

Hands-On Workshop: MCUXpresso Software and Tools

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SECURE CONNECTIONS
FOR A SMARTER WORLD

Agenda

- Overview of MCUXpresso SW and Tools
 - MCUXpresso IDE, SDK, Config Tools
- Roadmap Overview
 - Typical Release Schedule / Roadmap
 - New features of May 2018 Release
- MCUXpresso SW and Tools Workflow
- Hands-on Overview of Tools
- Hands-on Getting Started Lab
- MQX Overview and Demonstration

MCUXpresso Software and Tools

MCUXpresso IDE

MCUXpresso SDK

MCUXpresso Config Tools

MCUXpresso Software and Tools

UNIFIED SUITE OF
TOOLS FOR EASY
DEVELOPMENT
WITH NXP MCUs



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MCUXpresso Software and Tools

for LPC & Kinetis MCUs and i.MX RT 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 IDE

Eclipse Framework for C/C++, extendible with many plug-ins

Integrated MCUXpresso Config Tools – Pins, Clocks, Peripherals

Quickstart Panel

Support for SDK and LPCOpen for ARM® Cortex®-M Cores

Peripheral View

Power Measurement

Advanced Build Steps

Combined Development Perspective

Instruction Trace

SWO Trace / Profiling

New Project Wizard

Linker and Memory Configuration

Data Watching

FreeRTOS Kernel Awareness

ARM GCC

ARM GDB

newlib

newlib-nano

RedLib

CMSIS-DAP

P&E

SEGGER

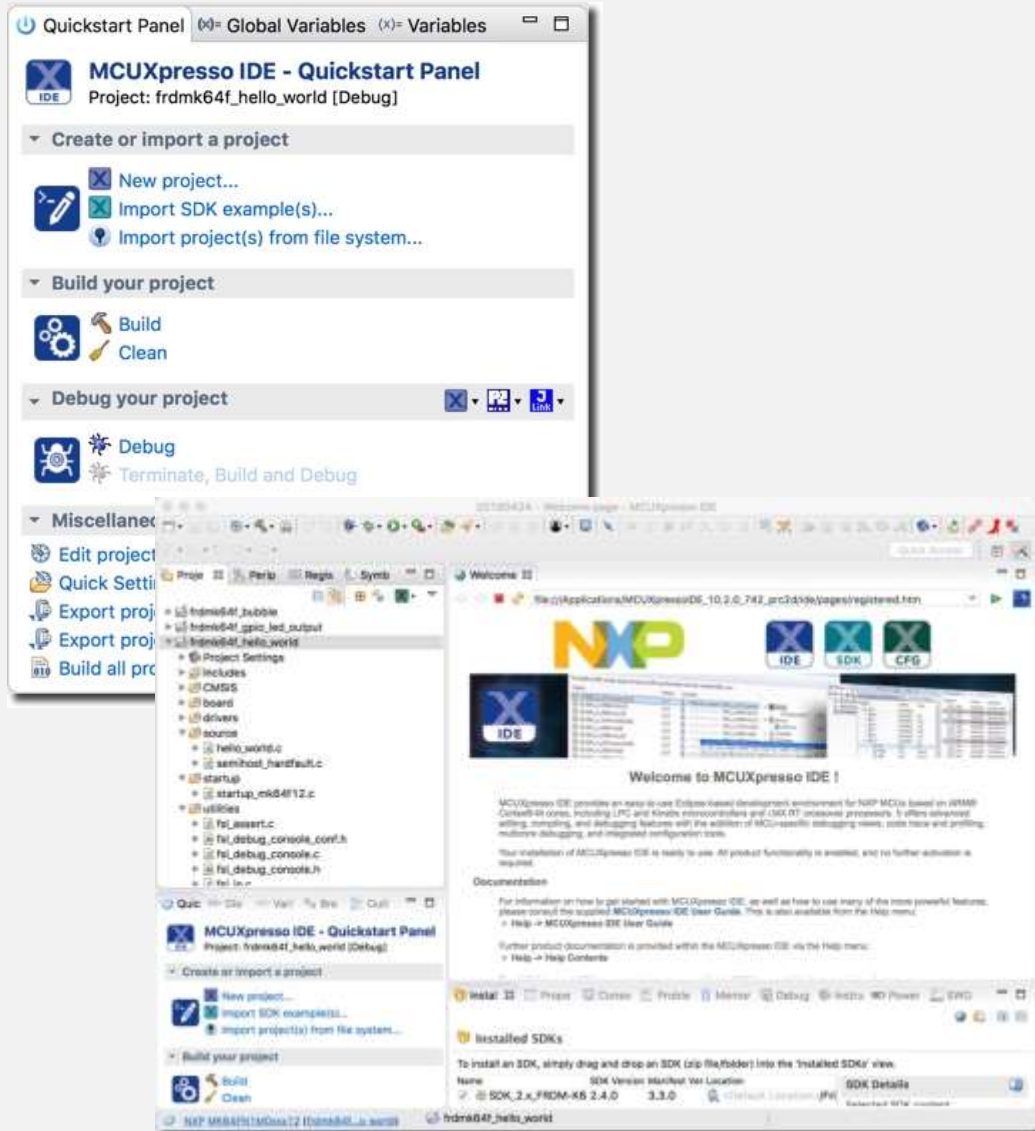
MCUXpresso IDE

Free Eclipse / GCC-based Development

- **Feature-rich, unlimited code size**, optimized for ease-of-use, based on industry standard Eclipse framework for NXP's **Kinetis** and **LPC** MCUs and **i.MX RT** crossover processors
- Application development with Eclipse and GCC-based IDE for advanced editing, compiling and debugging
- Supports custom development boards, Freedom, Tower and LPCXpresso boards, and i.MX RT evaluation kits with debug probes from NXP, P&E and Segger
- **Free:** Full Featured, unlimited Code Size, no special activation needed, community based support, advanced trace capabilities, MTB and ETB instruction trace
- Works in conjunction with **MCUXpresso Config Tools** and **MCUXpresso SDK** to provide complete development environment

MCUXpresso IDE

Built for Ease of Use

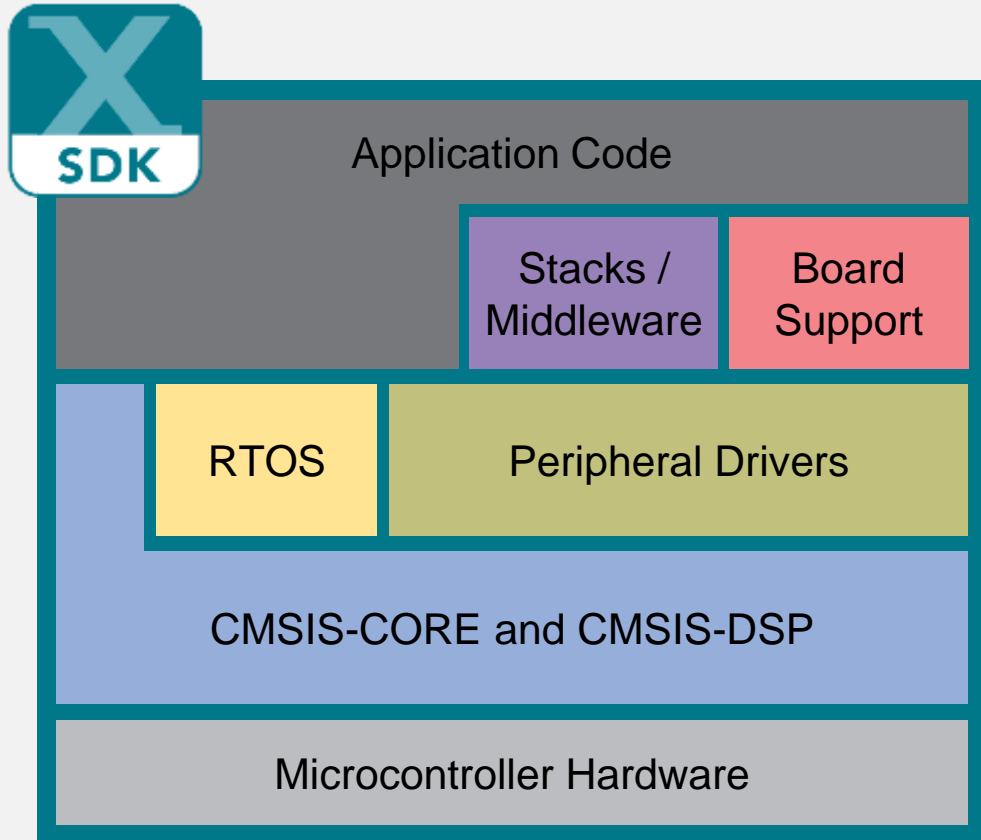


- **Quickstart Panel** guides users to most commonly used options
 - One-Click access to most used functions (Create, Build, Debug)
 - Direct access to standard debug functions (Debug, Attach, Program, Erase)
- **Develop Perspective** for both project editing and debugging
 - Simplifies Eclipse usage
- **Additional views** for in-depth debugging
 - Global Variables, Faults, Peripherals+, Registers, Symbol Viewer

MCUXpresso IDE New Project Wizard

- SDK MCUs (LPC and Kinetis) and i.MX RT crossover processors
- Preinstalled LPC and generic Cortex®-M
- Installable device support through SDK packages (data driven)
- Selection of package, RTOS, drivers, utilities
- Standalone and linked projects
- Advanced project settings





MCUXpresso SDK

Software Framework and Drivers

Architecture:

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

Reference Software:

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

License:

- Clear BSD 3-clause for startup, drivers, USB stack

Integrated RTOS support:

- Amazon FreeRTOS
- RTOS-native driver wrappers

Toolchains:

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

Integrated Stacks and Middleware:

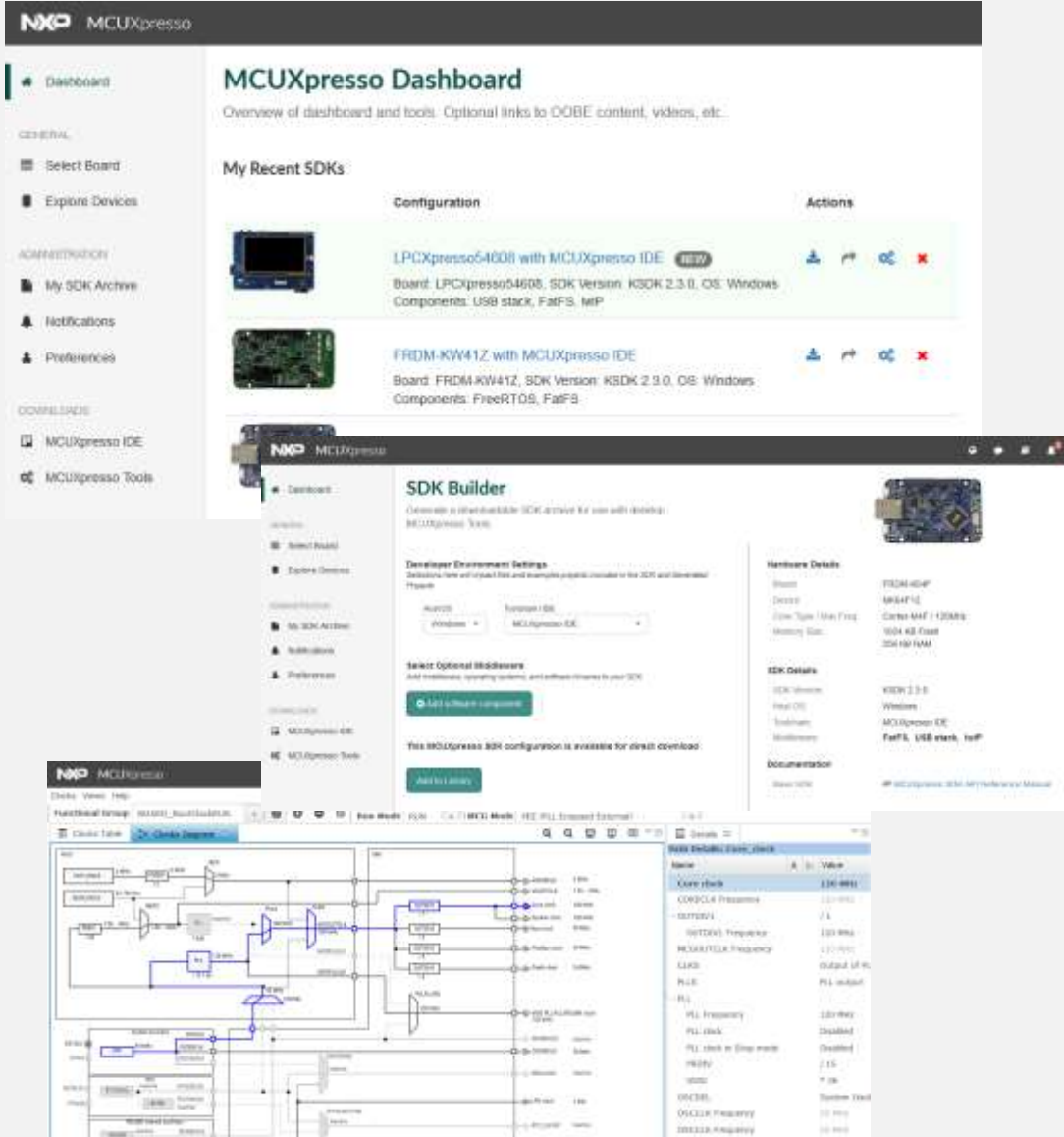
- USB Host, Device and OTG
- lwIP, FatFS, LittleFS
- Crypto acceleration plus wolfSSL & mbedTLS
- AWS IoT and Azure IoT
- SD and eMMC card support

Quality:

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



Open Source Initiative



MCUXpresso SDK

Online Builder and Dashboard

- MCUXpresso Dashboard
 - Access all previously downloaded SDKs
 - Notifications of update SDK content specific to your own SDK packages
 - Share SDK archive with other users
- MCUXpresso SDK Builder
 - Build customized SDKs for selected development board or device
 - Specify optional middleware, with dependency resolution
- Online MCUXpresso Config Tools
 - Run basic checks on Pin Muxing and Clock Configuration to aid in ideal device selection
 - Download Config Tool output for further development with desktop Config Tools



MCUXpresso SDK

Integrated Middleware

3rd Party Included Middleware

- Amazon FreeRTOS
 - FreeRTOS Kernel
 - AWS IoT Device SDK
- Microsoft Azure IoT
- Filesystem:
 - FatFS, littleFS
- TCP/IP stack (lwIP)
- SSL/TLS:
 - mbedTLS, wolfSSL
- QCA Wifi stack
- SEGGER emWIN Graphics
- NAND Flash Management
- JPEG Encode / Decode

NXP Developed Middleware






- USB Stack (Host, Device, OTG)
- SDMMC
- Crypto Acceleration Software Libraries
- Real-Time Control Embedded Software Libraries
 - Motor Control, Math Functions, Digital Filtering
- BLDC / PMSM Motor Control Algorithms
- Companion Product Support
 - NTAG, IoT Sensing SDK, Touch Software
- Wireless Stacks:
 - Thread, BLE, 802.15.4 MAC, Zigbee, GenFSK, SMAC
- DMA Manager (DMAMUX)
- MCU Bootloader
- EMV Level 1 Contact Stack
- Multicore support
 - eRCP (embedded Remote Procedure Call)
 - RPMSG-lite (Remote Processor Messaging)
 - Multicore Manager Software Libraries

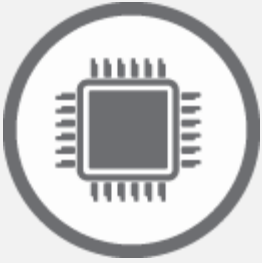


MCUXpresso Config Tools

Configuration and Code Generation

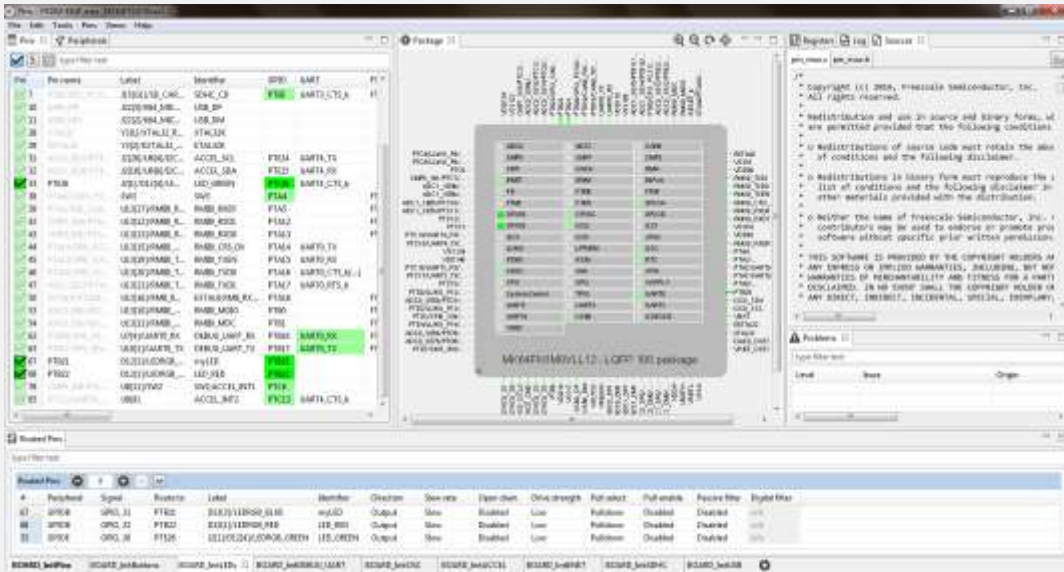


-  **SDK Builder** packages custom SDKs based on user selections of MCU, evaluation board, and optional software components.
-  **Pins, Clocks, Peripherals and Cloner** tools generate initialization for custom board support; cloner creates standalone SDK project based on SDK examples.
-  **Project Updater** works directly with existing SDK-based IDE projects with generated Pins, Clocks and Peripherals source files.
-  **Device Configuration** tool allows DCD commands sequence config for pre-initialization of devices at boot time.
-  **Trusted Execution Environment** configures protection and isolation of sensitive parts of the application.
- NEW!** **MQX App Builder** enables all key components of a networking application to be defined.



Easy-to-use muxing and pin assignments

MCUXpresso Config Tools Pins Configuration

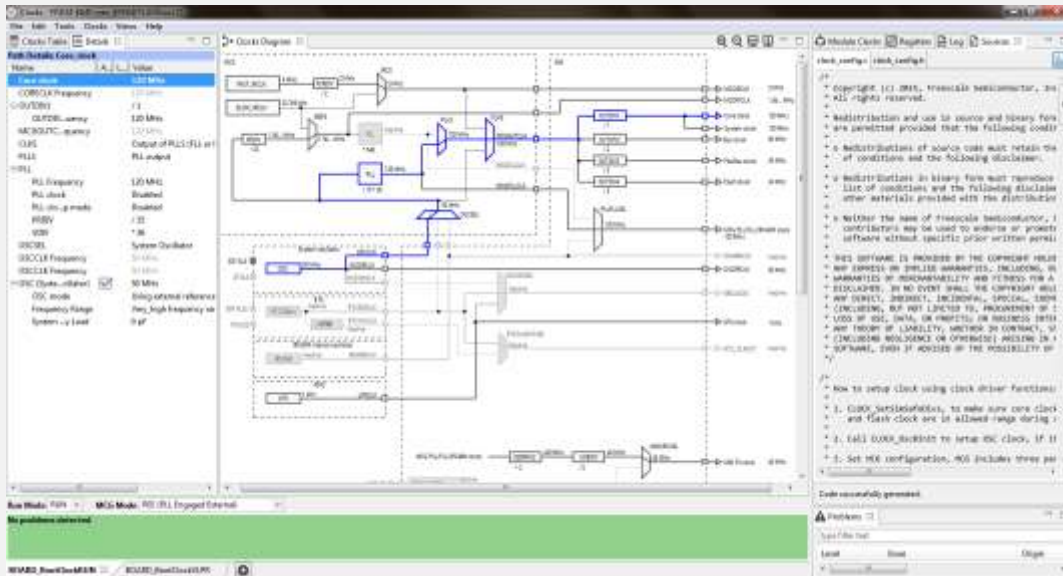


- Muxing and pin configuration with consistency checking
- ANSI-C configuration code
- Graphical processor package view
- Wizard for optimized assignments of functionality to available pins
 - Selection of Pins and Peripherals
 - Routed pins with electrical characteristics
 - Registers with configured and reset values
 - Source code for C/C++ applications
 - GPIO Input / Output initialization
- Documented and easy to understand source code
- Report generation
- Integrates with any compiler and IDE





Clock configuration and diagram view



MCUXpresso Config Tools Clock Configuration

- System clock configuration with consistency checking
- ANSI-C initialization code
- Graphical clock diagrams
- Easy-to-use guided graphical user interface
 - Selection of Clock Sources
 - Configuration of prescalers and clock outputs
 - Details and Full Diagram views with clock path
 - Registers with configured and reset values
 - Source code for C/C++ applications
- Documented and easy to understand source code
- Report generation

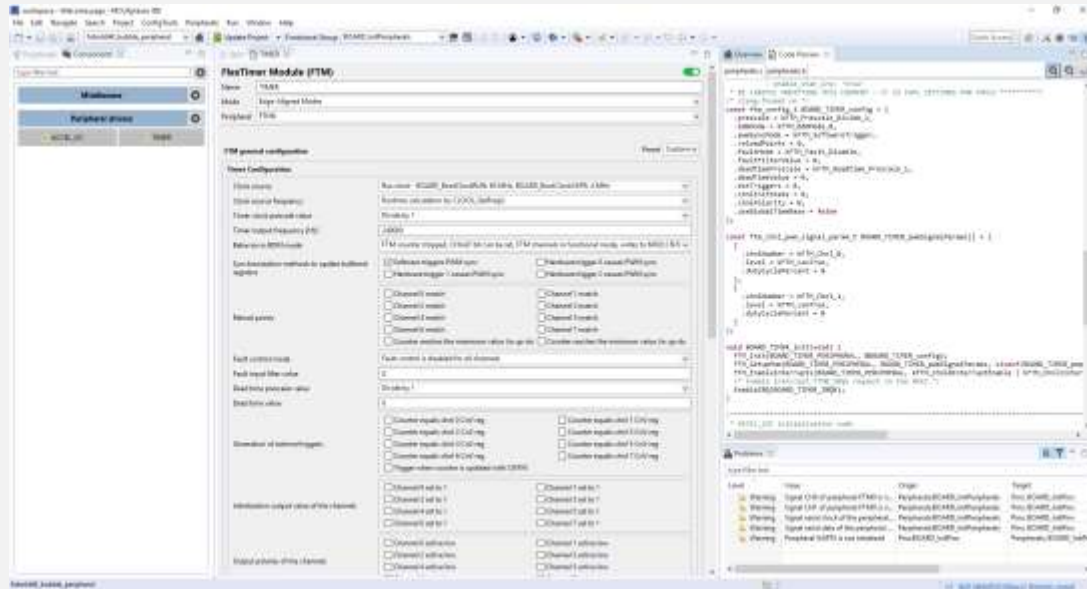




Automatic generation of peripheral initialization structures



MCUXpresso Config Tools Peripheral Configuration



- SDK peripheral configuration and USB middleware configuration
- Validation of user inputs / selection
- Generation of ANSI-C initialization code for SDK peripheral drivers
- Generation of MCUXpresso SDK Initialization Structure
- Selection of common use case configurations
- Support for over 50 different peripherals and 60 devices
 - Includes GPIO, UART, ADC, LPTMR, I2C, FTM
 - Additional devices and peripherals are continuing to be deployed
- Documented and easy to understand source code
- Report generation

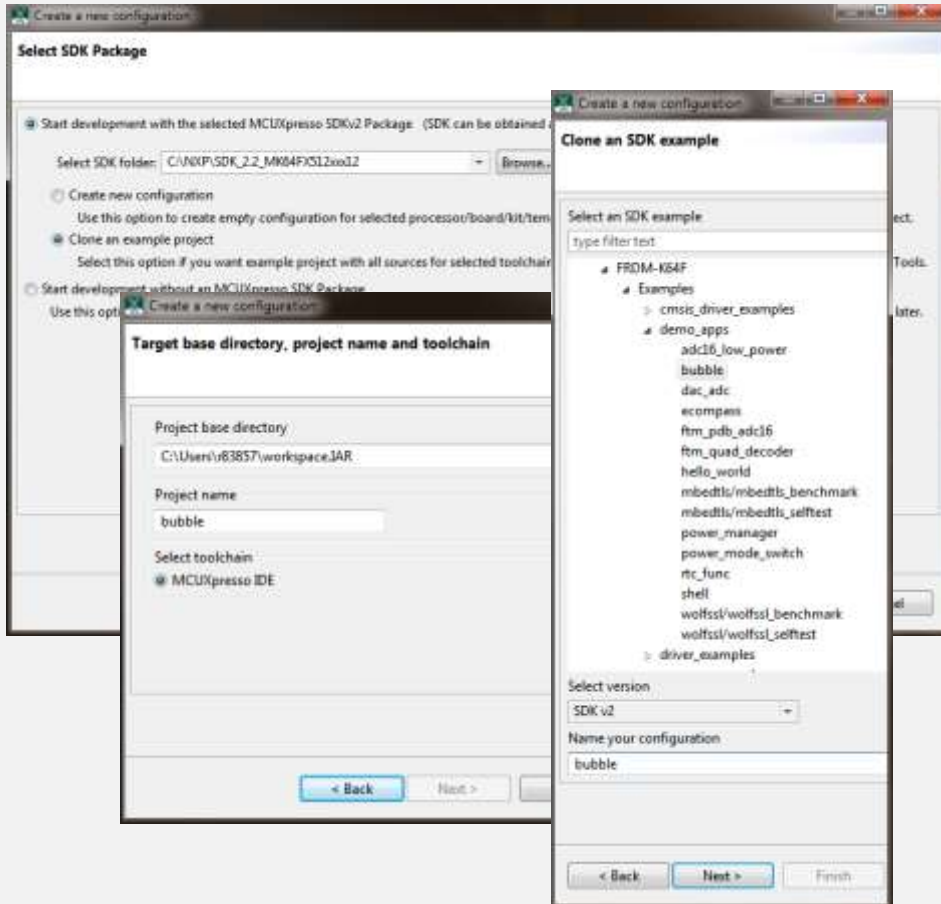




MCUXpresso SDK Project Cloning



MCUXpresso Config Tools Cloning Utility



- Ability to generate a fully standalone project cloned from one of the many included MCUXpresso SDK examples.
- Provides a native IAR, Keil, or GCC project as supported in your SDK configuration.
- Available in the desktop version on the MCUXpresso Config Tool as part of the “New configuration dialog”.
- Available in the online version of the MCUXpresso SDK Builder and webpage.
- Cloned example projects can be downloaded directly from the MCUXpresso webpage. Online cloned projects provide all project and SDK files required to quickly have an application running on a support NXP development board in a single download.

MCUXpresso SW and Tools

Typical Release Schedule / Roadmap

New features of Q2 2019 Release

MCUXpresso SW and Tools – Release Overview



- Comprised of three primary tools: **SDK, IDE, and Config Tools**
- Major releases targeted for twice a year (typically Q2 / Q4)
- Current release **June 2019**
- Next major release date scheduled for **Nov 2019**



- Current Release: **SDK v2.6.x**
- Support for current Kinetis, LPC, and i.MX RT devices
- New device support released throughout the year as required to support device availability
- **Major semi-annual releases** include updated drivers, middleware releases, and improvements



- Current Release: **IDE v11.0.0**
- Support for current Kinetis, LPC, and i.MX RT devices included via SDK releases
- Additional support for legacy LPC devices
- **Major semi-annual releases** include updated eclipse framework, compiler versions, and performance improvements



- Current Release: **Config Tool v6.0**
- Includes configuration for Pins, Clocks, and key Peripherals
- New device data and peripheral support released throughout the year, tool will update when connected online
- **Major semi-annual releases** include new features, additional peripheral support, and workflow improvements

MCUXpresso SW and Tools – New Features (SDK)



- Comprised of three primary tools:
**SDK, IDE,
and Config Tools**
- Major releases targeted for twice a year (typically Q2 / Q4)
- Current release
June 2019
- Next major release date scheduled for
Nov 2019



- New features in **SDK v2.6.0**
 - Updated peripheral drivers to v2.6.0 SDK code base for all included boards and devices
 - Updated to latest GNU Arm Embedded Toolchain to GCC8 (2018-q4-major)
 - Expanded device and board support for Cypress Wi-Fi
 - Added or Updated 3rd party middleware releases:

• Amazon Free RTOS v1.4.7+	• Arm MbedTLS v2.13.1
• lwIP TCP/IP Stack v2.1.2	• Microsoft Azure Cloud SDK v1.2.13
• Arm CMSIS-NN Libraries	• TensorFlow Lite
• Segger emWin 5.48r	

- Updates to NXP developed middleware:
 - USB Stack

MCUXpresso SW and Tools – New Features (IDE)



- Comprised of three primary tools:
**SDK, IDE,
and Config Tools**
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- Current release
June 2019
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Nov 2019



- New features in **IDE v11.0**
 - Improved Cortex-M33 Secure / Non-Secure project linking and debugging
 - Improved Symbols Browser view for analysis of project build results
 - Improved support for working with Linker Scripts and Map files
 - Update to latest Eclipse 2018-12 framework
 - Windows version will be release only as 64-bit
 - Upgraded integrated version of Config Tools to v6.0 and added support for SDK v2.6.0
 - Upgraded supplied GNU ARM Embedded Toolchain to Version 8 2018-q4-major

MCUXpresso SW and Tools – New Features (Config Tools)



- Comprised of three primary tools:
**SDK, IDE,
and Config Tools**
- Major releases targeted for twice a year (typically Q2 / Q4)
- Current release
June 2019
- Next major release date scheduled for
Nov 2019

- New features in **Config Tools v6.0**
 - Trusted Execution Environment (TEE) Configuration – Supporting Cortex M33 TrustZone
 - Device Configuration Tool (DCD code generation) – Supporting compatible RT devices
 - SEMC Peripheral Configuration w/ Memory Validation and DCD support
 - Updated version of Eclipse and Java in alignment with MCUXpresso IDE
 - Live tracking of code preview changes
 - Improved UI layout options for Peripheral Tool
 - Improved offline data management

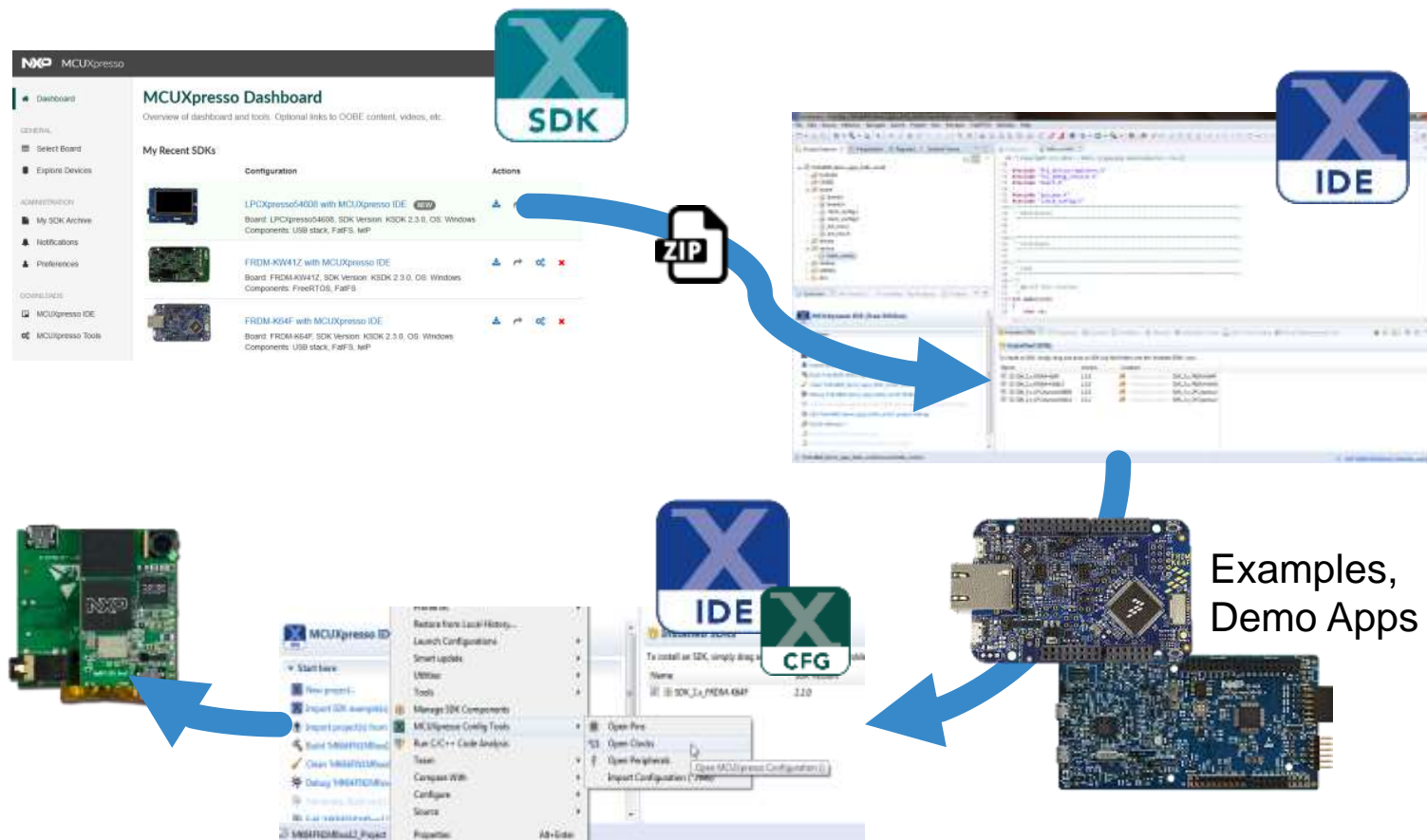
MCUXpresso SW and Tools Workflow

Efficient Development Flow

- SDK Configuration and Installation
- Integrated Config Tools

MCUXpresso SW and Tools

Efficient Development Flow



- Online Custom SDK Builder
- Drag-and-Drop installation of SDK into IDE
- SDK Project Importing / Cloning
- Demo applications, SDK driver examples, middleware use case projects
- Management of SDK drivers and middleware components
- Integrated Config Tools
- Pins and Clocks initialization for user defined boards

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Additional Resources

Web pages

- MCUXpresso Software and Tools – www.nxp.com/mcuxpresso
 - MCUXpresso SDK: www.nxp.com/mcuxpresso/sdk
 - MCUXpresso IDE: www.nxp.com/mcuxpresso/ide
 - MCUXpresso Config Tools: www.nxp.com/mcuxpresso/config

Communities

- MCUXpresso Software and Tools - <https://community.nxp.com/community/mcuxpresso>
 - MCUXpresso SDK: <https://community.nxp.com/community/mcuxpresso/mcuxpresso-sdk>
 - MCUXpresso IDE: <https://community.nxp.com/community/mcuxpresso/mcuxpresso-ide>
 - MCUXpresso Config Tools: <https://community.nxp.com/community/mcuxpresso/mcuxpresso-config>

Supported Devices

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

Hands-On Lab Overview of Tools

Online MCUXpresso SDK Builder

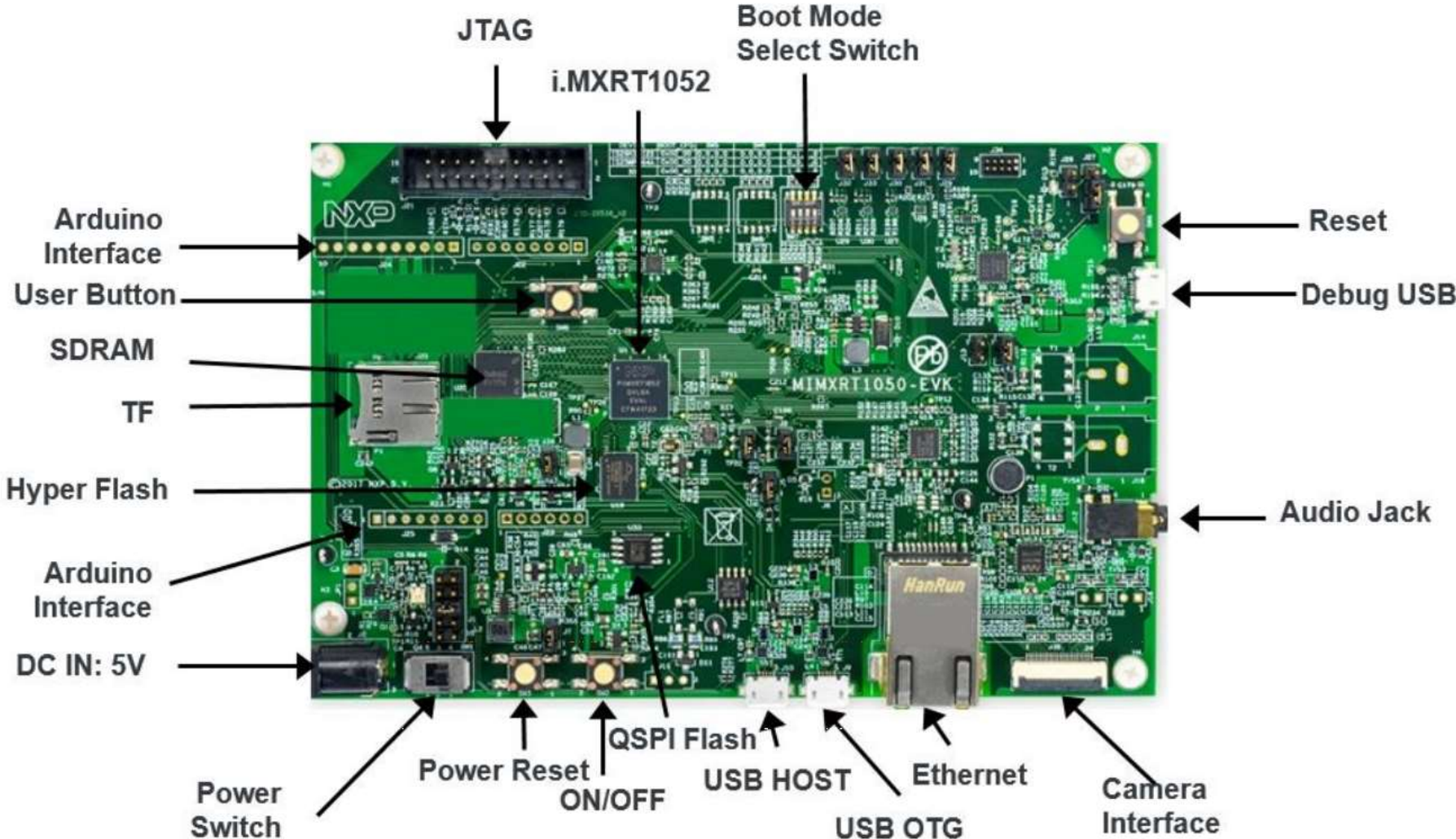
Importing MCUXpresso SDK into MCUXpresso IDE

Basic functionality of MCUXpresso IDE

Enabling / Using MCUXpresso Config Tools



MIMXRT1050 EVKB Hardware Overview



Hands-On Lab: Getting Started with MCUXpresso

Creating new IDE project

Working with Config Tools

Working with SDK APIs





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