

IoT
Online
Conference

arm

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Introduction to an Open Approach for Low-Power IoT Development

Reinhard Keil

Agenda

- (A)IoT Mission – Any Developer, Any Device, Any OS, Any Cloud
- Arm Cortex-M microcontrollers – Overview
- Developer choices with today's Arm tooling and software
 - A(IoT) example with Keil MDK and CMSIS
 - Secure IP connectivity and cloud connectivity to multiple providers
 - Scalable software components delivered with CMSIS-Pack
 - Optimize and customize for production
- Demo of MCU cloud application that uses Trusted Firmware-M
- Looking forward – Arm's focus on (A)IoT developer success
 - Unpacking the Arm developer experience
 - (A)IoT on Cortex-M developer roadmap
 - Preview of Arm's new web portal and cloud-based development tools

Mission: Make Low-Power (A)IoT easy on Arm Cortex-M

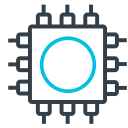
Provide a development tool platform for building and deploying (A)IoT devices

Offer resources and software blocks that scale to mass production



Any Developer

Students, Makers
and Professionals.



Any Device

Support a wide range of MCUs
and development boards.



Any OS

The popular RTOSs and IoT
stacks are all supported.



Any Cloud

Software and workflows to
connect a device to any cloud.

Better together

Strengthen Arm's ecosystem.

We build this on the strong foundation of CMSIS, Mbed and Keil MDK together with partnerships

Development Activity Overview – (A)IoT on MCUs

OUR PRIMARY FOCUS – “EMBEDDED/IOT SOFTWARE DEVELOPMENT”



ELECTRONIC
ENGINEERING AND
SOC DESIGN

System and processor design
and development



FIRMWARE AND
EMBEDDED
DEVELOPMENT

Firmware, low-level driver,
bare metal code and
middleware development



IOT AND EMBEDDED
APPLICATION
DEVELOPMENT

Writing software on top of
an existing stack, in most
cases using an RTOS



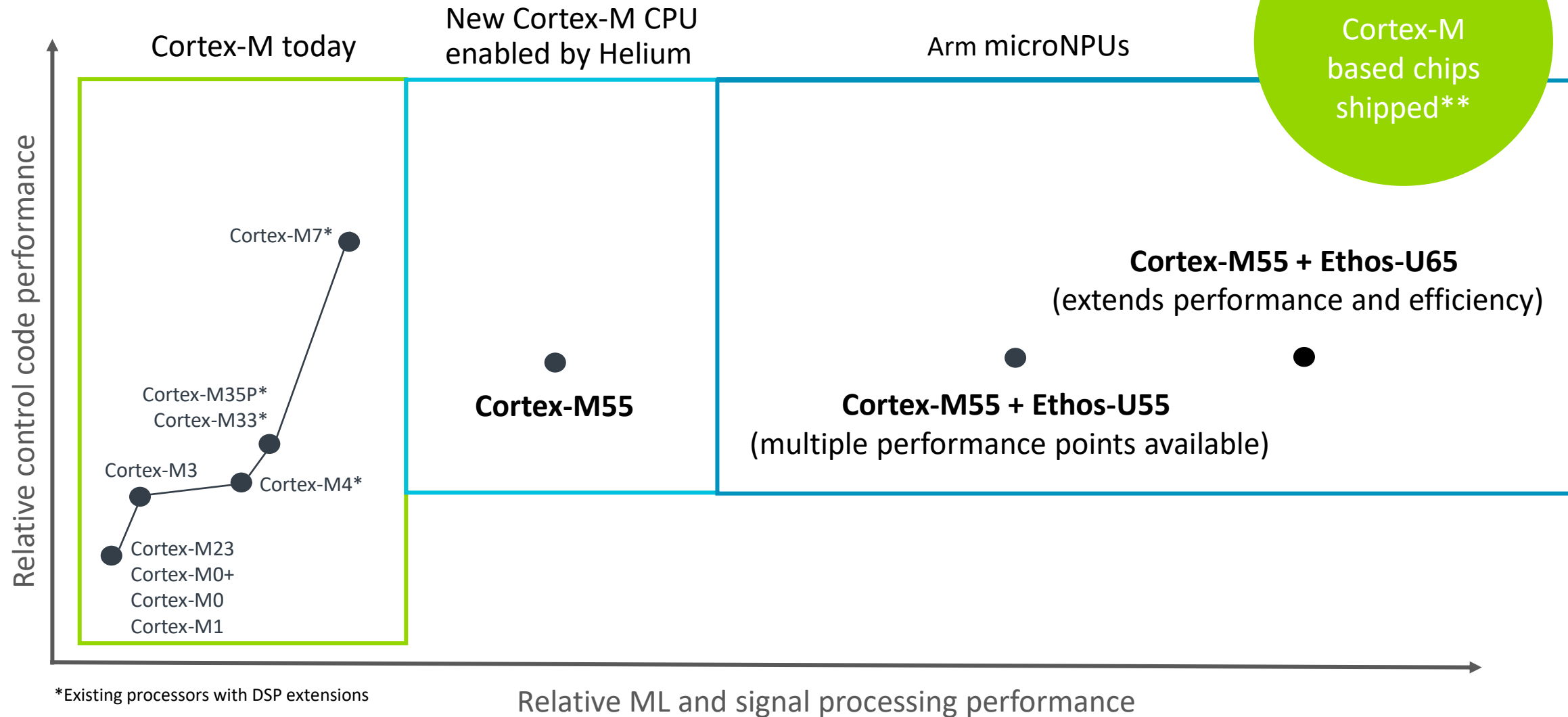
ML/AI DEVELOPMENT

Focused specifically on
model optimization and
deployment

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Develop IoT Endpoints with Cortex-M Microcontrollers

Arm Cortex-M Processor Portfolio



IoT endpoint devices are different –
how can we deploy
IoT software stacks efficiently at scale?

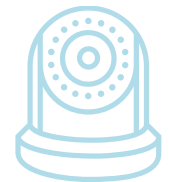


1 Trillion devices by 2035 =

~10 years

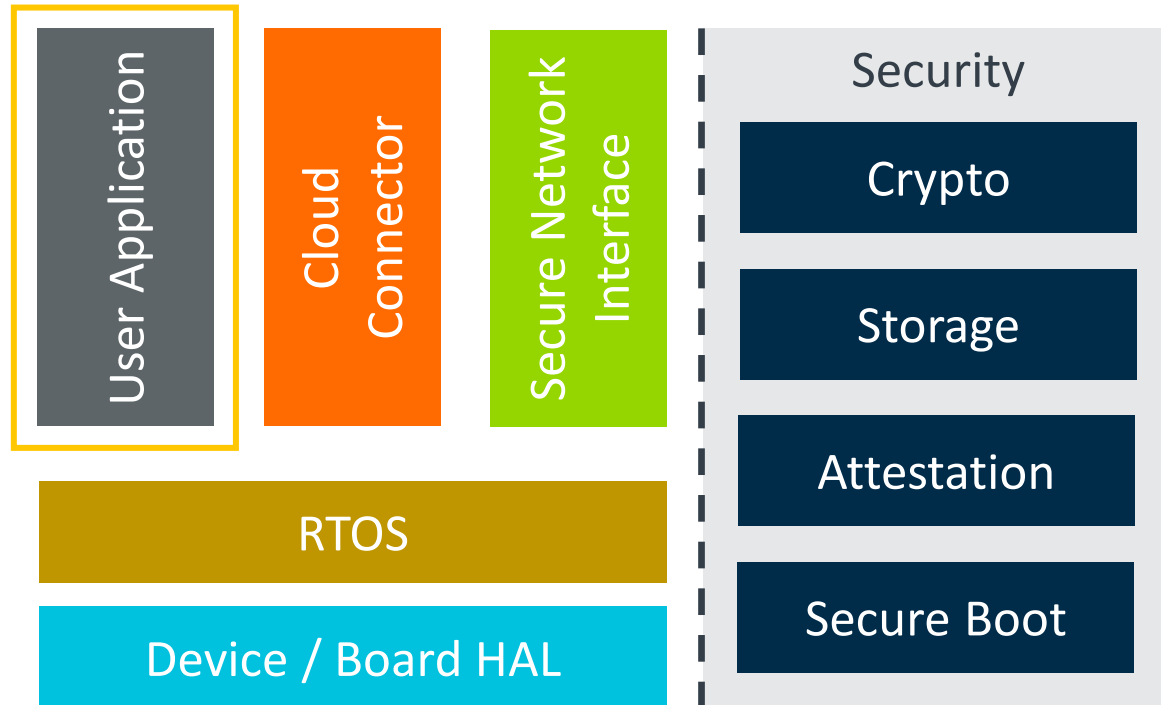
10 million units/year

10.000 bespoke designs



A Component Approach for IoT on Cortex-M

Simplified view to the software building blocks for IoT endpoints



- **Device / Board HAL:** abstraction of processor and peripherals with hardware specific configuration
- **RTOS:** thread and resource management
- **Secure Network Interface:** encrypted internet connection using different interfaces (Ethernet, WiFi, ...)
- **Cloud Connector:** protocol interface to cloud provider
- **User Application:** bespoke functionality of endpoints

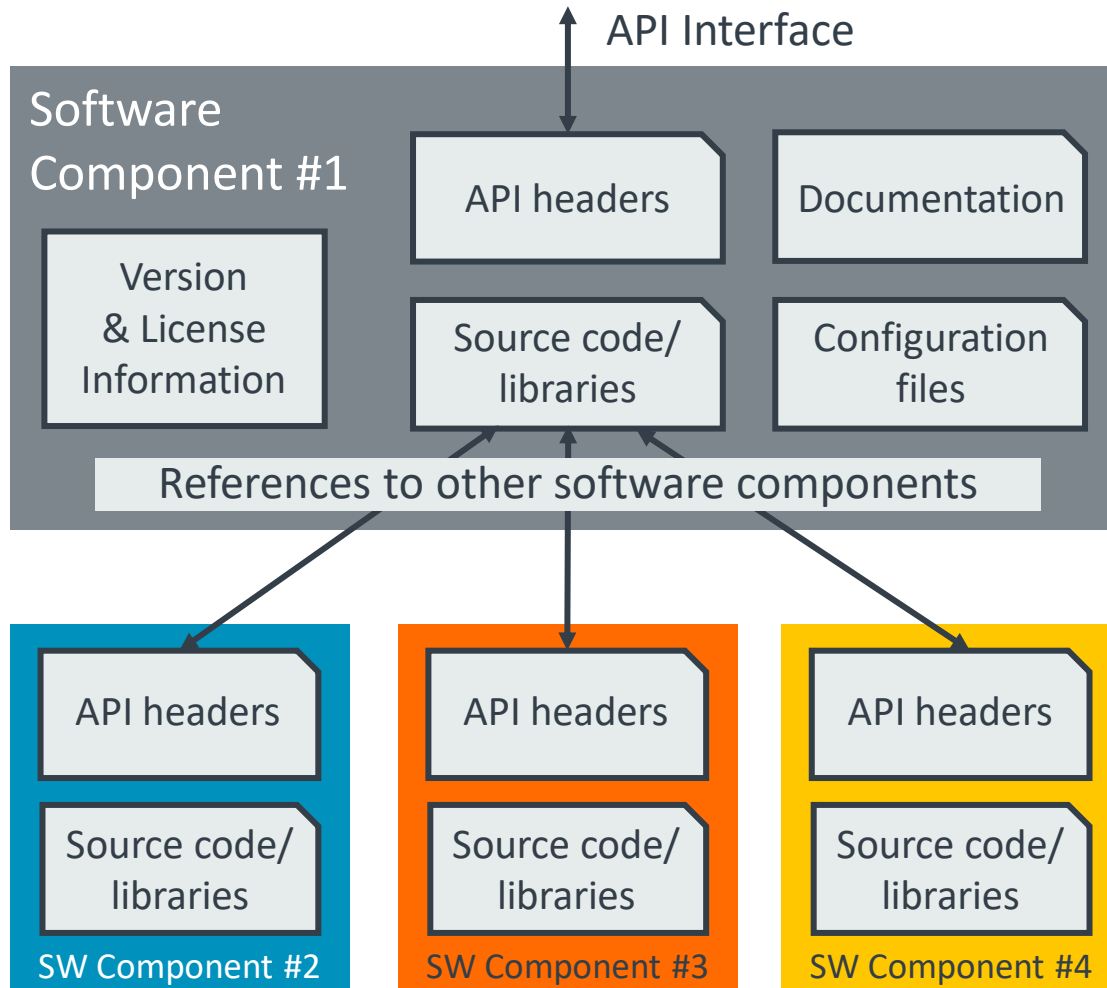
Security running on Secure Processing Environment:

- Crypto services and device identity

Combining various software building blocks effectively is enabled by the CMSIS-Pack system.

CMSIS-Pack: What is a Software Component?

XML framed information used by project management utilities from various tools



Software components should have:

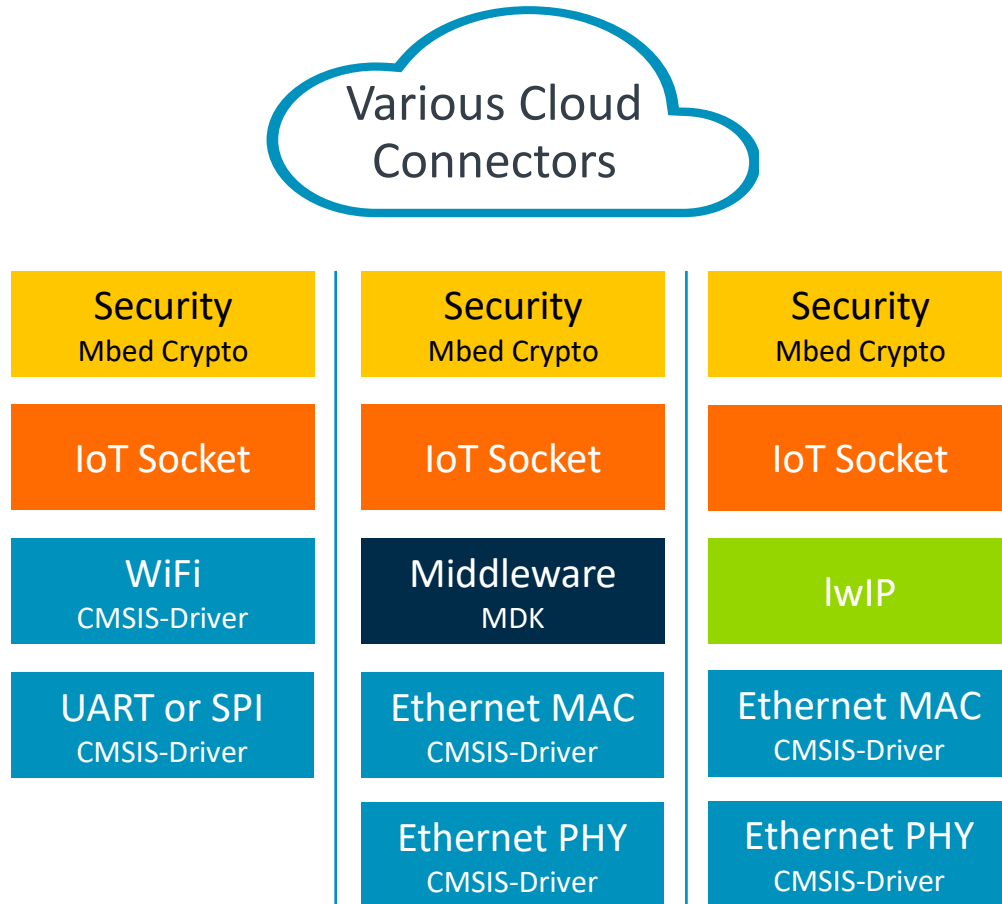
- Version and history information
- License information
- API interface definition
- Documentation
- Source files
- Configuration files (optional)
- Requirements to other components (optional)

CMSIS-Pack framed software is supported by:

- Mainstream IDEs: Arm DS, Keil MDK, IAR EWARM
- Silicon vendor tools: ADI, OnSemi, STCubeMX
- Several web portals
- Open-source and command-line build tools

Secure Network Interface – Implementation Choices

IoT devices need flexibility for implementing connectivity on Cortex-M



3 different ways to implement secure network connectivity

Available Cloud Connectors:

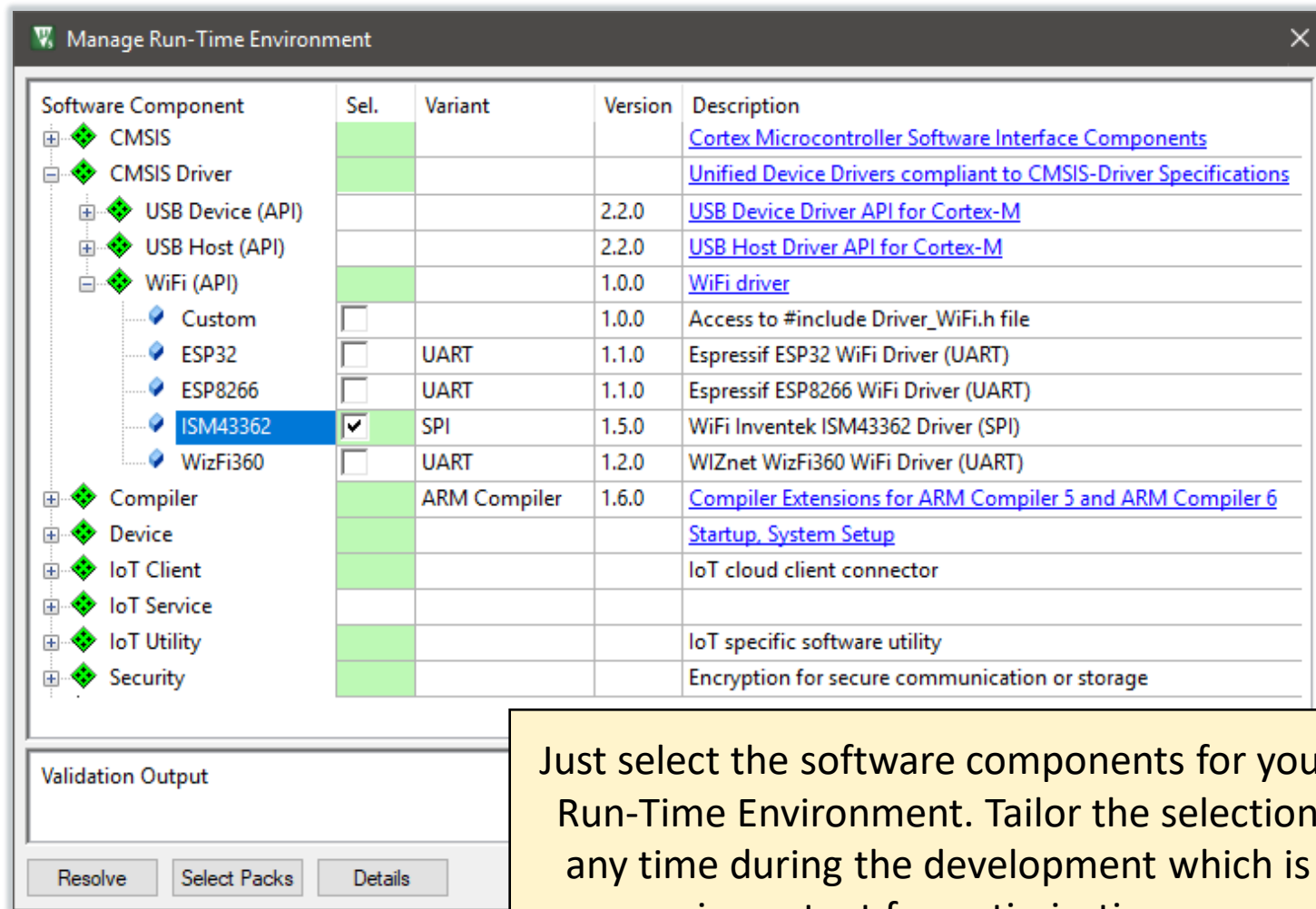


Mbed Crypto implements security

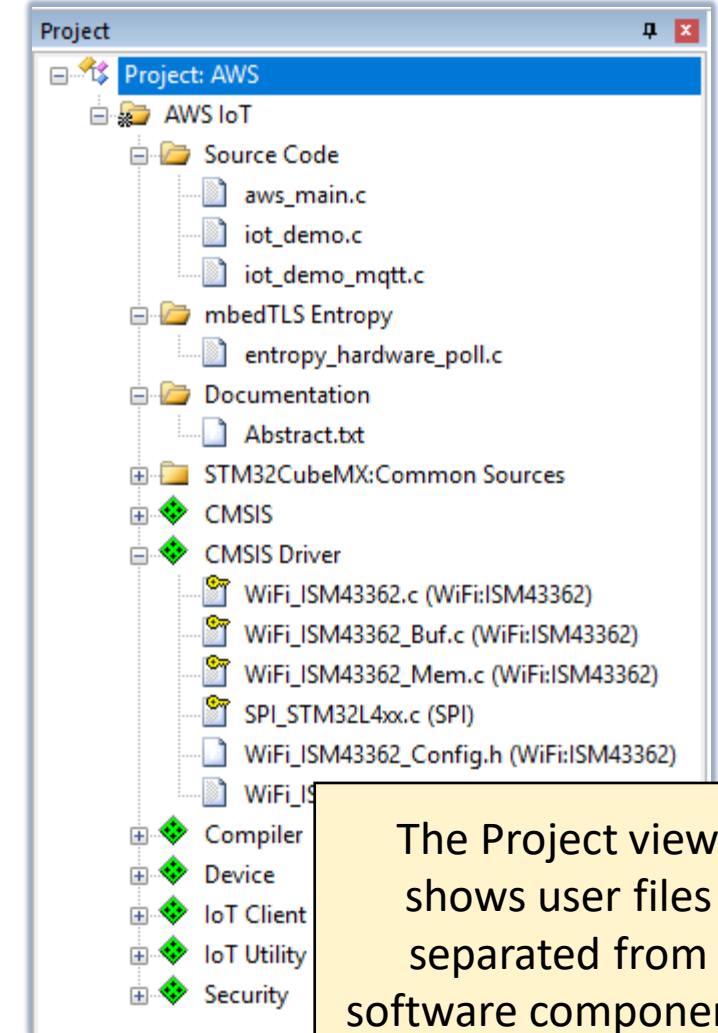
IoT Socket connects to networks with:

- CMSIS-Driver for WiFi implemented with various chipsets
- MDK-Middleware IP networking stack (wired or WiFi)
- LwIP open-source IP communication with wired Ethernet

Choose and Configure Software Components in an IDE

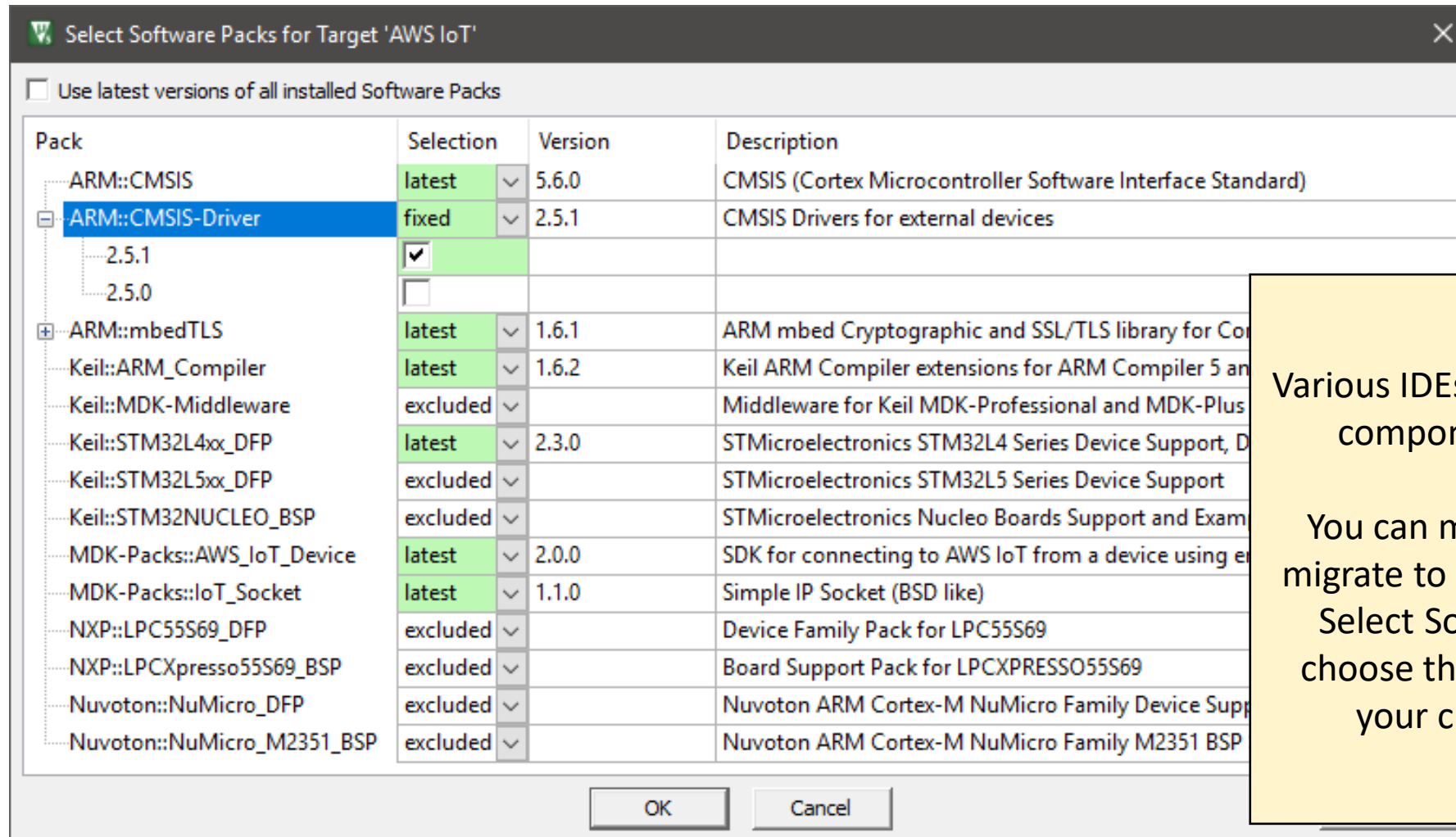


Just select the software components for your Run-Time Environment. Tailor the selection any time during the development which is important for optimization.



Product Life Cycle Management

Manage XML framed information used by project management utilities from various tools

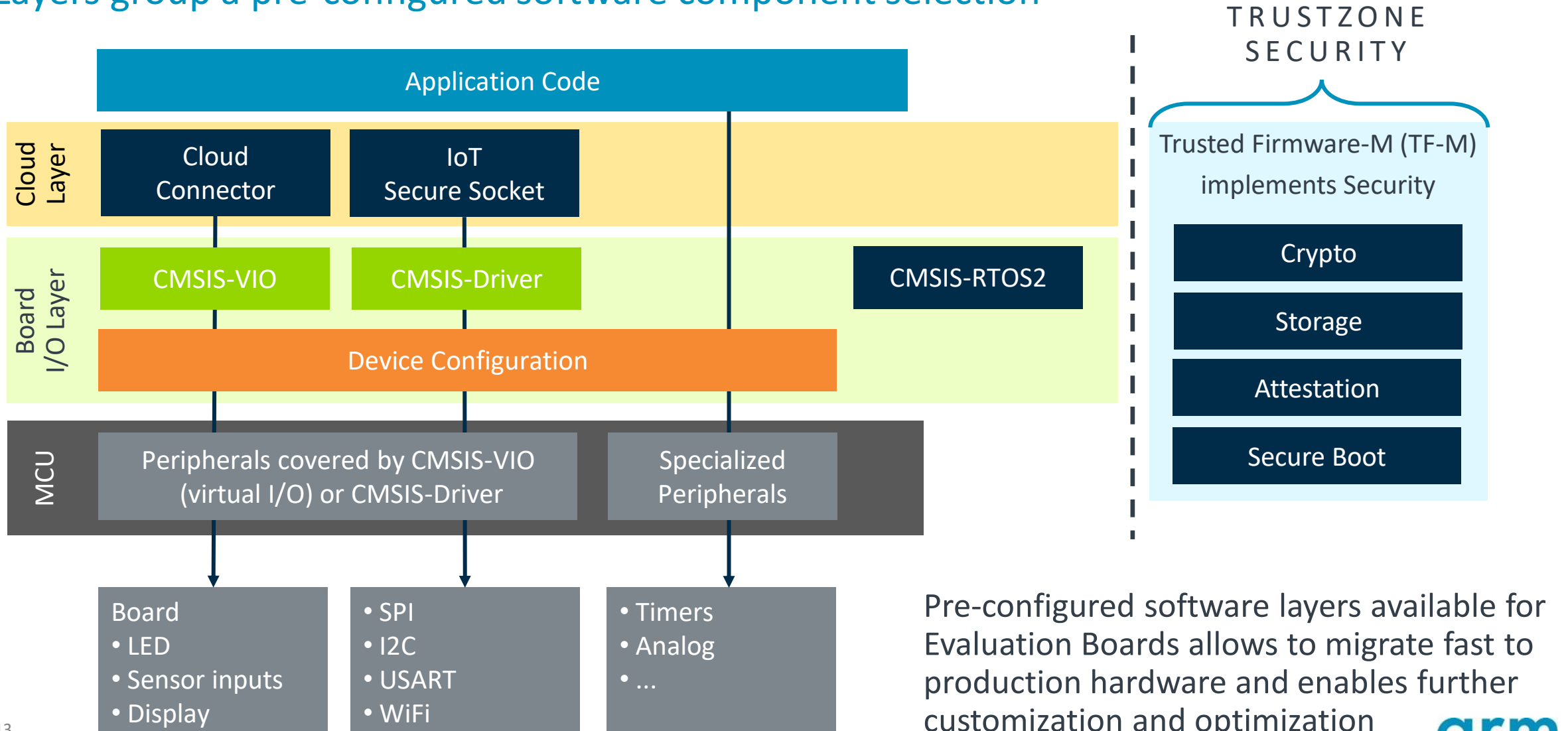


Various IDEs let you update the software components of your application.

You can manage the software packs, migrate to new software releases. With Select Software Packs you pick and choose the releases that are used for your current software project.

IoT for Cortex-M – Move to Custom Hardware

Layers group a pre-configured software component selection



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[Home](#) / [MDK](#) / Learning platform for Cortex-M microcontroller users


Learning platform for Cortex-M microcontroller users

This is a collection of resources that help you to create application software for Arm® Cortex®-M microcontrollers. It covers various topics from getting started to debugging your application and contains links to videos, example projects, application notes, and documentation.


- **Fundamentals:** Cortex-M Processor Collaterals
- **CMSIS:** Cortex Microcontroller Software Interface Standard
- **Updated!** **Start Programming:** Create an Application from Scratch
- **Debugging:** How to use Cortex-M Debug and Trace Features
- **Updated!** **IoT:** Software Components for the Cloud
- **Security** on Arm-based devices
- **Armv8-M:** Arm Cortex-M55/M33/M23
- **Middleware:** Manuals and Examples with Networking, File I/O, USB, and
- **Infineon XMC Devices:** Development Tools and Application Notes
- **Microchip SAM Devices:** Development Tools and Application Notes
- **NXP Kinetis and LPC Devices:** Application Notes
- **STMicroelectronics STM32 Devices:** Tools and application Notes
- **Texas Instruments Devices:** Application Notes




Online courses help engineers, students, and hobbyists to learn about state of the art technologies from Arm.




Application notes provide information about development tools and help to solve complex problems.




The **knowledge base** contains articles created by members of our support team, answering frequently asked questions.




Post questions and comments in the Arm Community's **Keil forum**. All articles are visible for everyone to read and respond.



A range of **books** is available covering Arm technology topics, related software and hardware, and embedded development.



The **Arm University Program** provides a variety of resources for educators, students, and researchers.



Join the **Arm Community** to keep you informed, learn, ask, and answer questions.

developer.arm.com

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Embedded


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[Keil MDK](#) [RTOS Partners](#) [Debug Probes](#)

Embedded Software Development

Scalable and low-power technology for any embedded market.


Software development for embedded applications includes anything which uses a microcontroller or microprocessor to execute dedicated tasks on its own or within a larger system. Arm supports embedded software development at every stage of the project workflow.



Choosing a Processor

Learn which processor is best for delivering more features at lower cost, increasing connectivity, better code reuse and improved energy efficiency.


[Learn more](#)



Development Boards

Explore Arm's range of development boards to help accelerate development of your next SoC design.

[Learn more](#)



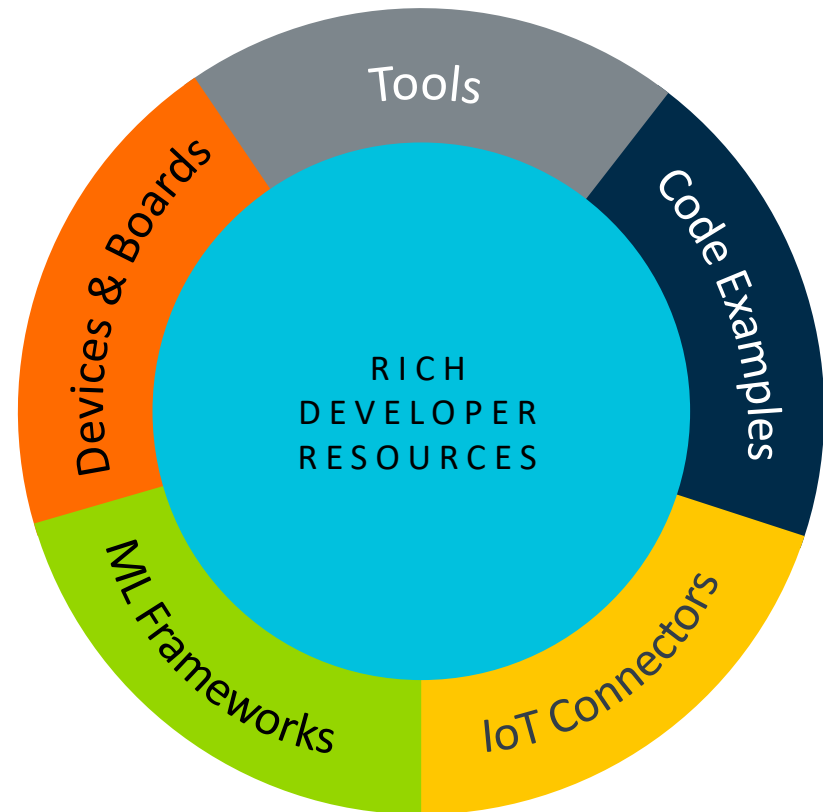
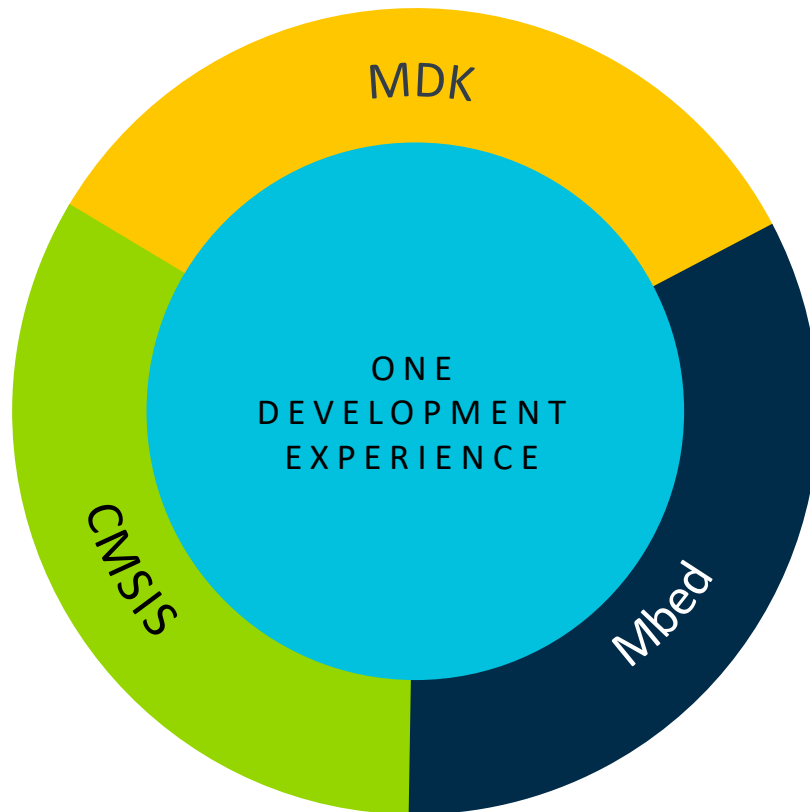
Software Development Tools

Arm offers a range of tools to help developers debug, analyze, and optimize their applications throughout the development cycle.

[Learn more](#)

Feedback

One Arm (A)IoT Development Experience – Developer Focus



Preview of Web portal


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Overview Hardware

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Boards > MIMXRT1064-EVK



MIMXRT1064-EVK

NXP

- i.MX RT1064 Crossover MCU
- Cortex-M7, 600MHz
- CAN and Ethernet connectivity

Mounted device **MIMXRT1064xxxxA**

The i.MX RT1064 EVK is a 4-layer through-hole USB-powered PCB. At its heart lies the i.MX RT1064 crossover MCU, featuring NXP's advanced implementation of the Arm Cortex-M7 core. This core operates at speeds up to 600 MHz to provide high CPU performance and excellent real-time response.

Develop with this board

+ Add to my boards

Download pack

Board features

+ Core Components

MIMXRT1064xxxxA

MCU features

MIMXRT1064xxxxA

+ Clock & Power

600MHz

+ Core

ARM Cortex-M7, 600MHz

Code

Blinky CMSIS

The Blinky project is a simple example that can be used to verify the basic tool setup.

Updated: 30 Jul 2020

Download

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Watson MQTT Demo CMSIS

This demo application connects to Watson IoT through MQTT and publishes messages.

Updated: 30 Jul 2020

Download

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Google MQTT Demo CMSIS

This demo application connects to Google Cloud IoT through MQTT and publishes messages

Updated: 31 Jul 2020

Download

Keil Studio

AWS MQTT Demo CMSIS

This demo application connects to AWS IoT through MQTT, subscribes to topics and publishes messages.

Download

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INFORMATION IS DERIVED FROM SOFTWARE PACKS


FIND REFERENCE DESIGNS
UNDERSTAND REQUIREMENTS & DEPENDENCIES

LOAD EXAMPLE IN KEIL STUDIO - CLOUD

DOWNLOAD REFERENCE CODE TO CLASSIC DESKTOP TOOLS

Development Phases

DISCOVER POSSIBILITIES



MIMXRT1064-EVK

NXP

- LMX RT1064 Crossover MCU
- Cortex-M7, 600MHz
- CAN and Ethernet connectivity

Mounted device **MIMXRT1064xxxxA**

Development Phases

The LMX RT1064 EVK is a 4-layer through-hole USB-powered PCB. At its heart lies the LMX RT1064 crossover MCU, featuring NXP's advanced implementation of the Arm Cortex-M7 core. This core operates at speeds up to 600 MHz to provide high CPU performance and excellent real-time response.

Code

Google MQTT Demo **CMSIS**

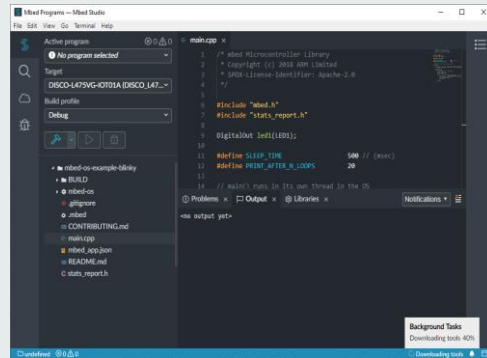
This demo application connects to Google Cloud IoT through MQTT and publishes messages

Updated: 31 Jul 2020

Enter parameters of your application

- Compare devices
- Evaluation boards
- Reference code examples

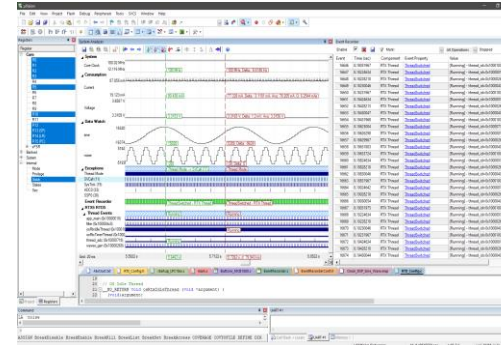
EXPLORE REFERENCE DESIGNS



Use online tools for evaluation

- Explore code
- Zero installation hassle
- Always up to date

DEVELOP APPLICATION



Download reference code and use classic tooling

- Develop and verify bespoke application functionality
- Extend software framework with additional functionality

DEPLOY TO BESPOKE DESIGN



Optimize application for mass production

- Retarget device pinout
- Verify system behavior
- Analyze power consumption

Endpoint AI for IOT



Find out more: arm.com/ai-endpoint

What next?



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Thank You

Danke

Merci

谢谢

ありがとう

Gracias

Kiitos

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