

Exploring the latest features of MCUXpresso IDE 11.1.x

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SECURE CONNECTIONS
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AGENDA

- Recap of the MCUXpresso ecosystem
 - Tools suite and key elements
- Live demonstration of
 - New welcome screen and SDK selection options
 - New image information features
 - Variable graphing
 - SWO profiling quick look
- Recap of other feature updates

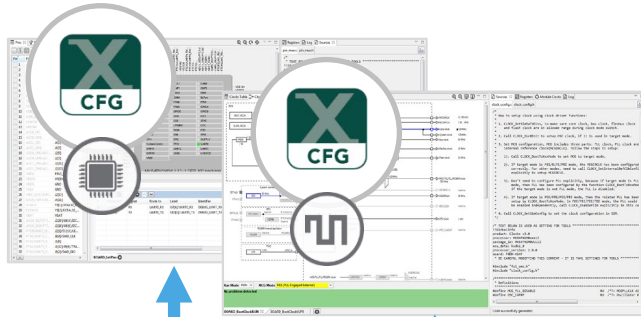
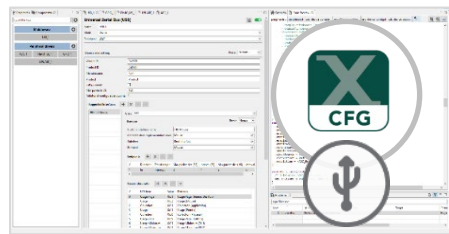
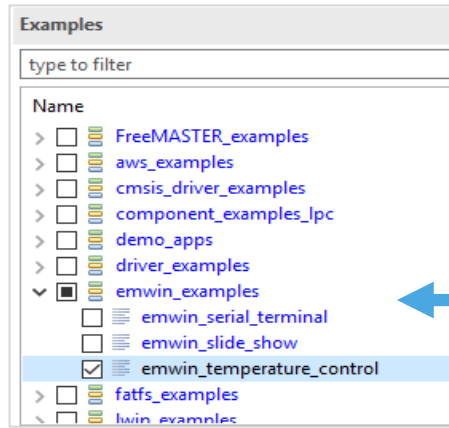
THE MCUXPRESSO ECOSYSTEM



- > **Core Technologies from NXP**
 - MCUXpresso IDE
 - MCUXpresso SDK
 - MCUXpresso Config Tools
 - MCUXpresso Secure Provisioning Tool
- > **Enabling Software Technologies**
 - Run time software libraries and middleware
 - Enable customers to focus on differentiation
 - From NXP and partners
- > **Enabling Tools Technologies**
 - Partner IDEs
 - Debug Probes
 - Development Boards
 - From NXP and partners

EVALUATION TO PROOF OF CONCEPT ON NXP EVALUATION BOARDS

Import/clone one of a large range of SDK examples
 Easy selection from with MCUXpresso IDE

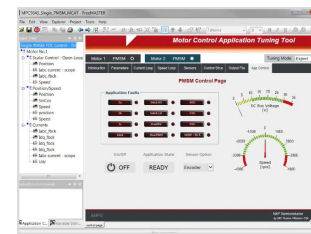
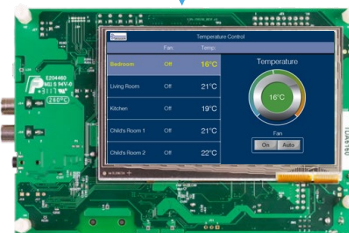


Modify pin/clock settings for your application
 Simple, push button updates into IDE project



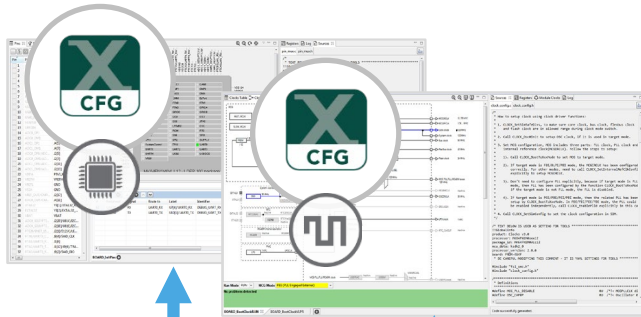
Visualize data in real time
 Implement debug control interfaces

Or use MCUXpresso IDE new project wizard and peripheral config tool to select and configure drivers and middleware

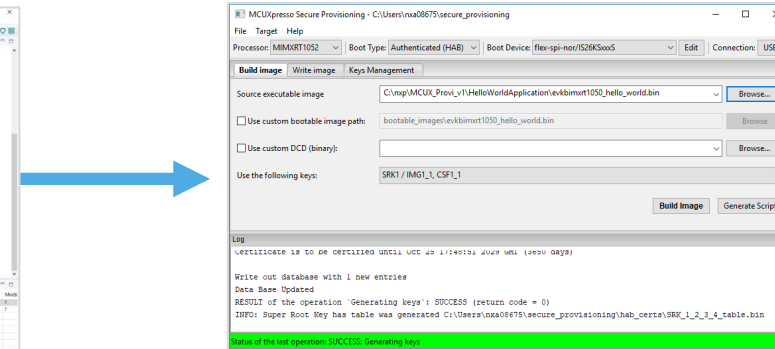
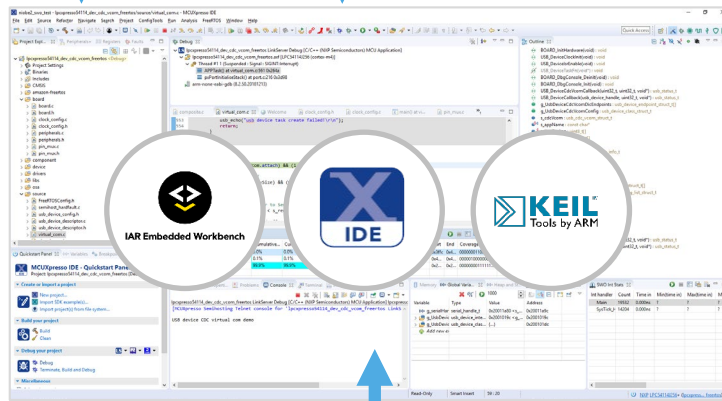


FREE MASTER

TRANSITION TO CUSTOM HARDWARE AND ON TO PRODUCTION



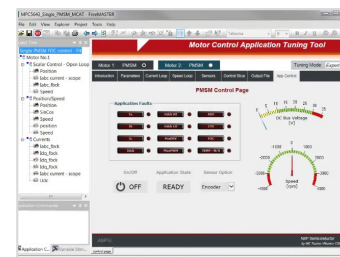
Modify pin/clock settings for your application
Simple, push button updates into IDE project



Encrypt/sign application images
Setup provisioning and programming scripts



Production



Same visualization and control as on
NXP evaluation board
Options to choose different interfaces

FREEMASTER

MCUXpresso Software and Tools

UNIFIED SUITE OF
TOOLS FOR EASY
DEVELOPMENT
WITH NXP MCUs



MCUXpresso Software and Tools

for General Purpose MCUs and Crossover processors



MCUXpresso IDE

Edit, compile, debug and optimize in an intuitive and powerful IDE



MCUXpresso SDK

Runtime software including peripheral drivers, middleware, RTOS, demos and more



MCUXpresso Config Tools

Online and desktop tool suite for system configuration and optimization



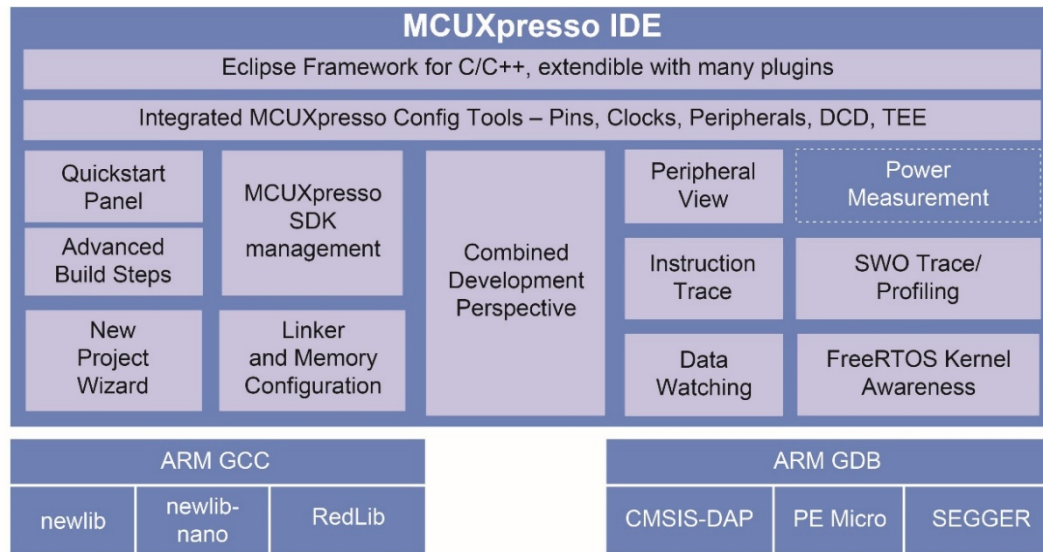
MCUXpresso Secure Provisioning Tool

Graphical and command line tool for securely provisioning and programming MCUs with secure boot

MCUXPRESSO IDE INTEGRATED DEVELOPMENT ENVIRONMENT



Free, professional grade, Eclipse-based tools
Optimized for ease-of-use
Extended for MCUXpresso SDK & NXP MCUs
Based on Arm GCC compiler



For supported boards

The screenshot displays the MCUXpresso IDE interface with several windows open:

- Source Editor:** Shows C code for a USB device task, including a while loop for attaching and starting transactions.
- Debug Console:** Shows the execution of the code, with a message "usb device task create failed!\r\n\r\n".
- Task List (FreeRTOS):** A table showing the state of tasks in the system.

TCB#	Task Name	Task Handle	Task State	Prior...	Stack Usage	Event Object	Runtime
> 1	app task	0x20013060	Running	4 (4)	236 B / 4.81 kB		
> 2	IDLE	0x20013248	Ready	0 (0)	0 B / 284 B		
> 3	Tmr Svc	0x20013690	Suspended	17 (17)	44 B / 596 B	TmrQ (Rx)	
- SWO Profile:** A table showing system performance metrics.

Function	Cumulative ...	Cumulative...	Current samples %	Coverage %	First	Last	Since	Avg Between	Start	End	Coverage bitmap
SysTick_Handler	2326	0.0%	0.0%	16.7%	3.9...	30...	45.8...	13.065ms	0x3ffc	0x4...	0000001100011...
xTaskIncrementTick	4576	0.1%	0.1%	3.7%	7.6...	30...	45.8...	6.642ms	0x4...	0x4...	00000100000000...

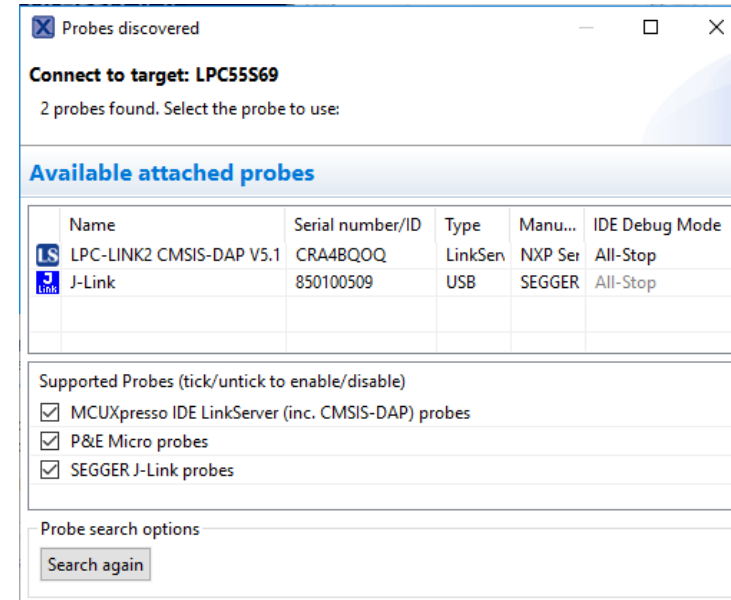


ENABLING TOOLS TECHNOLOGIES

DEBUG PROBE SUPPORT IN MCUXPRESSO IDE



- Plug and play probe support
 - SEGGER J-Link
 - PE Micro Multilink
 - NXP CMSIS-DAP
- Automatic detection of all probes
- ITM support for standard I/O (all probes)
- SWO trace support (NXP probes)



MCUXPRESSO SDK

SOFTWARE FRAMEWORK AND DRIVERS



Architecture:

- CMSIS-CORE compatible
- Single driver for each peripheral
- Transactional APIs w/ optional DMA support for communication peripherals

Integrated RTOS:

- Amazon FreeRTOS
- RTOS-native driver wrappers

Enabling SW Technologies:

- Connectivity
- Graphics/HMI
- Motor Control
- ML/AI
- Cloud connectivity
- Storage
- ...and more

Reference Software:

- Peripheral driver usage examples
- Application demos
- FreeRTOS usage demos
- IoT connectivity examples

License:

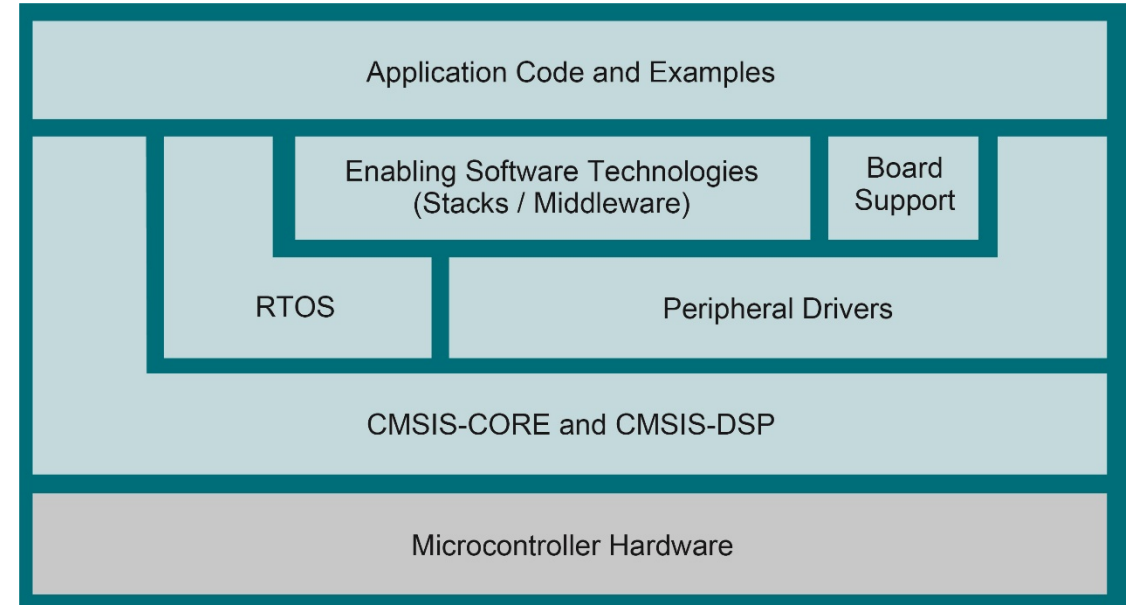
- BSD 3-clause for startup, drivers, USB stack
- All code Black Duck scanned

Toolchains:

- MCUXpresso IDE
- IAR®, ARM® Keil®, GCC w/ Cmake

Quality:

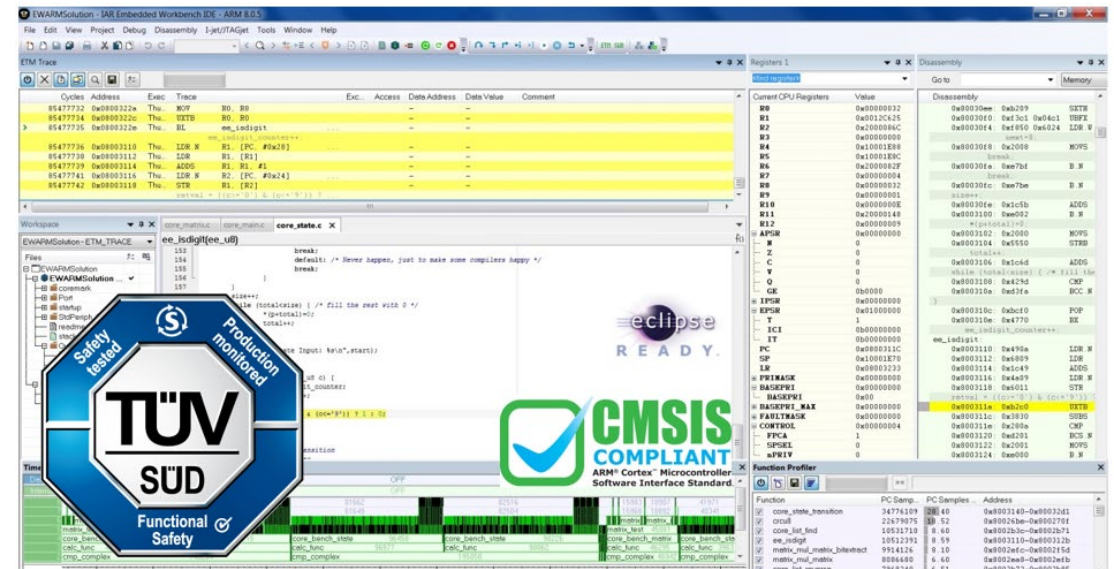
- Production-grade software
- MISRA 2004 compliance
- Checked with Coverity® static analysis tools



ENABLING TOOLS TECHNOLOGIES

LEAD DEVELOPMENT TOOL TECHNOLOGY PARTNER - IAR SYSTEMS

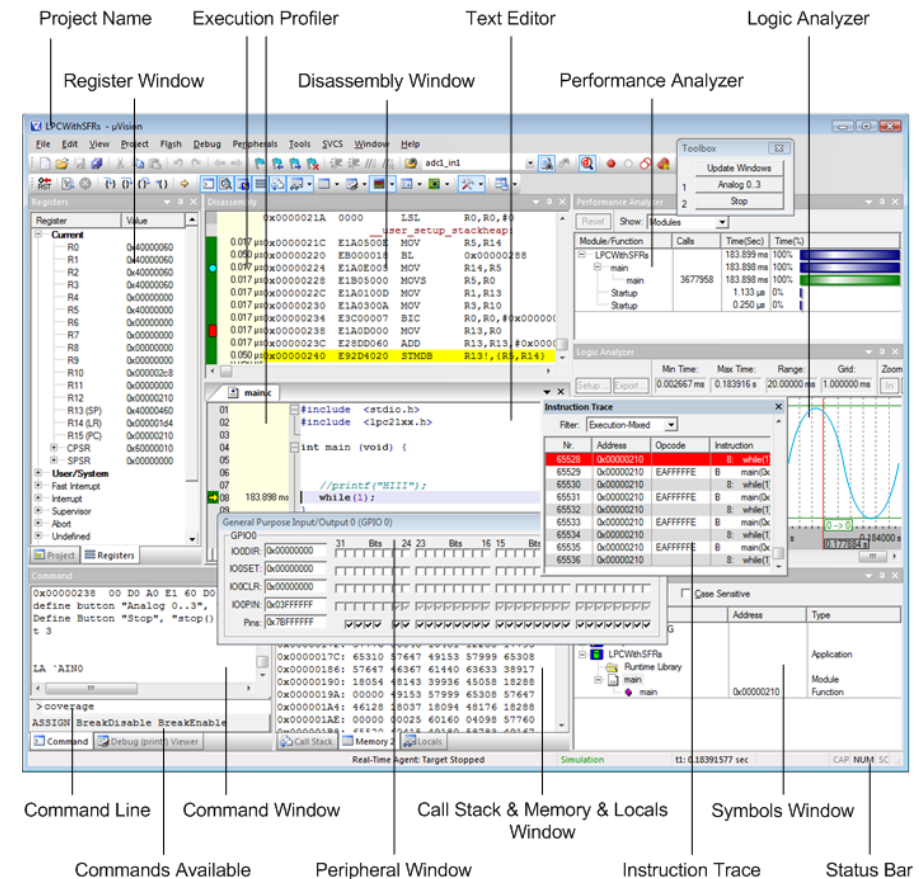
- IAR is an NXP Platinum Partner
- IAR Embedded Workbench (EWARM) has been integrated in MCUXpresso since its introduction
- MCUXpresso SDK
 - Projects for Embedded Workbench are included in all drivers/examples
 - CMSIS-DAP and J-link options included
- MCUXpresso Config Tools
 - Standalone config tools provide IAR-compatible initialization source and header files
 - Project cloner to create starting point projects from SDK examples



ENABLING TOOLS TECHNOLOGIES

LEAD DEVELOPMENT TOOL TECHNOLOGY PARTNER - ARM KEIL

- Arm is an NXP Platinum Partner
- Keil uVISION has been integrated in MCUXpresso since its introduction
- MCUXpresso SDK
 - Projects for uVISION are included in all drivers/examples
 - CMSIS-DAP and J-link options included
- MCUXpresso Config Tools
 - Standalone config tools provide uVISION -compatible initialization source and header files
 - Project cloner to create starting point projects from SDK examples



Live demonstrations



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Other enhancements



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IMPROVEMENTS IN 11.1 – REDUCED CODE SIZE FOR DEBUG BUILDS

- Code size of debug builds decreased by reducing the overhead of the assert() function, which is commonly called by SDK functions
 - Implemented by addition "-fmerge-constants" and "-fmacro-prefix-map" options to project compiler optimization settings
- Savings project specific, depending upon level of use of assert(). But particularly helpful on smaller footprint devices, like LPC8xx series

```
Memory region      Used Size  Region Size  %age Used
PROGRAM_FLASH:    9504 B    32640 B     29.12%
BOOT_FLASH:       0 GB     128 B       0.00%
SRAM:             1020 B    4 KB       24.90%
Finished building target: lpcxpresso804_usart_terminal.axf
```



1548 bytes saved

```
Memory region      Used Size  Region Size  %age Used
PROGRAM_FLASH:    7956 B    32640 B     24.38%
BOOT_FLASH:       0 GB     128 B       0.00%
SRAM:             1020 B    4 KB       24.90%
Finished building target: lpcxpresso804_usart_terminal.axf
```

```
Memory region      Used Size  Region Size  %age Used
PROGRAM_FLASH:    78128 B   1 MB        7.45%
SRAM_UPPER:       62416 B   192 KB     31.75%
SRAM_LOWER:       0 GB     64 KB       0.00%
FLEX_RAM:         0 GB     4 KB        0.00%
Finished building target: frdmk64f_lwip_dhcp_bm.axf
```

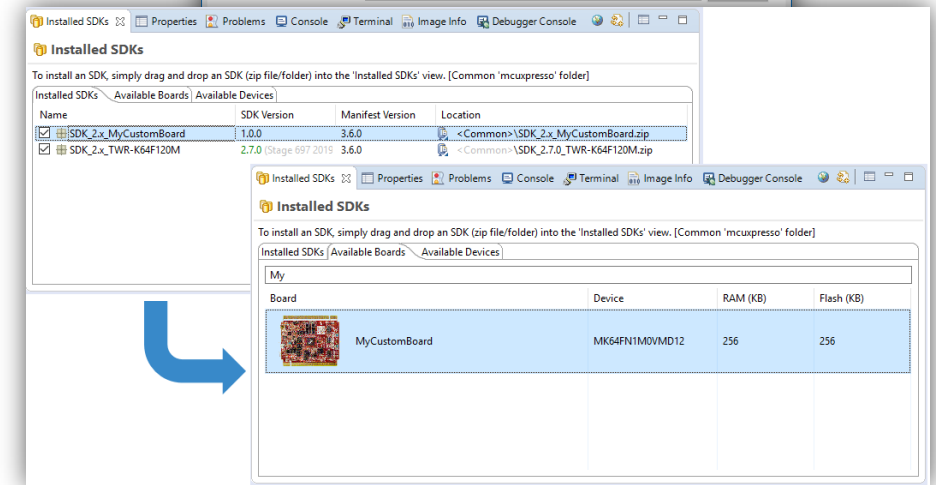
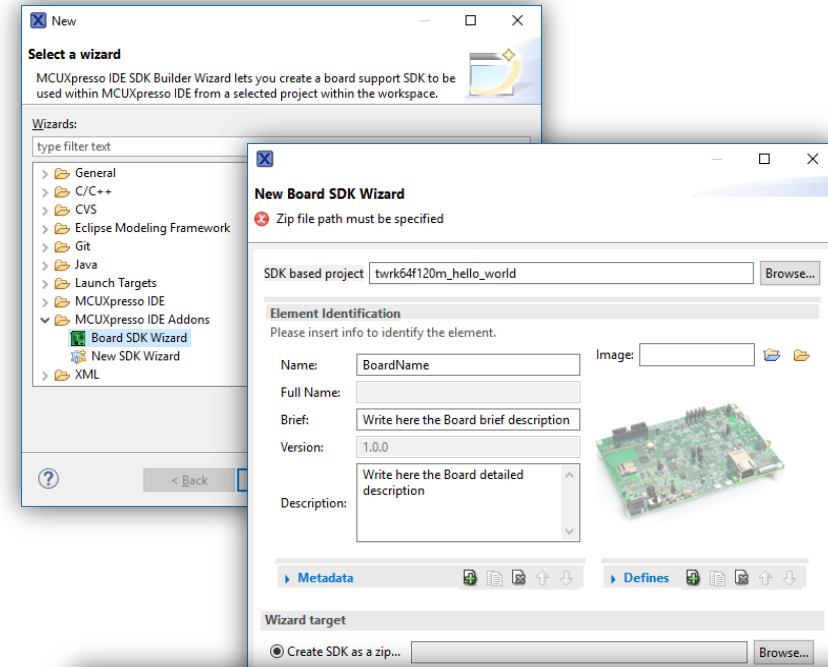


3136 bytes saved

```
Memory region      Used Size  Region Size  %age Used
PROGRAM_FLASH:    74992 B   1 MB        7.15%
SRAM_UPPER:       62416 B   192 KB     31.75%
SRAM_LOWER:       0 GB     64 KB       0.00%
FLEX_RAM:         0 GB     4 KB        0.00%
Finished building target: frdmk64f_lwip_dhcp_bm.axf
```

SDK BOARD CREATOR

- MCUXpresso SDKs are supplied configured for use with standard NXP evaluation boards
- Once you have your own board, you can use the MCUXpresso Config Tools to make appropriate project modifications for pins, clocks and other configuration settings
- The Board SDK Creator functionality inside MCUXpresso IDE provides a means of generating a secondary SDK to contain these configuration settings for your board, that can be used in conjunction with the original SDK
 - This can then be used when creating new projects directly for your board and also be easily shared with other members of your team or customers



See blog on MCUXpresso IDE
Community for more information

IMPROVED CORTEX-M33 SECURE / NON-SECURE PROJECTS (LPC55XX)

- Can now set source level breakpoints in CMSE functions on Secure side, to allow debugging of these functions when they are called from Non-Secure code

```

52 */
53 int main(void)
54 {
55     funcptr_ns ResetHandler_ns;
56
57     /* Init board hardware. */
58     /* attach main clock divide to FLEXCOMM0 (debug console) */
59     CLOCK_AttachClk(BOARD_DEBUG_UART_CLK_ATTACH);
60
61     BOARD_InitPins();
62     BOARD_BootClockPLL150M();
63     BOARD_InitDebugConsole();
64
65     PRINTF("Hello from secure world!\r\n");
66
67     /* Set non-secure main stack (MSP_NS) */
68     __TZ_set_MSP_NS(*(uint32_t *) (NON_SECURE_START));
69
70     /* Set non-secure vector table */
71     SCB_NS->VTOR = NON_SECURE_START;
72
73     /* Get non-secure reset handler */
74     ResetHandler_ns = {funcptr_ns}(*(uint32_t *) ((NON_SECURE_START) + 4U));
75
76     /* Call non-secure application */
77     PRINTF("Entering normal world.\r\n");
78     /* Jump to normal world */
79     ResetHandler_ns();
80     while (1)
81     {
82         /* This point should never be reached */
83     }
84 }
    
```

Secure to Non-Secure



```

20 *****
21 *****
22 /* Code
23 * Code
24 *****
25
26 void SystemInit(void)
27 {
28 }
29 /*!
30 * @brief Main function
31 */
32 int main(void)
33 {
34     int result;
35
36     PRINTF_NSE("Welcome in normal world!\r\n");
37     PRINTF_NSE("This is a text printed from normal world!\r\n");
38
39     result = StringCompare_NSE(&strcmp, "Test1\r\n", "Test2\r\n");
40     if (result == 0)
41     {
42         PRINTF_NSE("Both strings are equal!\r\n");
43     }
44     else
45     {
46         PRINTF_NSE("Both strings are not equal!\r\n");
47     }
48     while (1)
49     {
50 }
    
```

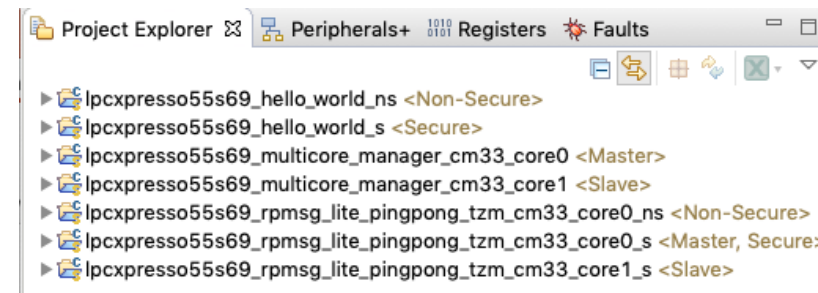
Call back into Secure



```

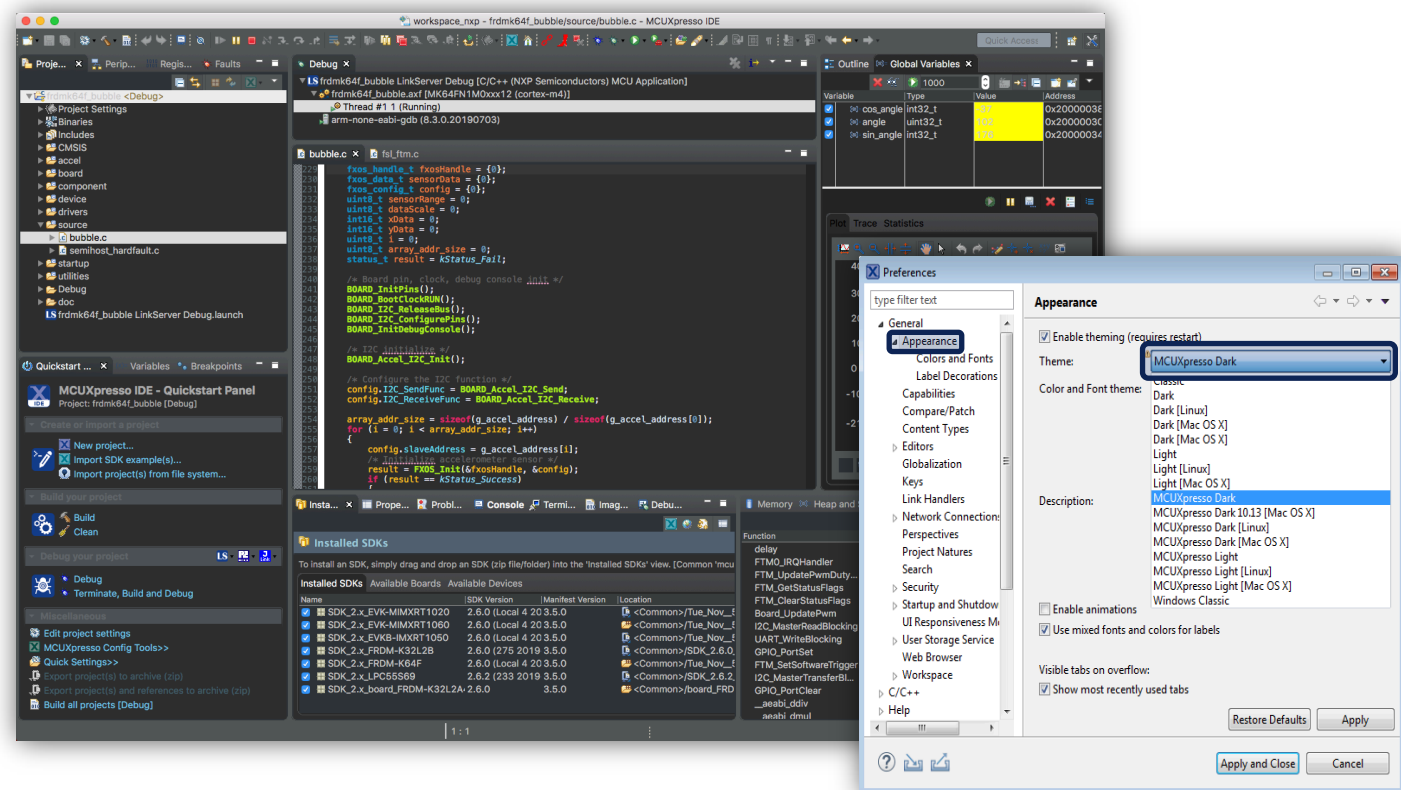
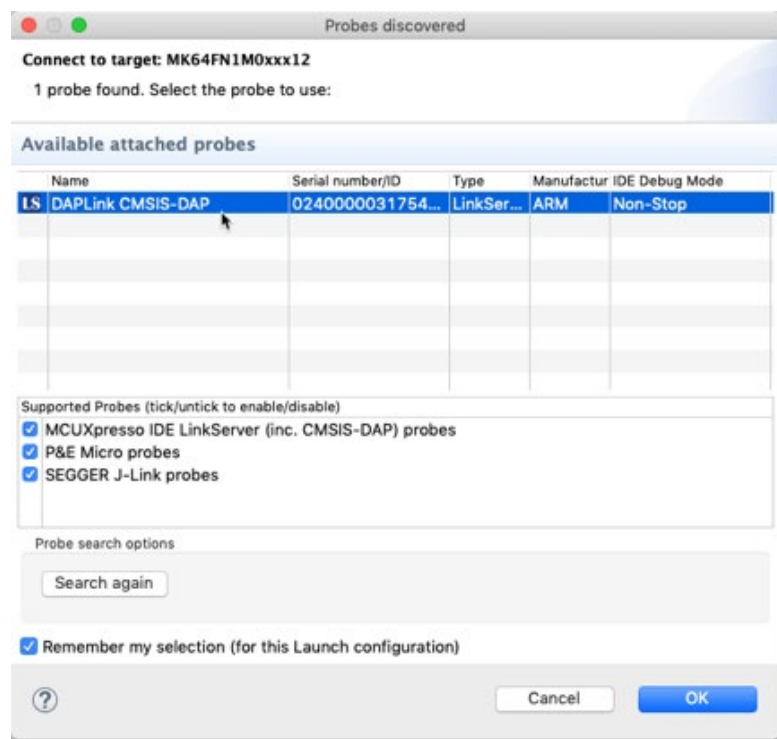
30 #if defined(__arm__)
31 size_t strlen(const char *s, size_t maxLength)
32 {
33     size_t length = 0;
34     while ((length <= maxLength) && (*s))
35     {
36         s++;
37         length++;
38     }
39     return length;
40 }
41 #endif
42
43 @attribute__((cse_nonsecure_entry)) void DbgConsole_Printf_NSE(char const *s)
44 {
45     size_t string_length;
46     /* Access to non-secure memory from secure world has to be properly validated
47     /* Check whether string is properly terminated */
48     string_length = strlen(s, MAX_STRING_LENGTH);
49     if ((string_length == MAX_STRING_LENGTH) && (s[string_length] != '\0'))
50     {
51         PRINTF("String too long or invalid string termination!\r\n");
52         abort();
53     }
54
55     /* Check whether string is located in non-secure memory */
56     if (cse_check_address_range((void *)s, string_length, CMSE_NONSECURE | CMS
57     {
58         PRINTF("String is not located in normal world!\r\n");
59         abort();
60     }
    
```

- Project Explorer View now implements project decorators for Secure / Non-secure projects
 - Also Master / Slave project decorators (for all multicore devices)



GENERAL IMPROVEMENTS

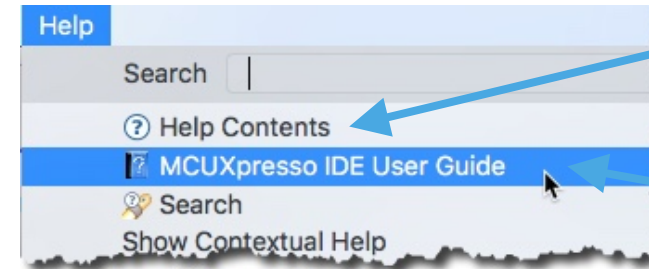
- Added MCUXpresso Dark Theme, providing better support for IDE's tailored set of Views being used in dark mode



- Required debug probe can now be selected by double-clicking on it in the "Probes discovered" dialog, rather than having to use OK

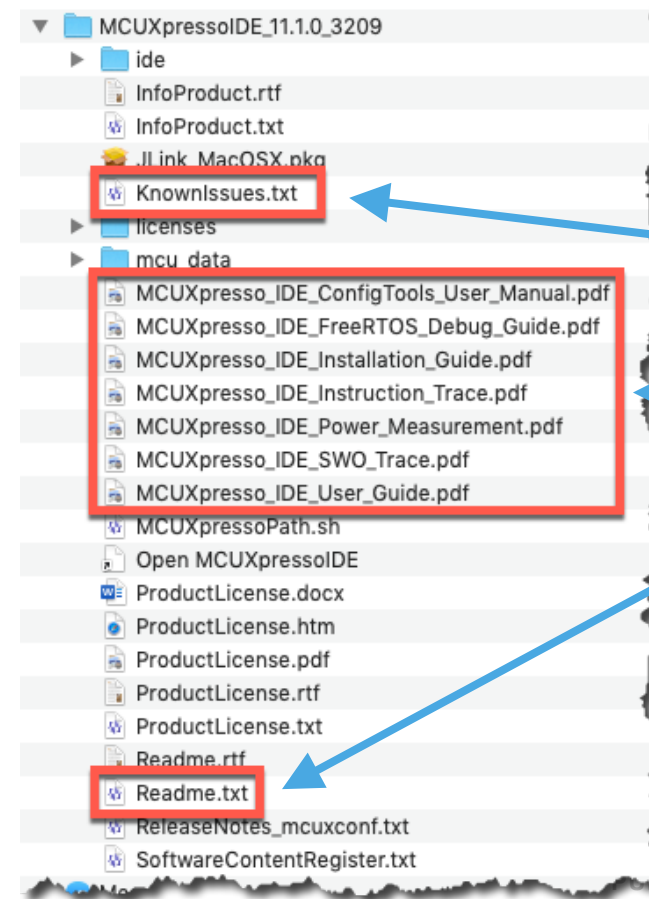
FOR MORE INFORMATION ...

- Extensive information can be found in the supplied MCUXpresso IDE v11.1.1 documentation, which can be
 - Accessed via the IDE's built-in Help System
 - Found in PDF format inside the product installation directory
 - Downloaded from NXP website
- Release notes containing a more extensive list of changes in MCUXpresso IDE v11.1.1 can also be found in the product installation directory
 - Or in "What's New" page of Welcome System
- For general product information and links to the product installers and documentation, visit:
<http://www.nxp.com/mcuxpresso/ide>



Open docs
in built-in
Help System

Open User
Guide



Browse to
manuals and
release notes
inside IDE
install
directory

MCUXpresso

Software and Tools

UNIFIED SUITE OF
TOOLS FOR EASY
DEVELOPMENT
WITH NXP MCUs



MCUXPRESSO SOFTWARE AND TOOLS ADDITIONAL WEB RESOURCES



MCUXpresso Software and Tools Overview Page:
<https://www.nxp.com/mcuxpresso>

MCUXpresso Software and Tools Community Site:
<https://community.nxp.com/community/mcuxpresso>



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Support devices

[Supported Devices Table \(Community Doc\)](#)

