IoT
Online
Conference

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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

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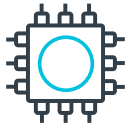
Mission: Make Low-Power (A)IoT easy on Arm Cortex-M

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

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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

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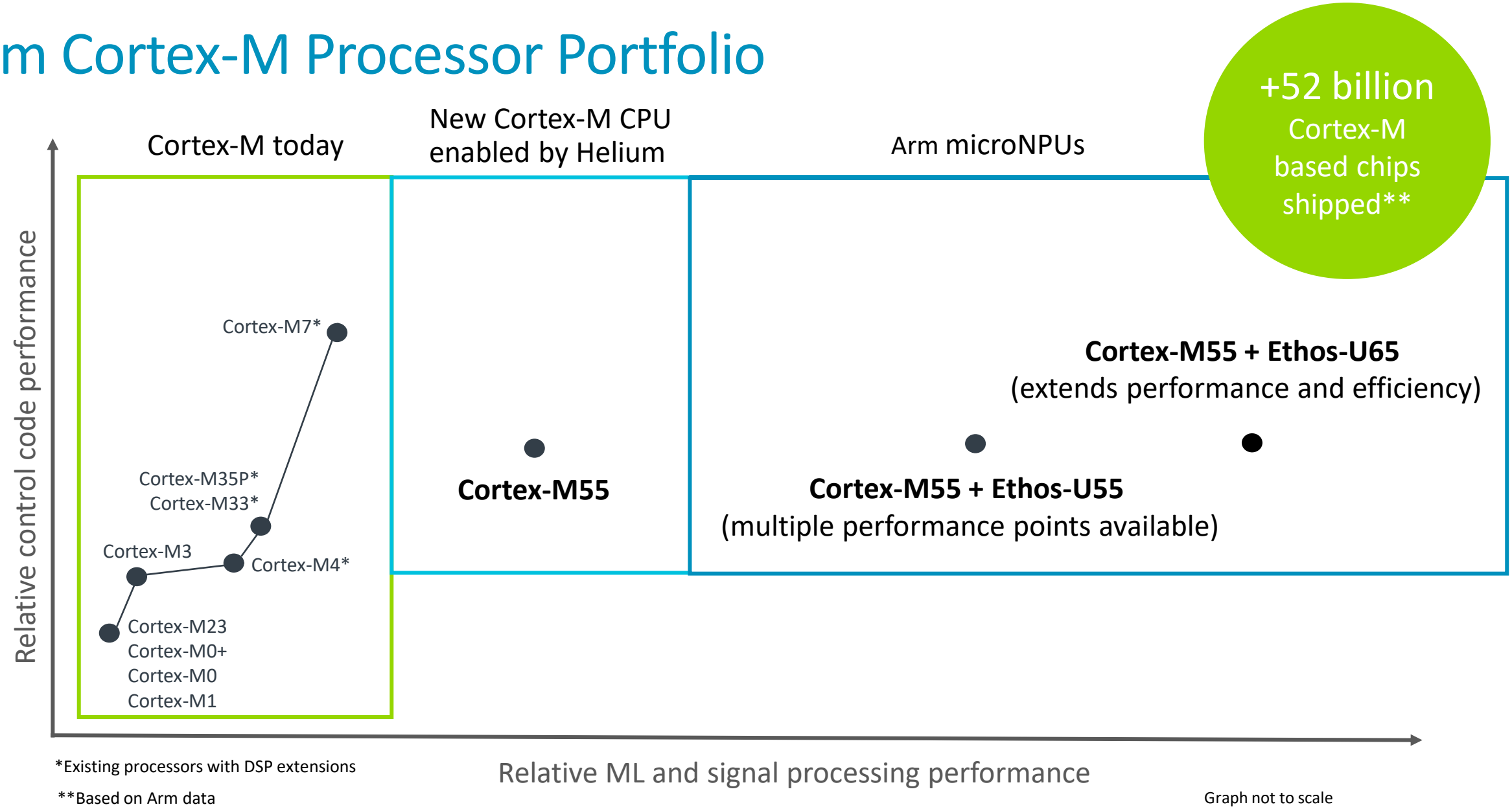
Arm Cortex-M Processor Portfolio



*Existing processors with DSP extensions

**Based on Arm data

Graph not to scale

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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

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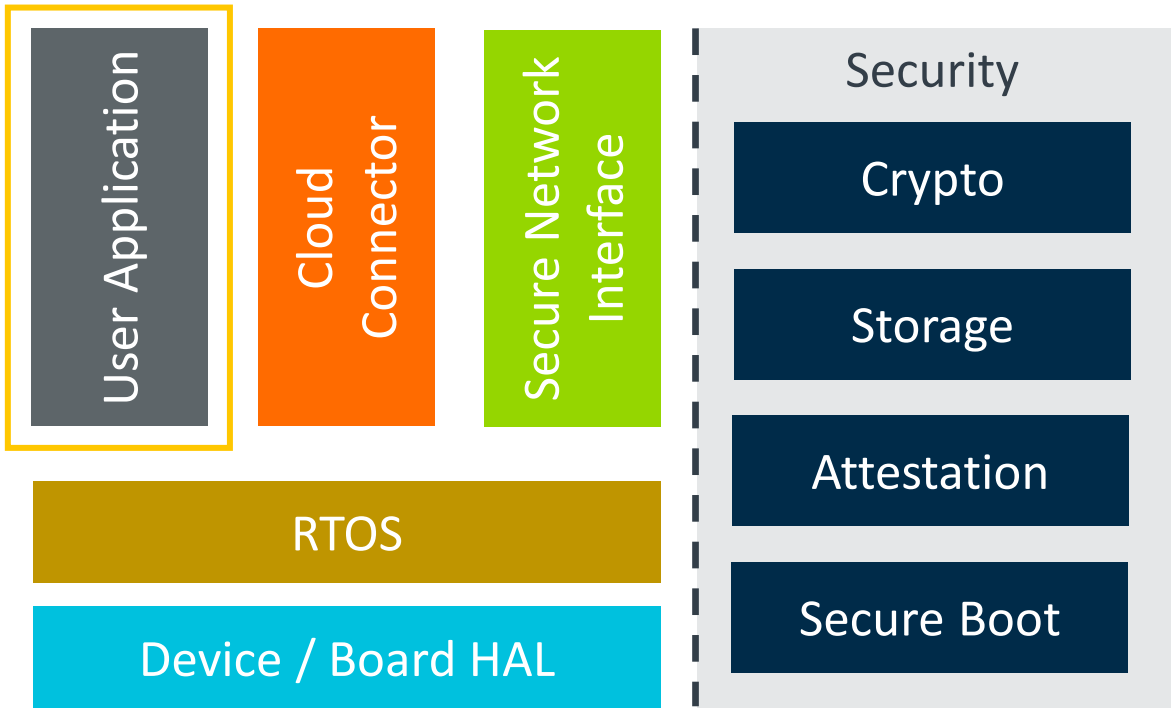
A Component Approach for IoT on Cortex-M

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.

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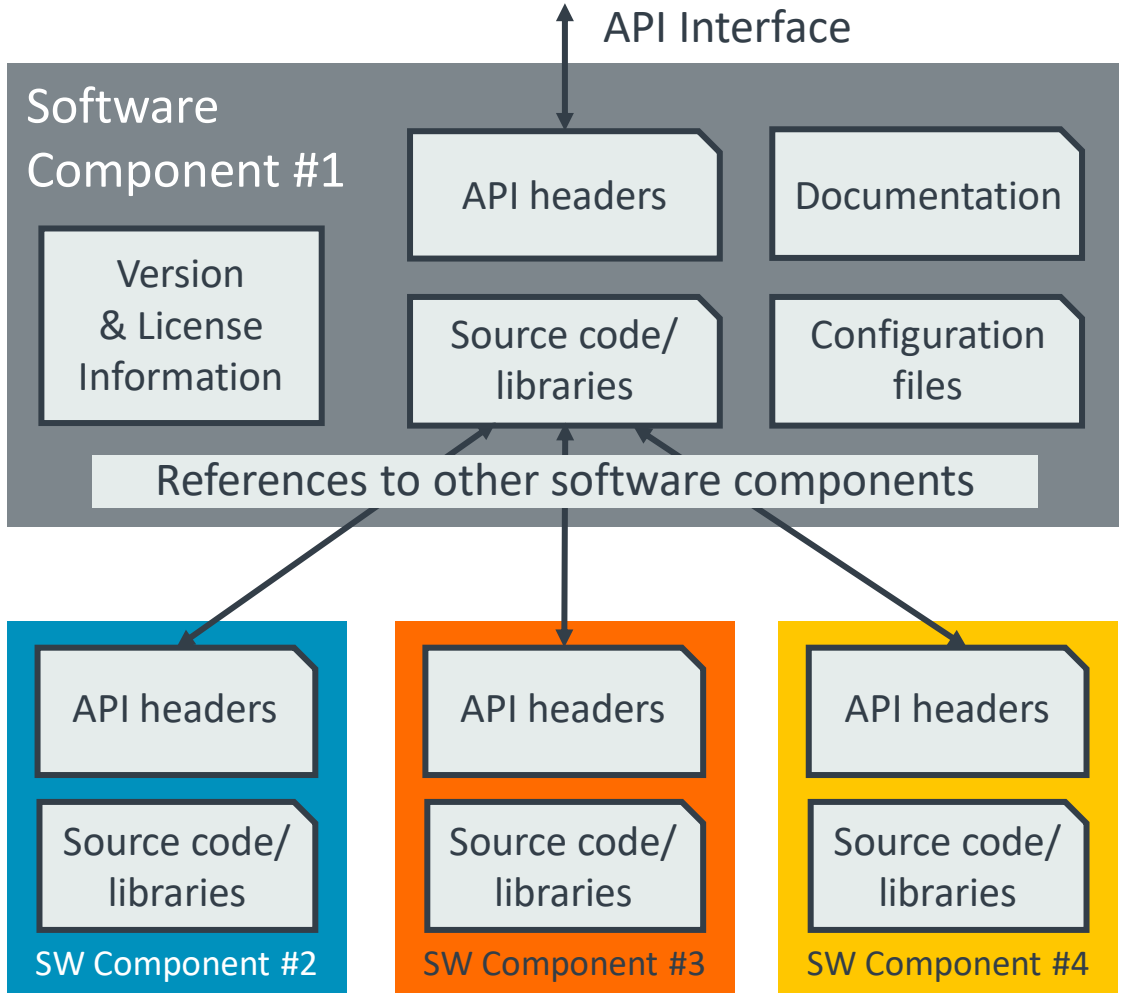
CMSIS-Pack: What is a Software Component?

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

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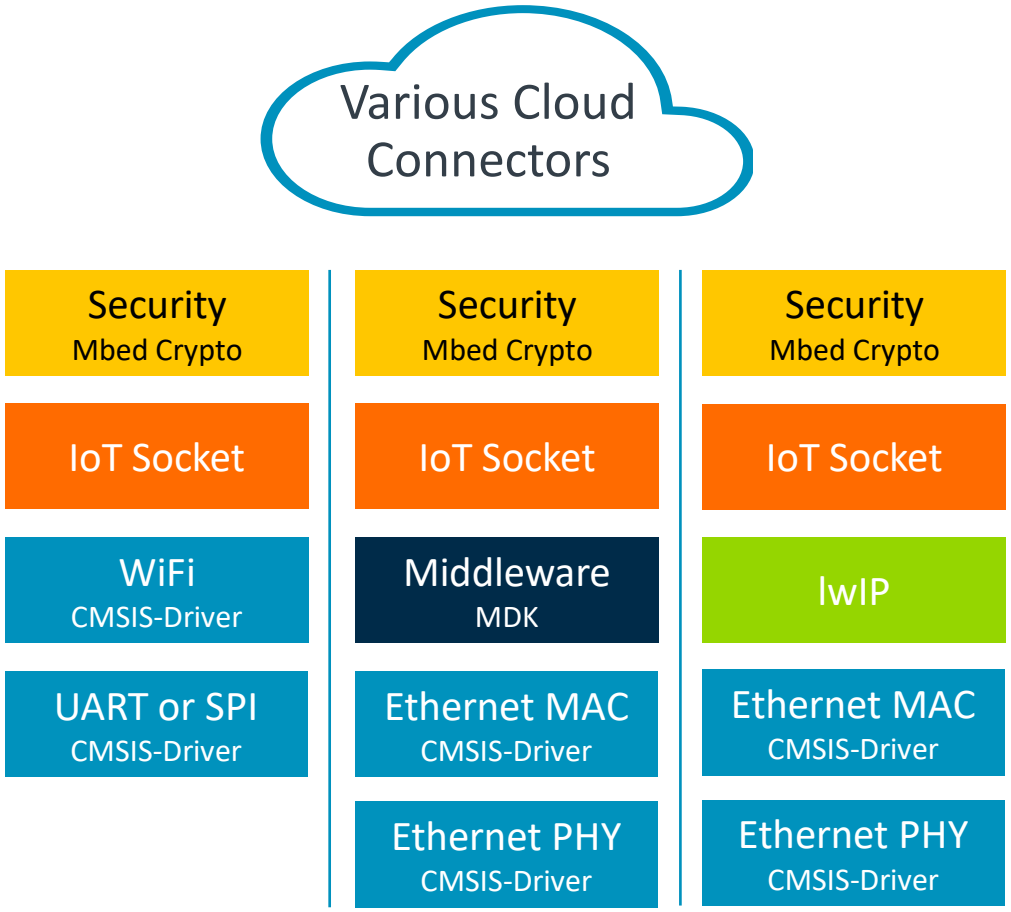
Secure Network Interface – Implementation Choices

IoT devices need flexibility for implementing connectivity on Cortex-M



3 different ways to implement secure network connectivity

Available Cloud Connectors:

Azure

IBM

Google Cloud Platform

aws

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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

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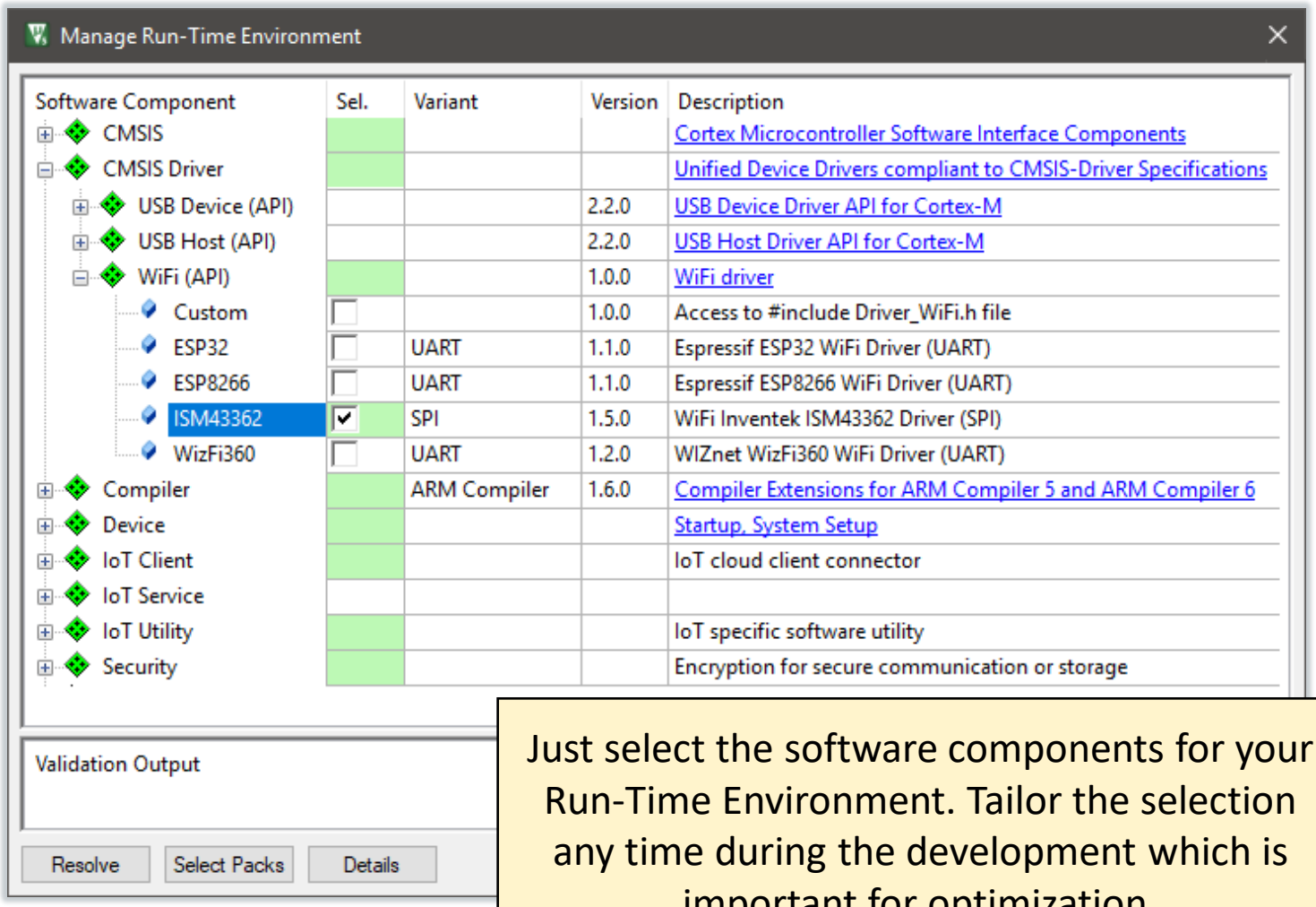
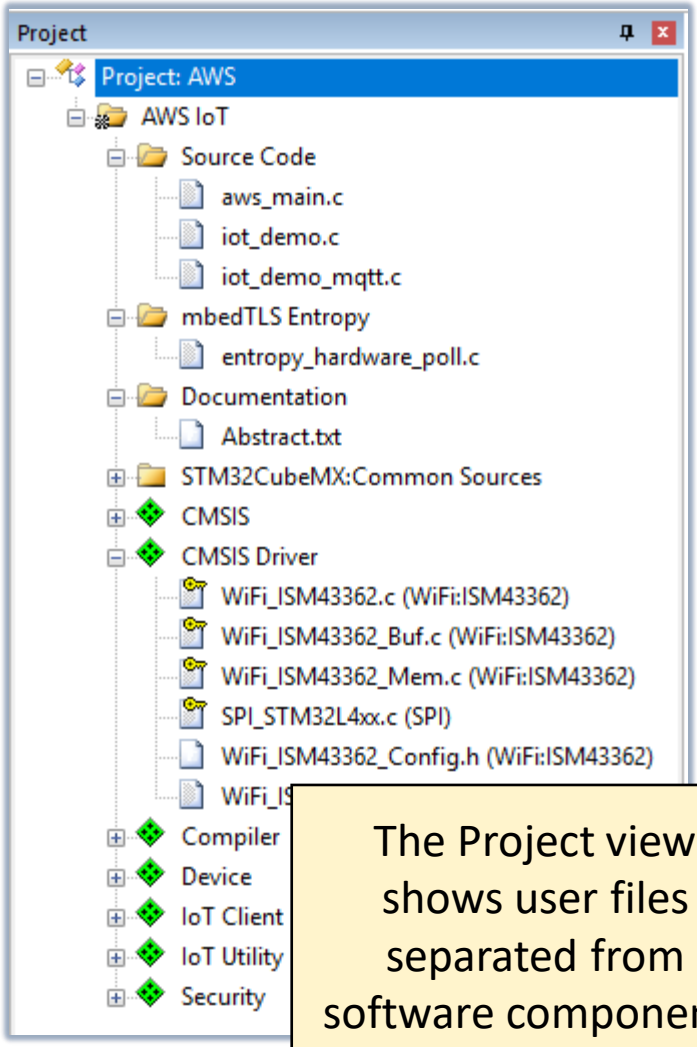
Choose and Configure Software Components in an IDE



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



The Project view shows user files separated from software components

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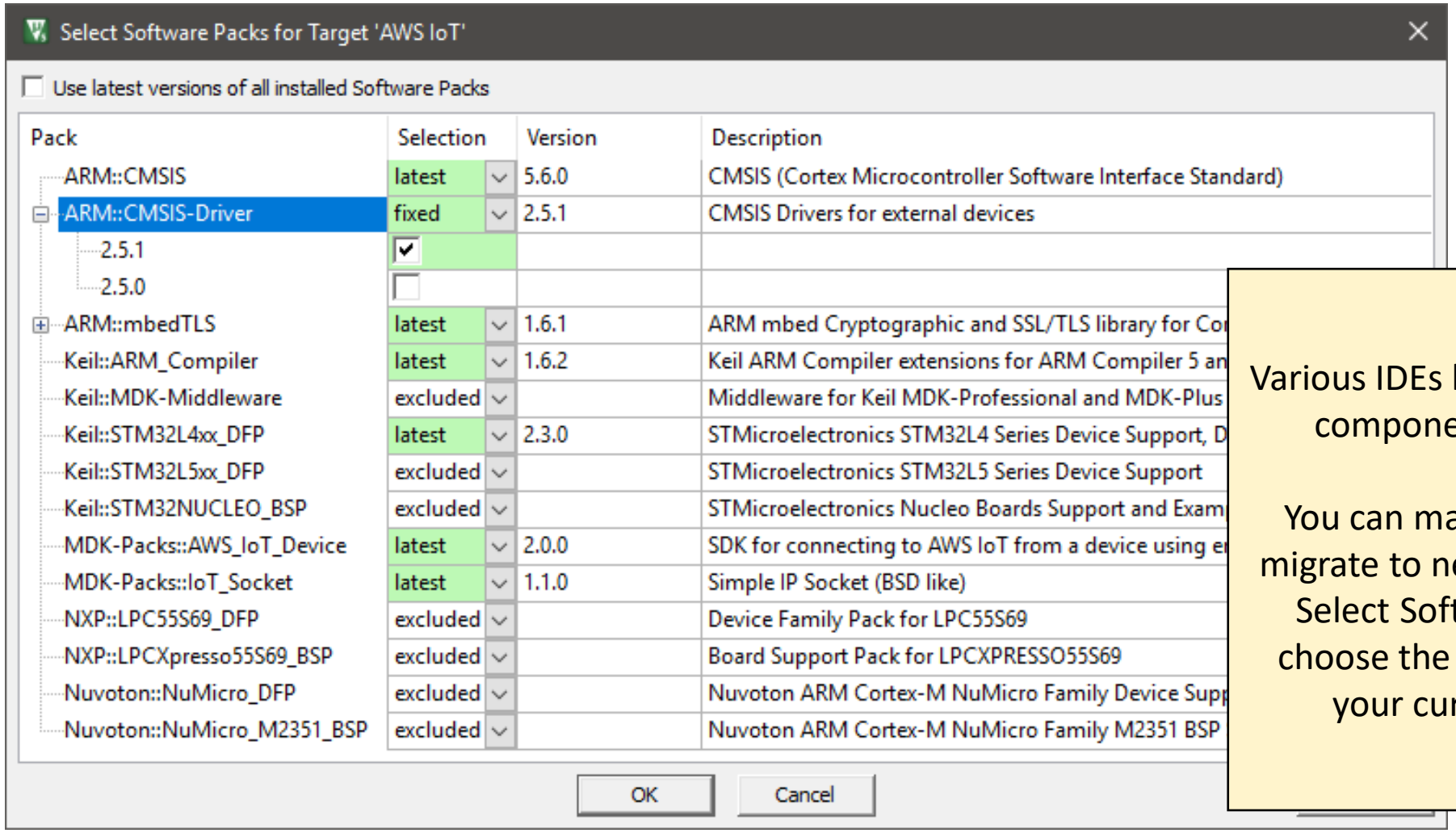
Product Life Cycle Management

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.

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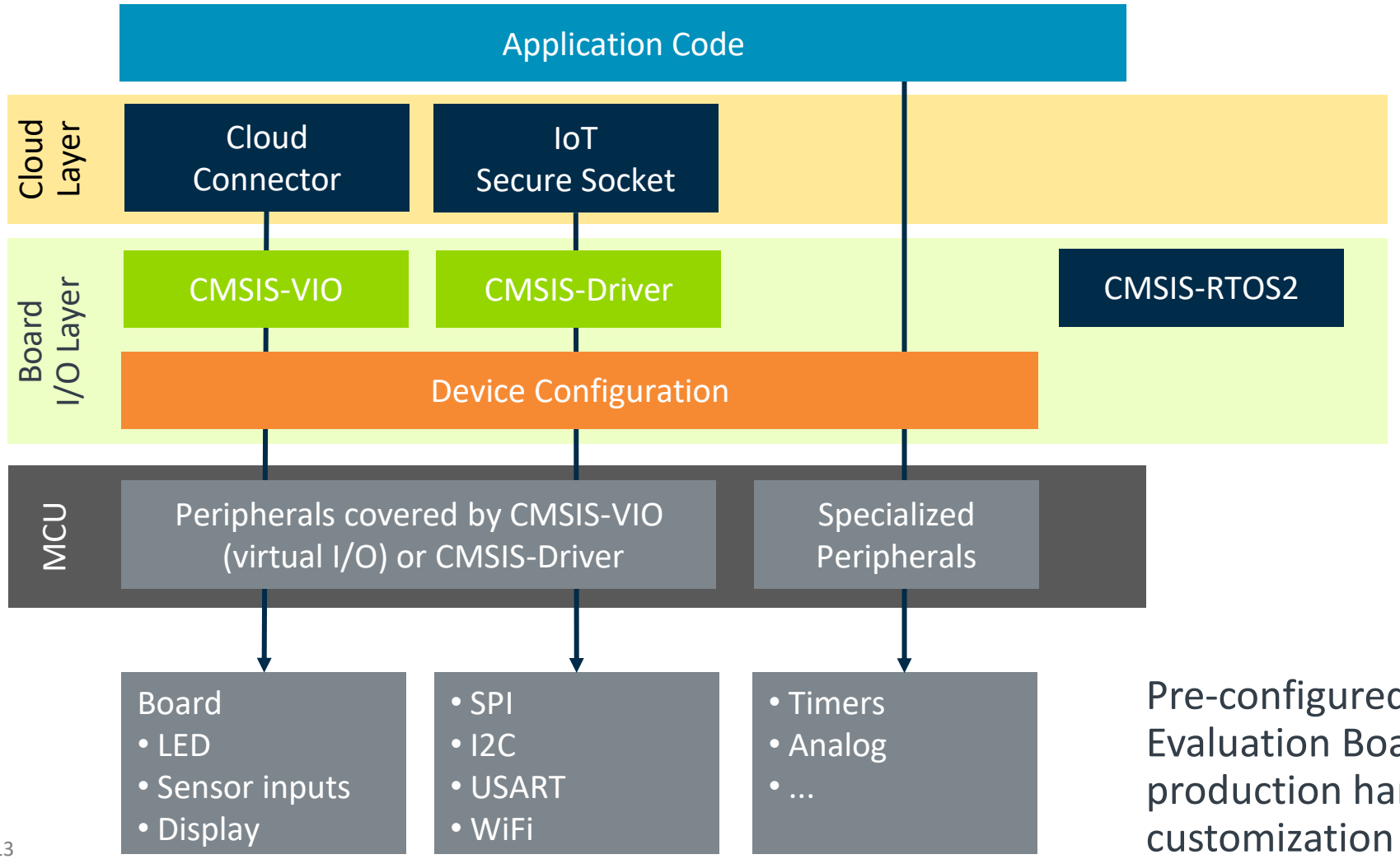
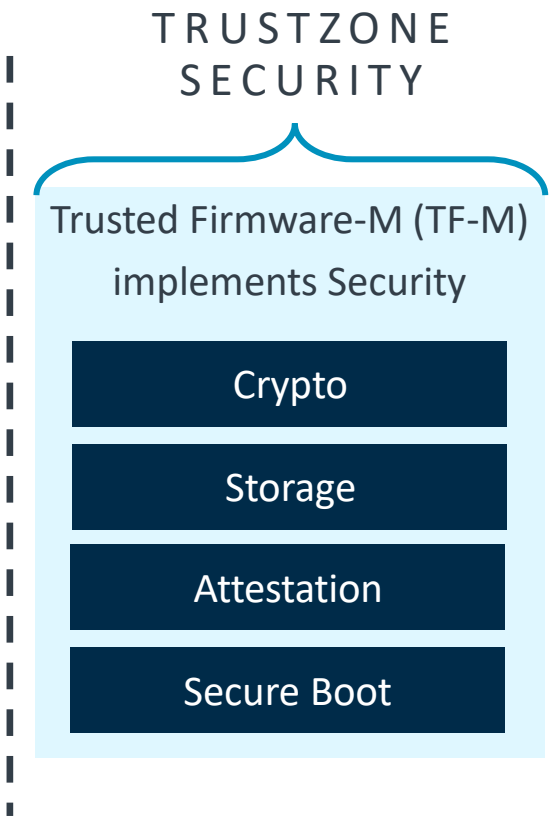
IoT for Cortex-M – Move to Custom Hardware

Layers group a pre-configured software component selection





Pre-configured software layers available for Evaluation Boards allows to migrate fast to production hardware and enables further customization and optimization

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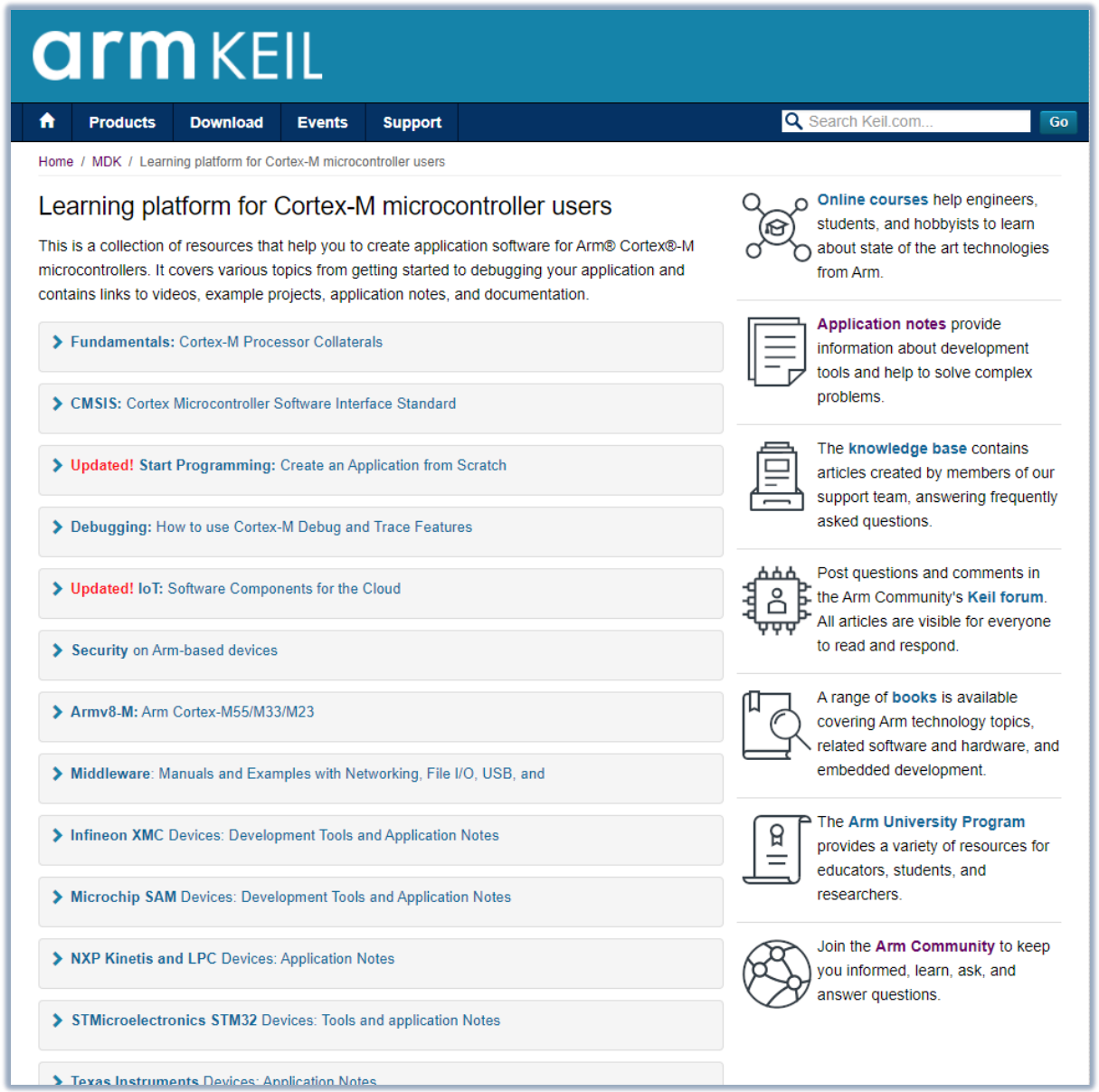
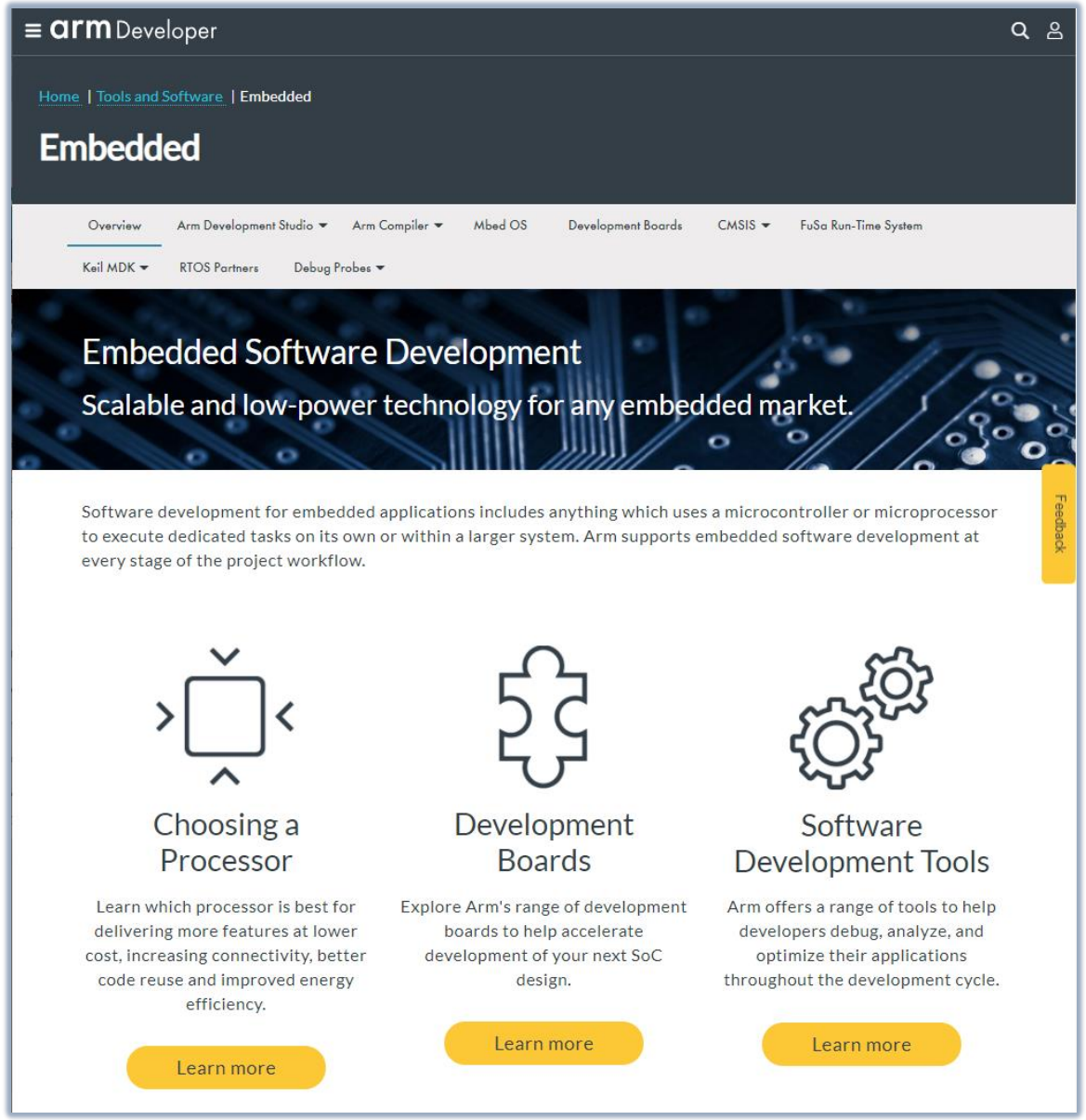
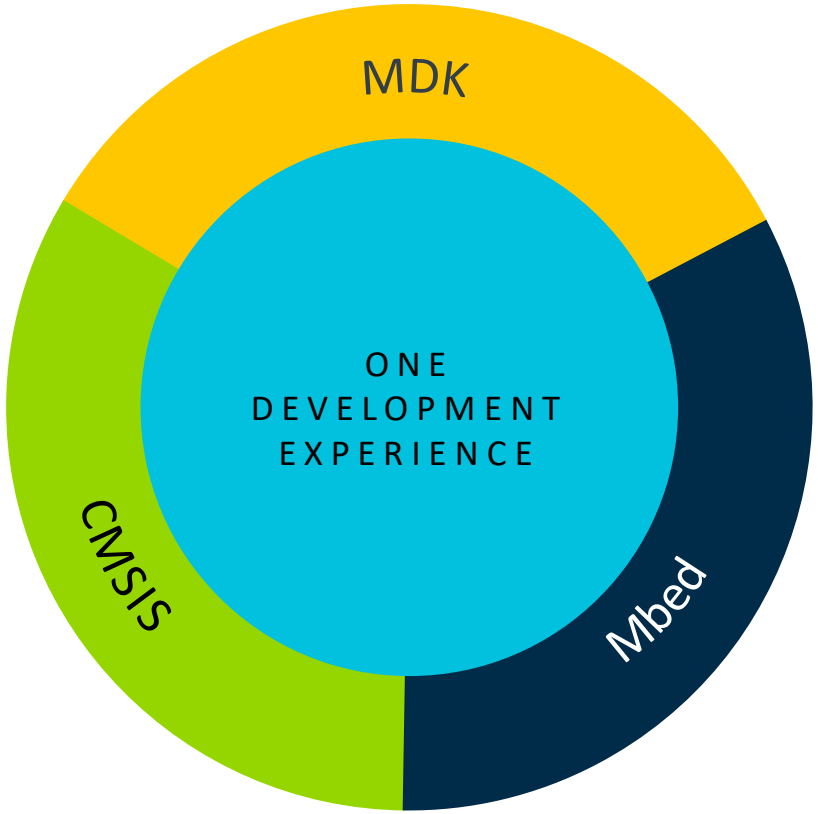
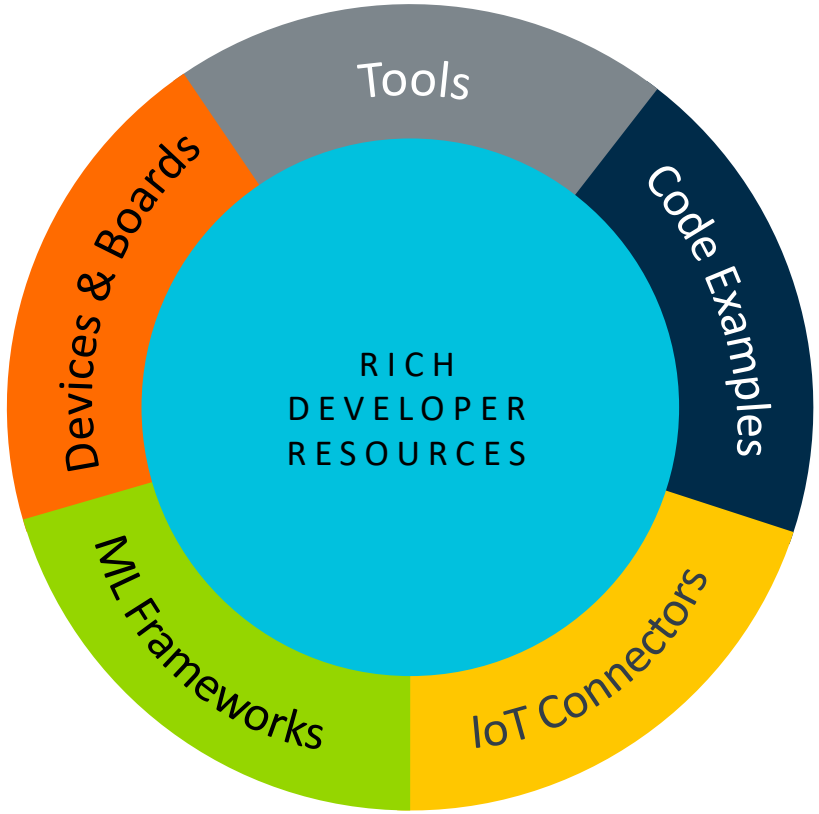




One Arm (A)IoT Development Experience – Developer Focus





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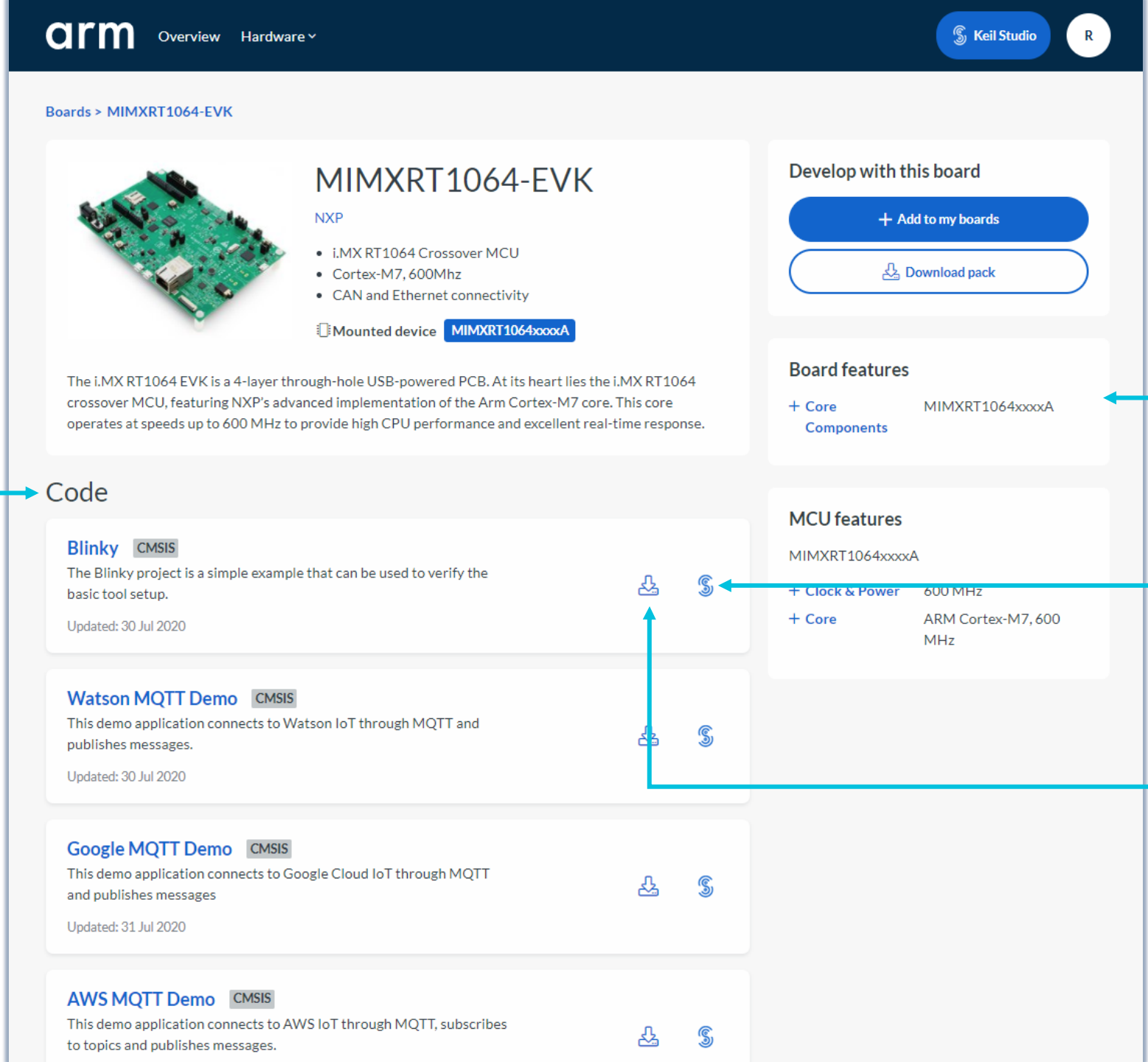
Preview of Web portal



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

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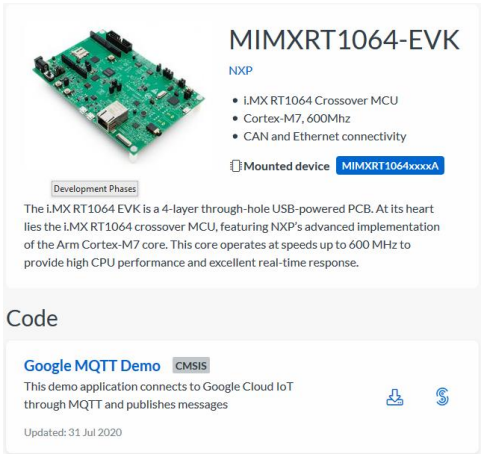
Development Phases

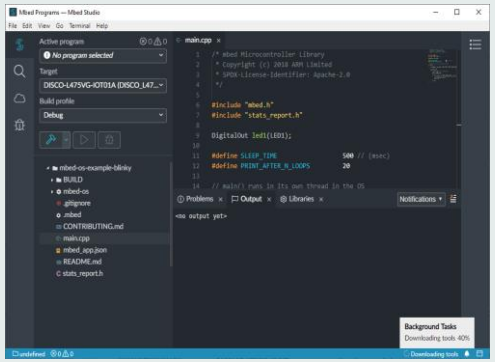
DISCOVER POSSIBILITIES



Enter parameters of your application

- Compare devices
- Evaluation boards
- Reference code examples

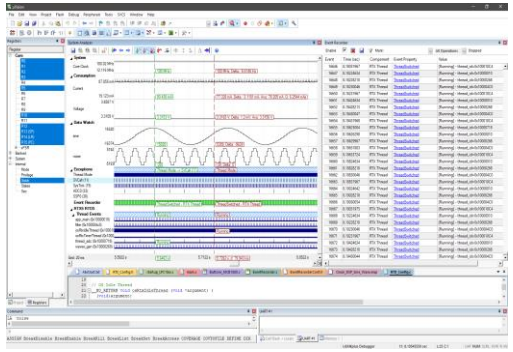
EXPLORE REFERENCE DESIGNS



Use online tools for evaluation

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

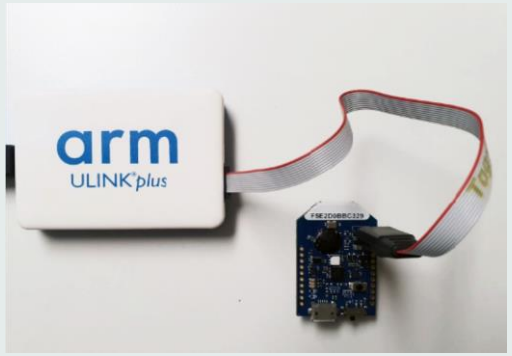
DEVELOP APPLICATION



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

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Endpoint AI for IOT

Find out more: arm.com/ai-endpoint

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Kiitos
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