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Embedded Systems Essentials with Arm: Getting Started

Module 2

KV4 (2): The Cortex Microcontroller Software Interface Standard (CMSIS)

The Cortex Microcontroller Software Interface Standard or CMSIS is a vendor-independent hardware abstraction layer for the Cortex-M processor series. This means that the developer can write code for an array of platforms without having to worry so much about the underlying hardware.

CMSIS standardizes several programming features, including:

- the functions to access features such as Nested Vectored Interrupt Controller, the System Control Block, and the System Tick Timer
- the access to special registers, such as the PRIMASK register and the ability to set the control register
- functions to access special instructions
- and the names of system initialization functions.

Using CMSIS has many benefits. It makes it easier to port application code from one Cortex-M-based microcontroller to another. This saves time adapting code to suit the new board, and makes it easier to reuse code between different microcontrollers.

CMSIS improves compatibility when integrating third-party software components, such as applications, embedded OS, middleware, and so on, because they can share the same standard CMSIS interface.

Finally, it offers better code density and a smaller memory footprint, since the code in CMSIS has been optimized and tested.

The CMSIS consists of the following components:

- CORE, which offers a standardized API for the Cortex-M processor core and peripherals
- Real-time operating system or RTOS, which provides a common API for real-time operating systems, along with a reference implementation. It enables software components that can work across multiple RTOS systems
- The Digital Signal Processing or DSP library collection, which has over 60 functions for various data types, both fixed-point and single precision floating-point
- Neural Network or NN, a collection of neural network kernels developed to maximize the performance of and minimize the memory footprint on Cortex-M processor cores
- And the Debug Access Port or DAP, a firmware for a debug unit that interfaces to the CoreSight Debug Access Port.

Multiple tools can use CMSIS-DAP. Examples include pyOCD, which is an open-source Python package for programming and debugging Arm Cortex-M microcontrollers, Keil MDK, and IAR Workbench.

CMSIS-DAP can also be utilized by DAPLink, an open-source project that implements the embedded firmware required for a Cortex debug probe.

The DAPLink debug probe is connected to the host computer via USB. Its Human Interface Device uses CMSIS-DAP to access the Cortex Debug Access Port of an ARM Cortex microcontroller via USB.

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The DAPLink debug probe also supports USB drag-and-drop programming, and provides a USB serial port.