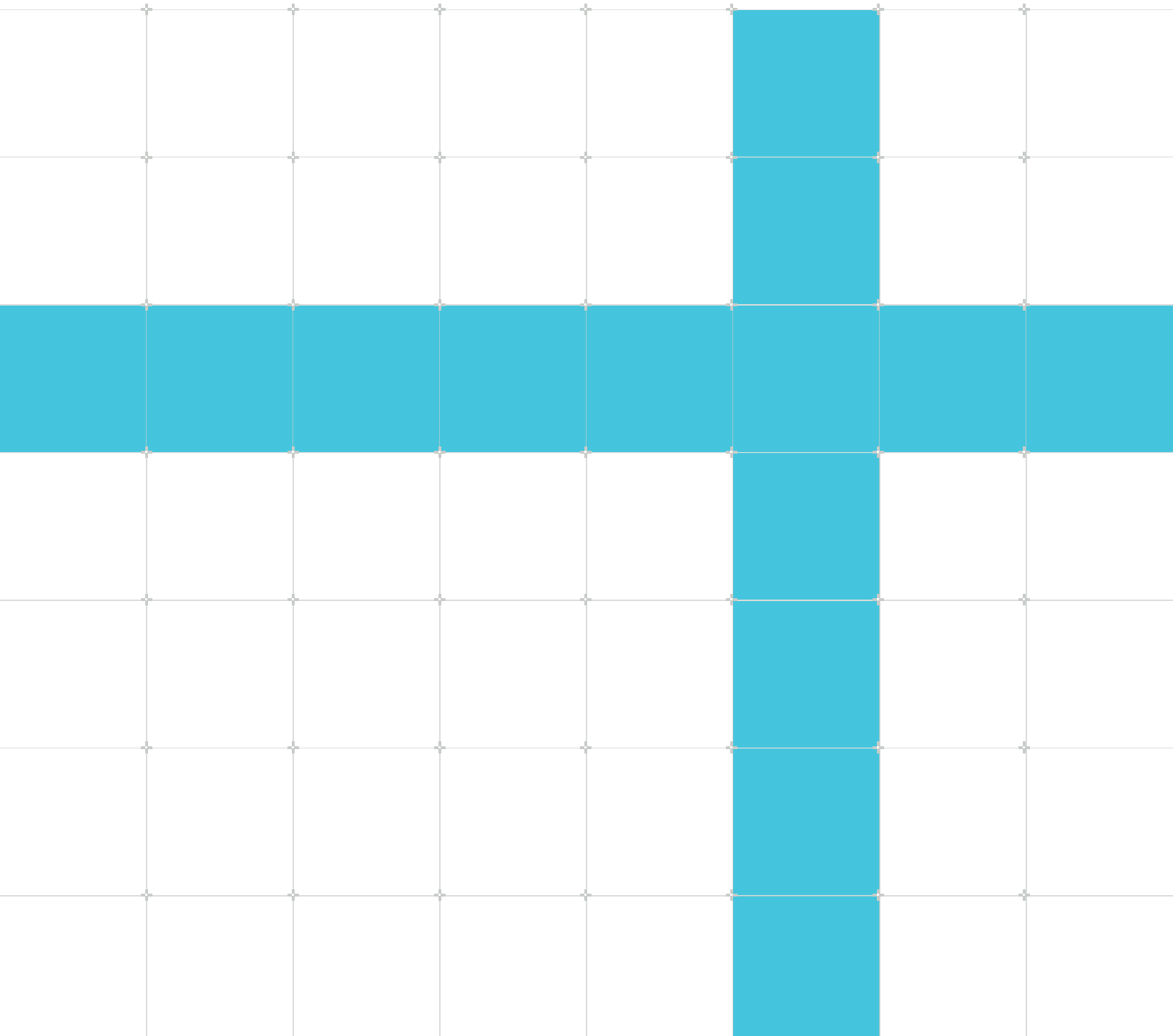
Arm Keil MDK

Version 5.37

Release Note

Issue
107778_5.37_en



Arm Keil MDK

Release Note

Release information

Document history

Issue	Date	Confidentiality	Change
1.0	2 May 2022	Non-Confidential	Initial release

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Arm Limited. Company 02557590 registered in England.

110 Fulbourn Road, Cambridge, England CB1 9NJ.

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Contents

1. Introduction

1.1 Conventions

The following subsections describe conventions used in Arm documents.

Glossary

The Arm Glossary is a list of terms used in Arm documentation, together with definitions for those terms. The Arm Glossary does not contain terms that are industry standard unless the Arm meaning differs from the generally accepted meaning.

See the Arm® Glossary for more information: developer.arm.com/glossary.

Typographic conventions

Arm documentation uses typographical conventions to convey specific meaning.

Convention	Use
italic	Citations.
bold	Interface elements, such as menu names. Terms in descriptive lists, where appropriate.
`monospace`	Text that you can enter at the keyboard, such as commands, file and program names, and source code.
`monospace underline`	A permitted abbreviation for a command or option. You can enter the underlined text instead of the full command or option name.
`<and>`	Encloses replaceable terms for assembler syntax where they appear in code or code fragments. For example: `MRC p15, 0, <Rd>, <CRn>, <CRm>, <Opcode_2>`
SMALL CAPITALS	Terms that have specific technical meanings as defined in the *Arm® Glossary*. For example, **IMPLEMENTATION DEFINED**, **IMPLEMENTATION SPECIFIC**, **UNKNOWN**, and **UNPREDICTABLE**.
	Recommendations. Not following these recommendations might lead to system failure or damage.
	Requirements for the system. Not following these requirements might result in system failure or damage.
	Requirements for the system. Not following these requirements will result in system failure or damage.
	An important piece of information that needs your attention.

Convention	Use
Tip	A useful tip that might make it easier, better or faster to perform a task.
Remember	A reminder of something important that relates to the information you are reading.

1.2 Useful resources

This document contains information that is specific to this product. See the following resources for other useful information.

Access to Arm documents depends on their confidentiality:

- Non-Confidential documents are available at developer.arm.com/documentation. Each document link in the following tables goes to the online version of the document.
- Confidential documents are available to licensees only through the product package.

Note

Arm tests its PDFs only in Adobe Acrobat and Acrobat Reader. Arm cannot guarantee the quality of its documents when used with any other PDF reader.

Adobe PDF reader products can be downloaded at http://www.adobe.com

1.3 Other information

See the Arm website for other relevant information.

- Arm® Developer.
- Arm® Documentation.
- Technical Support.
- Arm® Glossary.

2. Preface

The Arm Keil MDK (Microcontroller Development Kit) supports software development and debugging for Arm-based microcontroller devices. A detailed description of MDK may be found in Complete User's Guide Selection which may be accessed on the µVision Project Workspace — Books page.

The Getting Started User's Guide gives you a good starting point, since it introduces you to the IDE and gives guidelines for programming Arm devices. The following sections list the changes instituted in each release of Arm Keil MDK.

MDK Version 5 is capable of using MDK Version 4 projects after installation of the Legacy Support. This adds support for Arm7, Arm9, and Arm Cortex-R4 processor-based devices.

Supported Operating Systems

Refer to System Requirements for hardware and operating system requirements.

Technical Support

Open a support case for technical problems or inquiries.

You can also search the documentation for application notes, knowledge base articles, user guides, and product information.

The Keil Forum is an open forum where you may post questions and comments about Keil products.

Contact Details

You may contact us directly at one of the offices listed on the Keil Support page. You may also receive sales and support through your local distributor.

3. MDK Version 5.37

Release date: 2nd May, 2022.

uVision updated to V5.37.0.0

- Added: support for Arm Cortex-M85 processor.
- Added: support for Arm China STAR-MC1 processor.
- Enhanced: UV4.exe [-n|-np] updates device names for multi-project workspaces (.uvmpw).
- Enhanced: reserved identifier warnings suppressed for Arm Compiler 6.17 and later ("-Wno-reserved-identifier")
- Enhanced: only save coverage information for executed code addresses to reduce COVERAGE SAVE output file size.
- Corrected: Call-Stack + Locals dialog shows incomplete information if in active interrupt service routine.
- Corrected: issue with displaying C++ std::string objects for Arm Compiler 6.16 and later in Watch Window.

Arm Compiler Included

- Arm Compiler 6 version 6.18 - see Release Notes for further details.
  - Known issue: Significant performance degradation due to continuous Microsoft Defender Antivirus scans (refer to this Knowledgebase Article).
- Arm Compiler 5 is no longer included in the MDK-Core Installer.
  - Arm Compiler 5 is still supported by uVision and can be downloaded, installed, and configured separately.

Software Packs Included

- Keil - MDK-Middleware 7.15.0 (All libraries have been built using Arm Compiler 6)
  - Network Component Version 7.17.0
  - FileSystem Component Version 6.15.0
  - USB Component Version 6.16.0
- Keil - MDK-Middleware Graphics 1.1.0 (All libraries have been built using Arm Compiler 6)
  - Updated to Segger emWin Version 6.24.
- Arm - CMSIS 5.9.0
  - For a comprehensive list of changes refer to CMSIS 5.9.0 Release.
- Arm - CMSIS-Driver 2.7.1
  - For a comprehensive list of changes refer to CMSIS-Driver 2.7.1 Release.
- Keil - Arm Compiler 1.7.2

CMSIS-Toolbox

- Added: CMSIS-Toolbox Version 0.10.0 including compiler configuration file for Arm Compiler 6.18 located in the C:_v5- directory.
- Follow the setup instructions for Windows to use the compiler and packs from MDK also with the commandline tools from cmsis-toolbox.
- uVision supports the import/export of the 'cprj' project description format specified by the Open-CMSIS-Pack project.

Cortex-M Models

- Arm Virtual Hardware (AVH) models Version 11.17.40 are replacing the FVP models. The models are fully compatible and add these virtual interfaces:
  - Virtual Input/Output (VIO) for controlling simple I/O such as LED and switches.
  - Virtual Streaming Interface (VSI) for data streaming for audio, video and senors.
  - Virtual Socket Interface (VSocket) for IP network connectivity via the host system.
- Existing projects require to update the model executable name in the Model Launch Configuration settings.
- Enhanced: these models can be invoked directly from the command line and do not mandate the use of uVision.
- Added: Corstone_SSE-300 (Cortex-M55) and Corstone_SSE-310 (Cortex-M85) platform models.
- Fixed Virtual Platform (FVP) models are no longer included in the MDK-Core installer.
- Version 11.17.21 of the models is available as Add-On installer from the MDK-ARM Version 5.37 Product Update area (valid PSN/LIC required).

Target Debugging

- Fast Models (CADI) - AVH/FVP:
  - Added: debug and trace support for Arm Cortex-M85 based devices.
  - Added: debug support for Armv8.1-M Pointer Authentication and Branch Target Identification (PACBTI) extensions.
- ULINKpro:
  - Added: debug and trace support for Arm Cortex-M85 based devices.
  - Added: debug support for Armv8.1-M Pointer Authentication and Branch Target Identification (PACBTI) extensions.
  - Added: support for ADIv6 based debug in SDF files.
  - Added: support ETMv4 conditional instruction trace for complete code coverage on Cortex-M7, Cortex-M33, Cortex-M35P, Cortex-M55, and - Cortex-M85 based devices.
- ULINKplus:
  - Added: debug and trace support for Arm Cortex-M85 based devices.
  - Added: debug support for Armv8.1-M Pointer Authentication and Branch Target Identification (PACBTI) extensions.

    - Added: support for ADIv6 based debug in SDF files.
- ULINK2:
    - Enhanced: support more than 16 FPB/BPU breakpoints in Cortex-M devices if provided by target device.
    - Note: Use the CMSIS-DAP mode for debug and trace support for Arm Cortex-M85 based devices.
- CMSIS-DAP:
    - Added: debug and trace support for Arm Cortex-M85 based devices.
    - Added: debug support for Armv8.1-M Pointer Authentication and Branch Target Identification (PACBTI) extensions.
    - Added: support for ADIv6 based debug in SDF files.
- Segger J-Link:
    - Updated debug driver to version 7.64.
    - STMicroelectronics ST-LINK:
    - Updated firmware upgrade utility ST-LinkUpgrade.exe to version 2.5.7.
- Nuvoton NU-Link:
    - Updated debug driver to version 3.08.7313r.

4. MDK Version 5.36

Release date: 15th September, 2021.

uVision updated to V5.36.0.0

- Added: a new uVision command line option to update the configured device for all targets of an existing project, e.g. `UV4 MyProject.uvprojx - -np Device1234`
- Added: support for zip archive feature *extended local headers* in packunzip.exe (V1.20.40) as used by STM32PackCreator from - STMicroelectronics. Previously packunzip reported "Error: Pack integrity check failed" and could not install the Software Pack. *Note*: The packunzip utility is invoked when double clicking on a pack file, or by the Pack Installer.
- Corrected: in MDK 5.35 the predefined debug function `printf` was incorrectly reporting "error 149, line N, invalid parameter" for some ANSI - C compliant format strings.

Arm Compiler Included

- Arm Compiler 5 version 5.06u7 - see Release Notes for further details. - same as in MDK version 5.32.
- Arm Compiler 6 version 6.16 - see Release Notes for further details. - same as in MDK version 5.34.

Software Packs Included

- Keil - MDK-Middleware 7.13.0
  - Network Component Version 7.15.0
  - FileSystem Component Version 6.14.1
  - USB Component Version 6.15.0
  - Graphics Component Segger emWin to version 6.16.3 (see revision history for details).
- Arm - CMSIS 5.8.0
- Arm - CMSIS-Driver 2.6.1
- Keil - Arm Compiler 1.6.3

Cortex-M Models (same as in MDK v5.35)

- Fixed Virtual Platform (FVP) version 11.15.14 (MDK-Professional only).

5. MDK Version 5.35

Release date: 30th June, 2021.

uVision updated to V5.35.0.0

- Disabled: external oscillator frequency (Xtal) configuration in Options for Target dialog for µVision 5 projects (*.uvprojx).
- Updated: Arm Compiler 6 generates DWARF4 debug format when Debug Information is enabled.
- Corrected: dragging of symbols from the editor into Watch, Command, Memory, System and Logic Analyzer window not working in MDK v5.34.
- Corrected: debug information processing for C++ resulting in symbol out of scope message.
- Corrected: setting breakpoints in Disassembler window in case a single source code line is associated with non-continuous addresses.
- Corrected: single step code at address `0x00000000`.
- Corrected: disassembly of some Armv8-M instructions.
- Corrected: fixed aborting debug script execution causing a target access error (Cortex-M targets).

Arm Compiler Included

- Arm Compiler 5 version 5.06u7 - see Release Notes for further details (same as in MDK version 5.32).
- Arm Compiler 6 version 6.16 - see Release Notes for further details (same as in MDK version 5.34).

Software Packs Included

- Keil - MDK-Middleware 7.13.0
  - Network Component Version 7.15.0
    - Added functions netARP_ClearCache and netNDP_ClearCache to clear the ARP or NDP cache at runtime.
    - Improved dynamic memory debugging, added more memory allocation and memory free debug events.
    - Improved DNS response validation to improve robustness and resilience against DNS cyber attacks.
    - Updated for use with the FuSa C Library, sprintf and sscanf are no longer used in the network library.
    - Fixed duplicate AutoIP addresses if the same firmware is deployed on multiple devices.
    - Fixed nonce caching issue in HTTP Digest authentication.
    - Corrected BSD select function to report a socket closed by a peer as readable.
    - Fixed an Ethernet connectivity issue when the ARP cache table is fully utilized.

        - Added functions in the user API that enable or disable echo response at runtime.
        - Fixed Ethernet driver handling so that the receive function is not called before the link-up.
        - Fixed possible NULL pointer dereference in a multi-interface configuration.
        - Fixed issue with HTTP Digest authentication with Apple Safari browser.
    - FileSystem Component Version 6.14.1
        - Added health status (S.M.A.R.T.) access support for eMMC and SD devices.
        - Enhanced error handling and return status propagation in EFS.
        - Corrected bug in ftime_set which could cause long file name entry overwrite.
        - Corrected bug in FAT name cache which could cause a cache miss situation when switching directories using fchdir.
    - USB Component Version 6.15.0
        - USB Host: Added support for Isochronous transfers (only for EHCI full-speed).
        - USB Host: Fixed sporadic crash when disconnecting device from port 1.
        - USB Host: Fixed OHCI driver causing HardFault during debugging.
        - USB Device: ClearEndpointFeature request passes to low level driver even if endpoint was not in halt state.
    - Graphics Component Segger emWin to version 6.16.3 (see revision history for details).
- Arm - CMSIS 5.8.0
    - For a comprehensive list of changes refer to CMSIS 5.8.0 Release.

Cortex-M Architecture Models

- Updated Fixed Virtual Platform (FVP) support to version 11.15.14 (MDK-Professional only).

Target Debugging

- ULINKpro:
    - Corrected: Fixed ETMv4 decoder falsely raising errors on not-taken unconditional branches in IT blocks.
- Updated Segger J-Link debug driver to version 7.22b.
- STMicroelectronics ST-LINK:
    - Updated debug driver to version 3.0.9.0.
    - Updated firmware upgrade utility ST-LinkUpgrade.exe to version 2.5.6.
- Updated Nuvoton NULink debug driver to version 3.05.7215r.

6. MDK Version 5.34

Release date: 12th March, 2021.

uVision updated to V5.34.0.0

- Added: Update interval for the generation of Source Browser Information for Arm Compiler 6 based projects is globally configurable. Updates can also be triggered manually via the context menu and/or keyboard shortcut.
- Corrected: Editor is unable to display Russian or Japanese encoded characters. Updated to Scintilla V4.4.6.

Arm Compiler Included

- Arm Compiler 5 version 5.06u7 - see Release Notes for further details (same as in MDK version 5.33).
- Arm Compiler 6 version 6.16 - see Release Notes for further details.

This version is correcting how volatile bit-fields, typically used for peripheral register accesses, are handled by the compiler. For full details see the knowledgebase article: How does Arm Compiler 6 access bit-fields and volatile bit-fields?.

Software Packs Included

Same as in MDK version 5.33:

- Keil - MDK-Middleware 7.12.0
- Arm - CMSIS 5.7.0
- Arm - CMSIS-Driver 2.6.1
- Keil - Arm Compiler 1.6.3

Target Debugging

- Nuvoton NU-Link updated debug driver to version 3.05.7174.

7. MDK Version 5.33

Release date: 16th November, 2020.

uVision updated to V5.33.0.0

- Added: display of effective Compiler/Assembler Control String to Options for Component dialog.

Arm Compiler Included

- Arm Compiler 5 version 5.06u7 - see Release Notes for further details. - same as in MDK version 5.32.
- Arm Compiler 6 version 6.15 - see Release Notes for further details.

Software Packs Included

Same as in MDK version 5.32:

- Keil - MDK-Middleware 7.12.0
- Arm - CMSIS 5.7.0
- Arm - CMSIS-Driver 2.6.1
- Keil - Arm Compiler 1.6.3

Target Debugging

Same as in MDK version 5.32 except:

- Fast Models (CADI):
  - Added configuration option to disable CADI client/server inter process communication timeout for accomodating complex models with exceptionally long response times.

8. MDK Version 5.32

Release date: 6th October, 2020.

uVision updated to V5.32.0.0

- µVision Editor
  - Enhanced: Reduced memory consumption of Dynamic Syntax Checking and Source Browser Information collection.
  - Enhanced: Added missing trigger points for updating Dynamic Syntax Checking and Source Browser Information.
  - Corrected: Including 'define' attribute of 'compile' elements in device description for collecting Dynamic - Syntax Checking and Source Browser Information.
- µVision Project Manager and Run-Time Environment
  - Added: Support for the Custom Datapath Extension (CDE) for Cortex-M33 based devices.
  - Added: Treating Markdown files (.md) as 'Text Document file' type, displayed as standard text files.
  - Enhanced: Allow addition of assembler files with C-preprocessing (file ending '.S') in Add New Item dialog.
- µVision Debug
  - Enhanced: EXIT command in INI script before Flash Download cancels the Flash Download request at end of INI - script.
  - Corrected: Stepping over C++ STL container methods.
- µVision Product License Manager
  - Corrected: Displayed number of seats for FlexNet licenses.
- Pack Installer
  - Corrected: Allow removal of Local Repository that were deleted from user's file system.
- µVision CPRJ Format Support
  - Enhanced: Configuration dialog for Project and Software Layer Information.
  - Added: Menu entry "Project - Import - Import Project from CPRJ Format" instead of "File - Open".
  - Added: Import of software layer definitions and assignments from CPRJ file.
  - Added: Import - Prepopulate default debugger selection and settings for On-board debugger from the package - description of the board referenced in CPRJ file.
  - Added: Import - Add board specific external flash programming algorithms to debugger configuration from package description of the board referenced in CPRJ file.

Arm Compiler Included

- Arm Compiler 5 version 5.06u7 - see Release Notes for further details.
- Arm Compiler 6 version 6.14.1 - see Release Notes for further details.

Software Packs Included

- Keil - MDK-Middleware 7.12.0 (All libraries have been built using Arm Compiler 6)
  - Network Component Version 7.14.0
    - Fixed a problem in the netUninitialize function that active BSD sockets remain blocked when the function is called by a low priority thread.
    - Fixed a problem with the HTTP server when uploading files from the Firefox browser.
    - Corrected OS layer timeouts for RTOS2, if the RTOS tick frequency is not 1000 Hz.
    - Fixed a build error when IPv6 was disabled in all LAN interfaces.
    - Fixed "no route found" error when sending broadcast frames.
    - Added netUDP_OptionInterface option to change the default interface for sending broadcast frames.
    - Updated the netFTPs_ffind function in the File System interface of the FTP server.
    - Added configuration option to prevent sending ping response (no echo reply).
    - Added blocking functions netARP_ProbeX and netNDP_ProbeX for easy use.
  - FileSystem Component Version 6.13.8
    - Corrected bug in fwrite for EFS which could cause a write error in multithreaded environment.
    - Corrected bug in fdelete for EFS which could cause that files could not be deleted.
  - USB Component Version 6.14.1
    - USB Host
      - USB Host: Corrected enumeration of a CDC device if it is a part of a composite device.
    - USB Device
      - USB Device: Corrected RNDIS (incomplete type is not allowed).
  - Unchanged Graphics Component version 6.10.8.
  - Unchanged Board Support Interface specification.
- Arm - CMSIS 5.7.0 - same as in MDK version 5.31.
- Arm - CMSIS-Driver 2.6.1
  - Updated ESP8266, ESP32 and WizFi360 WiFi drivers:
    - Added auto protocol selection in SocketCreate.
    - Fixed socket default timeout (zero == no time out).
    - Fixed SocketRecv/RecvFrom non blocking mode when received less than buffer length.
  - Updated Inventek ISM43362 WiFi driver (version 1.9.0):
    - Corrected Initialize function failure if called shortly after reset.
    - Corrected default protocol selection in SocketCreate function.

        - Detected STM firmware limitation: SocketConnect does not work if any of IP address octets is 255 (for example IP like x.y.z.255).
- Keil - Arm Compiler 1.6.3 - same as in MDK version 5.31.

Cortex-M Architecture Models

- Fixed Virtual Platform (FVP) updated to version 11.12.38.

Target Debugging

- ULINKpro:
    - Added: JTAG and SWD support for DAP-Lite2 shipped with Arm Cortex-M55 r0p2.
    - Corrected: Switch out of dormant state for SW-DPv2 and later for devices with CMSIS pack debug description.
- ULINKplus:
    - Added: ETB support for ITM and ETM trace.
    - Added: SWD support for DAP-Lite2 shipped with Arm Cortex-M55 r0p2.
    - Corrected: Switch out of dormant state for SW-DPv2 and later for devices with CMSIS pack debug description.
- ULINK2:
    - Corrected: Switch out of dormant state for SW-DPv2 and later for devices with CMSIS pack debug description.
- CMSIS-DAP:
    - Added: SWD support for DAP-Lite2 shipped with Arm Cortex-M55 r0p2.
    - Corrected: Switch out of dormant state for SW-DPv2 and later for devices with CMSIS pack debug description.
- Updated Segger J-Link debug driver to version 6.86
- STMicroelectronics ST-LINK:
    - updated debug driver to version 3.0.8.0.
    - updated firmware upgrade utility ST-LinkUpgrade.exe to version 2.5.4.
- Updated Nuvoton NULink debug driver to version 3.04.7130.

9. MDK Version 5.31

Release date: 2nd July, 2020.

uVision updated to V5.31.0.0

- µVision Editor
  - Enhanced: Performance of Dynamic Syntax Checking and Source Browser Information collection improved.
- µVision Run-Time Environment
  - Added: Support for condition attribute in api element.
- µVision Build Engine
  - Corrected: '-D_RTE_' added to compiler command line despite no RTE components being selected in project.
  - Changed: Default optimization level setting for AC6 has been changed from -Oz to -O1.
- µVision Debug
  - New: Source Browser information snapshot remains available while debugging also when using Arm Compiler 6.
  - New: Extended support for handling up to 480 external interrupt sources.
  - Improved: Display of STL container datatypes in Call Stack + Locals window.
- µVision Product Licensing
  - Corrected: Displayed product version for MDK Plus FlexNet license.
  - Fixed: Code generation for ARMv8m targets and building secure projects with MDK Lite product variant fails.

Arm Compiler Included

- Arm Compiler 5 version 5.06u6
- Arm Compiler 6 version 6.14

Software Packs Included

- Keil - MDK-Middleware 7.11.1
- Arm - CMSIS 5.7.0
- Arm - CMSIS-Driver 2.6.0
- Keil - Arm Compiler 1.6.3

Cortex-M Architecture Models

- Fixed Virtual Platform (FVP) version 11.10.22.

Target Debugging

- Segger J-Link debug driver version 6.70e

- Nuvoton NU-Link debug driver version 3.02.6990.
- STMicroelectronics ST-LINK version 3.0.7.0.

10. MDK Version 5.30

Release date: 4th May, 2020.

uVision updated to V5.30.0.0

- Added support for Arm Cortex-M55 based devices.
- Added M-Profile Vector Extension debug dialog for configurable data vector display.
- Updated the product editions MDK-Lite and MDK-Essential to support secure/non-secure build and debug of Armv8-M and Armv8.1-M compliant processor based devices.
- Added debug functions for conversions between raw integer and floating point values: F32ToRawF16, F32ToRawF32, F64ToRawF64, RawF16ToF32, RawF32ToF32, and RawF64ToF64.
- Arm Compiler 6 gets selected by default when creating a New Project for Arm Cortex-M based devices.
- Arm Compiler 6 assembler ('armclang') gets selected by default instead of legacy 'armasm', when selecting - Arm Compiler 6 toolchain. For backwards compatibility there are new Language/Code Generation Assembler Options to choose from.
- Default Compiler Version configuration has been simplified to configure one version for Arm Compiler major - version 5 and 6 each, which is independent from the processor of the selected device. Note that some - processors are exclusively supported by a major version of the Arm Compiler.
- Disabled dynamic syntax checking for files opened in the editor that do not belong to the active project of - a multiproject workspace.
- Added new Editor window icon to indicate that a file does not belong to the active project of a multiproject workspace. In addition the filename is displayed in grey.
- Added support for import and export of the CMSIS-Build project format (*.cprj).
- Added support for Project Information and Layers used by CMSIS-Build tools.
- Discontinued support for the toolchain independent project description format (*.cpdsc).

Arm Compiler Included

- Updated Arm Compiler 6 to version 6.14 - see Release Notes for further details.

Software Packs Included

- Keil - MDK-Middleware 7.11.1
  - Network Component Version 7.13.1
    - Corrected backward compatibility with a few older versions of network configurations, causing build failures.
    - Updates from version 7.12.0 to 7.13.0:
      - Added support for multiple LAN interfaces (Ethernet, WiFi) that can be used simultaneously.

        - Added netCGI_CustomHeader function to add a custom HTTP header to the web server response.
        - Added netHTTPs_CalcHashHA1 function to calculate MD5 hash HA1 for HTTP Digest authentication.
        - Corrected IGMP checksum check error if the IGMP message is longer than 8 octets.
        - Corrected possible memory corruption in HTTP server, when a long HTTP URL request is received and Root Folder is used.
        - Corrected memory issue when BSD stream socket keeps sending data on half-closed connection.
        - Corrected DHCPv6 client issue to discard address offers, if preferred lifetime is equal to valid lifetime.
        - Corrected modem driver issue with modem initialization string length limited to 64 characters.
        - Reworked network system viewer in debugger, added status view for multiple network interfaces.
        - Updated HTTP server to also add custom HTTP headers to internally generated server error messages.
    - FileSystem Component Version 6.13.5
        - Corrected bug in FAT name cache which could cause a cache miss situation on file entry scan.
        - Corrected bug in FAT name cache which could cause a long file name entry overwrite.
        - Corrected bug in fwrite for EFS which could cause invalid file allocation order.
        - Corrected bug in fseek for EFS which caused invalid setting of the file position pointer.
        - Corrected bug in fchdir which failed to operate in case of single character folder names and FAT.
        - Minor optimizations and fixes in fdefrag (EFS only).
    - USB Component Version 6.14.0
        - USB Host
            - USB Host: Added abort functionality to CDC ACM transfers.
    - Updated Graphics Component to version 6.10.8.
    - Unchanged Board Support Interface specification.
- Arm - CMSIS 5.7.0
    - Updated: CMSIS-Core (Cortex-M) to version 5.4.0.
        - Added: Cortex-M55 cpu support.
        - Enhanced: MVE support for Armv8.1-MML.
        - Added: L1 Cache functions for Armv7-M and later.
    - Updated: CMSIS-Core (Cortex-A) to version 1.2.0.
        - Added: missing DSP intrinsics.

        - Reworked: assembly intrinsics volatile, barriers and clobbers.
        - Corrected: GIC_SetPendingIRQ to use GICD_SGIR instead of GICD_SPENDSGIR for compliance with all GIC specification versions.
    - Updated: CMSIS-DSP to version 1.8.0.
        - Added: support for the M-Profile Vector Extensions (MVE) "Helium".
        - Added: example functions for Vector Machine programming in folder `./DSP/Examples/ARM/arm_svm_example/`.
        - Added: example functions related to Bayesian Probability programming in folder `./DSP/Examples/ARM/arm_bayes_example/`.
        - Added: new folder with Distance Functions to cluster algorithms in folder `./DSP/Source/DistanceFunctions/`.
        - Added: Statistic Functions arm_entropy_f32, arm_kullback_leibler_f32, arm_logsumexp_f32 and arm_logsumexp_dot_prod_f32 in folder `./DSP/Source/StatisticsFunctions/`.
    - Updated: CMSIS-NN to version 1.3.0.
        - Added functions for int8 operators with symmetric quantization.
    - Updated: CMSIS-RTOS2 to version 5.5.2.
        - Added: support for Cortex-M55 cpu
        - Corrected: thread priority restore on mutex acquired timeout. This is the case when priority inherit is used.
        - Enhanced: support for Armv8-M by specifying the thread TrustZone module identifier as optional.
        - Updated: configuration default values for Global Dynamic Memory and Thread Stack.
    - Utilities
        - Updated SVDConv to version 3.3.35.
        - Updated PackChk to version 1.3.90.
- Arm - CMSIS-Driver 2.6.0
    - Updated ESP8266, ESP32 and WizFi360 WiFi drivers:
        - API V1.1: SocketSend/SendTo and SocketRecv/RecvFrom (support for polling).
        - Added DHCP setting before station Activate.
        - Added read of DHCP assigned IPs after station activate.
        - Fixed serial tx busy flag handling.
        - Fixed function AT_Resp_ConnectAP for NULL argument.
        - Enhanced serial communication startup procedure.
    - Updated Inventek ISM43362 WiFi driver (version 1.8.0):
        - API V1.1: SocketSend/SendTo and SocketRecv/RecvFrom (support for polling).
        - Corrected GetModuleInfo return string termination.

        - Corrected functionality when DATARDY line is used in polling mode.
        - Corrected SocketConnect function never returning 0 in non-blocking mode.
        - Corrected SocketRecv/SocketRecvFrom function polling if called without previous Bind.
        - Corrected delay after module reset.
        - For non-STM firmware variant only firmware version 6.2.1.7 is supported.s
    - Documented firmware update procedure for Inventek ISMART43362-E WiFi shield.
- Keil - Arm Compiler 1.6.3
    - Added ARMCM55 to the list of supported processors.
    - Updated Event Recorder documentation describing the concept of heart beat events.
    - Updated SCVD examples to Arm Compiler 6.

Cortex-M Architecture Models

- Updated Fixed Virtual Platform (FVP) support to version 11.10.22.
- Added FVP Model for Cortex-M55.
- Added support to configure loading and storing µVision coverage information.

The coverage information is stored to the file on disconnecting/terminating the model. The coverage information from a previous run can be loaded at connecting to the model.

Target Debugging

- ULINKpro:
    - Added debug and trace support for Arm Cortex-M55 based devices.
    - Added debug and trace support for Armv8.1-M Unprivileged Debug Extensions (UDE).
    - Corrected missing invocation of CMSIS debug sequence “DebugCoreStop”.
    - Corrected “Trace HW not present” errors after repeated connection to ST devices with trace.
    - Corrected instruction trace support based on ETMv4 and enhanced performance.
- ULINKplus:
    - Added debug and trace support for Arm Cortex-M55 based devices.
    - Added debug and trace support for Armv8.1-M Unprivileged Debug Extensions (UDE).
    - Added support for TraceDataPoint and TraceAccessPoint debug commands previously only available for ULINKpro.
    - Corrected missing invocation of CMSIS debug sequence “DebugCoreStop”.
    - Corrected “Trace HW not present” errors after repeated connection to ST devices with trace.

- ULINK2:
  - Added support for TraceDataPoint and TraceAccessPoint debug commands previously only available for ULINKpro.
  - Corrected missing invocation of CMSIS debug sequence “DebugCoreStop”.
  - Corrected “Trace HW not present” errors after repeated connection to ST devices with trace.
- CMSIS-DAP:
  - Added debug and trace support for Arm Cortex-M55 based devices.
  - Added debug and trace support for Armv8.1-M Unprivileged Debug Extensions (UDE).
  - Added support for TraceDataPoint and TraceAccessPoint debug commands previously only available for ULINKpro.
  - Corrected missing invocation of CMSIS debug sequence “DebugCoreStop”.
  - Corrected “Trace HW not present” errors after repeated connection to ST devices with trace.
- Updated Segger J-Link debug driver to version 6.70e with
  - Added support for debugging ARM China STAR core based devices.
  - Added support for instruction trace based on the Embedded Trace Macrocell (ETM) version 4.
  - Added support for trace stored into the optional on-chip Embedded Trace Buffer (ETB).
  - Corrected defects in the Code Coverage feature.
- Updated Nuvoton NULink debug driver to version 3.02.6990.

11. MDK Version 5.29

Release date: 18th November, 2019.

uVision updated to V5.29.0.0

- Added: option in License Manager to request a 30-day evaluation license of the MDK Professional edition.
- Added support for v8.1-M architecture extensions (requires MDK Professional).
- Enhanced: auto-generated scatter files can manage multiple modules with the same name.
- Enhanced: librarian is skipped in build if all contained objects are up to date shortening the build times.

Arm Compiler Included

- Included Arm Compiler 5 version 5.06u6 - unchanged: see Release Notes for further details.
- Updated Arm Compiler 6 to version 6.13.1. See release notes inside the installer for further details.

Software Packs Included

- Keil - MDK-Middleware 7.10.0
  - FileSystem Component Version 6.13.0
    - Added ftime_set and ftime_get functions used to manage the file or directory timestamps.
    - Added status codes fsAlreadyExists and fsNotDirectory that allow more control when using fmkdir, frmdir and fchdir.
    - Added debug configuration for debugging with Event Recorder.
    - Added second instance of the RAM drive (drive R1).
    - Corrected bug in FAT file name compare for names with equal root and 13 characters in length (LFN).
    - Corrected bug in FAT cluster handling when deleting file which could cause false out of space error.
    - Corrected bug in fmedia which could cause non-initialized pointer access when using uninitialized drive.
  - Network Component Version 7.12.0
    - Added support for Digest access authentication in HTTP server.
    - Added support for user accounts in HTTP server Digest authentication.
    - Added support for passwords stored as MD5 hash value HA1.
    - Added support for the WiFi interface.
    - Added send frame buffering, if the MAC address in the IPv6 NDP cache is not resolved (the first call to the netUDP_Send function does not fail anymore).

- Corrected possible memory corruption in CHAP authentication, when PPP interface used in client mode, and the server generates CHAP challenges of less than 16 bytes.
- Corrected memory issue when receiving fragmented broadcast message.
- Corrected return code from BSD_EINVAL to BSD_ESOCK if BSD socket is not created.
- Corrected filtering for link-layer addressed UDP messages (datagrams with correct MAC address and invalid IP address are no longer received).
- Corrected Neighbor Discovery failure, when the requested global IPv6 address is on-link.
- Corrected problem in BSD socket timeouts, when the blocked receiving and blocked sending in the socket are simultaneously used from two threads.
- Corrected problem, that the device is not accessible to IPv6 after changing the MAC address.
- Corrected possible TCP socket retransmission failure in keep-alive mode for very short time limits, when the keep-alive timer expired before the retransmission timer.
- Corrected CHAP authentication failure in the PPP interface, when used in client mode.
- Improved and optimized network core processing.
- Improved versioning, added library version to a map file (i.e.: “network_ip4_release_v7.10.6”).
- Improved access to ethernet, serial and modem drivers.
- Improved Event Recorder debug support and updated documentation for the debug events available in the Network Services.
- Optimized send_frame functions for network interfaces.
- Updated IGMP multicast address filtering.
- Updated lease renewal in the DHCP client also updates the default Gateway.

◦ USB Component Version 6.13.7

- Added thread name for all threads created by the USB stack.
- USB Host
  - Corrected CMSIS-RTOS1 compatibility mode compilation error in USART_CDC_ACM.c and USART_PL2303.c templates.
  - Corrected USBH_Device_GetController, USBH_Device_GetPort, USBH_Device_GetAddress, USBH_Device_GetVID, and USBH_Device_GetPID functions to work in device enumeration Initialize callbacks.
- USB Device
  - Corrected delay on USB out transfer when multiple USB devices are used.
  - Corrected handling if endpoint configuration in driver fails.
  - Corrected MSC class support for sector size different than 512.
  - Corrected MAC_str_to_addr function in Ethernet RNDIS driver.

        - Corrected MAC_str_to_addr function in USBD_User_CDC_ACM_RNDIS_ETH.c and USBD_User_CDC_ACM_RNDIS_VETH.c templates.
        - Improved USB input buffers alignment (aligned to 32 bytes, support cache up to 32 bytes per cache line).
    - Unchanged Graphics Component to version 5.50.
    - Unchanged Board Support Interface specification.
- Arm - CMSIS 5.6.0
    - Updated: CMSIS-Core (Cortex-M) to version 5.3.0.
        - Added provisions for compiler-independent C startup code.
        - Corrected a compilation issue in cmsis_armclang_ltm.h introduced in 5.2.0.
    - Updated: CMSIS-Core (Cortex-A) to version 1.1.4.
        - Corrected an issue in the Floating Point Unit Function __FPU_Enable().
        - Modified functions __get_SP_usr() / __set_SP_usr() to work with ArmClang.
        - Corrected a zero argument handling in function __CLZ().
    - Updated: CMSIS-DSP to version 1.7.0.
        - Modified arm_math.h.
            - Removed dependance on cores.
            - Deprecated __SIMD32 and introduced new functions for SIMD accesses.
        - Added compilation flags for FFT. It is now possible to include only the tables required for FFTs.
    - Updated: CMSIS-NN to version 1.2.0.
        - Added arm_status arm_depthwise_conv_u8_basic_ver1 function for depthwise convolution with asymmetric quantization.
        - Added arm_nn_sat_doubling_high_mult and arm_nn_divide_by_power_of_two support functions for quantization.
    - Updated: CMSIS-RTOS to version 4.82.
        - Corrected: Recursive Mutex 16-bit lock counter is now checked to not overflow.
    - Devices
        - Generalized C startup code for all Cortex-M family devices.
        - Updated Cortex-A memory regions and system configuration files.
    - Utilities
        - Updated SVDConv to version 3.3.27.
        - Updated PackChk to version 1.3.87.
- Arm - CMSIS-Driver 2.4.1
    - Added CMSIS-WiFi driver for the Espressif ESP8266 WiFi module.
    - Updated CMSIS-WiFi driver for the Inventek ISM43362 WiFi module to version 1.2.0.

        - Corrected SocketClose functionality.
        - Updated Initialization function to handle unavailable reset pin.
        - Updated functionality to comply with CMSIS WiFi Driver Validation.
        - Added debug of SPI traffic to Event Recorder.
        - Corrected PHY_LAN8742A power down bit definition.
- Keil - Arm Compiler 1.6.2
    - Added ARMV81MML to the list of supported processors.
    - Updated EventRecorder.scvd:
        - Using level 'Detail' for start/stop A event group to not show in red.
        - Adding prefix attribute to enable linking the event property to the doxygen documentation.

Cortex-M Architecture Models

- Updated Fixed Virtual Platform (FVP) support to version 11.8.59.

Target Debugging

- ULINKpro:
    - updated firmware to version 1.59 adding support for JTAG-DPv3 (ADIv6).
    - added support for CoreSight DAP v3 based on ADIv6.
    - added support for SDF files from CMSIS debug description for complex trace topologies.
    - added support for switch out of dormant state for CoreSight SW-DPv2 (Serial Wire Debug Port).
- ULINKplus:
    - added support for CoreSight DAP v3 based on ADIv6.
    - added support for SDF files from CMSIS debug description for complex trace topologies.
    - added support for switch out of dormant state for CoreSight SW-DPv2 (Serial Wire Debug Port).
- ULINK2:
    - added support for SDF files from CMSIS debug description for complex trace topologies.
    - added support for switch out of dormant state for CoreSight SW-DPv2 (Serial Wire Debug Port).
- CMSIS-DAP:
    - updated firmware to version 1.59 adding support for JTAG-DPv3 (ADIv6).
    - added support for CoreSight DAP v3 based on ADIv6.
    - added support for SDF files from CMSIS debug description for complex trace topologies.
    - added support for switch out of dormant state for CoreSight SW-DPv2 (Serial Wire Debug Port).

- ST-LINK (STMicroelectronics):
  - updated debug driver to version 3.0.7.0.
  - including firmware upgrade utility ST-LinkUpgrade.exe version 2.5.2.
- NULink (Nuvoton) updated debug driver to version 3.01.6951.
- Stellaris ICDI support has been removed.

12. MDK Version 5.28a

Release date: 5th June, 2019.

Corrected MDK Nuvoton Edition - Cortex-M0/M23 not recognized as valid product by Arm Compiler 5 and 6.

13. MDK Version 5.28

Release date: 28th May, 2019.

uVision updated to V5.28.0.0

- µVision now has the ability to set the trace clock separately from the core clock, so that trace is captured and processed correctly. This is available for all ULINK debug adapters and CMSIS-DAP.
- The System Analyzer data can now be saved as a comma separated or tab separated value file for further processing.

Arm Compiler Included

- Included Arm Compiler 5 version 5.06u6 - same as in MDK version 5.26: see Release Notes for further details.
- Updated Arm Compiler 6 to version 6.12: - same as in MDK version 5.27: see Release Notes for further details.

Software Packs Included

- ARM - CMSIS 5.5.1 - same as in MDK version 5.27.
- CMSIS-Driver 2.4.0 - same as in MDK version 5.27.
- Keil - ARM Compiler Extensions 1.4.0 - same as in MDK version 5.27.
- Keil - MDK Middleware 7.8.0 - same as in MDK version 5.27.

Licensing

- This version of MDK introduces the new editions Keil MDK Holtek Edition - Cortex-M0+ and Keil MDK Holtek Edition - Cortex-M.
- This version of MDK does not support the MDK Professional 7-day evaluation license

Target Debugging

- Added: P&E Micro Debugger driver installation can be launched from within µVision Options for Target Debug Settings dialog.
- Updated: Segger J-Link debug driver to version 6.46.
- Updated: NULink driver to version 3.00.6909.

14. MDK Version 5.27

Release date: 21th March, 2019.

MDK installation

- With this MDK release the default directory for pack installation has been changed from `c:\Keil_v5\ARM\PACK` to `%LOCALAPPDATA%\Arm\Packs`.
- The End User License Agreement is now unified across all Arm software development tools and links to product specific license information.

uVision updated to V5.27.1.0

- Improved µVision multi-core debugging support using CMSIS-DAP and ULINK debug adapters. The first connected instance of the debugger is the master; every other instance now displays Client Mode in the status bar.
- The System Analyzer shows statistical information for exceptions and Event Recorder events, for example Keil RTX5 thread switches.
- The Event Statistics window shows thread execution statistics based on events from the RTOS.
- µVision breakpoint management was extended with the action to Kill All Breakpoints in active Project and Kill All Breakpoints in Multi-Project Workspace.
- Corrected: µVision set incorrect ERRORLEVEL when Flex license checkout fails.

Arm Compiler Included

- Included Arm Compiler 5 version 5.06u6 (same as in MDK version 5.26): see Release Notes for further details.
- Updated Arm Compiler 6 to version 6.12: see Release Notes for further details.

Software Packs Included

- ARM - CMSIS 5.5.1
  - Folders removed:
    - The folder `.\CMSIS\Lib\` has been superseded by `.\CMSIS\DSP\Lib\`.
    - he folder `.\CMSIS\DSP_Lib\` has been superseded by `.\CMSIS\DSP\`.
  - Folder deprecated:
    - The folder `.\CMSIS\Include\` has been superseded by `.\CMSIS\DSP\Include\` and `.\CMSIS\Core\Include\`.
  - Updated: CMSIS-Core (Cortex-M) to version 5.2.0.
    - Added generic Armv8.1-M Mainline device support.
    - Reworked Stack/Heap configuration for ARM startup files.
    - Added Cortex-M35P device support.
  - Updated: CMSIS-Driver to version 2.4.0.

        - Added specification for WiFi Driver API version 1.0.0-beta.
        - Added “Custom” components for project specific driver implementations.
    - Updated: CMSIS-RTOS2 to version 2.1.3.
        - Updated: Keil RTX5 to version 5.5.0
            - Updated and enhanced generated events (reorganized components).
            - Updated configuration (Event Recorder).
            - Updated Component Viewer (improved performance).
    - Updated: CMSIS-DSP to version 1.6.0.
        - Reworked DSP library source files and documentation.
        - Updated Arm DSP libraries using Arm Compiler 6.12 for improved performance.
        - Added component variants ‘Source’ and ‘Library’. ‘Library’ variant is selected by default.
        - Moved DSP libraries from `.\CMSIS\Lib\` to `.\CMSIS\DSP\Lib\`.
- Keil - ARM Compiler Extensions 1.4.0
    - Improved Event Recorder documentation and examples.
- Keil - MDK Middleware 7.8.0
    - Added support for Arm Cortex-M1 based devices.
    - Added Event Recorder configuration in debug configuration.
    - Updated: the Network Component to version 7.10.0.
        - Added Virtual LAN (VLAN) support in the Ethernet interface.
        - Added dynamic port range settings in TCP and UDP sockets.
        - Improved Ethernet debugging.
    - Updated: the USB Component to version 6.13.0.
        - USB Host
            - Added unsupported state for a mounted device in the Component Viewer if no driver is available for this device.
            - Corrected EHCI driver for handling transfers larger than 16kB.
            - Corrected Component Viewer display when ARM Compiler 6 is used.
        - USB Device
            - Implement application specific behavior for a CDC ACM class by using the RNDIS protocol.
            - Increased the number of available CDC instances to 8.

Cortex-M Architecture Support

- Updated Fixed Virtual Platform (FVP) support to version 11.6.36 adding new models for:
    - MPS2_Cortex-M35P
    - MPS2_SecureCore-SC000

- MPS2_SecureCore-SC300

Some models added new parameters or updated parameter names. You may need to update project specific configuration files. Updated default configuration files are located in `C:\Keil_v5\ARM\FVP\MPS2_Cortex-M` or `C:\Keil_v5\ARM\FVP\MPS2_AEMv8M`.

Target Debugging

- Updated: STMicroelectronics ST-LINK debug driver to version 3.0.6.0.
- Updated: Segger J-Link debug driver to version 6.44a.
- Updated: NULink driver to version 2.06.6875.
- ST-Link now supports Pack settings that access debug definitions provided in Software Packs.

It might be required to update the ST-Link firmware using ST-LinkUpgrade.exe provided in the folder `C:\Keil_v5\Arm\STLink`.

FlexNet Floating Licenses

- Corrected a license activation failure for the 7 days evaluation of MDK Professional.

15. MDK Version 5.26

Release date: 10th September, 2018.

uVision updated to V5.26.2.0

- Improved Event Recorder performance and stability.
- Enhanced System Analyzer displaying RTX5 RTOS threads and thread events as well as long-term and cursor marker based energy measurement (ULINKplus).
- Added support for flash programming of Microchip SAML11 devices using debug sequences from the pack description instead of flash programming algorithms loaded into and executed from on-chip RAM.
- Updated PackInstaller supporting configuration of individual pack versions from local folders. This simplifies the workflow during the development and test of packs as it avoids the processing steps for pack generation and installation.
- Updated uVision's Customize Tools Menu ... with an Export/Import capability for sharing tools menu customization across PCs via a file.

Arm Compiler Included

- Included Arm Compiler 5 version 5.06u6 - same as in MDK - Version 5.25: see Release Notes for further details.
- Updated Arm Compiler 6 to version 6.10.1: see Release Notes for further details.

This release of the Arm Compiler 6 resolves the licensing issue caused by the Windows 10 update V1803. All previous versions of Arm Compiler 6 fail to checkout a license when used with Keil Single-User or Keil Floating licenses.

Software Packs Included

- ARM - CMSIS 5.4.0
  - Updated: CMSIS-Core (Cortex-M) to version 5.1.2 and CMSIS-Core (Cortex-A) to version 1.1.2
- Keil - MDK Middleware 7.7.0
  - Updated: the File System Component to version 6.10.1.
    - Minor change in Flash driver timeout handling (EFS).
  - Updated: the Network Component to version 7.9.0.
    - Updated BSD sockets. See revision history for details.
    - Updated DNS Client control adding the following blocking functions: netSNTPc_GetTimeX, netPing_EchoX, and netDNSc_GetHostByNameX.
    - Corrected DHCP client problem assigning an address, if the IP address has already been set by AutoIP.

- Updated: the USB Component to version 6.12.8.
  - Corrected timer, semaphore and mutex section location (for debugging).
  - Improved robustness by adding 2 retries for failed driver operations.
  - USB Host
    - Corrected USART_CDC_ACM.c CMSIS UART driver receive function returning invalid data in receive buffer.
    - Improved USB Flash-Disk unmount procedure.
  - USB Device
    - Corrected USBD_MSCn_GetMaxLUN callback return type from bool to uint8_t.
- The Graphic Component remains unchanged at version 5.46.5 (5.46e).

- Keil - Arm Compiler Extensions 1.6.0
  - Event Recorder:
    - Updated Documentation.
    - Extended SCVD file format with state information.
    - Changed protocol version to 1.1.
    - Updated Event Recorder configuration file.
    - Added example projects for Cortex-M0 and state information.

Target Debugging

- Updated: Segger J-Link debug driver to version 6.32i.
- Updated: STMicroelectronics ST-LINK debug driver to version 3.0.5.0 adding option for integrated firmware updates.
- Updated: P&E Micro debug driver to version 6.83.
- Updated: NULink driver to version 2.04.6725.

16. MDK Version 5.25

Release date: 22nd March, 2018.

uVision updated to V5.25.2.0

- New: System Analyzer shows relevant execution information over time in a single window. It displays program events, interrupt execution, data trace, and power consumption (when using ULINKplus).
- New: Event Statistics Window displays execution time and current consumption (when using ULINKplus) between corresponding start and stop events. It provides statistics for average values across a number of executions and captures minimum and maximum time/current events.
- Added: Event Recorder debug commands: event file logging, filter setup save/restore, and statistic reset/file logging.
- New: Editor Improvements: grey text shows inactive source code between `#if/#endif` statements; underlined text shows help links for symbols, types and functions. Press the F1 key to open the corresponding documentation.
- New: Energy Measurement without Debug disables the CoreSight debug hardware for pure power measurement of the target hardware using ULINKplus.

Arm Compiler Included

- Updated ARM Compiler 5 to version 5.06u6: see Release Notes for further details.
- Updated ARM Compiler 6 to version 6.9: see Release Notes for further details.

Software Packs Included

- ARM - CMSIS 5.3.0
  - Added: Initial version of Neural Network Library CMSIS-NN version 1.0.0.
  - Updated: CMSIS-Core (Cortex-M) to version 5.1.1 and CMSIS-Core (Cortex-A) to version 1.1.1
  - Updated: the CMSIS-DAP to version 2.0.0 (Communication via WinUSB to achieve higher transfer rates).
- Keil - ARM Compiler Extensions 1.4.0
  - Added dedicated start/stop events to the Event Recorder component. These events enable the MDK debugger's Event Statistics dialog to display minimum, maximum and average execution time, number of passes and current consumption in between these events.
- Keil - MDK Middleware 7.6.0
  - The File System Component remains unchanged to version 6.10.0.
  - Updated: the Network Component to version 7.8.0.
    - Added: netUninitialize function to uninitialize the Network component.
    - Corrected: a failure in netSMTPc_SendMail function, when sending an email with a large attachment.

        - Corrected: netSMTPc_SendMail functionality, if the requested attachment does not exist, the function fails with error code netFileError, rather than send a dummy attachment.
        - Changed: return code netError to netFileError where appropriate in TFTP client.
        - Corrected: quoted-printable encoding for the character '=' in netSMTPc_SendMail function.
        - Documented: possible return codes for Network API functions.
        - Updated: the USB Component to version 6.12.4.
    - USB Host
        - Corrected: timer, semaphore and mutex section location for debugging purposes.
        - Improved: robustness by adding 2 retries for failed driver operations.
        - Corrected: USART_CDC_ACM.c CMSIS UART driver receive function returning invalid data in receive buffer.
        - Improved: USB Flash disk unmount procedure.
    - USB Device
        - Corrected: timer, semaphore and mutex section location for debugging purposes.
        - Improved: robustness by adding 2 retries for failed driver operations.
    - Updated: the Graphic Component to version 5.46.5 (5.46e).
        - Added new set of functions for runtime rotation.
        - Added new function GUI_SetClearTextRectMode() to manage the background drawing behavior of GUI_DispStringInRect()

Target Debugging

- Added: Arm ULINKplus debug adapter support. See the ULINKplus User's Guide for further information. The User's Guide also covers the uVision features introduced for Power Measurement and Test Automation using ULINKplus.
- Updated: P&E Micro debug driver to version 6.78.
- Updated: Segger J-Link debug driver to version 6.30h.
- Updated: NULink driver to version 2.03.6674.

17. MDK Version 5.24a

Release date: 05th July, 2017.

uVision updated to V5.24.2.0

- Fixed: 3rd party peripheral simulation, dialog DLLs and debugger DLLs fail to load implicitly linked DLLs.

18. MDK Version 5.24

Release date: 30th June, 2017.

uVision updated to V5.24.1.0

- Updated: Feature map of the MDK Editions are reflected by the product i.e.:
  - Introduction of MDK Essential superseding MDK Cortex-M.
  - MDK Plus supporting secure mode application development and debug of Cortex-M23 and Cortex-M33 based devices.
- Added: Source Browse information is now available in project targets using ARM Compiler 6:
  - Information is generated dynamically, does not require a successful project build and is updated as the source code is edited.
  - While the source code is processed, the status bar displays: `Creating Browse Information ...`.
- Improved: Source Browser window redesign for better usability for project targets using the ARM Compiler 6.
- Improved: Dynamic Syntax Checker for project targets using the ARM Compiler 6:
  - Warning level configured for the build is also considered by dynamic syntax checking.
  - Warning and Errors are now consistent with the build output window.
- Added: ARM Compiler 6 warning level MISRA Compatible suppressing compiler warnings contradicting MISRA rules. Warning level Moderate - Warnings got renamed to AC5-like Warnings.
- Improved: PC-Lint setup:
  - separate configuration settings for C and C++ modules.
  - the generated lint command files are stored in the output folder configured for object files.
- Extended: the ARM-Compiler version selection in Options for Target dialog adds the option to select the latest installed version of ARM Compiler 5 and ARM Compiler 6.
- Improved: the MDK-ARM installer creates a backup of the TOOLS.ini file in case an existing installation folder is used.

Arm Compiler Included

- The ARM Compiler 6.7.
- The ARM Compiler 5.06u5.

Software Packs Included

- ARM - CMSIS 5.0.1 same as in MDK - Version 5.23.
- Keil - MDK Middleware 7.4.1
  - Updated the FileSystem Component to version 6.9.8.

        - Added: for memory cards connected via SPI a bus frequency adaptation algorithm is implemented.
        - Enhanced: debug messaging for Event Recorder.
    - Updated the USB Component to version 6.11.0.
        - Added: support for ARMCLANG compiler version 6.
        - USB Host
            - Corrected: enumeration of USB HID devices which stall SetIdle request.
        - [USB Device]https://www.keil.com/pack/doc/mw/USB/html/_u_s_b__device.html()
            - Added: Mass Storage Class support for multiple Logical Units (up to 4).
    - Updated the Network Component to version 7.5.0.
        - Added: support for IPv4 fragmentation and reassembly.
        - Added: configurable MTU parameter at runtime.
- Keil - ARM Compiler Extensions 1.3.1
    - Updated SCVD examples to build without warnings for use with ARMCLANG compiler.
    - Updated SCVD Event Recorder documentation.

Target Debugging

- Updated: Nuvoton NULink debug driver to version 2.01.6592.
- Updated: P&E Micro debug driver to version 6.42.
- Updated: Segger J-Link debug driver to version 6.16c adding support for ARMv8-M based devices.
- Updated: STMicroelectronics ST-LINK debug driver to version 3.0.1.0 adding support for ST-Link V3.

19. MDK Version 5.23

Release date: 10th February, 2017.

uVision updated to V5.23.0.0

- Improved: PC-lint and MISRA Validation configurations are available for ARM Compiler 5 and 6. Misra C 1998, 2004, 2012 and Misra C++ 2008 coding guidline setups are included.
- Added: ability to export Code Coverage data into *.gcov format.
- Enhanced: printf support for Cortex-M0/M0+ based devices by redirecting the Event Recorder printf-Events to the Debug-Printf-Viewer window.
- Added: support for Target Access Functions QueryValue(), Message(), and LoadDebugInfo() in the CMSIS-Pack Debug Access Sequences section.

Arm Compiler Included

- The ARM Compiler 6.6 can be used now with all code size restricted MDK-ARM product variants.

Software Packs Included

- ARM - CMSIS 5.0.1
  - Updated: CMSIS DSP library to version 1.5.0.
  - Updated: CMSIS-RTOS2 API to version 2.1 and the RTX kernel to version 5.1.0.
- Keil - MDK Middleware 7.4.0
  - The FileSystem, USB, and Network libraries have been made RTOS agnostic which allows the usage of CMSIS-RTOS v1 or CMSIS-RTOS v2. All OS calls are external and at compile time available.
  - Updated the FileSystem Component to version 6.9.4.
    - Added: parameter checking for finfo and corrected the behavior when a specified drive is unmounted.
    - Updated: ARM Compiler 6 compatible configuration files.
  - Updated the USB Component to version 6.10.0.
    - USB Host Corrected: a deadlock which occurs when a USB Flash Disk is disconnected while there was active read or write to it.
  - Updated the Network Component to version 7.4.0.
- Keil - ARM Compiler Extensions 1.3.0

FlexNet Floating Licenses

- Customers using FlexNet floating licenses should update the FlexNet License Server to version 11.14.1.0. This FlexNet server version is mandatory for upcoming tool releases.
- FlexNet Version 11.14.1.0 License Server tools for Windows are located in the directory `..\Keil\UV4\FlexNet`. Refer the FlexLM licensing knowledgebase article for more information.

- FlexNet Version 11.14.1.0 License Server tools are also available on developer.arm.com for other hosts platforms.

PackInstaller

- Improved: PackInstaller can import Software Components from other sources located on your computer or on a mapped network drive and manage them as separate software packs.
- Added: option Check for Updates on Launch to download any updated PDSC file form www.keil.com when the PackInstaller is started.

Target Debugging

- Updated: ULINKpro firmware to version 1.58, which corrects connectivity issues for low supply voltage targets.
- Improved: Multi-Core debug stability for CMSIS-DAP debuggers.
- Improved: download of large applications into RAM at low debug clock frequencies of the ULINKpro debugger.
- Enhanced: Reset Type selection in the Debug Setup Dialog. The setup is now based on the CMSIS Pack information.
- Updated: P&E Micro driver to version 6.27.

20. MDK Version 5.22

Release date: 11th November, 2016.

This release includes support for Cortex-M33 and Cortex-M23 devices based on the ARMv8-M architecture. For using Cortex-M33 and Cortex-M23 a MDK-Professional Edition is required.

uVision updated to V5.22.0.0

- Added: Event Recorder that shows dynamic execution status and event information which helps to analyze the operation of software components. The required annotations are implemented in debug variants of the MDK middleware.
- Added: Cortex-M23 and Cortex-M33 processor support.
- Enhanced: Core peripheral dialogs (Secure/Non-Secure MPU, SysTick, SAU, NVIC) for ARMv8-M based devices
- Enhanced: Debug status bar displays Debug and Core security status for TrustZone for ARMv8-M enabled devices
- Enhanced: New PC-Lint configuration option to add project target and compiler specific preprocessor symbols

Arm Compiler Included

- ARM Compiler 5.06u4. Refer to ARMCC 5.06u4 Specific Release Notes for details.
- ARM Compiler 6.6 which supports Cortex-M33 and Cortex-M23 based devices. Refer to ARMCLANG 6.6 Specific Release Notes for details.

Software Packs Included

- ARM - CMSIS 5.0.0 supports now the ARMv8-M architecture including TrustZone for ARMv8-M hardware security extensions and the Cortex-M23 and Cortex-M33 processors.
  - Added CMSIS-RTOS V2 API which extends the CMSIS-RTOS v1 API by supporting the ARMv8-M architecture, dynamic object creation, provisions for multi-core systems, and binary compatible interface across ABI compliant compilers.
- Keil - MDK Middleware 7.3.0
  - Added debug library variants for Networking, USB, and FileSystem with Event Recorder support.
  - FileSystem Component 6.9.0 Enhanced eMMC (embedded Multimedia Card) initialization robustness.
  - USB Component 6.9.0
    - USB Host Improved USB memory stick enumeration to cope with long timeouts after initial reset.
    - USB Device Added capability to disable string for Custom Class interfaces.
- Keil - ARM Compiler Extensions 1.2.0
  - Added support for Cortex-M23 and Cortex-M33 processors.

- Added new component Event Recorder.

FlexNet Floating Licenses

- Customers using FlexNet floating licenses should update the FlexNet License Server to version 11.14.0.0. This FlexNet server version is mandatory for upcoming tool releases.
- FlexNet Version 11.14.0.0 License Server tools for Windows are located in the directory `..\Keil\UV4\FlexNet`. Refer the FlexLM licensing knowledgebase article for more information.

Target Debugging

- Updated: Segger J-Link driver for ARM devices to version 6.10i.
- Updated: P&E Micro driver to version 6.03.
- Updated: NULink driver to version 2.00.6561.
- Added: Event Recorder Support.
- Improved: support for V8M based CPUs.
- Improved: Core peripheral dialogs.

21. MDK Version 5.21a

Release date: 18th August, 2016.

uVision updated to V5.21.1.0

- Corrected: regression on debug exit.

22. MDK Version 5.21

Release date: 12th August, 2016.

uVision updated to V5.21.0.0

- Introduce the Component Viewer debug window which shows information about the state of Software Components in the current application.
- Extended: UVSOCK functionality to output data on selectable ITM channels.

Arm Compiler Included

- ARM Compiler 5.06u3. Refer to ARM Compiler 5.06 toolchain documentation for details.
- ARM Compiler 6.5 Refer to ARMCLANG 6.5 toolchain documentation for details.

Software Packs Included

- ARM - CMSIS 4.5.0 same as in MDK - Version 5.20.
- Keil - ARM Compiler Extensions 1.1.1 adds support for ARM Compiler 6 and ARMv8-M architecture.
- Keil - MDK-ARM Professional Middleware 7.2.0
  - Network Component 7.2.0 provides now three variants, selectable in the Manage Run-Time Environment dialog:
    - MDK-Pro supports IPv4, IPv6, SSL/TLS. Migration of projects that use API of Network v6 is supported using the Legacy API.
    - MDK-Plus supports IPv4. Migration of projects that use API of Network v6 is supported using the Legacy API.
    - MDK-Pro Net_v6 supports IPv4 and uses the API of Network v6. Select this variant to maintain older projects without migration.
  - FileSystem Component 6.8.0 enhances for FAT-32 speed of 'mount' operation for removable media; adds for EFS uniform flash sector.
  - USB Component 6.8.0
    - USB Host adds notification functions for each supported class and extends the API with functions to get additional device information.
    - USB Device adds user notifications for device events and Interface Association settings for Custom Class.

Target Debugging

- Updated: Segger J-Link driver for ARM devices to version 6.00.
- Updated: debug support for the Texas Instruments XDS110 debug probe that is used on the TI MPS432 Launchpad to version 1.0.2.
- Added: ULink2/ULink-ME and CMSIS-DAP debug support for ARMv8-M based devices.

23. MDK Version 5.20

Release date: 9th May, 2016.

uVision updated to V5.20.0.0

- Added: Component Viewer which shows the status of the Network, USB, and the File System middleware components during operation by using the µVision debugger.
- Added: annotation items <c> and <!c> in the Configuration Wizard to control code sections using comments.

Arm Compiler Included

This release includes two ARM Compiler Versions.

- ARM Compiler 5.06u2: should be used for Cortex-M devices. Refer to Compiler Specific Release Notes for details.
- ARM Compiler 6.4 (LLVM technology): should be used for ARMv8-M processors (currently not supported in MDK-Lite). The usage for Cortex-M devices is possible, however requires CMSIS Version 5 that is currently available as beta version. Refer to ARMCLANG Specific Release Notes for details.

Software Packs Included

- ARM - CMSIS 4.5.0 adds CMSIS-Driver CAN and corrects issues in CMSIS-RTOS RTX.
- Keil - ARM Compiler Extensions 1.1.0 adds support for ARM Compiler 6 and ARMv8-M architecture.
- Keil - MDK-ARM Professional Middleware 7.1.0 adds support for mbed TLS, HTTPS server, and several other improvements.

The API of the Network 7 component is not backwards compatible to Network version 6. When loading projects that use Network 6, uVision will report:

```
   Error #540: 'Keil.MDK-Pro::Network:CORE:Release:6.5.0' component is
not available for target ...
```


Note

There are two ways to resolve this issue:

1. Install Keil - MDK-ARM Professional Middleware 6.6.0 and open the dialog Select Software Packs to select the version of the pack.
2. Migrate the application to Network 7 as described in the user's guide of the Network Dual-Stack Component - Migration. Using the Compatibility Mode simplifies the migration of existing projects.

Several Device Family Packs (DFP) contain example projects for the Network 6 and Network 7 component. Examples specific to Network 7 are marked with IPv4/IPv6.

ARMv8-M Architecture Support (MDK-Professional Edition only)

Software Development for the ARMv8-M Architecture is fully supported with:

- ARM Compiler 6.4 (LLVM technology): that includes ARMv8-M Security Extensions for TrustZone.
- Fixed Virtual Platform: with complete simulation model for ARMv8-M Baseline and ARMv8-M Mainline.
- ARM - CMSIS 5.0.0: with support for ARMv8-M processor architecture. Currently available as beta version via PackInstaller or www.keil.com/pack.
- Keil - V2M-MPS2_CMx_BSP 1.3.0: is the ARM V2M-MPS2 Board Support PACK for Cortex-M System Design Kit Devices and contains ARMv8-M with example projects. Available via PackInstaller or www.keil.com/pack.

Target Debugging

- Updated: Segger J-Link driver for ARM devices to version 5.12e.
- Added: debug support for the Texas Instruments XDS110 debug probe that is used on the TI MPS432 Launchpad.
- Updated: P&E Micro driver for Freescale Kinetis devices to version 2.4.6.0.

24. MDK Version 5.18a

Release date: 22nd March, 2016.

uVision updated to V5.18.1.0

- Corrected: potential stability issues introduced in version 5.18 when using trace features of the debugger.
- Corrected: ULINKpro, ULINK2, and CMSIS-DAP interface drivers to correct the stability issues.

25. MDK Version 5.18

Release date: 5th February, 2016.

uVision updated to V5.18.0.0

- µVision now offers Japanese localization on Windows PCs with the 'primary language' Japanese. To select the language use the uVision menu item Edit - Configuration - Other - Startup - Language.
- A Japanese Getting Started user's guide is available in the uVision Books Window.

Arm Compiler Included

- ARM Compiler 5.06u1. Refer to Compiler Specific Release Notes for details.

Software Packs Included

- ARM - CMSIS 4.5.0 adds CMSIS-Driver CAN and corrects issues in CMSIS-RTOS RTX.
- Keil - ARM Compiler Extensions 1.0.0 enables I/O re-targeting via File System, UART, ITM debug channel, or user-defined functions.
- Updated: Keil - MDK-ARM Professional Middleware 7.0.0 introducing Network Dual Stack (IPv4/IPv6) Version 7.0 and updated Graphic Library, File System, and USB Host.

The API of the Network 7 component is not backwards compatible to version 6. When loading projects that use Network 6, uVision will report:

```
Error #540: 'Keil.MDK-Pro::Network:CORE:Release:6.5.0' component is not
 available for target ...
```

There are two ways to resolve this issue:

1. Install Keil - MDK-ARM Professional Middleware 6.6.0 and open the dialog Select Software Packs to select the version of the pack.

2. Migrate the application to Network 7 as described in the user's guide of the Network Dual-Stack Component - Migration. Using the Compatibility Mode simplifies the migration of existing projects. Example projects of existing Device Family Packs (DFP) are based on the Network 6 component and currently the following software packs are affected:

- Keil.EFM32GGxxx_DFP.2.2.0.pack
- Keil.SAM-ESV7_SFP.2.2.0.pack
- Keil.Kinetis_SDK_DFP.2.2.0.pack
- Keil.LPC1700_DFP.2.2.0.pack
- Keil.LPC1800_DFP.2.6.0.pack
- Keil.LPC4000_DFP.2.0.0.pack

- Keil.LPC4300_DFP.2.6.0.pack
- Keil.STM32F1xx_DFP.2.0.0.pack
- Keil.STM32F2xx_DFP.2.5.0.pack
- Keil.STM32F4xx_DFP.2.7.0.pack
- Keil.STM32F7xx_DFP.2.4.0.pack

These example projects are based on the Network 6 component: BSD Client, BSD Server, FTP Server, HTTP Server, HTTP Upload, SMTP Client, SNMP Agent, Telnet Server. Future releases of DFPs will be based on the Network 7 component.

Target Debugging

- Updated: Segger J-Link driver for ARM devices to version 5.10i.
- Implemented multicore support for CMSIS-DAP debugger. It is possible to debug two different cores on the same device by using two instances of µVision.

26. MDK Version 5.17

Release date: 30th October, 2015.

uVision updated to V5.17.0.0

- Added: new option to limit the Find in Files utility to the “Current Document”.
- Added: new option Stop after Reset in Debug driver configuration to stop program execution on reset (Reset Vector Catch).
- Enhanced: editor now supports Arabic, Baltic, Eastern European, Greek, Hebrew, Russian, Thai, Turkish, and Vietnamese character sets.
- Corrected: Bookmark navigation is now working only on the “Current Document”.
- Corrected: System and Thread Viewer shows now also the stack usage of os_idle_demon.
- Corrected: while creating a project and selecting different devices, device startup files of previous selected devices are renamed to - filename.NNNN to provide a backup.
- Corrected: STM32CubeMX for configuration of the STM32Cube framework sometimes failed to start.
- Corrected: opening struct elements in the Watch Window did not always show up-to-date values.

Arm Compiler Included

- ARM Compiler 5.06u1 solves a ARM7, ARM9, and Cortex-R related defect introduced with ARM Compiler 5.06 in MDK 5.16. Refer to Compiler Specific Release Notes for details.

Software Packs Included

- Updated: Keil - MDK-ARM Professional Middleware 6.5.0 improved are the Graphic Library, File System, and USB Host.
- Updated: ARM - CMSIS 4.5.0 adds CMSIS-Driver CAN and corrects issues in CMSIS-RTOS RTX.
- Keil - ARM Compiler Extensions 1.0.0 enables I/O re-targeting via File System, UART, ITM debug channel, or user-defined functions.

Target Debugging

- Updated: Segger J-Link driver for ARM devices to version 5.02f.
- Updated: the STMicroelectronics ST-LINKIII-KEIL_SWO.dll to version 2.0.18.
- Updated: the NuLink Keil driver to version 1.30.6491.
- Added: the NuLink USB driver version 1.1.

27. MDK Version 5.16a

Release date: 27th August, 2015.

uVision updated to V5.16.1.0

- This MDK release contains µVision V5.16.1.
- Corrected: export of mbed projects had potential build errors.

Arm Compiler Included

- The ARM Compiler 5.05u2 must be used for ARM7, ARM9 and Cortex-R4 processor based targets due to a regression in ARM Compiler 5.06. This defect will be fixed in MDK Version 5.17. This MDK release installs:
  - ARM Compiler 5.06 (default for Cortex-M targets) which includes support for STM32L4 Series. All compiler related files located in `..\ARM\ARMCC\` directory. Details can be found in the Compiler specific Release Notes.
  - ARM Compiler 5.05u2 (default for ARM7, ARM9, Cortex-R4). All compiler related files located in `..\ARM\ARMCC_505u2\` directory. Details can be found in the Compiler specific Release Notes.

28. MDK Version 5.16

Release date: 12th August, 2015.

uVision updated to V5.16.0.0

- This MDK release contains µVision V5.16.0.
- Improved: Project build now takes advantage of systems that have multiple processors or multiple-core processors. Additional build - processes are created to utilize the available processors and therefore drastically reduce the overall built time. µVision can process - these builds simultaneously, and therefore overall build time is reduced.
- Added: With the menu Edit – Configuration - Right Margin a line boarder can be configured which is show as vertical line or coloured - background.
- Added: compiler toolchain documentation is now also accessible in PDF format from the Books Window.

Arm Compiler Included

- This MDK release contains ARM Compiler 5.06 (build 20) which includes support for STM32L4xx based devices. All compiler related files located in `..\ARM\ARMCC\` directory. Details can be found in the Compiler specific Release Notes.

Software Packs Included

- Keil - MDK-ARM Professional Middleware 6.5.0
  - The Keil::MDK-Middleware 6.5.0 Software Pack contains several enhancements and corrections. Improved are the Graphic Library, File System, - and USB Host.
- ARM - CMSIS 4.3.0
  - The ARM::CMSIS 4.3.0 Software Pack adds a CMSIS-Driver for Serial Audio Interface (SAI) and improves CMSIS-RTOS RTX with Stack Watermark and IRQ timing statistics. Included are also several other enhancements such as cache control functions for Cortex-M7.
- Keil - ARM Compiler Extensions 1.0.0
  - The Keil::ARM_Compiler 1.0.0 Software Pack contains the new Software Component Compiler that expands MicroLib with assert and enables I/O re-targeting via File System, UART, ITM debug channel, or user-defined functions.

Target Debugging

- Updated: Segger J-Link driver for ARM devices to version 4.98e.
- Updated: the STMicroelectronics ST-LINKIII-KEIL_SWO.dll to version 2.0.17.

29. MDK Version 5.15

Release date: 29th May, 2015.

uVision updated to V5.15.0.0

- This MDK release contains µVision V5.15.0.
- Improved: Support for multiple ARM Compiler Versions that allows now to Setup Default ARM Compiler Versions for each processor core.
- Added: Support for Stack usage watermark in the System and Thread Viewer that is available with CMSIS-RTOS RTX V4.78 or higher. This also shows the maximum stack load during execution of a thread.
- Improved: Icons in the Project Window for RTE Configuration Files indicate compatibility of current files with software components from new - Software Packs. The new command Update Config File and Lauch Merge available from context menu in the Project Window simplifies the migration of existing configuration settings.
- Improved: MDK now uses Semantic Versioning for Software Packs, software components, and configuration files.
- Added: Set-up PC-Lint has a new option to include all project-target related folders for searching header files.
- Added: Source Version Control System (SVCS) templates files for GIT and Tortoise SVN.

Arm Compiler Included

- This MDK release contains ARM Compiler 5.05u2 (build 169). All compiler related files located in `..\ARM\ARMCC\` directory. Details can be found in the Compiler specific Release Notes.

Software Packs Included

- Keil - MDK-ARM Professional Middleware 6.4.0
  - The Keil::MDK-Middleware 6.4.0 Software Pack supports now ARM Cortex-M7 devices and solves a problem with File System (fpwd function) and - Networking (HTTP server). Keil::MDK-Middleware 6.4.0 requires ARM::CMSIS 4.3.0 and Keil::ARM_Compiler 1.0.0 Software Pack.
- ARM - CMSIS 4.3.0
  - The ARM::CMSIS 4.3.0 Software Pack adds a CMSIS-Driver for Serial Audio Interface (SAI) and improves CMSIS-RTOS RTX with Stack Watermark and IRQ timing statistics. Included are also several other enhancements such as cache control functions for Cortex-M7.
- Keil - ARM Compiler Extensions 1.0.0
  - The Keil::ARM_Compiler 1.0.0 Software Pack contains the new Software Component Compiler that expands MicroLib with assert and enables I/O re-targeting via File System, UART, ITM debug channel, or user-defined functions.

Target Debugging

- Updated: Driver for Segger J-Link with bug fixes and support for JTAG clock speed: 20, 25, 33, and 50 MHz.
- Updated: Driver and firmware for STMicroelectronics ST-Link to support the latest STM32 devices.
- Updated: Driver for Nuvoton Nulink with bug fixes and support for M0519, NM1320 and Mini58 Cortex-M0 based devices.

Pack Installer

- Improved: Selection of Devices and Boards lists Device Specific and Generic Software Packs and relevant Project Examples. When the Pack Installer is launched from uVision the device of the project target is selected.
- Added: Output window that summarizes warning and error messages.

30. MDK Version 5.14

Release date: 13th February, 2015.

uVision updated to V5.14.0.0

- This MDK release contains µVision V5.14.0.0.
- Improved download support for missing Software Packs where a fixed version is selected in the project. Before the latest version was downloaded.
- At load time of a project the device name can be manually changed when the project was using an obsolete device that no longer available with the current Software Pack.
- The new debug command SBC allows to control software breakpoints which is for example important for algorithm verification that calculate CRC over a code area.
- The Event Viewer displays now also timing information for interrupt execution.

Arm Compiler Included

- This MDK release contains ARM Compiler 5.05u1 (build 106). All compiler related files located in `..\ARM\ARMCC\` directory. Details can be found in the Compiler specific Release Notes.
- The ARM Compiler 5.04u2 for safety critical applications is available from ARM Compiler download area (a registration or login is required).

Software Packs Included

- Keil.MDK-Middleware Version 6.2.0
- CMSIS Version 4.2.0

Target debugging

- Updated: ULink2 Firmware version update to 2.03 that fixes a potential problem with USB 3.0 ports.
- Updated: Segger J-Link driver for ARM devices to version 4.96d that now supports Cortex-M7.
- Updated: *NuLink* version 1.28.6386 with correct access to Flash algorithms from Software Packs.

31. MDK Version 5.13

Release date: 18th December, 2014.

uVision updated to V5.13.0.0

- This MDK release contains µVision V5.13.0.0.
- With the new menu Project - Manage - Migrate to Version 5 Format ... an existing MDK version 4 project is converted to the new MDK version 5 format.
- The toolbar Batch Build is now available also for single projects providing a convenient way to build a selection of project targets in one working step.
- Missing Software Packs are detected by uVision and the PackInstaller is launched to download and install them while loading the project.

Arm Compiler Included

- This MDK release contains ARM Compiler 5.05u1 (build 106). All compiler related files located in `..\ARM\ARMCC\` directory. Details can be found in the Compiler specific Release Notes.
- The ARM Compiler 5.04u2 for safety critical applications is available from ARM Compiler download area (a registration or login is required).

Software Packs Included

- Keil.MDK-Middleware Version 6.2.0
- CMSIS Version 4.2.0

Target debugging

- Updated: Segger J-Link driver for ARM devices to version 4.91j.
- Updated: STMicroelectronics ST-Link driver for STMicroelectronics devices to version 2.0.14.

32. MDK Version 5.12

Release date: 24th September, 2014.

This MDK version introduces support for ARM Cortex-M7 processor based devices.

The STM32 Device Family Packs Version 1.x.x are *incompatible* with CMSIS Version 4.2.0 and MDK-Middleware Version 6.1.1. The compatible STM32 Device Family Packs Version 2.x.x will be released shortly. The application note 266 Using Keil MDK v5.11 with STM32 devices describes how to use the older STM32 Device Family Packs.

uVision

- Enhanced performance in the Project View and new file, group, and component attributes.

Arm Compiler Included

This MDK release contains two ARM Compiler versions that can be selected in the dialog Project - Options for Target - Target (under Code Generation):

- ARM Compiler 5.05 (build 41) (in directory `..\ARM\ARMCC\`) with support for Cortex-M7 and other enhancements (see release notes).
- ARM Compiler 5.04u2 (build 82) (in directory `..\ARM\ARMCC_504u2\`) for safety critical applications in combination with the ARM Compiler Qualification Kit (only available with a license for MDK-Professional).

Software Packs Included

- CMSIS Version 4.2.0: Cortex-M7 related updates to CMSIS-CORE, CMSIS-DSP, CMSIS-PACK, and CMSIS-SVD.
- MDK-Middleware Version 6.1.1: Driver Network/Driver/ETH_KSZ8851SNL.c corrected an invalid power status in function `MAC_PowerControl`.

FlexNet Floating Licenses

- Customers using FlexNet floating licenses are required to update their license server software to Version 11.12.1 or higher. Using older versions of the FlexNet license server will result in error messages by the ARM Compiler tools. `FlexNet Licensing error:-96,7. System Error: 11001 "Comm. error"`
- FlexNet Version 11.12.1 License Server tools for Windows are located in the directory `..\Keil\UV4\FlexNet`. For other operating systems please contact support.

Target debugging

- Updated: Segger J-Link driver for ARM devices to version 4.91b.
- Updated: NuLink software to version 6.3.14.
- Updated: STMicroelectronics ST-Link driver for STMicroelectronics devices to version 2.0.10.0.

- Updated: ULINKpro-DAP driver to support Cortex-M7 based devices.

33. MDK Version 5.11a

Release date: 17th June, 2014.

This MDK release includes the Software Packs CMSIS Version 4.1 and MDK-Middleware Version 6.0 that are *incompatible with the current STM32 Device Family Packs*. The application note 266 Using Keil MDK v5.11 with STM32 devices describes the reasons and the resolution.

uVision updated to V5.11.1.0

- Updated µVision (V5.11.1.0):
  - gpdsc file reload problem fixed (Infineon DAVE3)
  - Select Software Packs dialog control via keyboard fixed
- Updated SystemViewer.dll (V2.28.0):
  - Periodic window update for child elements fixed
  - Abort on Display of LPC4300 GPIO registers fixed

34. MDK Version 5.11

Release date: 12th June, 2014.

uVision updated to V5.11.0.0

- µVision V5.11.0.0 with new features for Select Software Packs.
- Pack Installer V1.2 with minor bug fixes.

Arm Compiler

- The `absacc.h` header file has been removed from the `ARMCC\include` folder. Use the `_attribute_` syntax instead of the macro `__at`.

Software Packs Included

- CMSIS V4.1.0 with new CMSIS-Driver API.
- MDK-Middleware V6.0.0 that uses the new CMSIS-Driver API.

These Software Packs are compatible with the new DFP Version 2.0.x or higher for Infineon and NXP. All future DFP's will rely on the above Software Packs.

For using middleware with EnergyMicro and ST devices that are based on DFP Version 1.x select CMSIS V3.2.x and MDK-Middleware V5.1.x as described under Select Software Packs.

Target debugging

- Updated: STMicroelectronics ST-Link driver for STMicroelectronics devices to version 2.0.6.0 to support STM32L0 devices.
- Updated: NuLink software to version 6.2.11

35. MDK Version 5.10

Release date: 21st February, 2014.

uVision updated to V5.10.0.2

- This MDK release contains µVision V5.10.0.2.
- This MDK release contains Pack Installer V1.1. It features a new searchable right hand column, listing all supported Boards and Devices. Based on the selection available Software Packs and Examples are listed in the left hand column.

Arm Compiler Included

- This version contains ARM Compiler 5.04u1.
- Details can be found in the Compiler specific Release Notes.

Target debugging

- Updated: Segger J-Link driver for ARM devices to version 4.80g.
- Updated: STMicroelectronics ST-Link driver for STMicroelectronics devices to version 2.0.4.0. USB Drivers are located in `.\ARM\STLink\USBDriver`.
- Updated: P&E Micro driver for Freescale Kinetis devices to version 2.0.4.0.

36. MDK Version 5.01

Release date: 17th December, 2013.

uVision updated to V5.1.0.0

- This release includes an updated Software Pack schema definition. Software Packs that require this new schema version will not be - compatible with older releases of MDK.
- This MDK V5 release is delivered with µVision V5.1.0.0.

37. MDK Version 5.00

Release date: 7th September, 2013.

uVision

- The Run-Time Environment (RTE) defines the software components that are used in a project. The new Run-Time - Environment Dialog shows all installed Software Components that are available for the selected microcontroller.
- User Code templates contain example code for frequently used functionality in software components that are delivered - as a part of Software Packs.
- µVision 5 introduces new project file extensions *.uvprojx, *.uvoptx, and *.uvguix to indicate projects that use RTE. The - option Project - Manage - Use Run-Time Environment enables or disables RTE. When RTE is disabled, µVision 4 compatible project files are - created.
- This MDK V5 release is delivered with µVision V5.0.5.15.

Arm Compiler Included

- This version contains ARM Compiler 5.03u2.
- All compiler related files are located in `..\ARM\ARMCC\` directory.
- Details can be found in the Compiler specific Release Notes.

Software Packs Included

- MDK-ARM V5.0 (MDK V5) introduces Software Packs which make device support and middleware updates independent from the toolchain - installation. The MDK V5 installer contains the µVision IDE and Debugger, the ARM Compiler and the new Pack Installer which is used to - manage Software Packs. Device support, CMSIS and MDK-Professional Middleware are delivered as Software Packs.
- Software Packs can contain device database descriptions, CMSIS Core Device and CMSIS SVD files, as well as Flash Programming Algorithms and other Software Components. For more details refer to the documentation.

Software Installation and Updates

- The new Pack Installer is a utility for installing, updating, and removing Software Packs. In addition, it enables the user to copy example - projects which are part of a Software Pack to a local folder.
- A current set of Software Packs can be found on the MDK V5 Software Packs website.
- The MDK V5 Device List page shows all microcontrollers that are currently supported by Software Packs.
- For devices that currently aren't supported by Software Packs, Legacy Support packages are available.

CMSIS

- This version of MDK V5 ships with the CMSIS 3.20 Software Pack.

- The CMSIS Pack includes CMSIS-RTOS RTX, a CMSIS-RTOS compatible real-time OS.
- CMSIS-RTOS RTX replaces MDK V4.x RTX. For project maintenance, MDK V4.x RTX is still available as part of the Legacy Support.

MDK-Middleware

- The MDK V5 middleware requires a CMSIS-RTOS compatible RTOS like CMSIS-RTOS RTX.
- The MDK V5 middleware uses the new CMSIS-DRIVER API for hardware access.
- FileSystem Component
  - The File System Component is incompatible with the MDK V4.x RL-FlashFS middleware.
  - The differences to the RL-FlashFS can be found on the Differences to RL-FlashFS website.
  - A detailed description can be found on the File System Component Documentation website.
- Network Component
  - The Network Component is incompatible with the MDK V4.x RL-TCPnet middleware.
  - The differences to the RL-TCPnet can be found on the Differences to RL-TCPnet website.
  - A detailed description can be found on the Network Component Documentation website.
- USB Component
  - The USB Component is incompatible with MDK V4.x RL-USB middleware.
  - The differences to the RL-USB can be found on the Differences to RL-USB website.
  - A detailed description can be found on the USB Component Documentation website.
- Graphics Component
  - The Graphic Component is based on Segger emWin 5.22.
  - A detailed description can be found on the Graphic Component Documentation website.

Target debugging

- Updated: The CMSIS-DAP driver now supports the Micro Trace Buffer (MTB) of Cortex-M0+ devices.
- Updated: ULINK2 device firmware to version 2.02. This version removes the Windows warning “This device can perform faster if connected to - USB 2.0”.
- Updated: Segger J-Link driver for ARM devices to version 4.76d.