CMSIS-Toolbox: A new standard for building MCU software

By Trevor Martin

Introduction

The CMSIS-Toolbox is a modern, flexible build system designed to develop applications for Arm Cortex-M microcontrollers. It enables developers to efficiently configure, build, and manage embedded software projects across multiple platforms, toolchains, and workflows. CMSIS-Toolbox is the build system used by the MDK-6 extensions within VS-Code, it is also installed in the latest versions of MDK-5 and Microvision.

Cross-Platform Development Environment

CMSIS-Toolbox is designed for versatility, offering full support for all key operating systems including, Windows, macOS, and Linux. CMSIS Toolbox may be used as a command line tool (CLI) or as the build system within an IDE. This makes it very easy to migrate from an IDE project directly to Continuous Integration (CI) system, enabling automated builds and testing.

Multi-Compiler Support

The build system supports a broad range of embedded toolchains, ensuring compatibility with different project requirements and team preferences:

- Arm Compiler for Embedded
- Arm GNU Toolchain (GCC)
- IAR Compiler
- Clang Compiler

Software Layers for Architectural Clarity

CMSIS-Toolbox promotes a layered software architecture, which enforces a strong architectural definition by separating application code, software components, and hardware dependencies. The layers approach also enables easy hardware retargeting, allowing

applications to be moved between boards or MCUs with minimal code changes. This approach also eases code reuse across multiple projects, improving development efficiency and maintainability.

Software layers support is an important feature of CMSIS-Toolbox that enables modern code development for embedded systems. The layers approach is covered in more detail in the following tech tip Overview of CMSIS Toolbox Layers

Software Layers for Architectural Clarity

CMSIS-Toolbox fully supports the CMSIS Software Pack ecosystem that was introduced with MDK-5. This gives your project access to a huge range of device packs and software component packs. CMSIS-Toolbox includes the Pack Management utility cpackget.exe to install and manage packs directly from the command line. The software packs description file is also used to configure the linker resource management. The ROM, RAM and peripheral allocation is automatically extracted from device and board packs. Each pack also contains a version number which can be used for Lifecycle Management throughout a project's lifetime. This approach ensures projects remain reproducible and maintainable over time, even as hardware or toolchains evolve.

Integration with Third-Party Code Generators

CMSIS-Toolbox can work seamlessly with popular MCU configuration and code-generation tools such as:

- STM32CubeMX (STMicroelectronics)
- MCUXpresso Config Tools (NXP)
- DAVE (Infineon)

This makes it easy to incorporate auto-generated initialisation code, peripheral drivers, and configuration files into the CMSIS-Toolbox build workflow. This greatly speeds up project development and reduces the time spent on low level bug hunting.

In Summary

By combining cross-platform compatibility, flexible compiler support, software layer architecture, and integrated pack management, CMSIS-Toolbox provides a build system that allows you to create portable and maintainable embedded projects that can be easily transferred from IDE to CI/CD pipelines. CMSIS-Toolbox also supports modern code development approaches that allow you to migrate between different hardware and simulation platforms and develop reusable code as software components.

Further Information

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