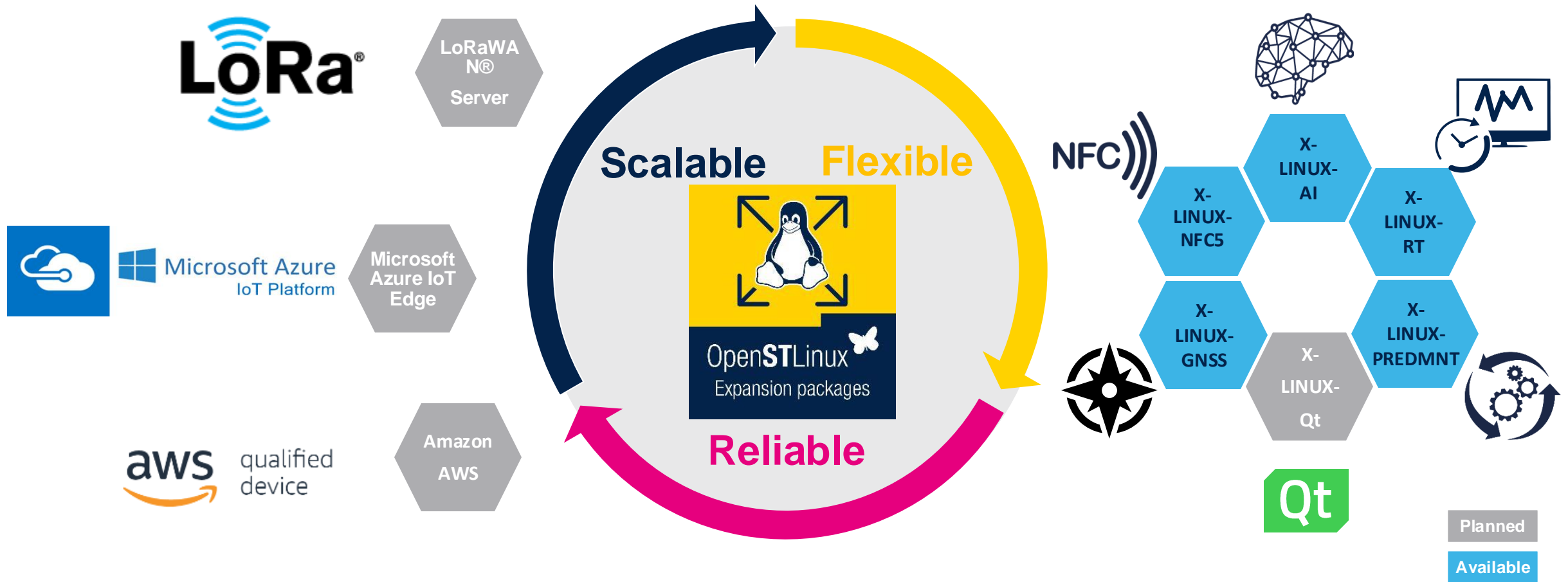
STM32 MPU OpenSTLinux Expansion Packages

STM32MP1 series OpenSTLinux

Same Linux software for STM32MP1 series for easy project migration

- **Linux Kernel Mainlined**

- **Yocto & BuildRoot Support**

- **Yearly LTS supported for 2 years**

- **Linux-RT capable**

- **Preintegrated Secure OS (OP-TEE)**

OpenSTLinux long-term Support Releases and support scheme

OpenSTLinux (5.10 LTS / Dunfell)

Features Migration & Corrective Support*	Corrective Support

OpenSTLinux (5.15 LTS / Kirkstone)

Features Migration & Corrective Support*	Corrective Support

OpenSTLinux (6.1 LTS / Mickledore)

Features Migration & Corrective Support*	Corrective Support

2 Kernels + 2 Year Support

2021   2022   2023   2024   2025
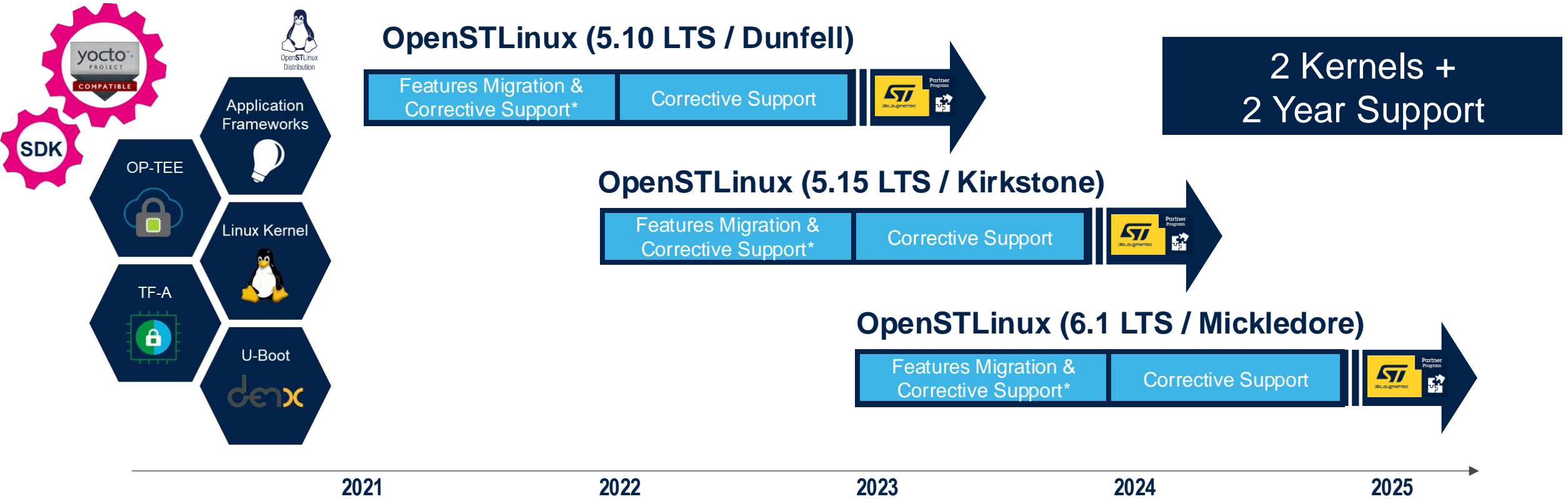
Software Partners proposed by STMicroelectronics

(*) Feature migration: new features on current Kernel
(*) Corrective support: issues reported during this time

Delivering real-time performance with OpenSTLinux on STM32MP1 MPU series

X-LINUX-RT expansion package enables OpenSTLinux real time extension, so called Linux-RT, reaching the determinism level needed for **factory automation** in key components such as **PLCs** (programmable logic controllers)

OpenSTLinux Expansion packages

Real-Time LINUX

OpenSTLinux

OpenSTLinux + X-LINUX-RT

Interrupt occurrences

Maximum latency reduced by 50%*

Latency

Real time

*depending on application.
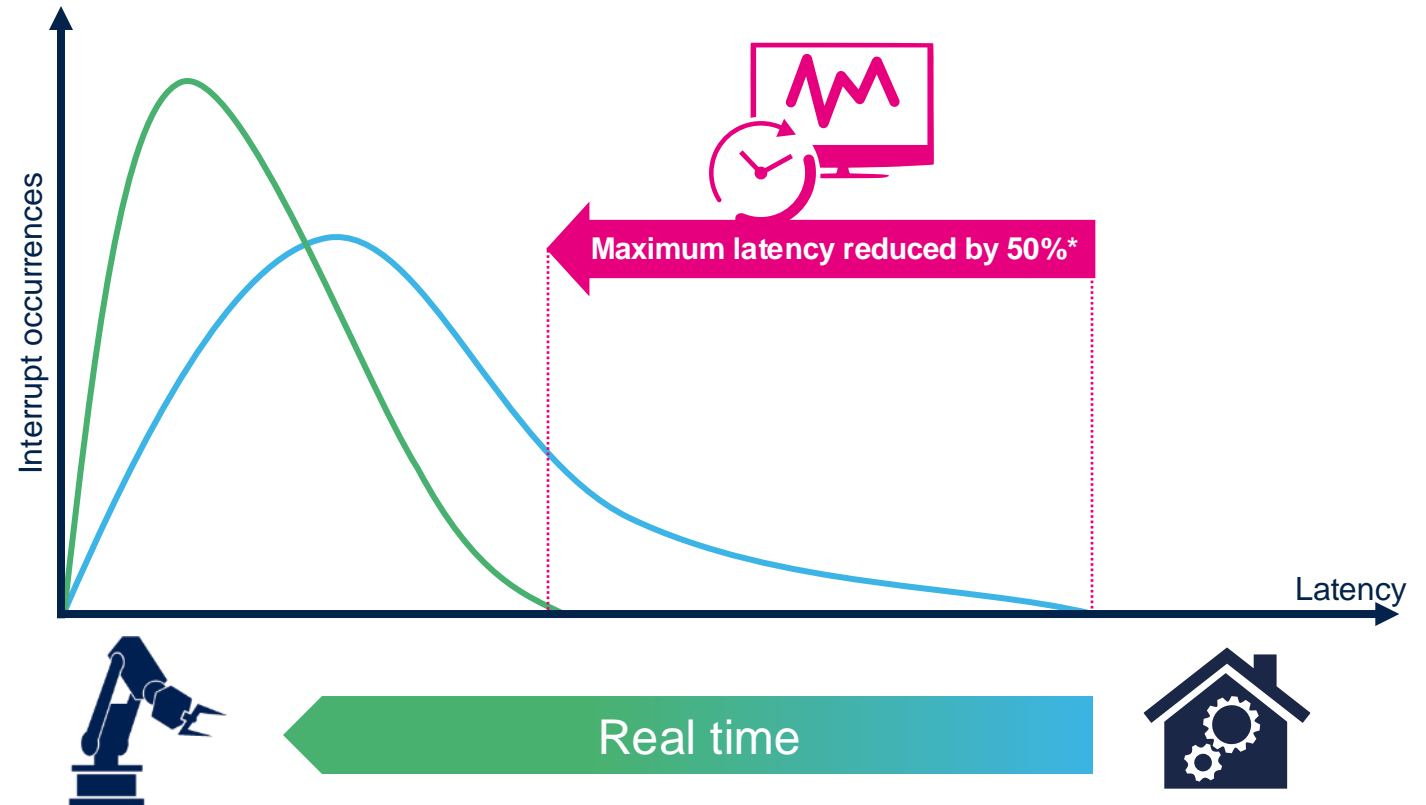
One step further in real-time performance: bare metal & RTOS for STM32MP13

Professional grade, highly reliable & market-proven middleware suite

- **Bare metal access**
  - All IP supported with **HAL interface**
  - Possibility to add your own **RTOS**

- **Microsoft Azure RTOS preintegrated:**
  - **Industrial-grade networking stack**: optimized for performance coming with many IoT protocols
  - **Advanced FS/FTL:** fully featured to support NAND/NOR Flash memories
  - **USB host and device stacks** coming with many classes
  - **Safety documentation packages** (available from Microsoft) enabling the use in application targeting IEC 61508, IEC 62304, ISO 26262
  - **High security assurance** from hardware to software, including middleware such as TLS/DTLS and cryptography

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Software tools

STM32Cube provides the same tools across the STM32MP1 series for greater ease of use

STM32CubeMX	IDEs Compile and Debug	STM32 programming tool
STM32CubeMX enhanced for MPU	**Multicore solutions**	**STM32CubeProgrammer**
• Device Tree configuration • Device Tree generation • DRAM interface tuning tool	• Free STM32CubeIDE • OpenSTLinux Developer package support • Import DRAM tuning project	• Flash, DRAM and/or system memory • OTP programming • Signing & key generation tools

Complete support of main cloud providers

Microsoft Azure

aws qualified device

Sensing
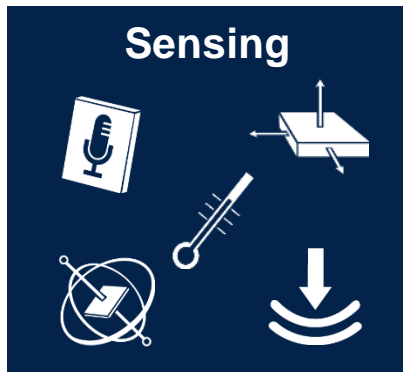
Example of STM32MP1 discovery board used for edge processing

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X-LINUX-AI: running AI at the edge on STM32MP1 MPU lines

A free open-source software package dedicated to running edge AI

STM32

AI

Open**ST**Linux
Expansion packages

X-LINUX-AI is a **complete ecosystem** that allows developers working with OpenSTLinux to **create edge AI applications very easily**

- **All-in-one AI solutions** for all STM32 MPU
- **Preintegrated** into Linux distribution based on ST environment
- Include **AI frameworks** to execute Neural Network models
- Include **AI model benchmark application tools** for MPU
- **Easy** application **prototyping** (Python language and AI frameworks Python API)
- **C++ API** for embedded high-performance applications
- Optimized **open-source solutions** provided with source codes that allow for extensive **code reuse** and **time savings**

Embedding neural networks for cutting-edge applications

AI framework And tools		TensorFlow Lite			ONNX RUNTIME	tvm
Execution engine		CPU	NPU	USB Edge TPU	CPU	CPU
Series	STM32MP15x	✓	NA	✓	✓	🧩
	STM32MP13x	✓	NA	✓	✓	🧩

✓ *Available*   🧩 *Integration on going*

Include AI frameworks to execute neural network models

ONNX RUNTIME   Coral   tvm   TensorFlow Lite

STM32Cube.AI tool for machine learning running on Cortex-M4 in STM32MP15

STM32 Cube.AI

Camera and audio interfaces to simplify the integration of these input devices

Enhance your added value by relying on ST and Authorized Partner solutions

A growing base of ST Authorized Partners

ST continues to invest in the most recognized open-source standards

From idea to final product, our partners help you build end-to-end solutions

Solutions for edge computing & IoT from sensors to the cloud

A growing base of partners addressing customer challenges

Software development tools

Hardware development tools

Embedded software

Evaluation boards

Development boards

Companion devices

Hardware integrated devices

Training

Engineering services

Design houses

Global services

Click to discover our partners

Partner Program

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Releasing your creativity

f /STM32

X @ST_World

STM32 MPU community.st.com

www.st.com/STM32MP1

wiki.st.com/stm32mpu

github.com/stm32-hotspot

STM32 MPU Developer Zone

STM32

Our technology starts with You

🌐 Find out more at www.st.com/MPU

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