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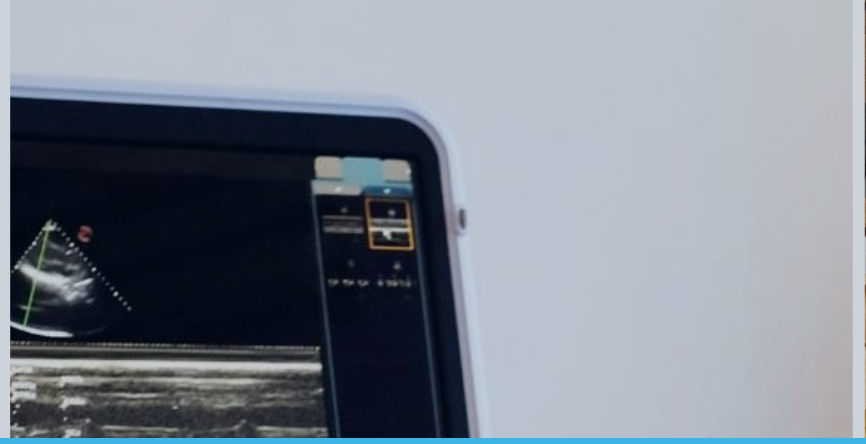
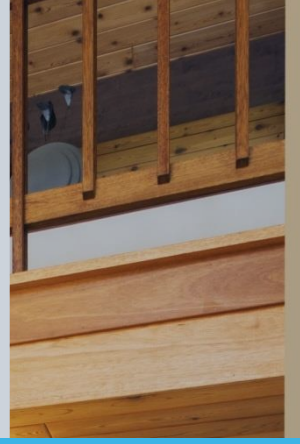
# STM32H7
# Dual-core world's most powerful MCU

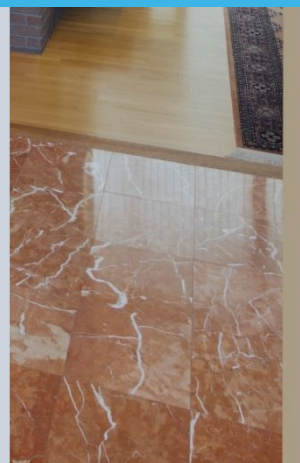
Marketing presentation

STM32

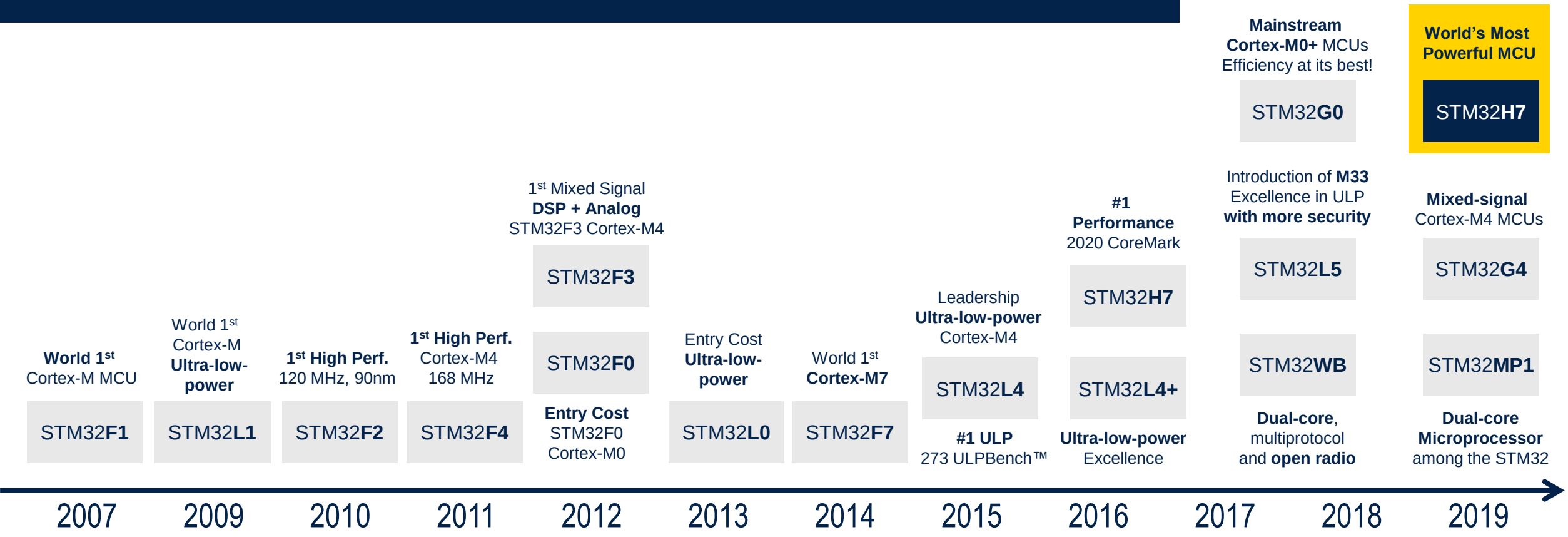
# STM32H7





# Continuing the STM32 success story

## Leader in Arm® Cortex®-M 32-bit General Purpose MCU

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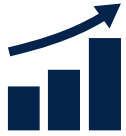
# STM32H7 series

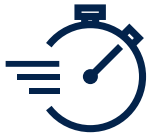
## New Dual core product lines expanding the STM32 portfolio



New Performance Record
2424 + 800 CoreMark (Cortex©-M7 @480Mhz + Cortex©-M4 @240Mhz)

Dual-core flexible architecture for industrial, security or AI applications
Accelerated graphics, fast data transfer, advanced peripherals

Advanced security features
Crypto Hash, Cortex©-M7 Security services



Rich eco-system to speed-up your design
SW tools, HW boards, community and partners

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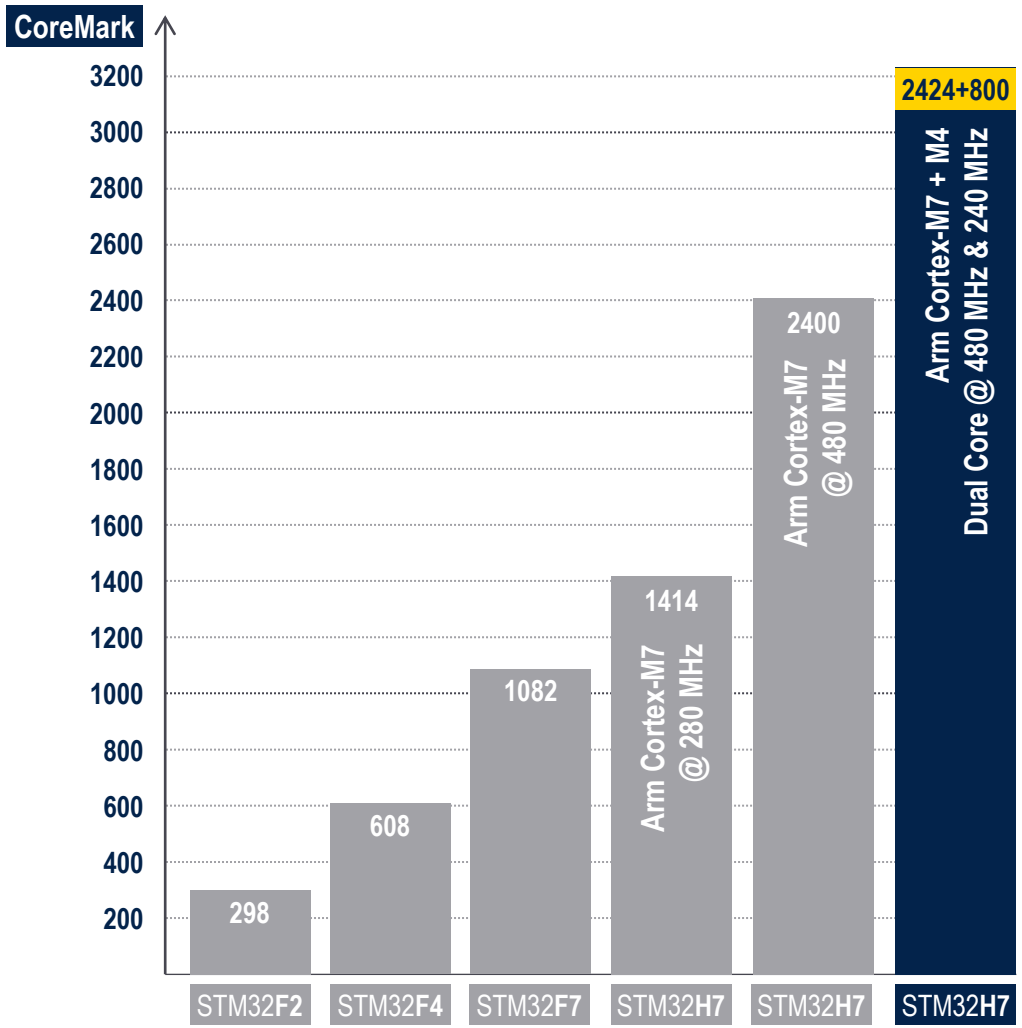
# Performance record

# High performance range






## Arm® Cortex® -M7 @480MHz

**Most powerful** Cortex core with double precision FPU, MPU, advanced DSP
and L1 cache

## Arm® Cortex® -M4 @240MHz

Best in class core for **real-time** with
single precision FPU, DSP, MPU
and ART Accelerator™

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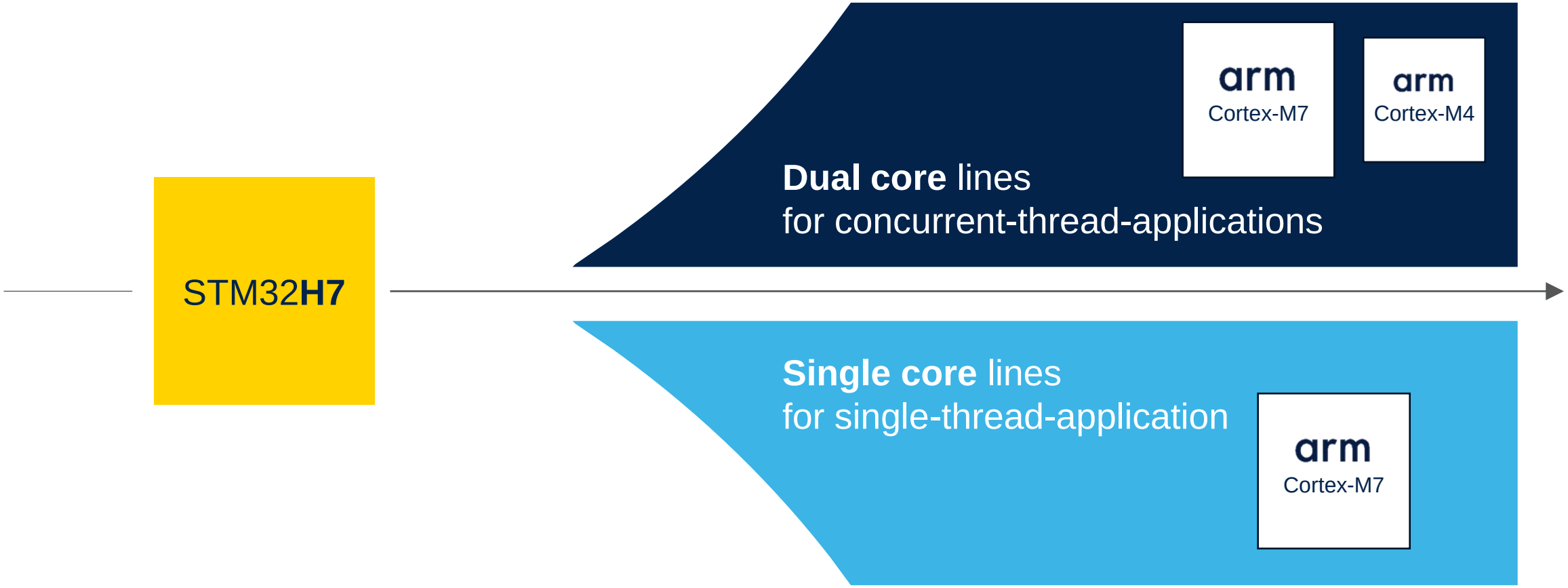
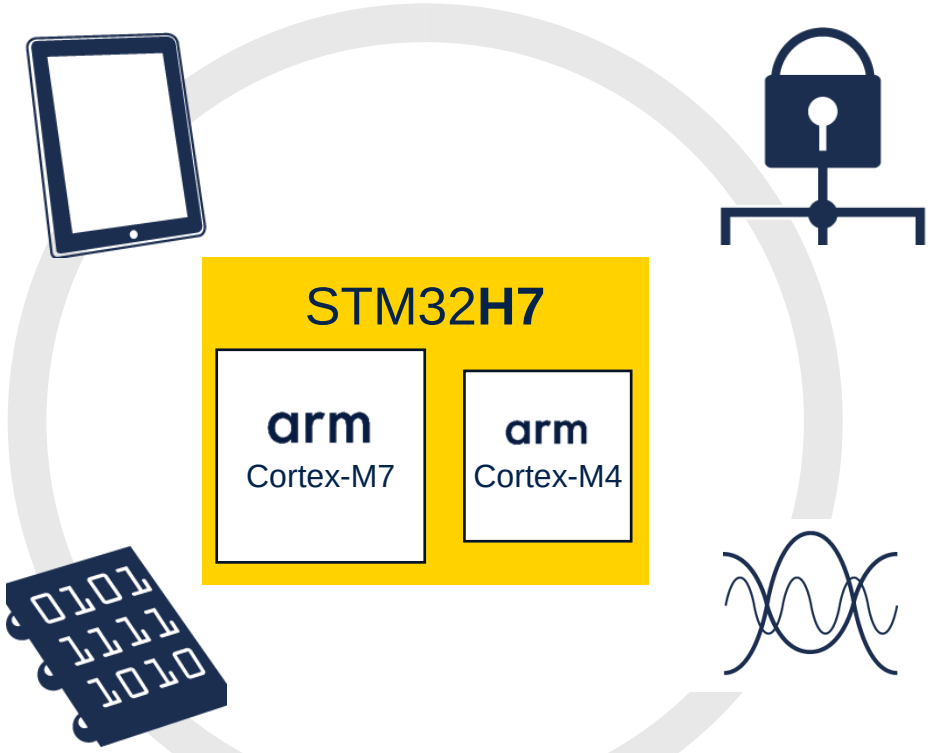
# Extend the STM32H7 experience



# Powerful cores supported by a powerful architecture

**Display nice graphic**
The Chrom-ART Accelerator
and MJPEG codec
**offload the CPU by more than 90%**

**Manage security**
Use dedicated **cryptography**
and **Hashing** HW acceleration
to **offload the CPU by more than 90%**

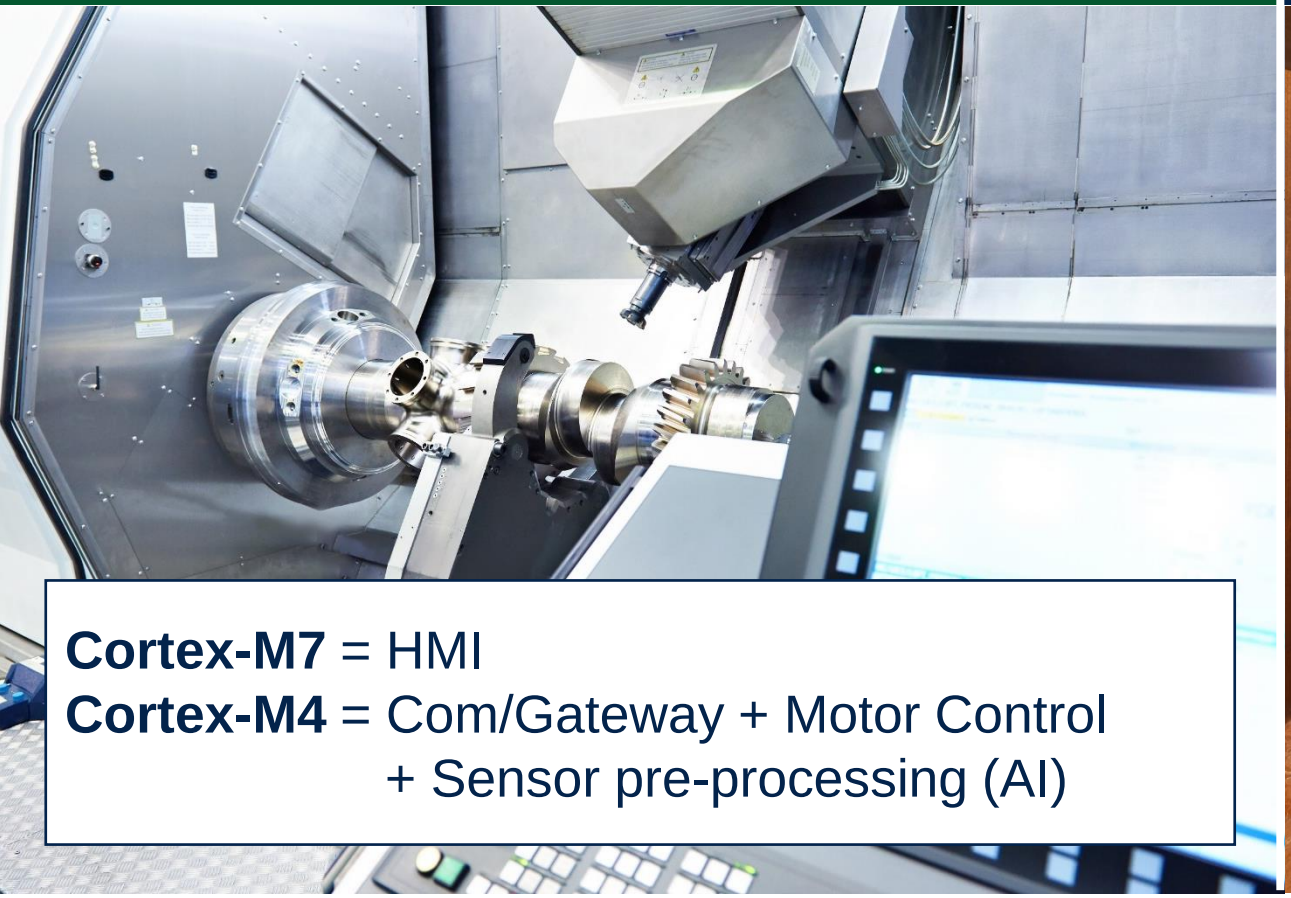



**Transfer data efficiently across peripherals**
The Main DMA takes care
of the most complex schemes
between memories and peripherals
with **up to 16 channels to offload the CPU**

**Generate complex wave forms**
**High-Resolution timer (2.1ns)**
can generate complex wave forms
synchronized on multiples events,
with no CPU assist

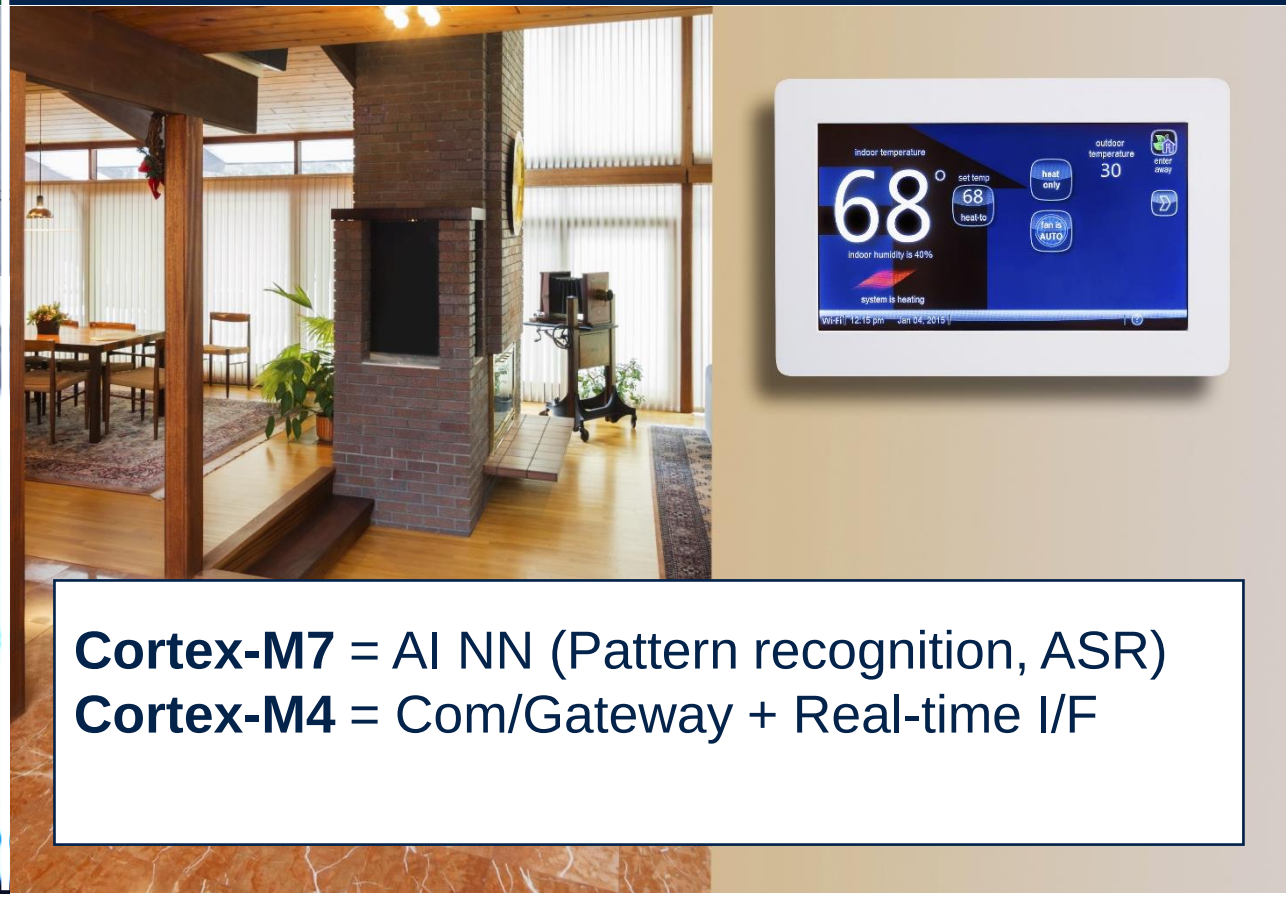
# Dual-core architecture approach
# 2 simple examples

## Industrial tool machine



**Cortex-M7** = HMI
**Cortex-M4** = Com/Gateway + Motor Control
+ Sensor pre-processing (AI)

## Home automation & security




**Cortex-M7** = AI NN (Pattern recognition, ASR)
**Cortex-M4** = Com/Gateway + Real-time I/F

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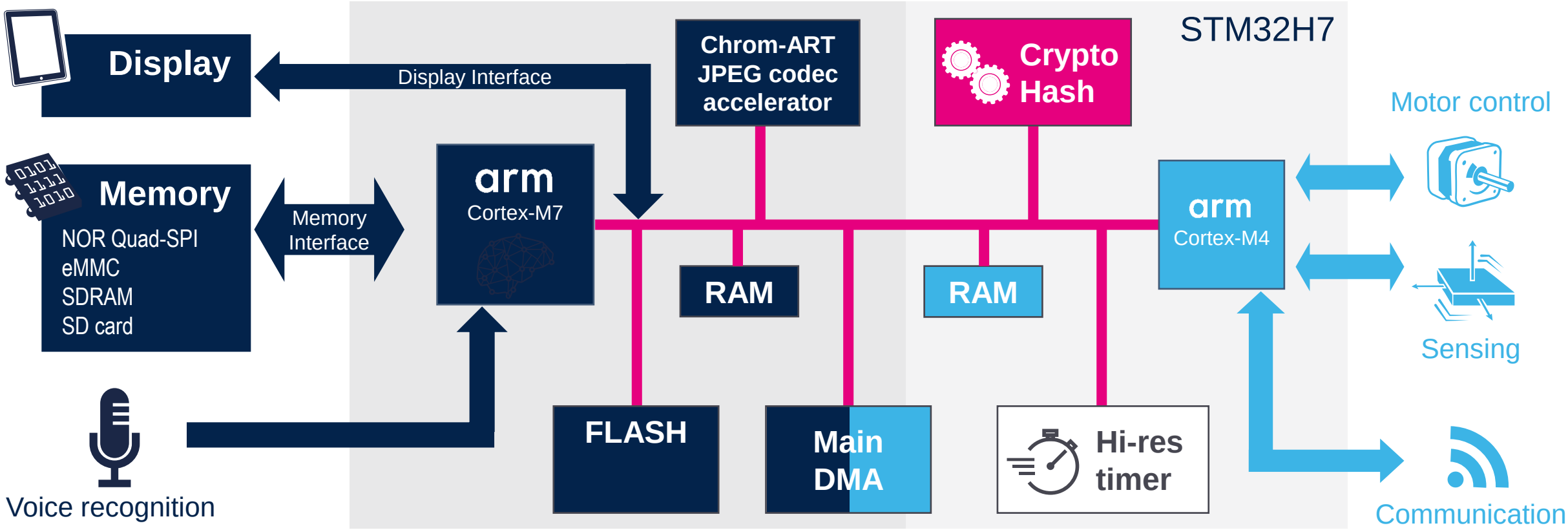
# Build complex applications mixing AI and real-time control

## Connected Kitchen Aid with advanced HMI (Large display and Voice recognition)



# Benefits of dual-core architecture

## Increase system performance

- 2x processing units working **in parallel (2 applications or run time safety check by 1 core)**
- **Reduces computation time** and average power consumption

## Reduce development time

Reduce development time

- Reduce dependencies between dev. Teams (one team per core)
- **Less components** on the PCB to **ease and shorten PCB design** and validation


## Increase system efficiency

**Workload balance** between 3 power domains

- **Cortex-M7 (more powerful)**: GUI, DSP, security
- **Cortex-M4 (real-time)**: Connectivity, RTOS, Motor control or process control task
- **Batch Acquisition Mode** domain: sensors acquisition, GPIO and low power management

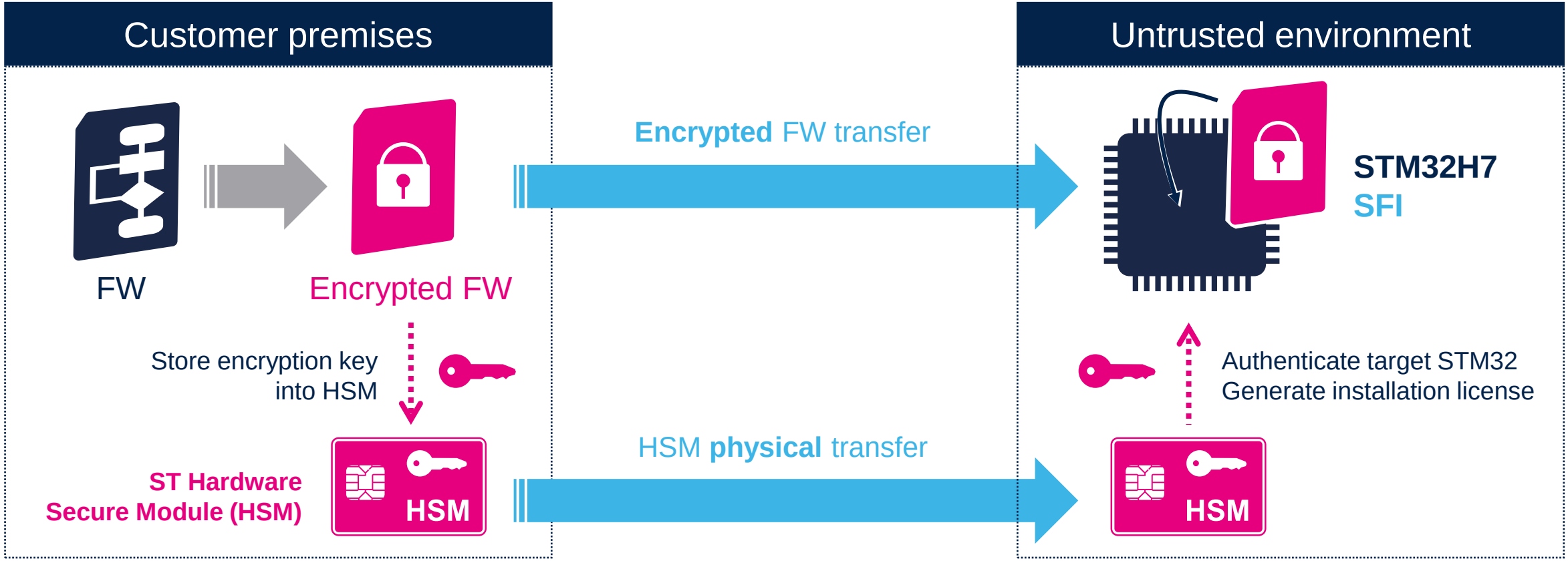
## Reduce system cost

**Reduce BOM cost** by transferring more tasks to STM32H7

- **Remove external devices** (by integrating secondary functions)
- 1 MCU instead of 2
- Extends **connectivity**
- Enhance **user interfaces**
- **Integrated SMPS** (few ext. components needed)

# Secure your production flow with secure firmware install (SFI*)

## Manage STM32 authentication, firmware decryption and installation




(*) : optional – SFI service available on specific part numbers

# A full set of security

## ENCRYPTION DECRYPTION AUTHENTICATION

- AES-128/256 Encryption
- SHA-256 Authentication
- Certified Crypto library
- True Random Number Generator
- Unique ID
- Key provisioning for STM32 authentication

STM32**H7**

## MEMORY and IP PROTECTION

- **Anti-tamper detection**
- Memory Protection Unit (MPU)
- Secure Boot
- Read and Write Protection
- **Secure User Area (Hide Protect)**
- **PC-ROP**
- JTAG fuse

Some of the above features are optional and require to procure dedicated part numbers. Please refer to product specification

# Detailed use-cases
# Performance and smart architecture are yours to innovate

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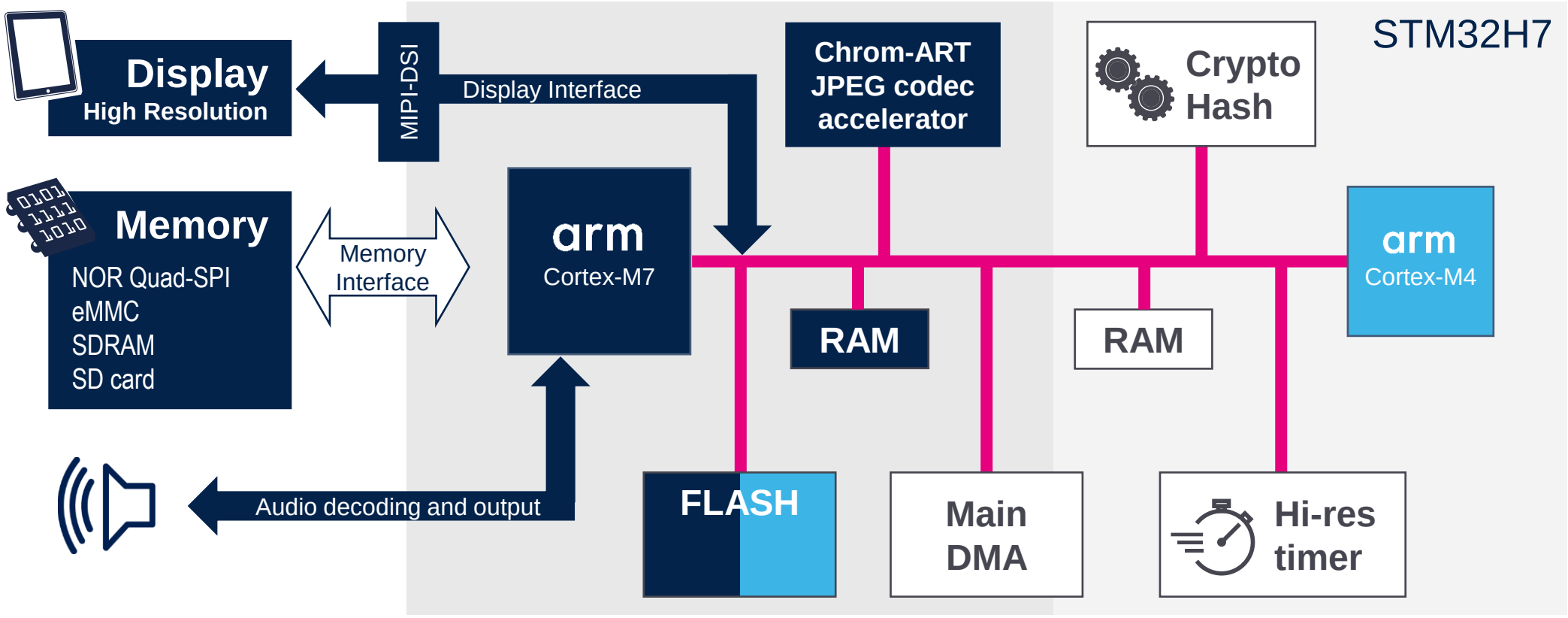
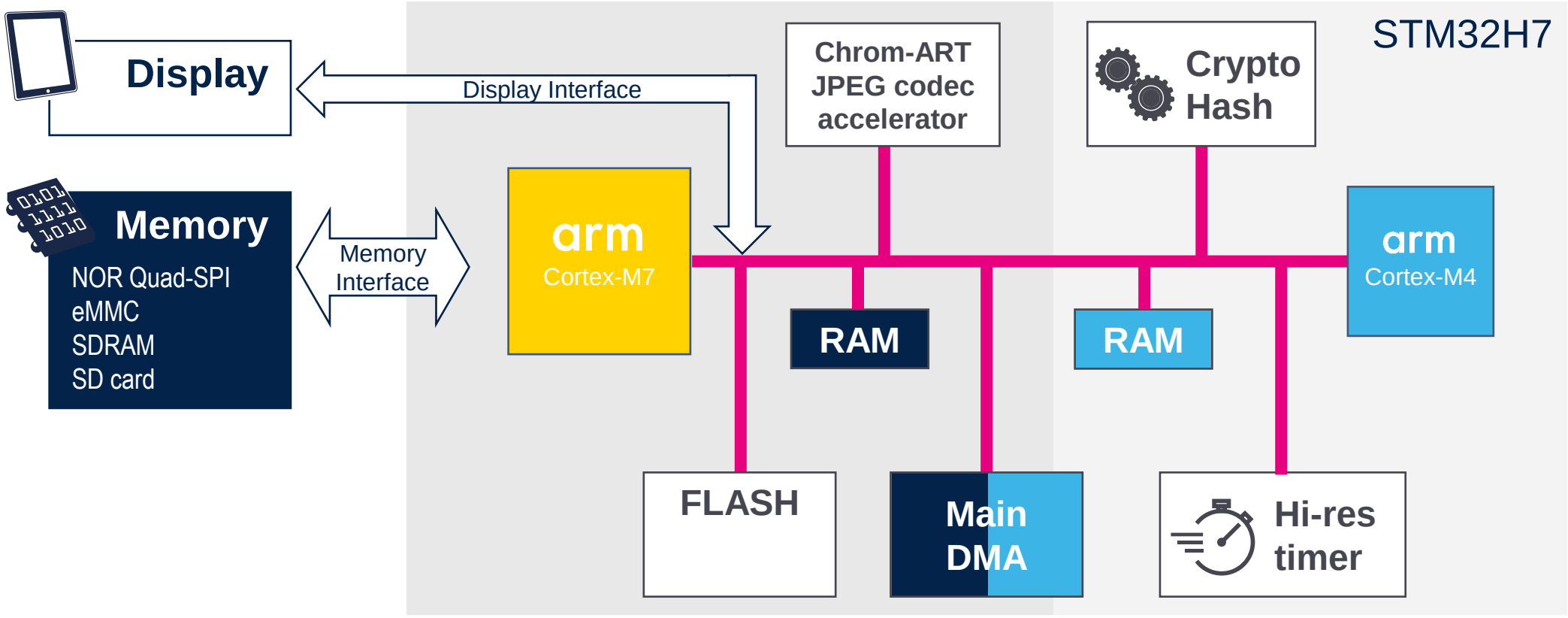
# Create a rich human machine interface

## Cortex-M7 - handling audio and rich HMI, Cortex-M4 running Real Time control tasks



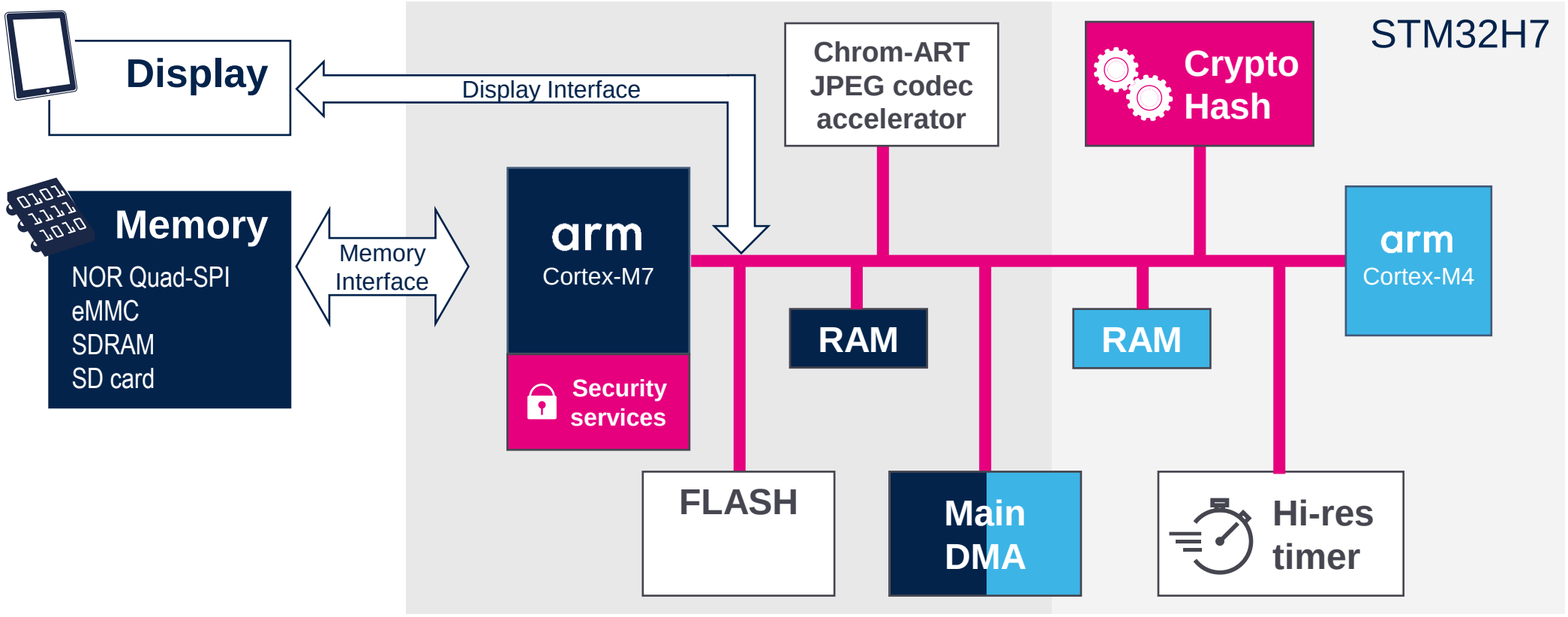
# Seamlessly move and format data

## Main DMA - Flexible and high speed data transfers schemes without CPU load



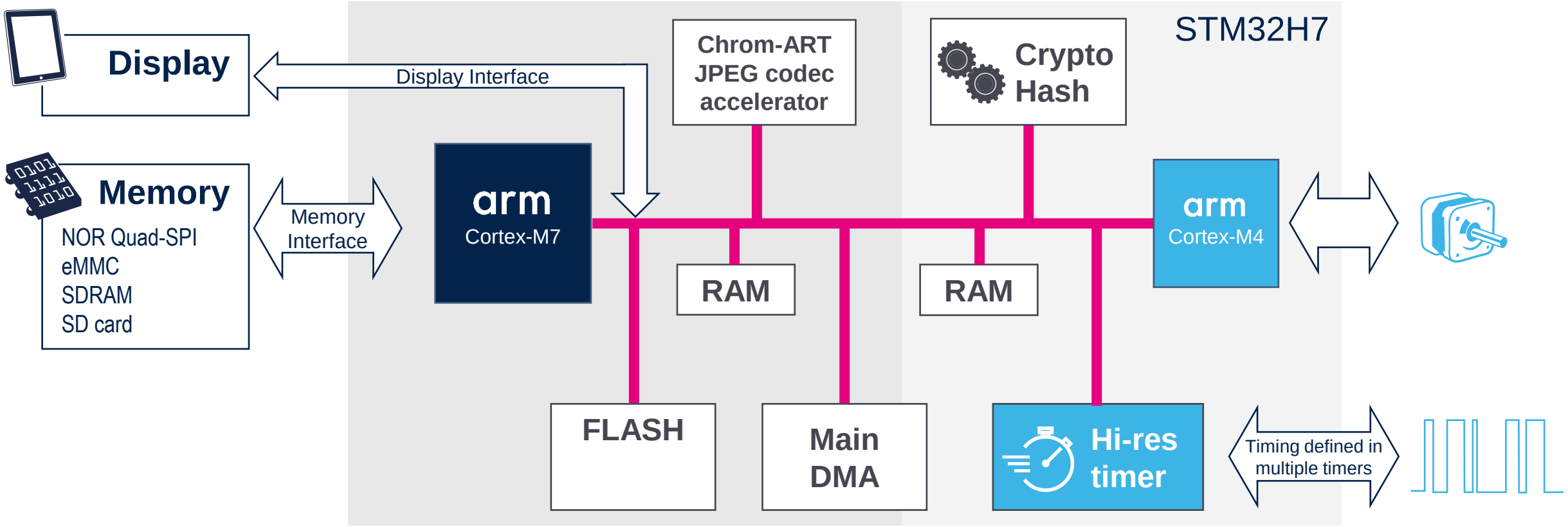
# Reinforce the security in your solution

**Cryptography and Hashing hardware assist**
**Authenticate your chip and securely install your code in memory**



# Control real-time applications

## High resolution timer: advanced wave forms generation



# Industrial and health & wellness DNA

| Industrial | Health & Wellness |
| --- | --- |

- Error Code Correction on all Flash and RAM  and dual core for safety
- Large choice of packages
- Advanced digital and analog

  (High resolution timer, 16-bit ADC, OpAmp, Ethernet, CANFD…)
- High temperature  -40°C up to 140°C junction temperature (avail. Q4-2019)

# Industrial and health & wellness DNA

## Industrial

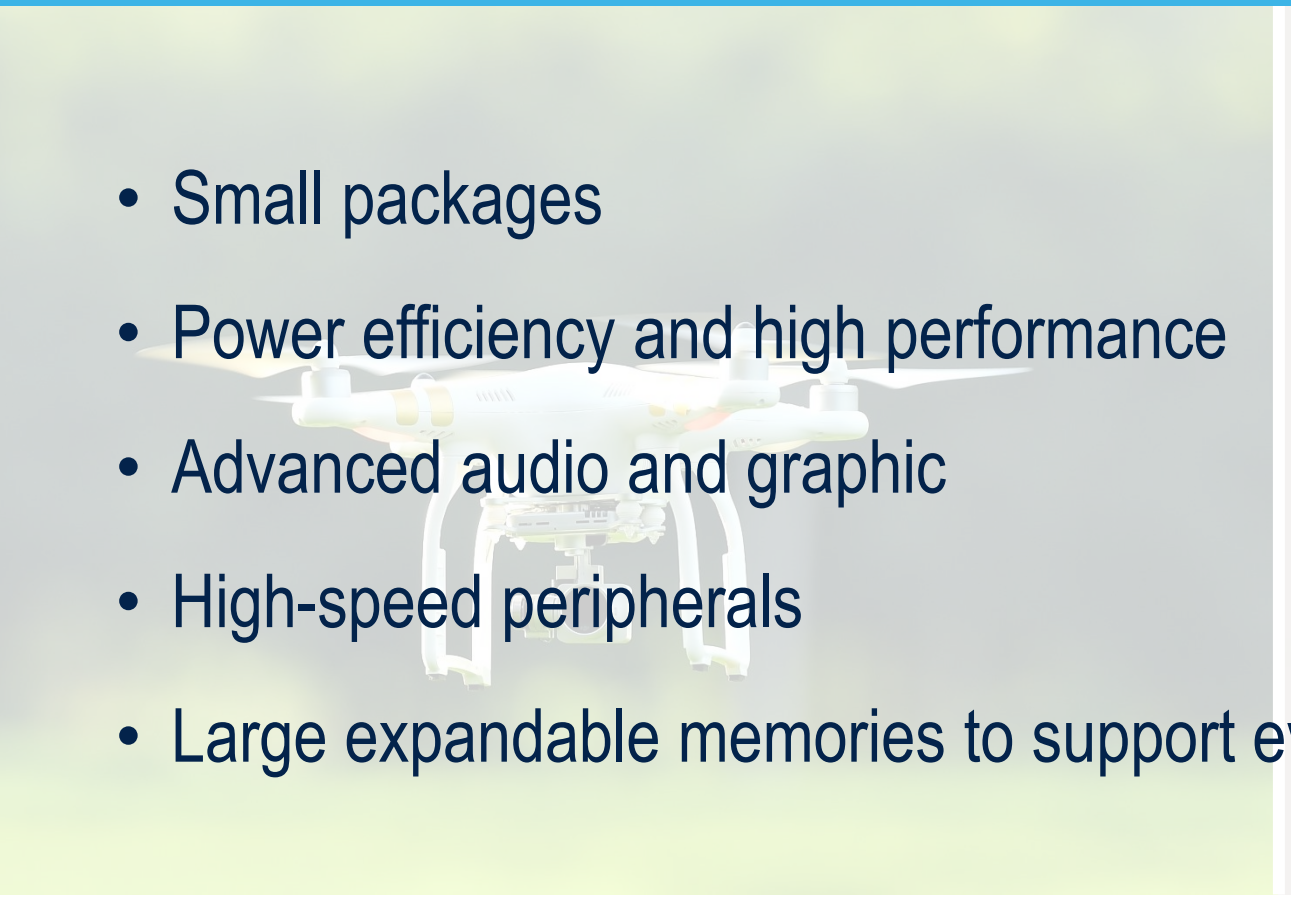
- **Inverters**
  Advanced timers and analog peripherals
- **Communication gateway**
  Rich connectivity and optional dual core
- **Human Machine Interface**
  Chrom-ART Accelerator and display interfaces for TFT and MIPI-DSI

## Health & Wellness

- **Health and wellness**
  Chrom-ART Accelerator and display interfaces for TFT and MIPI-DSI
- **Individual assistance** (hearing, respiratory)
  Advanced timers and analog
- **Measurements and Data logger**
  Advanced Analog

# Consumer DNA

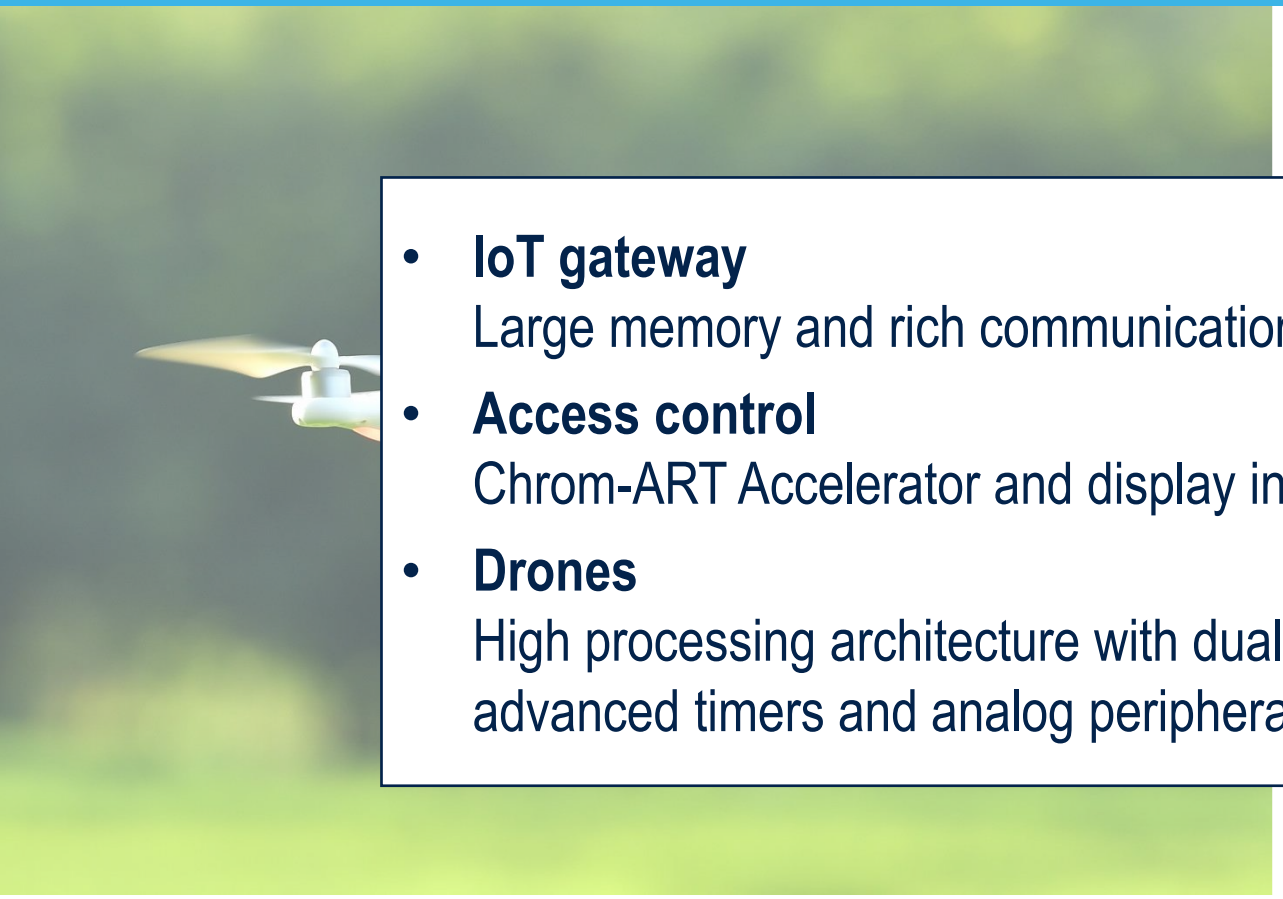
## Consumer



- Small packages
- Power efficiency and high performance
- Advanced audio and graphic
- High-speed peripherals
- Large expandable memories to support ever increasing communication protocols

# Consumer DNA

## Consumer



- **IoT gateway**
  Large memory and rich communication peripherals
- **Access control**
  Chrom-ART Accelerator and display interfaces for TFT and MIPI-DSI
- **Drones**
  High processing architecture with dual core option,
  advanced timers and analog peripherals, small packages

# Dual-core ready ecosystem

# Supported by the STM32 ecosystem

## Software

STM32 CubeMX

STM32 CubeProgrammer

## Hardware

STM32 Nucleo boards

Discovery kits

Evaluation boards

## Customer support

FAE - Worldwide Customer Support

community.st.com

MOOC

Partner Program

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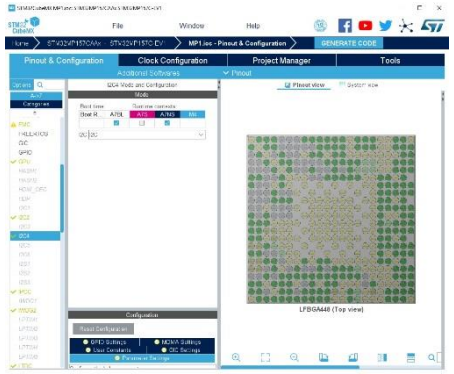
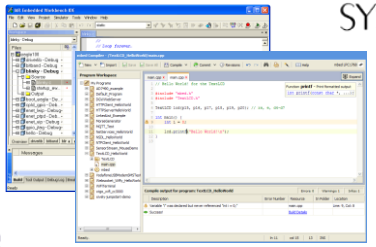
# Software tools for dual-core architecture

## Complete support of Arm Dual Cortex-M architecture






### STM32CubeMX

**STM32CubeMX enhanced for Dual-core**

- Configure and generate Code
- Multi-core resources allocation
- Peripherals configuration

### IDEs
Compile and Debug

**Multi-Core Solutions**

- Partners IDE
- Free IDE based on Eclipse
- **Multi-core** debugging

### STM32 Programming Tool

**STM32CubeProgrammer**

- Program the application into the chip
- Device information and readout
- Signing tool & license generation

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# STM32H7 hardware solutions

## Speed-up evaluation, prototyping and design

Startting at **$318**

Starting at **$87**

Starting at **$69**

Starting at **$27**

### Evaluation Boards

**Full feature STM32H7 evaluation**

- STM32H743I-EVAL2
- STM32H753I-EVAL2
- STM32H747I-EVAL
- STM32H757I-EVAL

### Discovery Kits

**Flexible prototyping & demo**

- STM32H745I-DISCO
- STM32H747I-DISCO
- STM32H747I-DISC1
- STM32H750B-DK

### Nucleo Boards

**Affordable and quick prototyping**

- NUCLEO-H743ZI2
- NUCLEO-H753ZI
- NUCLEO-H745ZI-Q / H755ZI-Q

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# Software, tools and services a broad ecosystem to support development

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**Large selection of partners already engaged for:**

- Embedded software
- Software tools
- Graphics UI
- Security
- Training and services

# STM32H7 line-up

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# Tailored for your needs

Arm® Cortex®-M7 – 480 MHz

**CORE, MEMORIES AND ACCELERATION**
- Single core Cortex-M7 480 MHz
- Dual core Cortex-M7 480 MHz and Cortex-M4 240 MHz (STM32H7x5 and STM32H7x7 only)
- Flash an RAM acceleration
- SP-FPU and DP-FPU
- 4 x DMA

**CONNECTIVITY**
- 2 x USB2.0 OTG FS/HS
- 2 x SDMMC
- USART, UART, SPI, I²C
- 2 x CAN (1 x FD and 1 x TT)
- HDMI-CEC
- FMC, Dual Q-SPI
- Ethernet MAC IEEE1588
- Camera I/F
- Analog (comp, AOP)

**AUDIO**
- 3 x PS + audio PLL
- 4 x SAI
- 2 x 12-bit DAC
- SPDIF-RX

**GRAPHIC**
- Chrom-ART Accelerator™

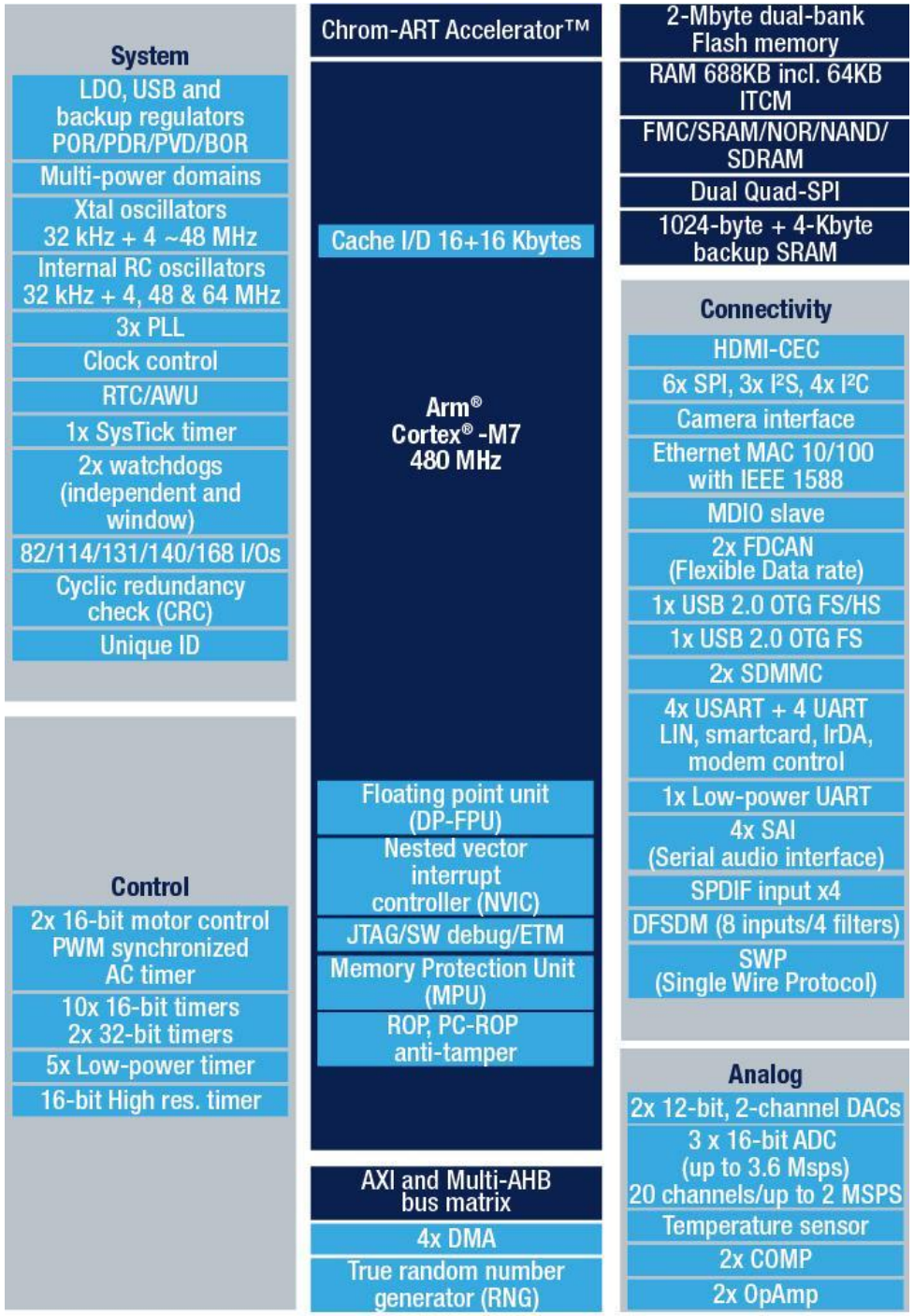
**OTHER**
- Crypto/Hash (except H742)[1]
- Security services (except H742)[2]
- TRNG
- DFSDM
- 16- and 32-bit timers
- 3 x 16-bit ADC (up to 3.6 Msps)
- Voltage range 1.62 to 3.6 V (except 100-pin package : 1.71 to 3.6 V)
- Multi-power domains

| STM32 H7 Product line | $F_{CPU}$ (MHz) | DB Flash (bytes) | RAM (bytes) | Graphic | Power supply | T° range |
|---|---|---|---|---|---|---|
| **Dual core lines** | | | | | | |
| STM32H7x7 | 480 + 240 | Up to 2MB | 1 MB (incl.128 K DTCM) + 64 K ITCM + 64 KB bckup1 + 4 K bckup2 | TFT-LCD JPEG codec MIPI-DSI | DCDC + LDO | Standard 85 °C |
| STM32H7x5 | 480 + 240 | Up to 2MB | 1 MB (incl.128 K DTCM) + 64 K ITCM + 64 KB bckup1 + 4 K bckup2 | TFT-LCD JPEG codec | DCDC + LDO | Standard 85 °C<br>(Opt. Industrial CPN 125 °C)[3] |
| **Single core lines** | | | | | | |
| STM32H7x3 | 480 | Up to 2MB | 1 MB (incl.128 K DTCM) + 64 K ITCM + 64 KB bckup1 + 4 K bckup2 | TFT-LCD JPEG codec | LDO | Standard 85 °C |
| STM32H742 | 480 | Up to 2MB | 692 K (incl.128 K DTCM) + 64 K ITCM + 16 KB bckup1 + 4 K bckup2 | no | LDO | Standard 85 °C |
| **Value line** | | | | | | |
| STM32H750 | 480 | 128K | 1 MB (incl.128 K DTCM) + 64 K ITCM + 64 KB bckup1 + 4 K bckup2 | TFT-LCD JPEG codec | LDO | Standard 85 °C |

Notes :
1 : optional - dedicated CPN, STM32H753, STM32H755, STM32H757 for the Crypto Variants
2 : SFI and SB-SFU available Mid-2019
3 : available Q4-2019 - Extended Temp range Max 125C Amb/140C junction. Dedicated part numbers

- 40nm Embedded Flash Process
- Single and Dual core versions
- High performance up to 480MHz
- 2MB Flash Dual Bank with ECC
- 1MB RAM with ECC
- More security features (Boot, Tamper …) and security services (optional)
- 35 communication peripherals
- New generation of peripherals including fast 16-bit ADC up to 3.6Msps,
  up to 5MSPS in 12-bit, Comparators, Op Amp
- New connectivity (TT-CAN and FD-CAN)
- High-Resolution timer (2.1ns)
- Several Low-Power Timers
- SMPS on Dual core variants
- Up to 140C junction temperature (optional, avail Q4-2019)

# STM32H742
# single core entry level





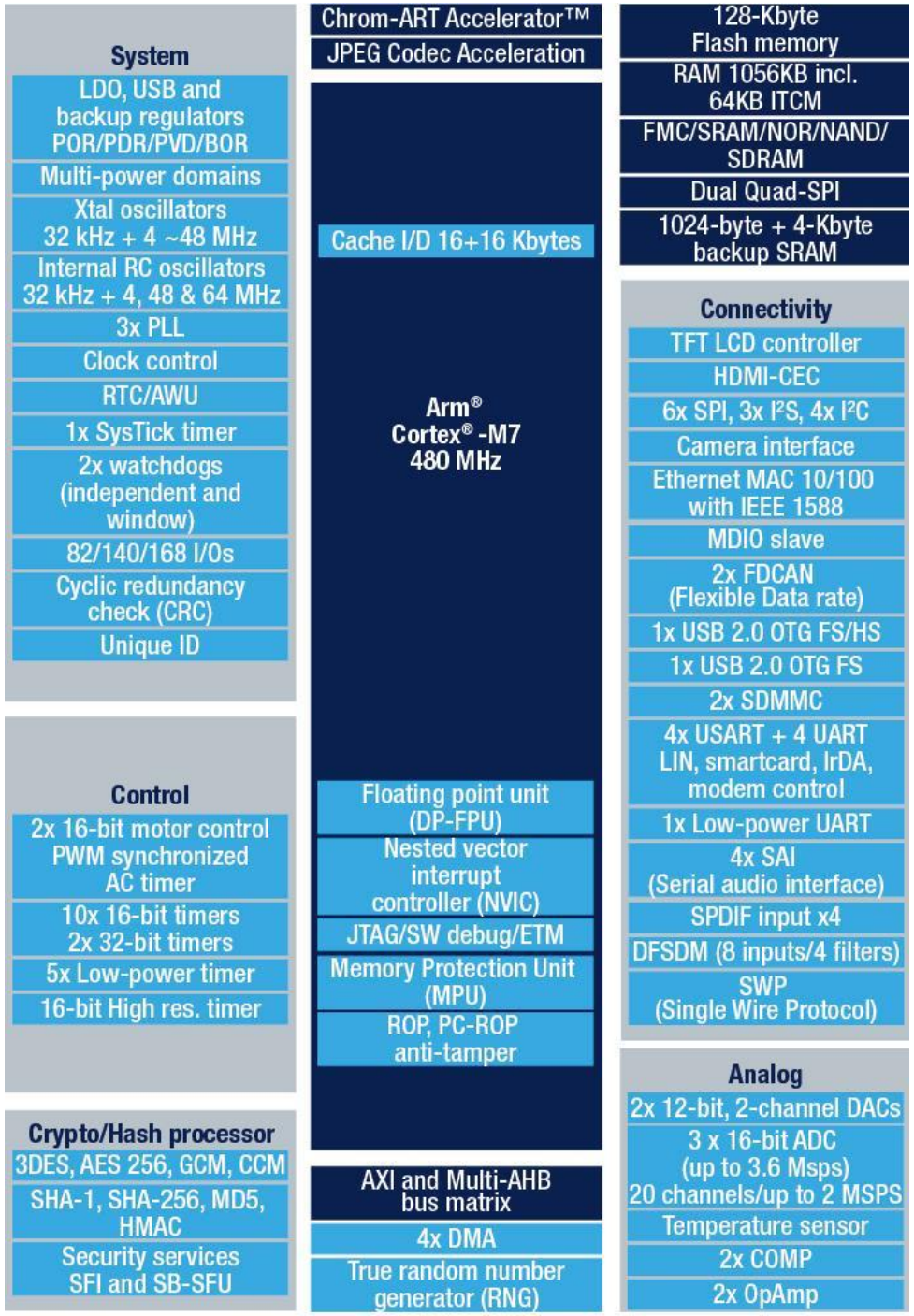
- An entry level version of the STM32H7 series
- Easy migration from the F7 and F4 series due to the pin for pin compatibility on common packages
- A wide choice of packages and form factors

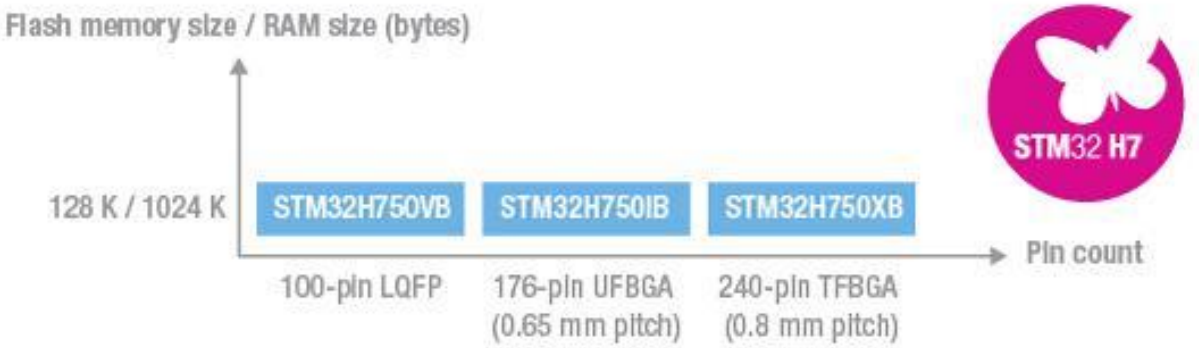
# STM32H753/H743 single core general purpose



- Easy migration from the F7 and F4 series due to the pin for pin compatibility on common packages
- A wide choice of packages and form factors
- Optional crypto variants offering the security services (SFI and SB-SFU) support

# STM32H750 value line



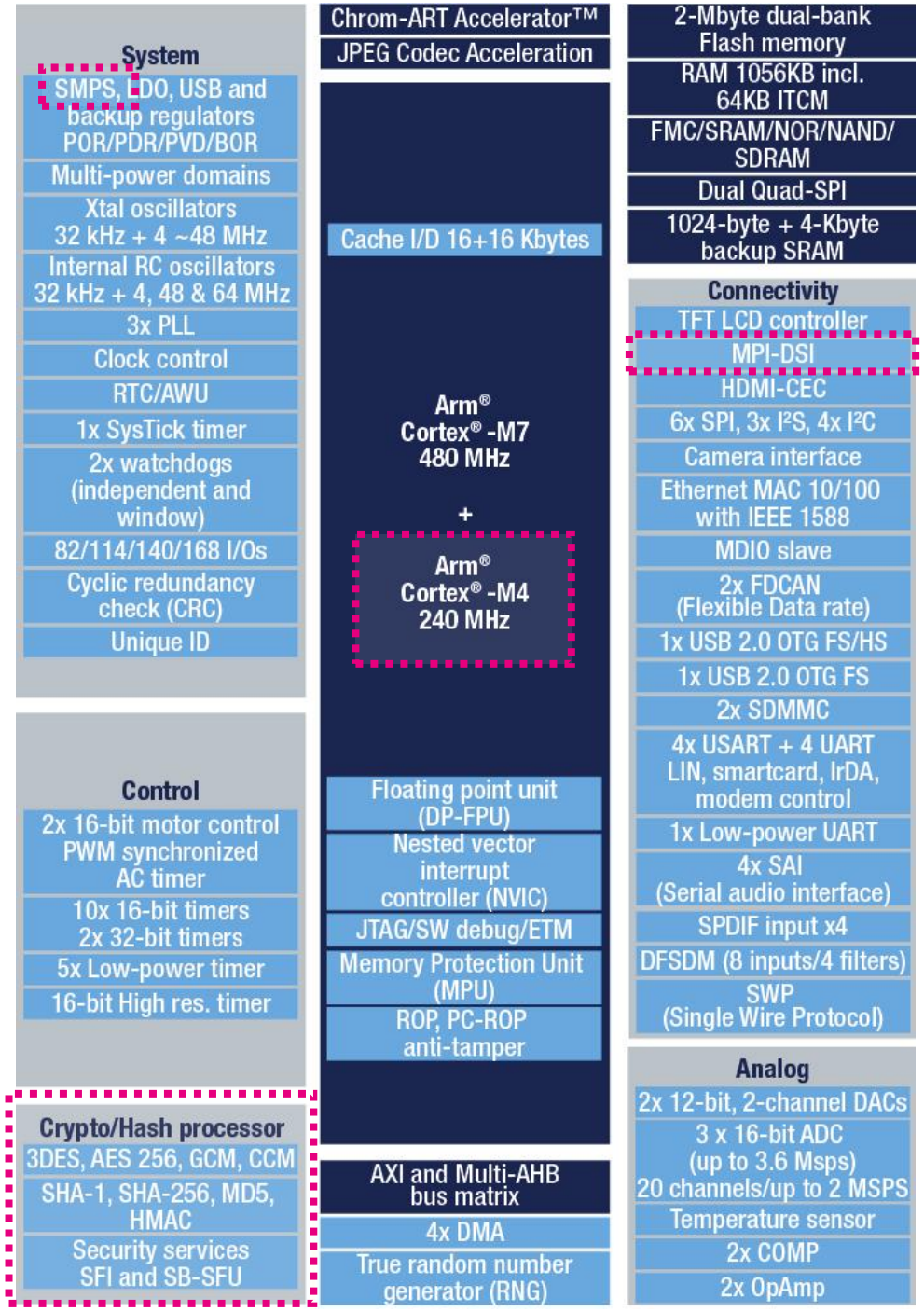

- A STM32H7 with Flash reduced to the essential to implement user bootloader and focus on external memories usage
- Lowest price point for the STM32H7 series
- Come natively in Crypto variants only

# STM32H755/H745 dual core industrial



- A STM32H7 Dual core version
- LDO and SMPS for optimized current consumption
- A wide choice of packages and form factors suitable for industrial or appliance applications
- Optional crypto variants offering security services (SFI & SB-SFU) support
- Optional support of extended Temperature range (avail. Q4-2019) on specific part numbers

# STM32H757/H747 dual core graphic

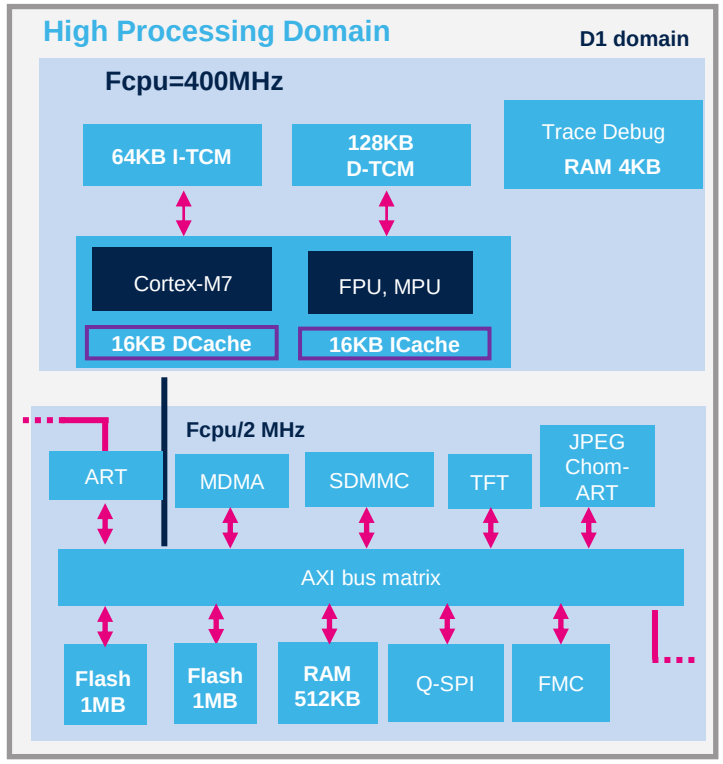


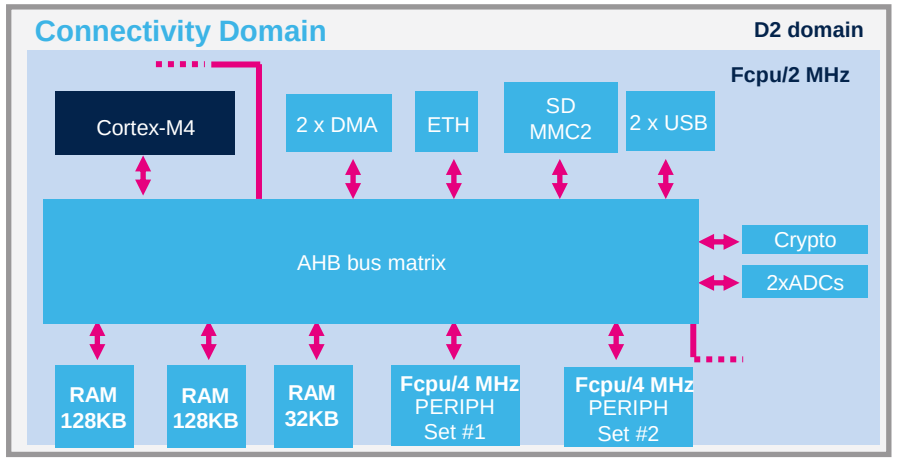


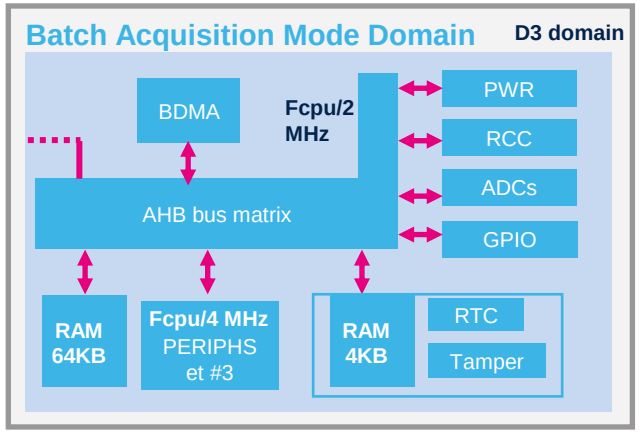
- A STM32H7 Dual core version for advanced graphic thanks to the MIPI-DSI Phy allowing to connect high resolution displays
- LDO and SMPS for optimized current consumption
- A wide choice of packages and form factors suitable for highly integrated applications
- Optional crypto variants offering the security services (SFI and SB-SFU) support

# Block diagram by power domain

## Multi-power domain architecture for maximum flexibility and minimum power consumption




- **Three power domains for maximum flexibility:** To allow the shutdown of unused domains and minimize current consumption
- **Power efficiency in RUN mode** Thanks to 40nm process, dynamic voltage scaling and SMPS
- **Batch Acquisition Mode Domain** For always ON tasks, Including Vbat subdomain with RTC and backup RAM

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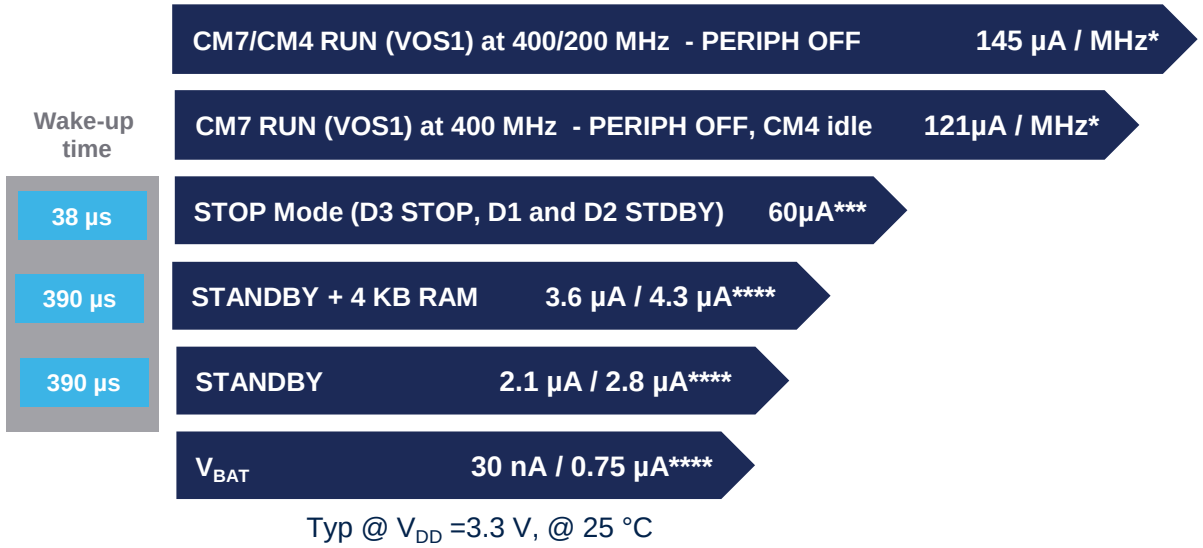
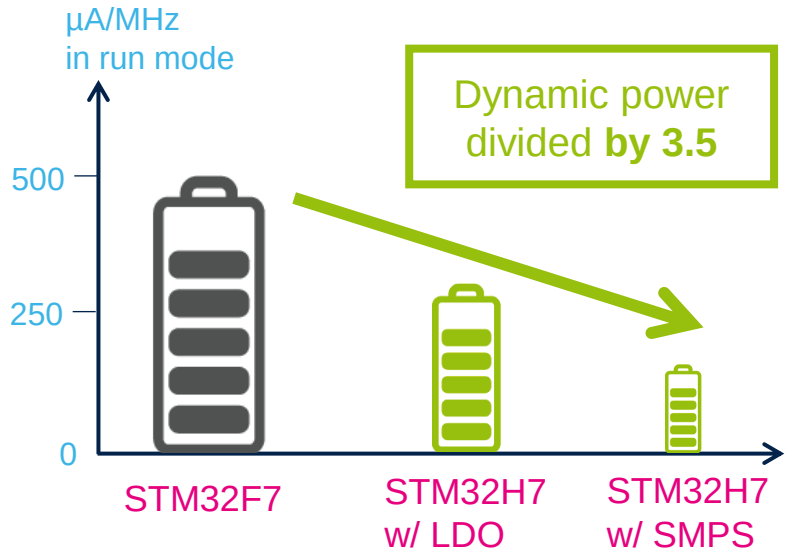
# STM32H7 Flexible architecture for power efficiency

## Only 60% of the dynamic power of the STM32H7 Single core thanks to the SMPS



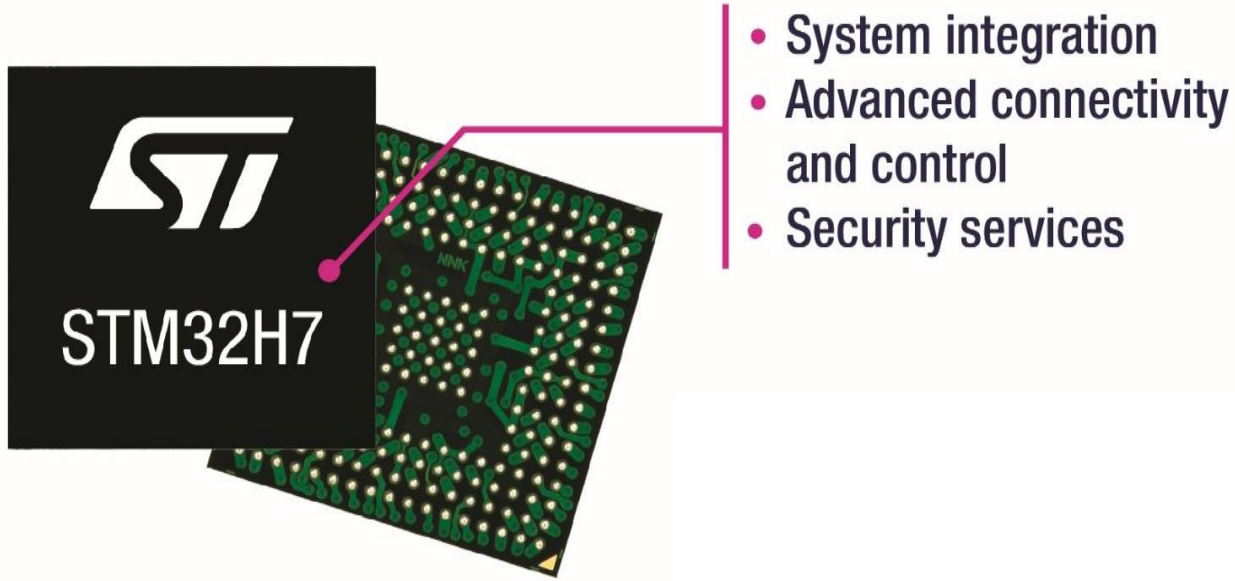

Typ @ $V_{DD}$ =3.3 V, @ 25 °C

Notes:
* from Flash (Cache ON and Reg. ON)
*** VOS5; Flash OFF, no IWDG
**** with RTC, at 3V
More details available in product Sheet available at www.st.com



# STM32H7 dual core
# STM32H7x5 & STM32H7x7

**New STMicroelectronics' STM32H7 Microcontrollers Combine Dual-Core Performance with Rich Feature Integration**




- STM32H7x5 here
- STM32H7x7 here
- ST blog article here

www.st.com/STM32H7

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# STM32 MCU “High Perf” series

**High Perf MCUs**

- STM32**F2**: 398 CoreMark, 120 MHz
- STM32**F4**: 608 CoreMark, 180 MHz
- STM32**H7**: **3224 CoreMark**, **240 MHz Cortex -M4**, **480 MHz Cortex -M7**
- STM32**F7**: 1082 CoreMark, 216 MHz

**Mainstream MCUs**

- STM32**F0**: 106 CoreMark, 48 MHz
- STM32**G0**: 142 CoreMark, 64 MHz
- STM32**F1**: 177 CoreMark, 72 MHz
- STM32**F3**: 245 CoreMark, 72 MHz ●
- STM32**G4**: 550 CoreMark, 170 MHz ●

**Ultra-low Power MCUs**

- STM32**L0**: 75 CoreMark, 32 MHz
- STM32**L1**: 93 CoreMark, 32 MHz
- STM32**L5**: 424 CoreMark, 110 MHz
- STM32**L4**: 273 CoreMark, 80 MHz
- STM32**L4+**: 409 CoreMark, 120 MHz

LONGEVITY 10 YEARS COMMITMENT

**Wireless MCUs**

- STM32**WL**: 161 CoreMark, 48 MHz
- STM32**WB**: 216 CoreMark, 64 MHz ●

**Arm® Cortex® core**: -M0 / -M0+ / -M3 / -M33 / -M4 / -M7

● Optimized for mixed-signal applications

● Cortex-M0+ Radio co-processor

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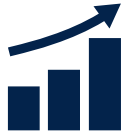
# STM32H7 series - key take away

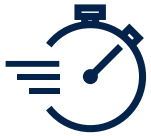
## New Dual core product lines expanding the STM32 portfolio



New Performance Record
2424 + 800 CoreMark (Cortex©-M7 @480Mhz + Cortex©-M4 @240Mhz)

Dual-core flexible architecture for industrial, security or AI applications
Accelerated graphics, fast data transfer, advanced peripherals

Advanced security features
Crypto Hash, Cortex©-M7 Security services



Rich eco-system to speed-up your design
SW tools, HW boards, community and partners

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# Releasing your creativity

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# Thank you



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