

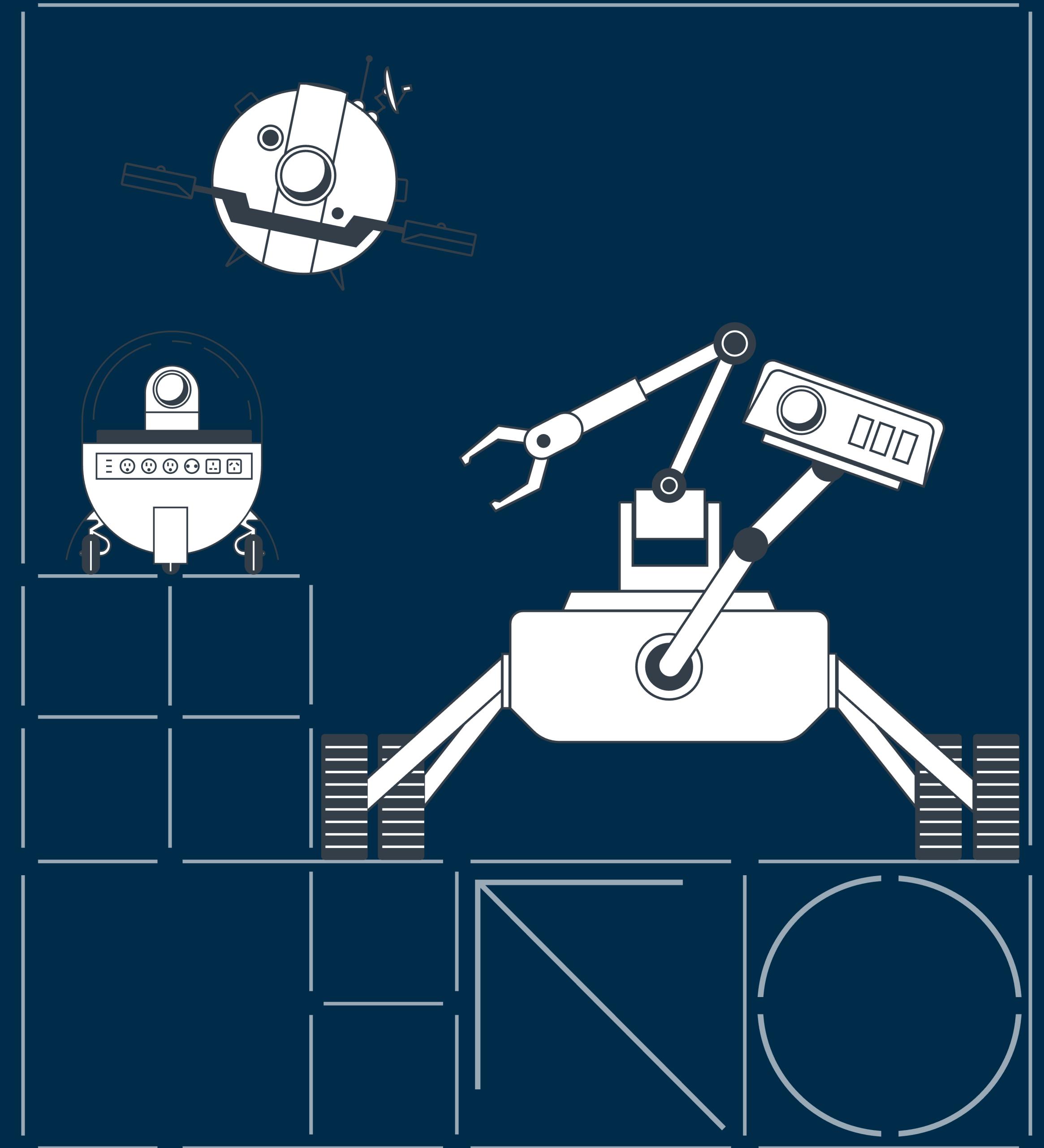


arm Developer Program

Introduction to MCU based on ARM

ARM-IEEE TAMU Technical workshop series

Fidel Makatia – ARM Ambassador





arm Developer Program

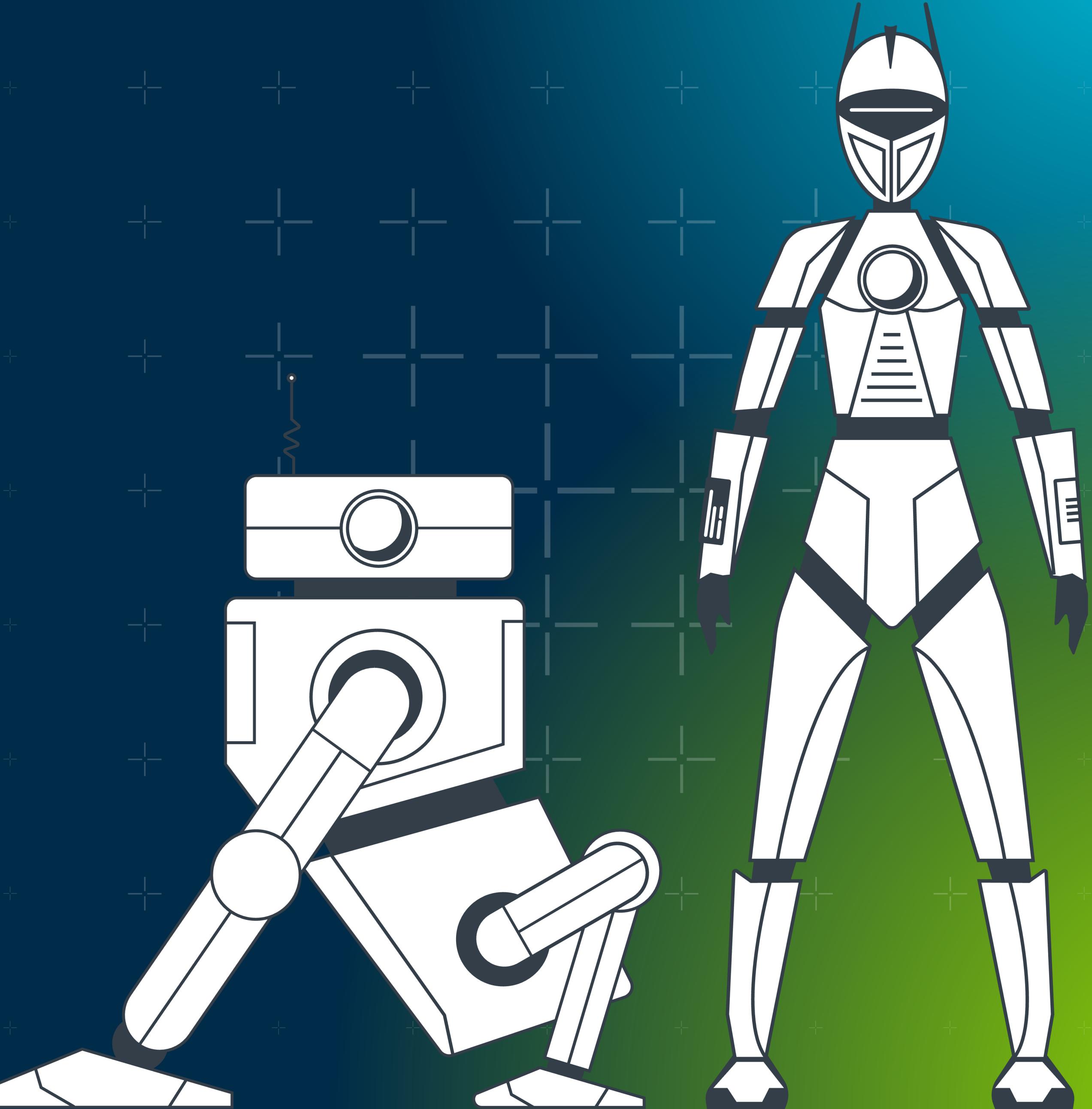
A Community to Build the Future on Arm.

I'm excited to join the Arm Developer Program as an Arm Ambassador.

It's an incredible community of experts and developers who come together to learn new skills and build better software.

Sign up as a member today and join me on my journey.

arm.com/developerprogram



MCUs and Embedded systems

- + All smart systems run some form of MCU
- + Popular MCUs are 8bit, 16bit or 32 bit
- + ARM architecture runs majority of the MCUs

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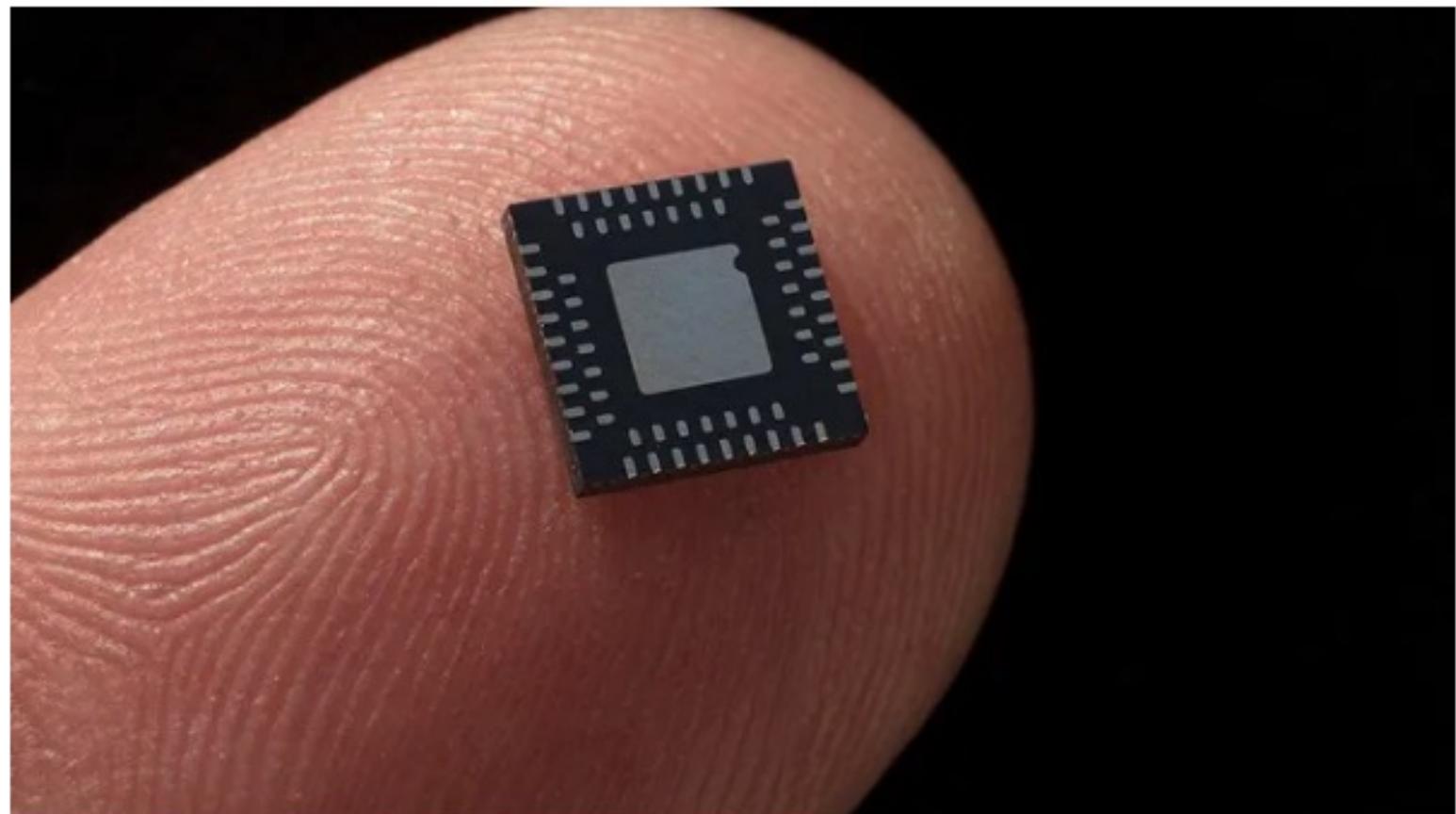
PC Components > CPUs

842 Chips Per Second: 6.7 Billion Arm-Based Chips Produced in Q4 2020

News By Anton Shilov published February 13, 2021

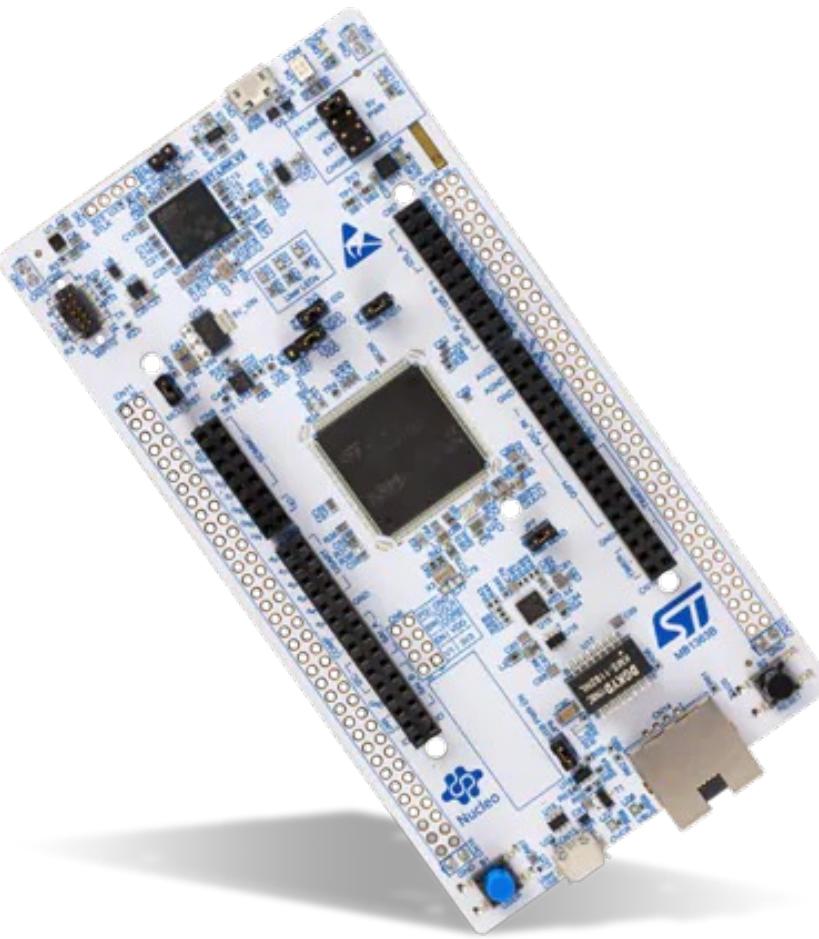
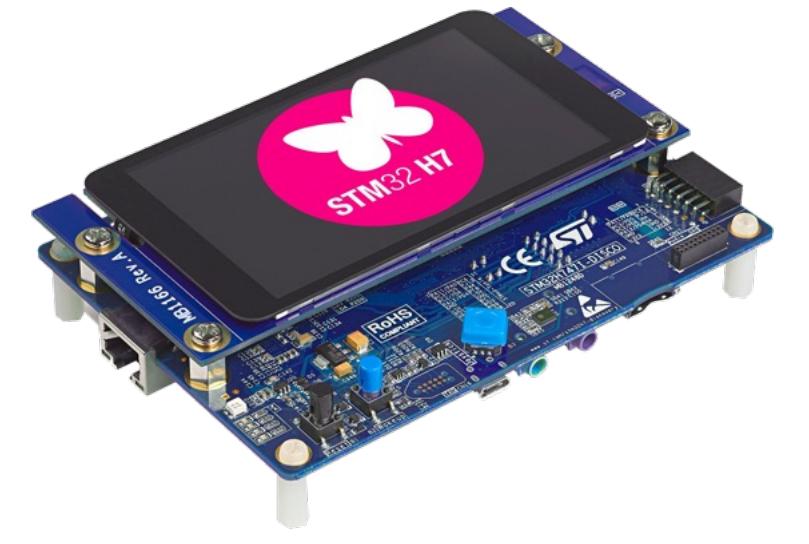
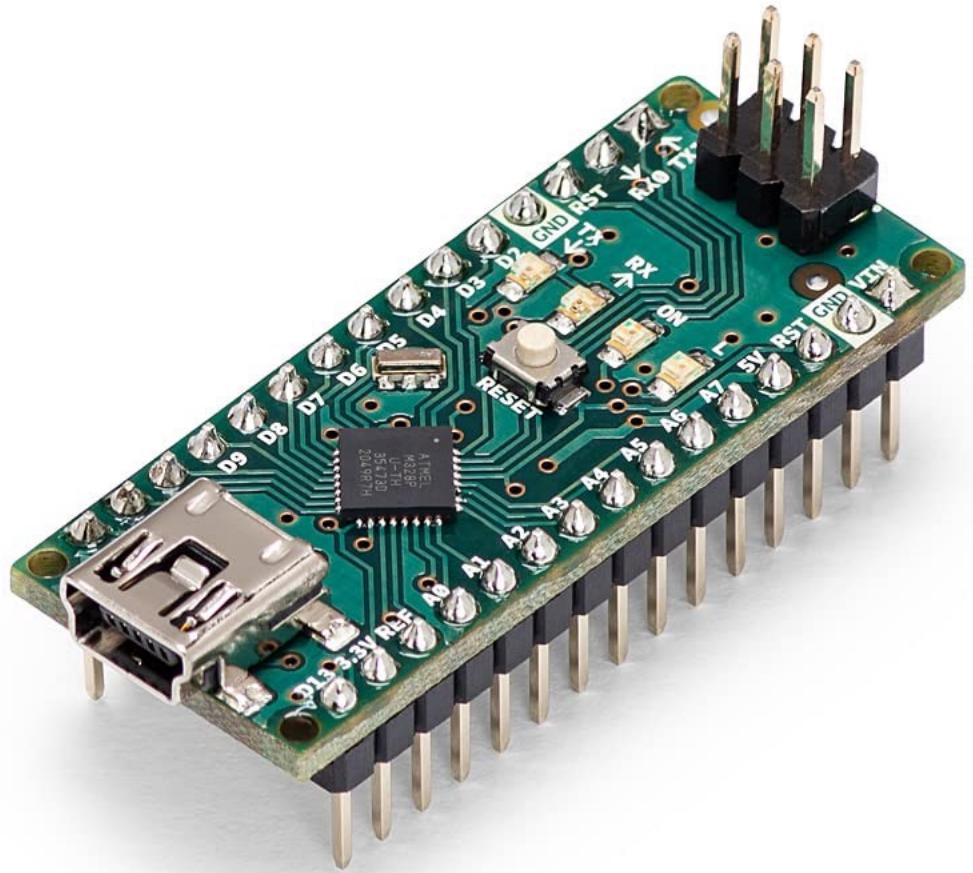
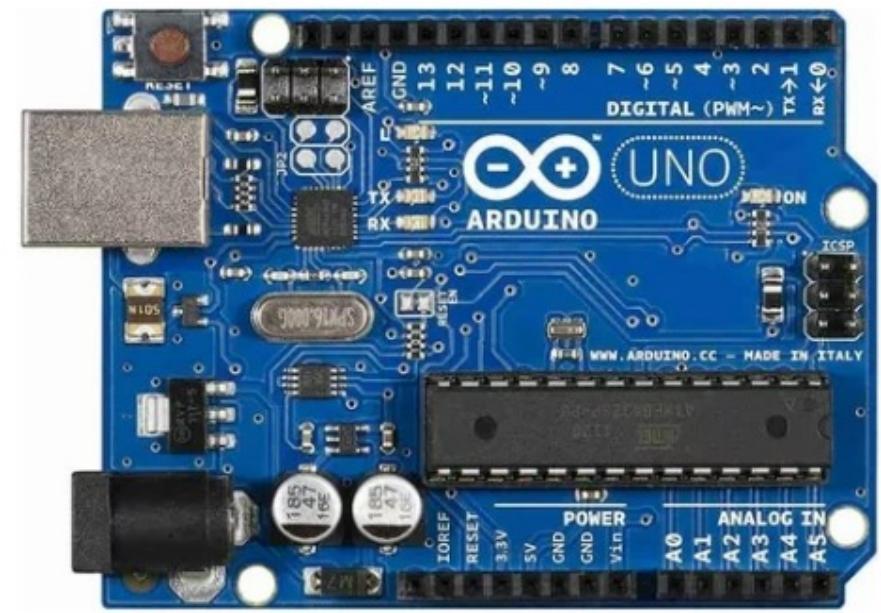
Arm-based chips surpass x86, ARC, Power, and MIPS-powered chips, combined

[Comments \(2\)](#)



(Image credit: Arm)

MCUs and Embedded systems



+ 8 bit board –based on AVR (CPU)

+ 32 bit board –based on ARM

8bit Vs 32 bit

Advantages of 32 bit MCUs

- + Higher processing power – clocks can run up to 400Mhz with cool things like DMA
- + Larger data bus size (2^{32}), more data per cycle and complex algorithm handling capabilities including TinyML
- + Some have embedded DSP and FPUs
- + More advanced peripherals
- + Supports multitasking (NVIC) and RTOS
- + Scalable
- + Power efficiency features

STMicro Launches the STM32WL3 Family, Offering Sub-GHz Communications with a 15-Year Battery Life

Supporting a broad range of sub-gigahertz protocols — but not LoRa — this low-power chip aims to simplify edge IoT device designs.



ghalfacree

4 months ago • HW101 / Internet of Things



ARM boards

ARM CPUS categories

Cortex - A

Highest performance

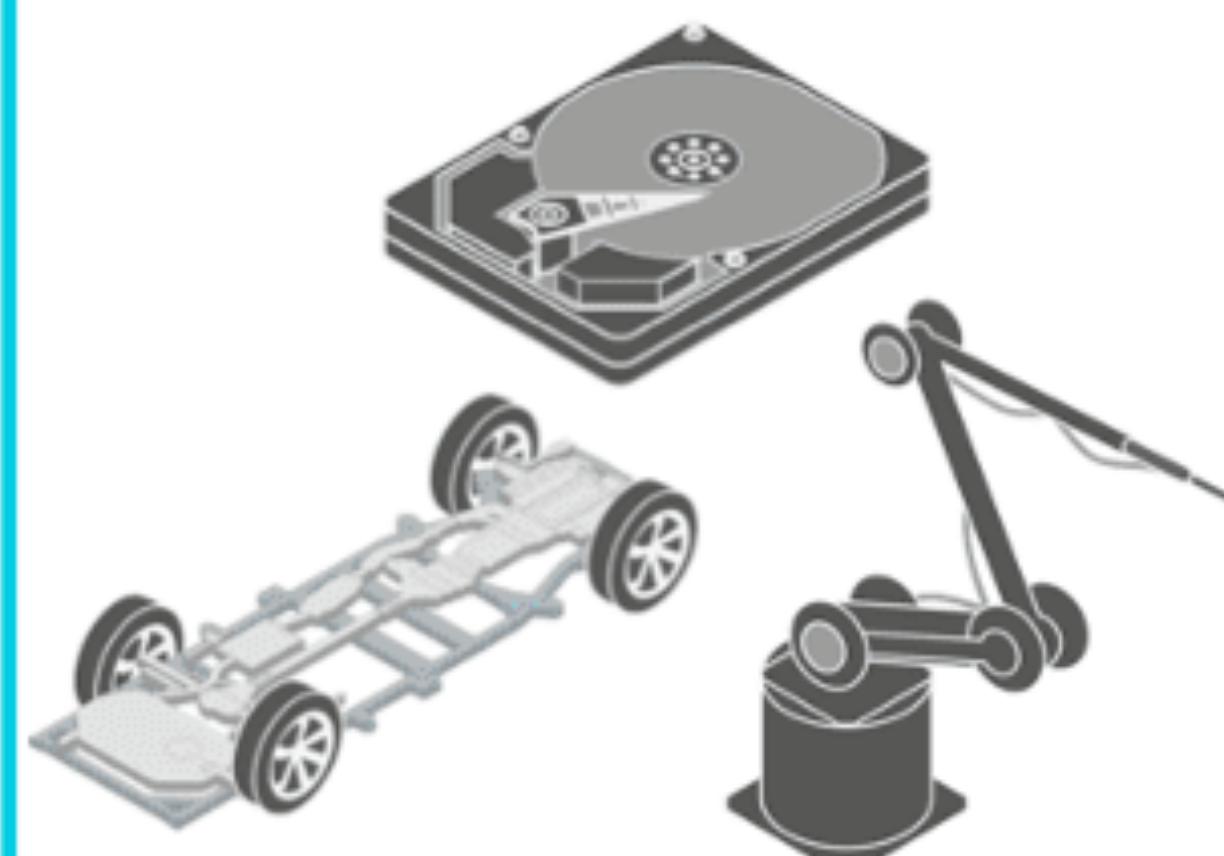
Optimised for
rich operating systems



Cortex - R

Fast response

Optimised for
high performance,
hard real-time applications



Cortex - M

Smallest/lowest power

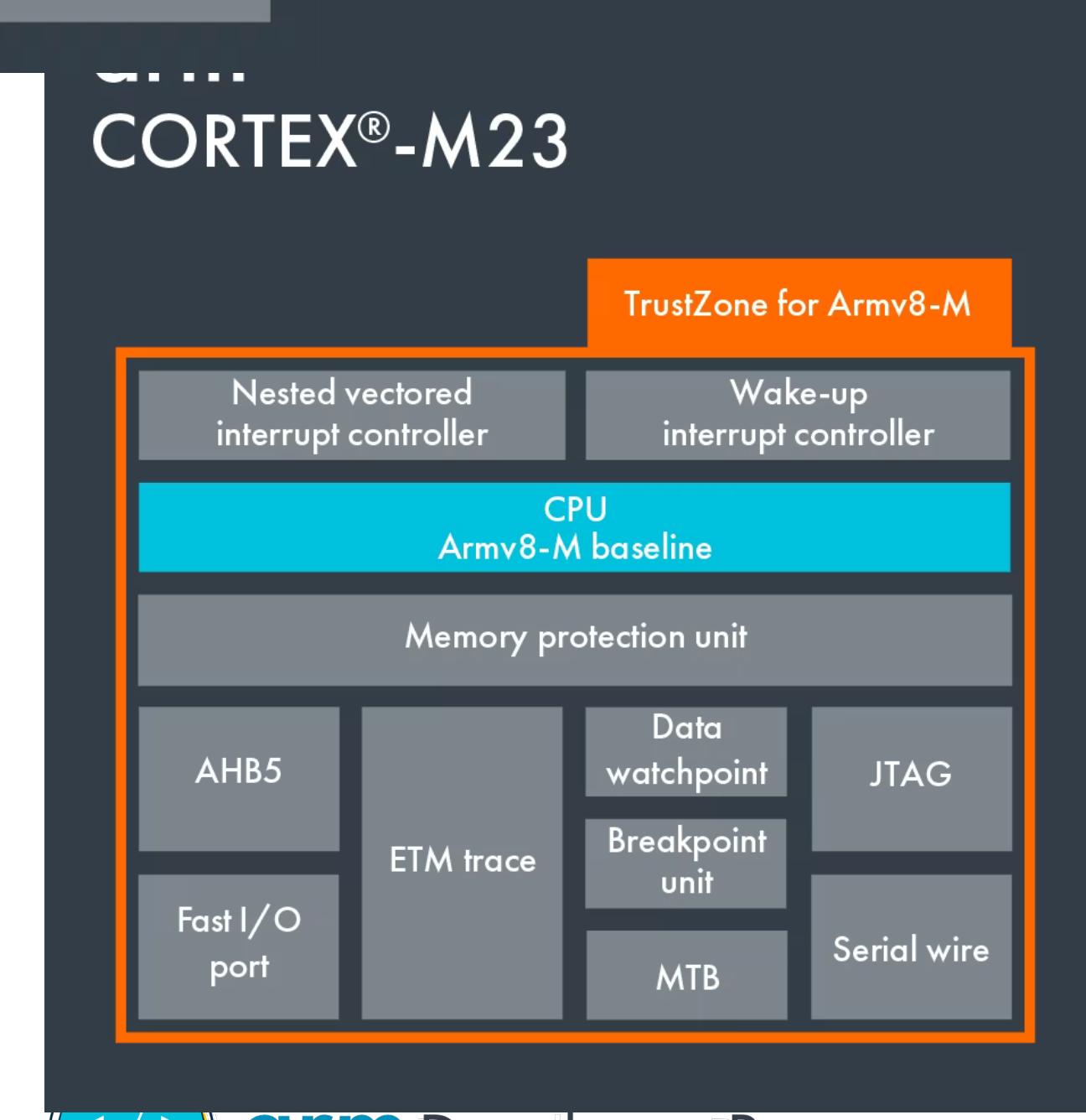
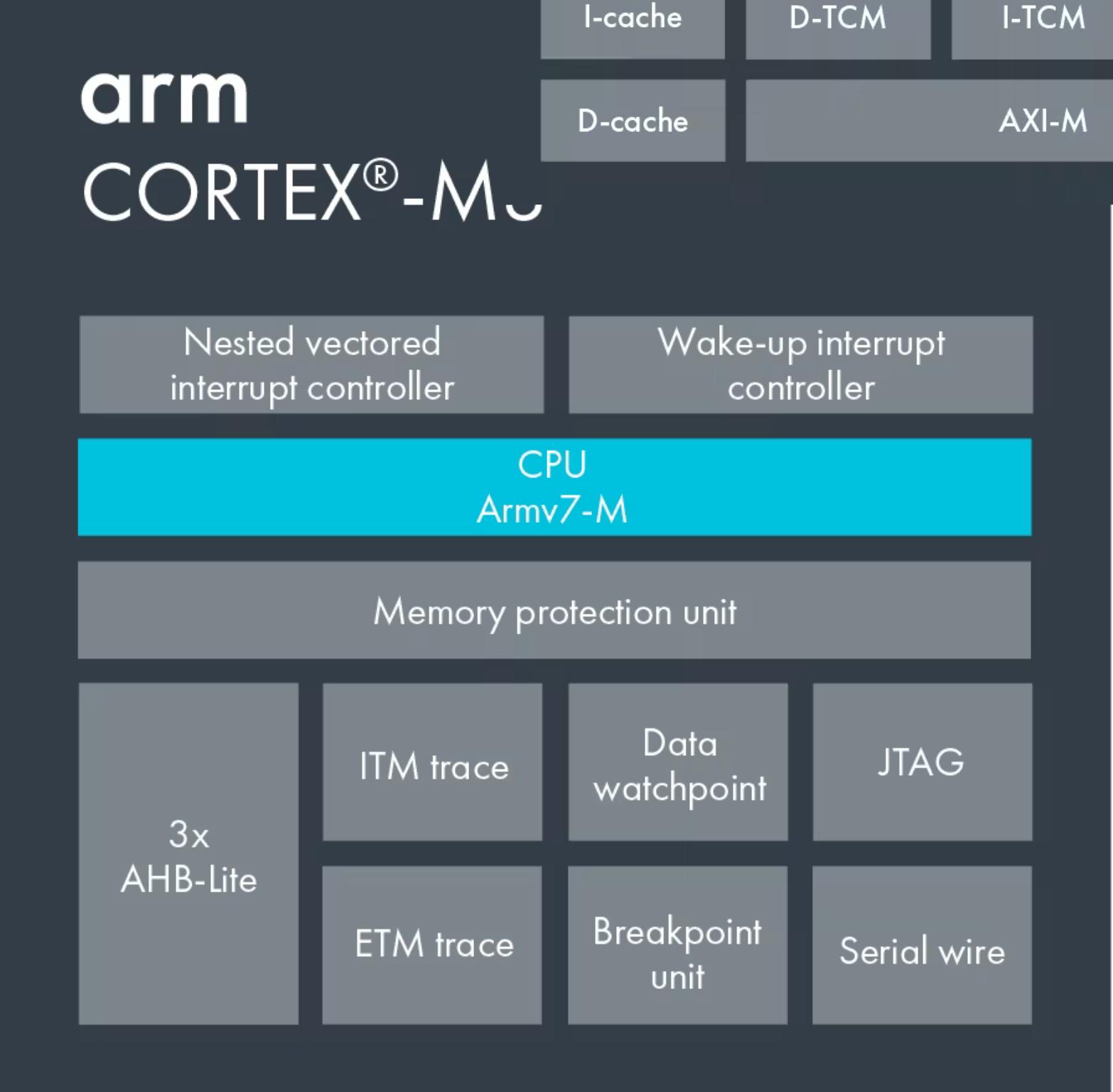
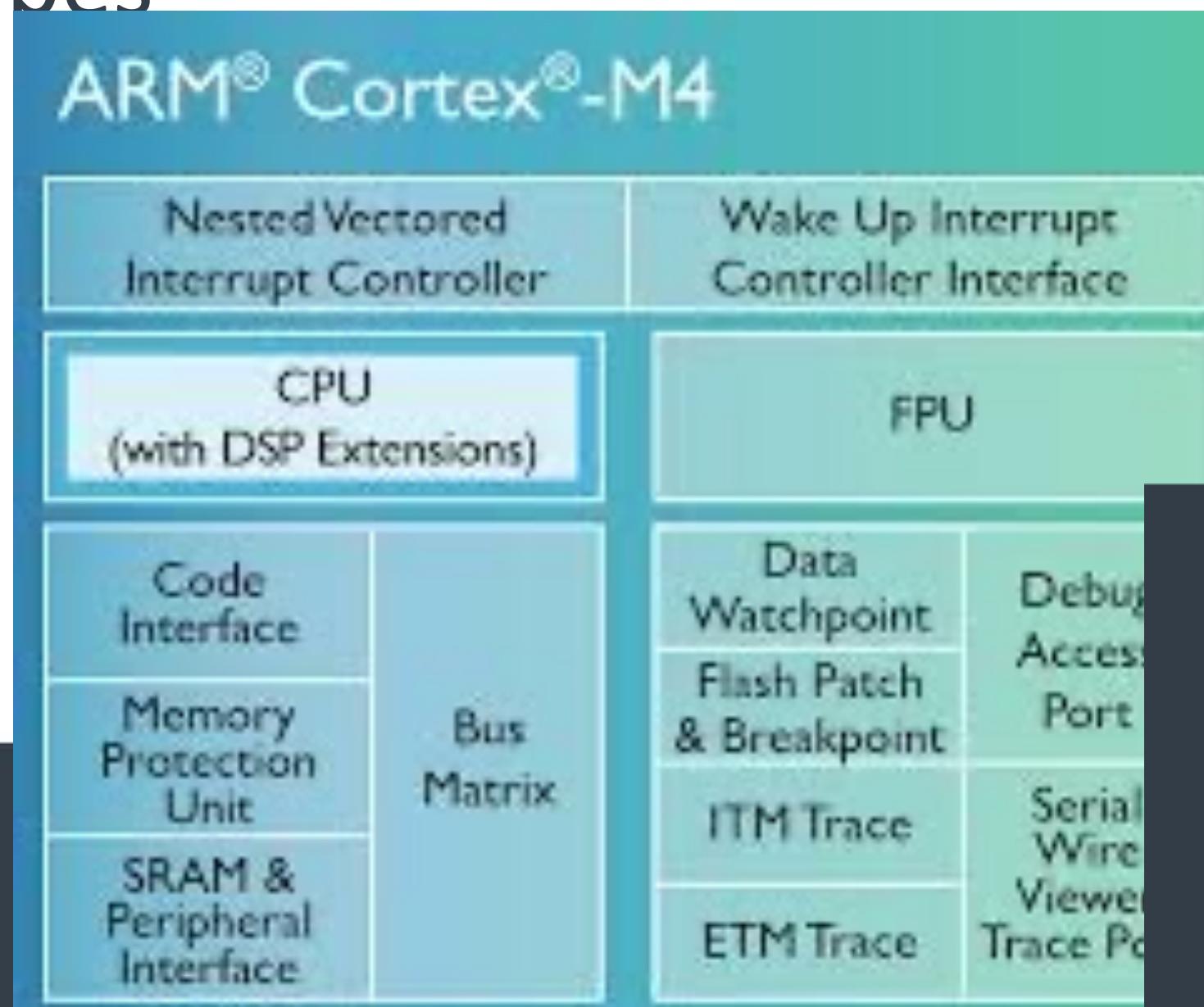
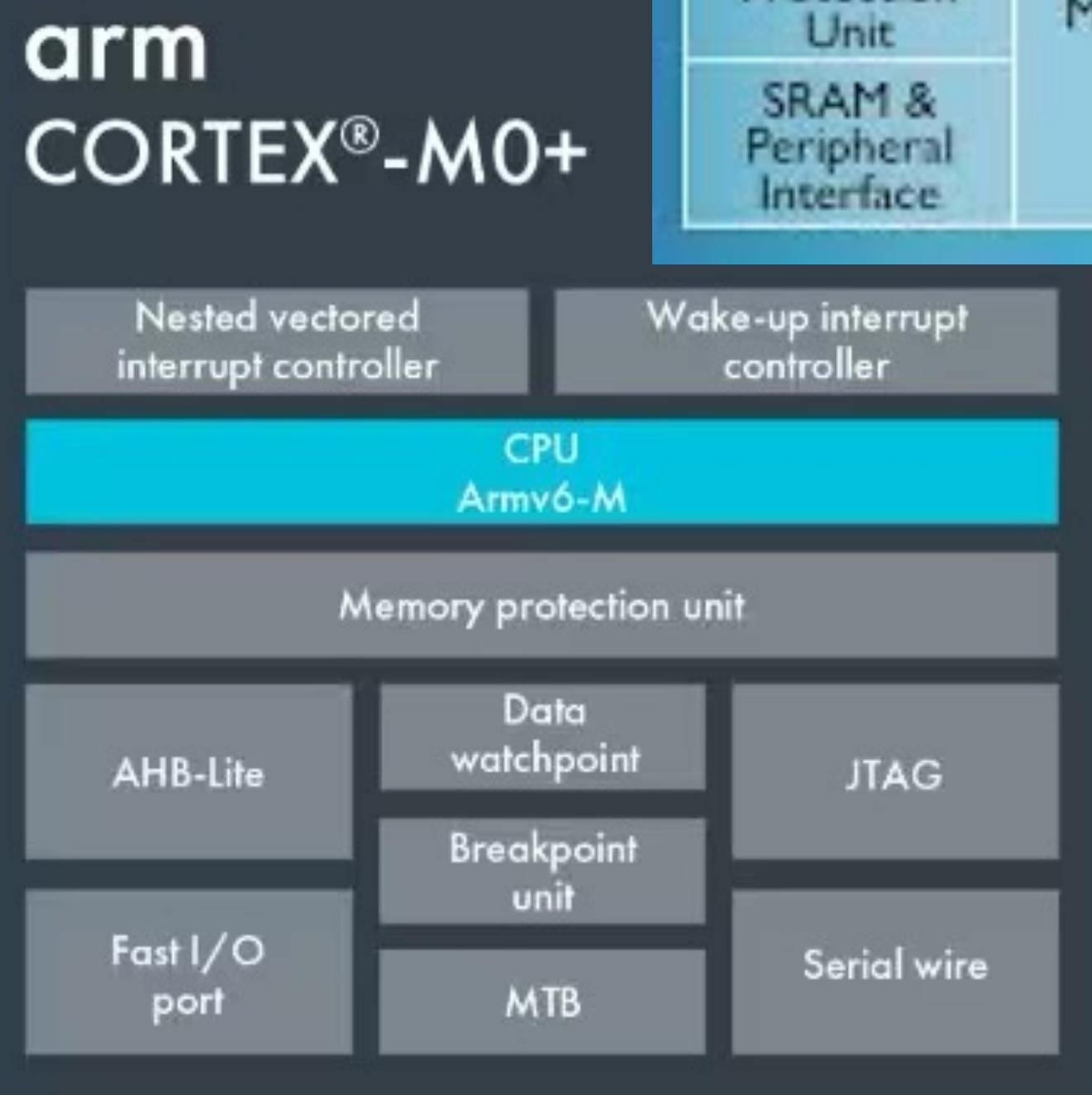
Optimised for
discrete processing and
microcontrollers



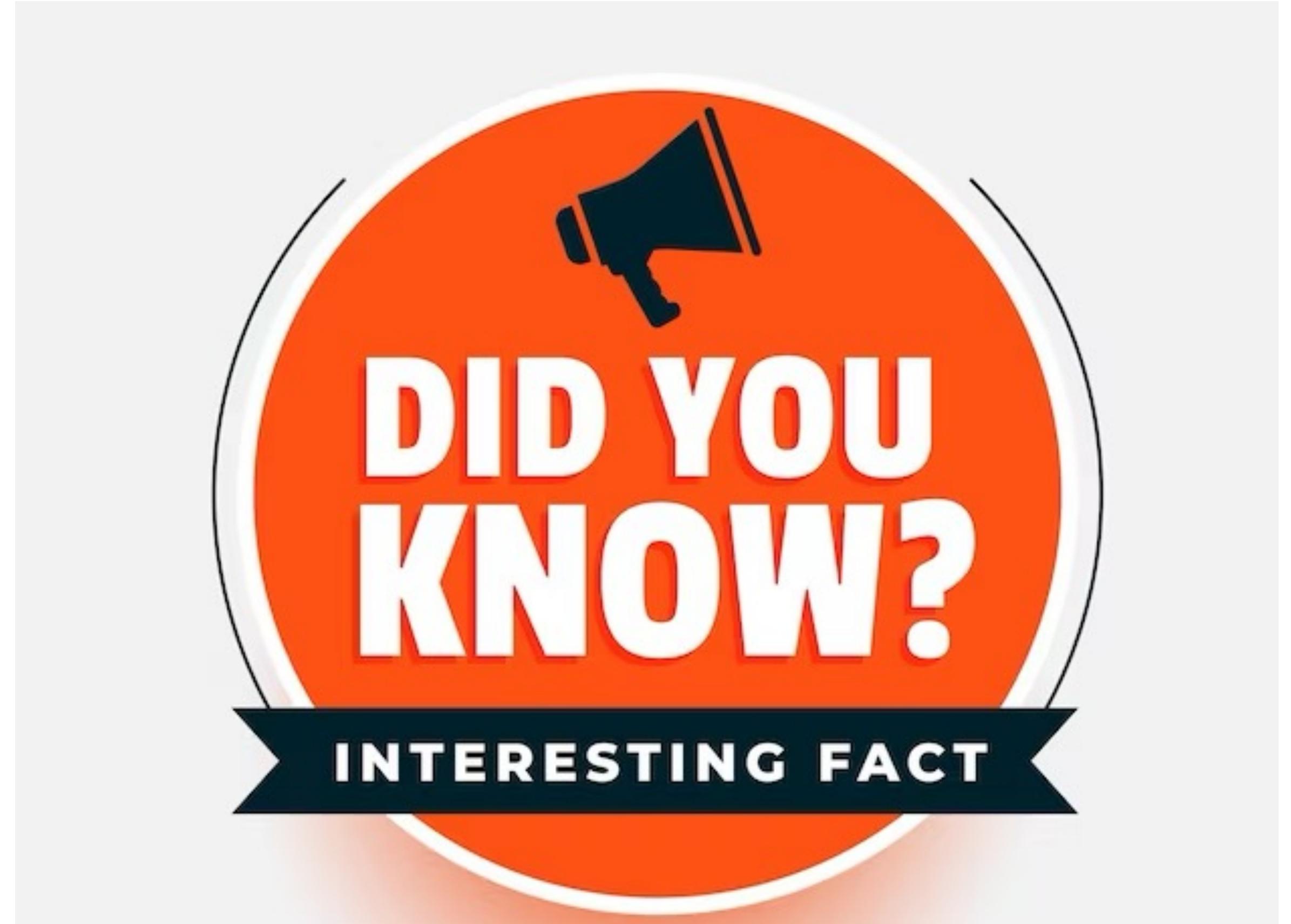
Source: <https://gsasindia.com/blog/cortex-a-cortex-r-and-cortex-m/>

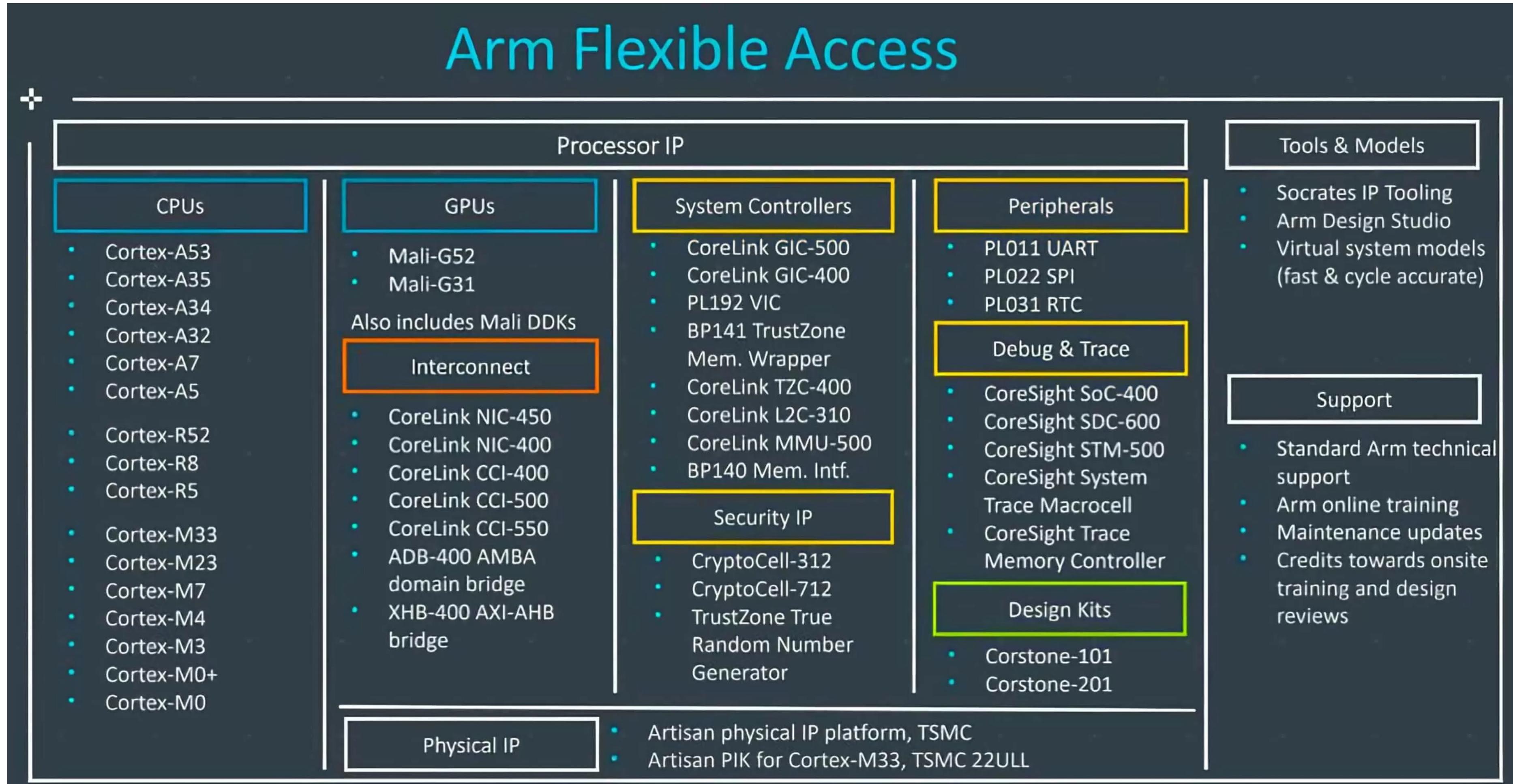
ARM Cortex M

Popular types

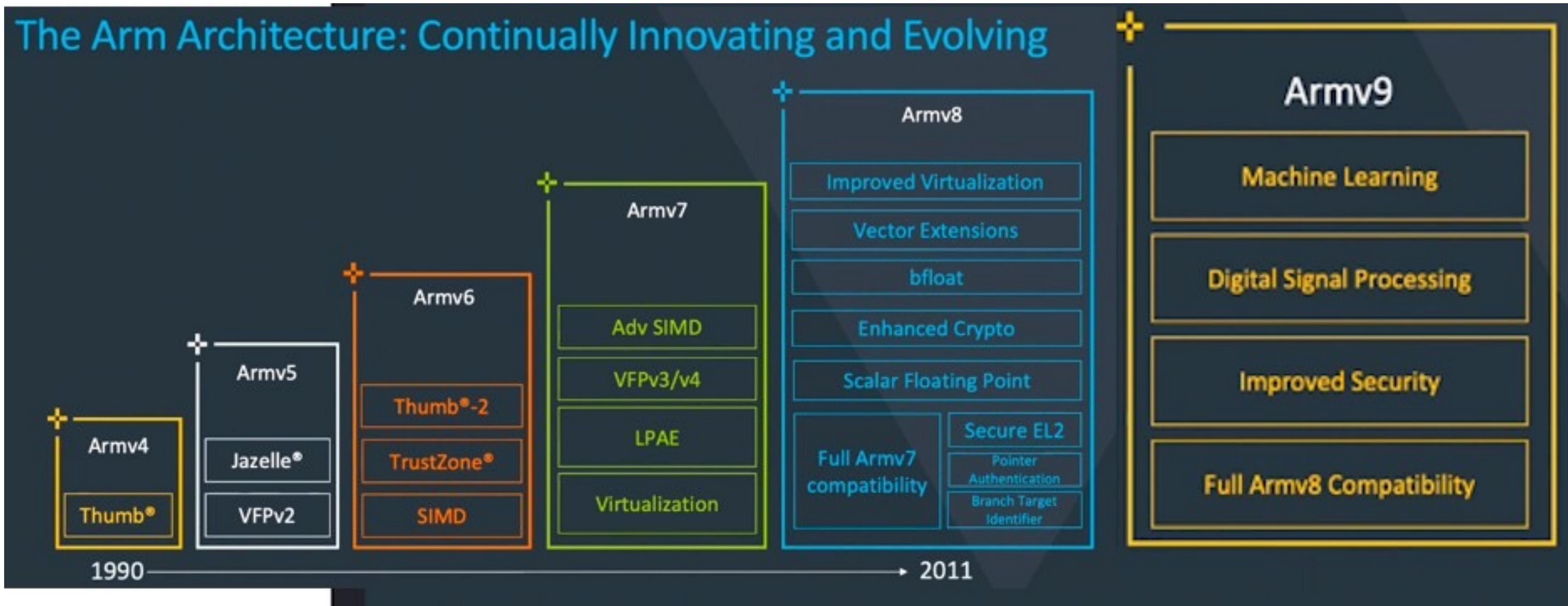


- + ARM doesn't make Chips, it licenses IPs , vendors make the Chips





ARM Architecture

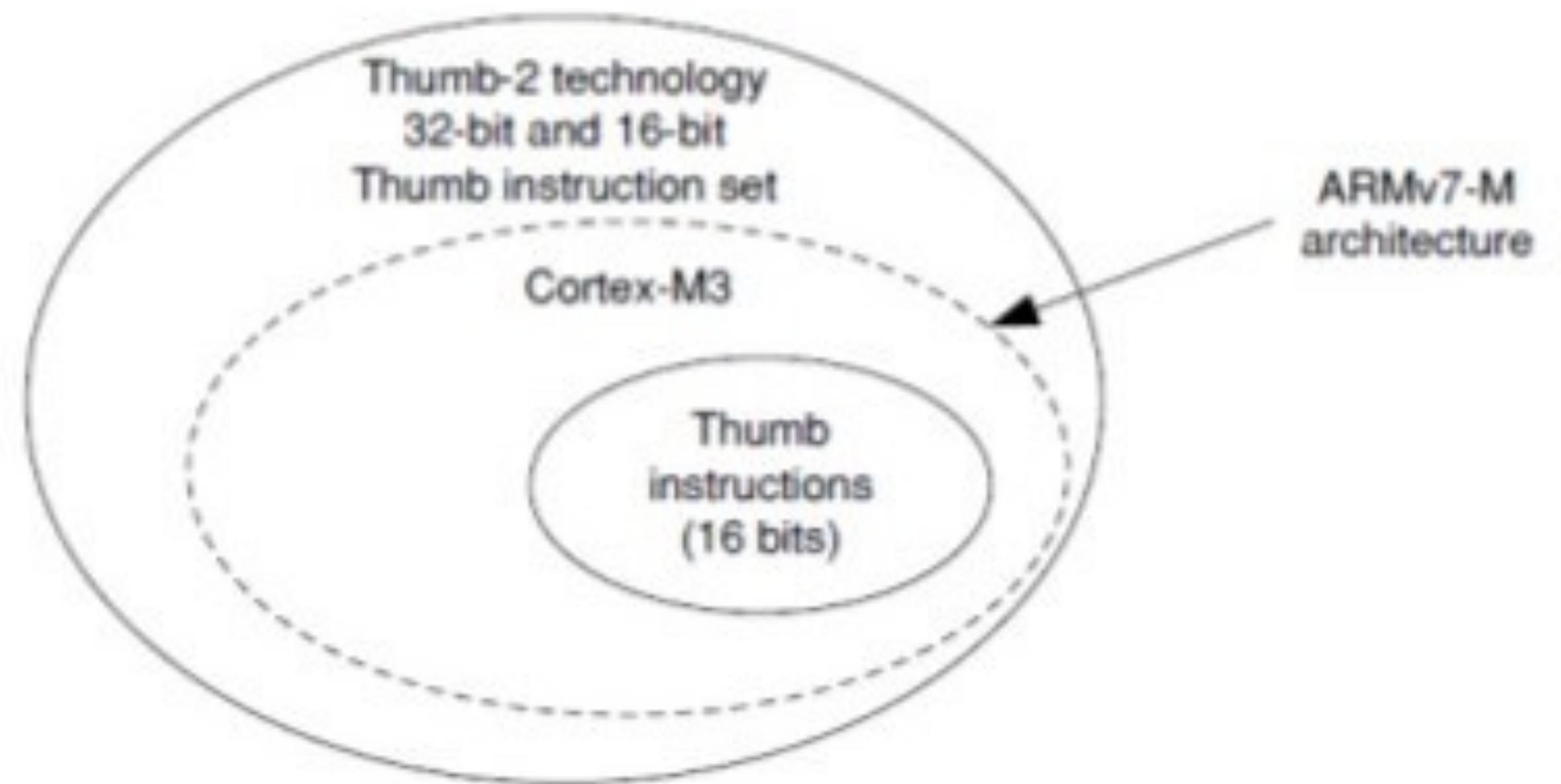


Source: <https://www.nextplatform.com/2021/03/30/arms-v9-architecture-explains-why-nvidia-needs-to-buy-it/>

ARM Architecture

Key Concepts

- + Difference between Architecture and Micro- Architecture?
- + Thumb and Thumb-2 instruction set
- + AMBA concept
- + Pipelining concept



ARM Cortex M

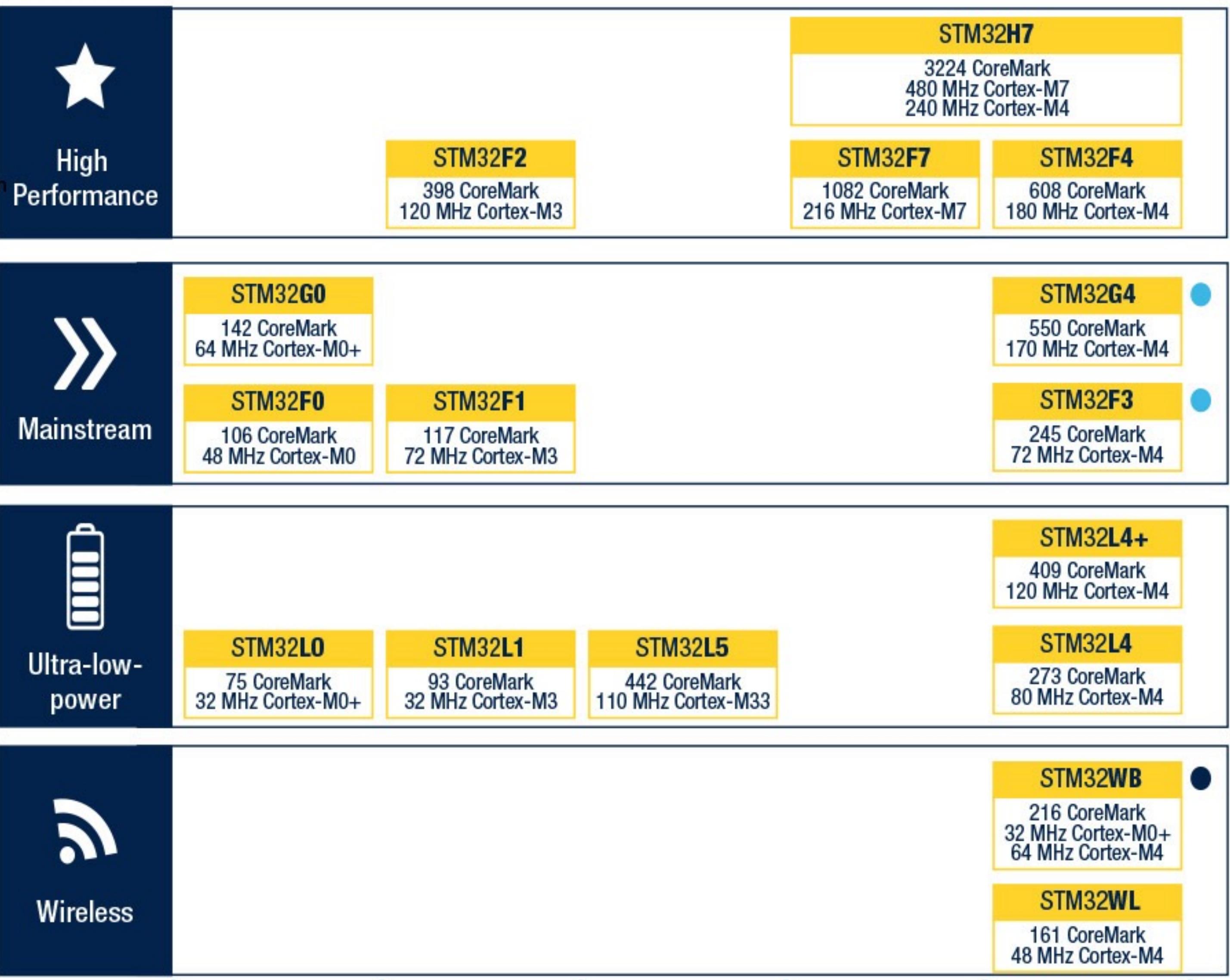


STM32 MCUs 32-bit Arm® Cortex®-M



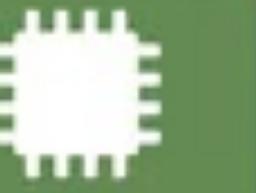
STM32 Solutions

Popular
Vendor:
STM32



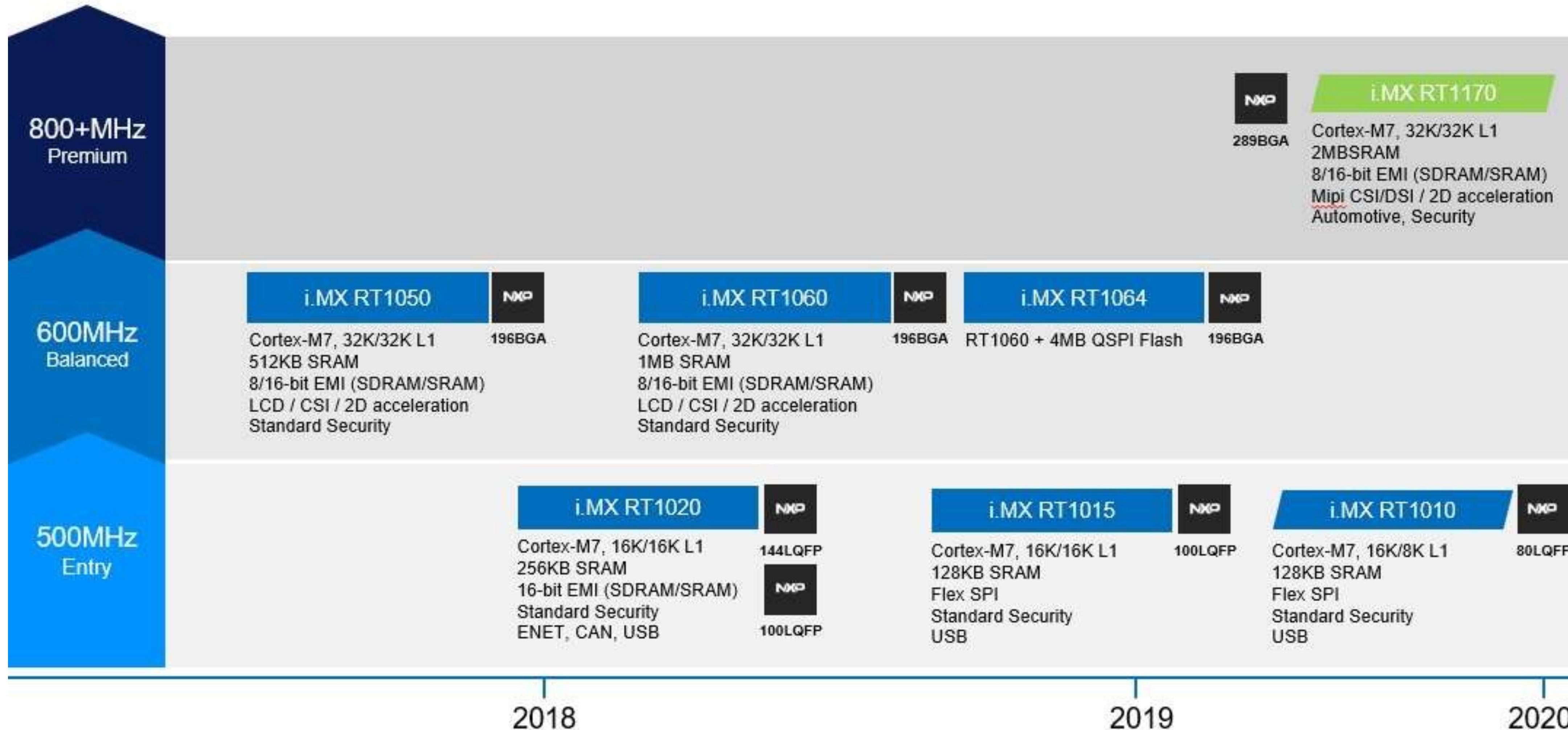
ARM Cortex M

Popular
Vendor:
Microchip

									
SAM V7x Arm® Cortex®-M7, 300 MHz	512–2048 KB/ 256–384 KB	●							
SAM E7x Arm Cortex-M7, 300 MHz	512–2048 KB/ 256–384 KB		●			●	●	●	●
SAM S7x Arm Cortex-M7, 300 MHz	512–2048 KB/ 256–384 KB		●	●		●	●	●	●
SAM E5x Arm Cortex-M4F, 120 MHz	256–1024 KB/ 128–256 KB	●	●	●	●	●	●	●	●
SAM D5x Arm Cortex-M4F, 120 MHz	256–1024 KB/ 128–256 KB	●	●	●	●	●	●	●	●
SAM G Arm Cortex-M4F, 120 MHz	256–512 KB/ 64–176 KB								●
SAM 4 Arm Cortex-M4F, 48–120 MHz	128–2048 KB/ 32–160 KB		SAM 4E/4S	●					SAM 4L ●
SAM D Arm Cortex-M0+, 48 MHz	8–256 KB/ 2–32 KB	●	●	●	●	●	●	●	●
SAM C Arm Cortex-M0+, 48 MHz	32–256 KB/ 4–32 KB	●	●	●	●	●	●	●	●
SAM L21/L22 Arm Cortex-M0+, 32–48 MHz	32–256 KB/ 4–40 KB			●				●	●
SAM L10/L11 Arm Cortex M-23, 32 MHz	16–64 KB/ 4–16 KB	●					●	●	●

ARM Cortex M

Popular Vendor:
NXP



List of Workshop topics

Week	Topic	Duration
1	Introduction to ARM architecture (Cortex A, M and R) Hello world on STM32 (bare metal and with libraries)	2 hrs
2	ADC Timers I2S DAC	2hrs
3	Communication protocols on ARM (USART,I2C, CAN,SPI) Interfacing advanced sensors	2hrs
4	LCD/Display interfacing	2hrs
5	Signal Processing on ARM (Basic DSP algorithms with CMSIS library)	2hrs
6	TinyML (Deploying ML algorithm on STM board) introduction to RTOS Introduction to embedded linux	2hrs
7	Putting it all together (project design and presentation)	2hrs
8	Putting it all together (project design and presentation)	2hrs

ARM Cortex M

HANDS ON SESSION USING STM32CUBE IDE or
KEIL
^D
BLINK AN LED WITH NUCLEO BOARD

List of hardware needed

The recommended hardware and software for the workshop series

- + Any STM32 based board (Nucleo boards/discovery board encouraged)
- + HC05 Bluetooth module
- + LCD/TFT display
- + Temperature and humidity sensor
- + Accelerometer
- + Jumper wires and breadboard
- + **FYI: Arduino devkit has all these except the board**
- + STM32Cube IDE (free to download)
- + Keil studio (also free. You do not need it if you have stm32Cube IDE)
- + TouchGFX – for GUI development on STM32 (free)



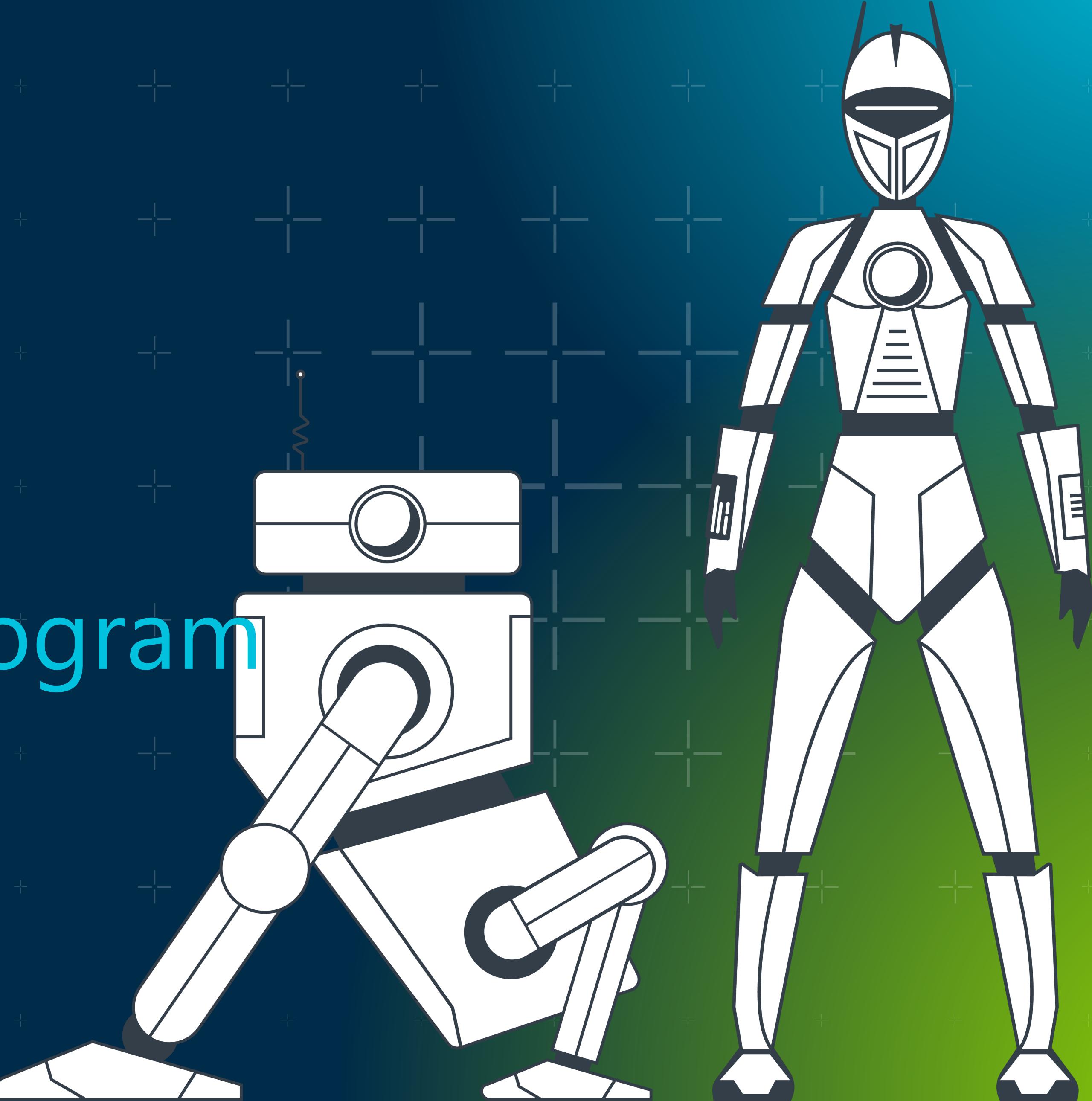
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Join the community

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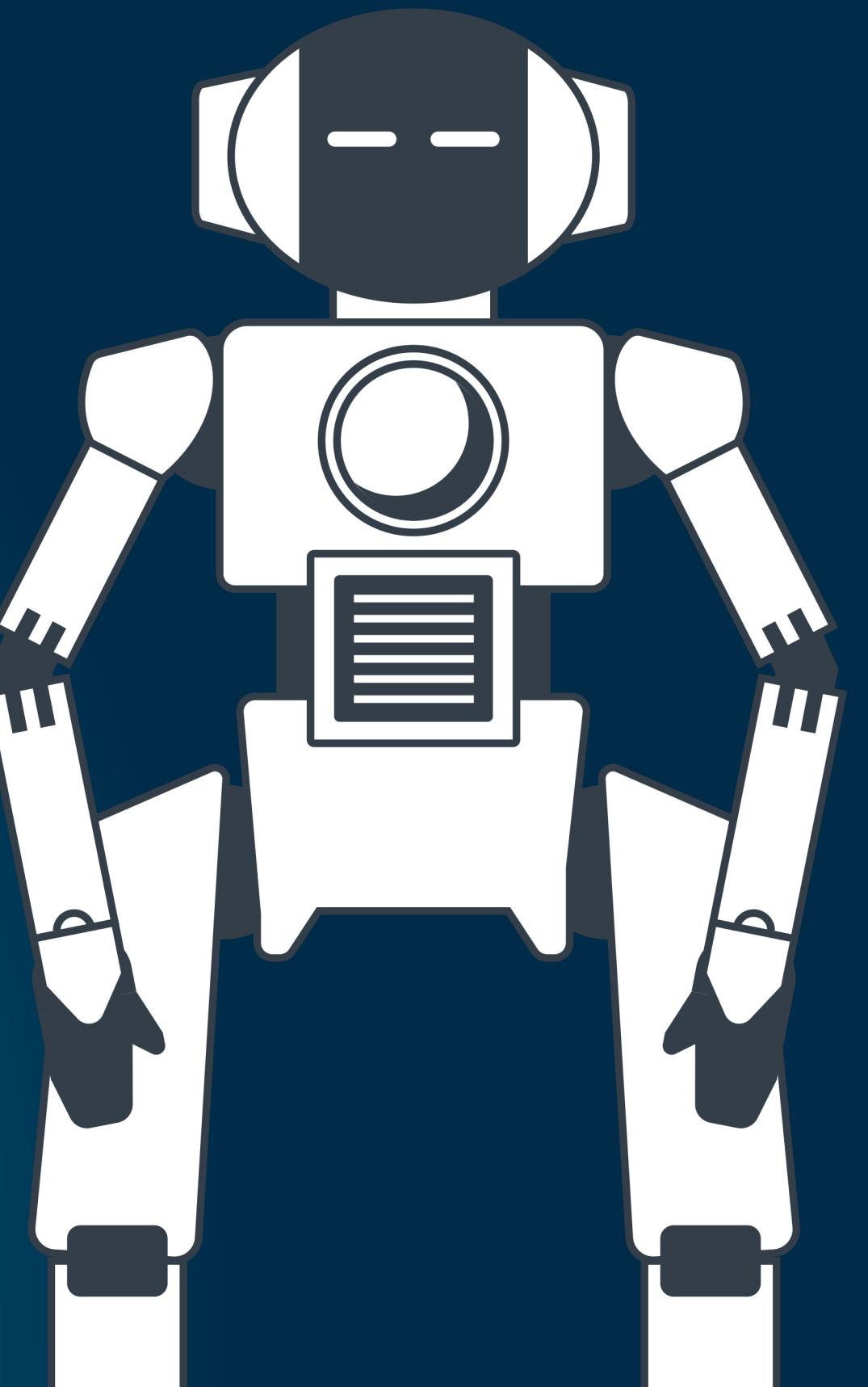
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Thank You

Danke

Gracias

Grazie

謝謝

ありがとう

Asante

Merci

감사합니다

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Kiitos

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