



FTF 2016
TECHNOLOGY FORUM

INDUSTRY'S MOST COMPREHENSIVE SOFTWARE TOOL PORTFOLIO

FTF-DES-N1957

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FTF-DES-N1957
MAY 16, 2016

PUBLIC USE



AGENDA

- Kinetis Enablement Overview
- Kinetis Development Environment (IDEs)
- Run-time Software & Configuration Tools
- MQX Software Solutions
- Application Specific Solutions
- Kinetis Hardware Development Platforms
- Professional Support and Services

Kinetis Enablement Overview

Runtime Software

NXP Solutions:

Kinetis SDK

- Drivers
- System Services
- FreeRTOS
- USB
- TCP/IP
- Filesystem

MQX PEG

Kinetis Bootloader

RTOS, Middleware Partners:



Comprehensive frameworks and solutions for low-power, connected, and secure embedded systems

Software Development Tools

IDE / Toolchains:



Software Configuration:

Kinetis Expert

- Power Estimation
- BSP Tools
- Project Generator
- Power Analyzer

PEG



Industry leading IDE support and intuitive software configuration tools to accelerate application development

Hardware Development Tools

Evaluation Kits:



Tower System



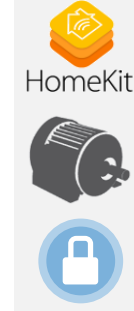
Freedom Development Platform

Partner Solutions



Low cost hardware platforms for evaluation and application development. Partner solutions for hardware debugging solutions

Application Specific



- HomeKit SDK
- Motor Control
- Wireless Charging
- Sensor Fusion
- MFi
- PEG GUI
- POS / EMV

Connectivity Solutions



Software frameworks and development tools for targeted applications and certified connectivity solutions

Support

Broad Market:

- OOB Walkthroughs
- NXP Community
- Embedded Blogs
- Kinetis Designs
- Kinetis Tutorials
- Application Notes
- Symbols & Footprints

High Touch:

- Professional Support
- Professional Services

Get started quickly and get the support you need, when you need it

KINETIS DEVELOPMENT ENVIRONMENT (IDES)

Kinetis IDE Options

Featured IDEs for Kinetis MCUs



Atollic® TrueSTUDIO®

- Professional ECLIPSE/GNU based IDE with a MISRA-C checker, code complexity analysis and source code review features
- Advanced RTOS-aware debugger with ETM/SWV/ITM tracing, live variable watch view and fault analyzer. Dual-core and multi-processor debugging
- Strong support for software engineering, workflow management, team collaboration and improved software quality



Green Hills Software® Multi® Integrated Development Environment

- Complete & integrated software and hardware environment with advanced multicore debugger
- Industry first TimeMachine trace debugging & profiler
- EEMBC certified top performing C/C++ compilers



Somnium® DRT

- The natural upgrade path for developers using Kinetis Design Studio IDE, with commercial support
- Advanced optimizations reduce energy, ROM and RAM usage while increasing performance
- Fully source code compatible with NXP's software enablement for Kinetis MCUs, with automatic import from Kinetis Design Studio IDE and CodeWarrior projects



IAR Embedded Workbench®

- A powerful and reliable IDE designed for ease of use with outstanding compiler optimizations for size and speed
- A broad NXP ARM Cortex® MCU offering with dedicated versions available with functional safety certification
- Support for multi-core, low power debugging, trace, and more



ARM® Keil® Microcontroller Development Kit

- Specifically designed for microcontroller applications, easy to learn and use, yet powerful enough for the most demanding embedded applications
- ARM® C/C++ build toolchain and Execution Profiler and Performance Analyzer enable highly optimized programs and is safety certified by TUV for IEC 61508 and ISO 26262 and other safety applications
- Complete Code Coverage information about your program's execution

www.nxp.com/kide

Kinetis IDE Options

Complimentary IDEs

Kinetis Design Studio IDE

- Complimentary basic capability integrated development environment (IDE) for Kinetis MCUs
- Eclipse and GCC-based IDE for C/C++ editing, compiling and debugging

Additional IDEs



Emprog ThunderBench™

- Highly optimized and integrated embedded C/C++ development tools for ARM Cortex with a large cloud based repository of BSPs and sample code
- Designed from the ground up for embedded C/C++ developers with best price to quality Ratio coupled with Emprog best in class technical support
- Plugins for Processor Expert and others supporting a wide range of middleware, JTAG probes and a large ecosystem



Lauterbach TRACE32® Microprocessor Development Tools

- Full featured debug and trace environment for embedded designs
- Powerful code coverage and run-time analysis of functions and tasks
- Energy profiling time correlated to the program flow



mbed Development Platforms

- The fastest way to get started with Kinetis MCUs
- Online project management and build tools – no installation required
- Includes comprehensive set of drivers, stacks and middleware with a large community of developers



iSYSTEM winIDEA/testIDEA

- Complete SW Development and Test Platform which is easy to learn and use
- Only fully scalable solution providing a free entry with unlimited code size ranging to a high end advanced analysis and test solution
- Unique test solution without code instrumentation



Rowley Crossworks for ARM

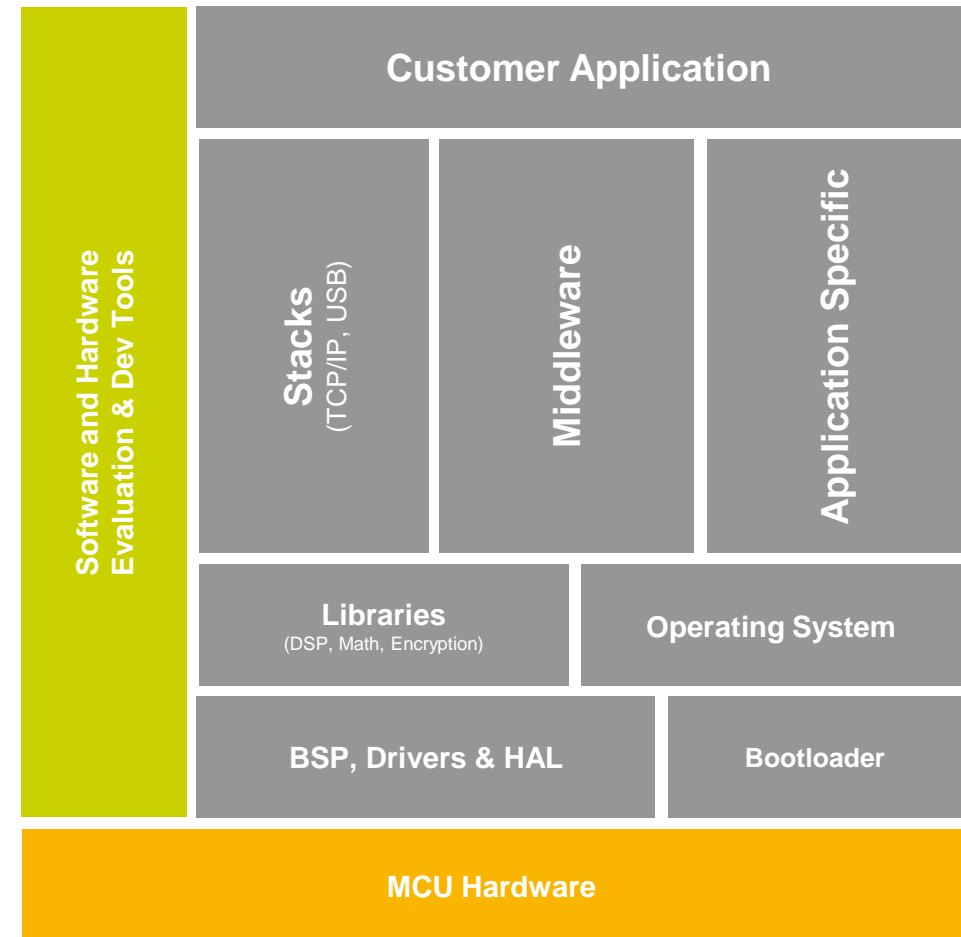
- CrossStudio embedded IDE natively built for Windows/Linux/Macos which takes care of edit, build, download, and debugging.
- C/C++ support from either GCC or CLANG/LLVM
- Debug and trace support for NXP MCU and MPU

www.nxp.com/kide

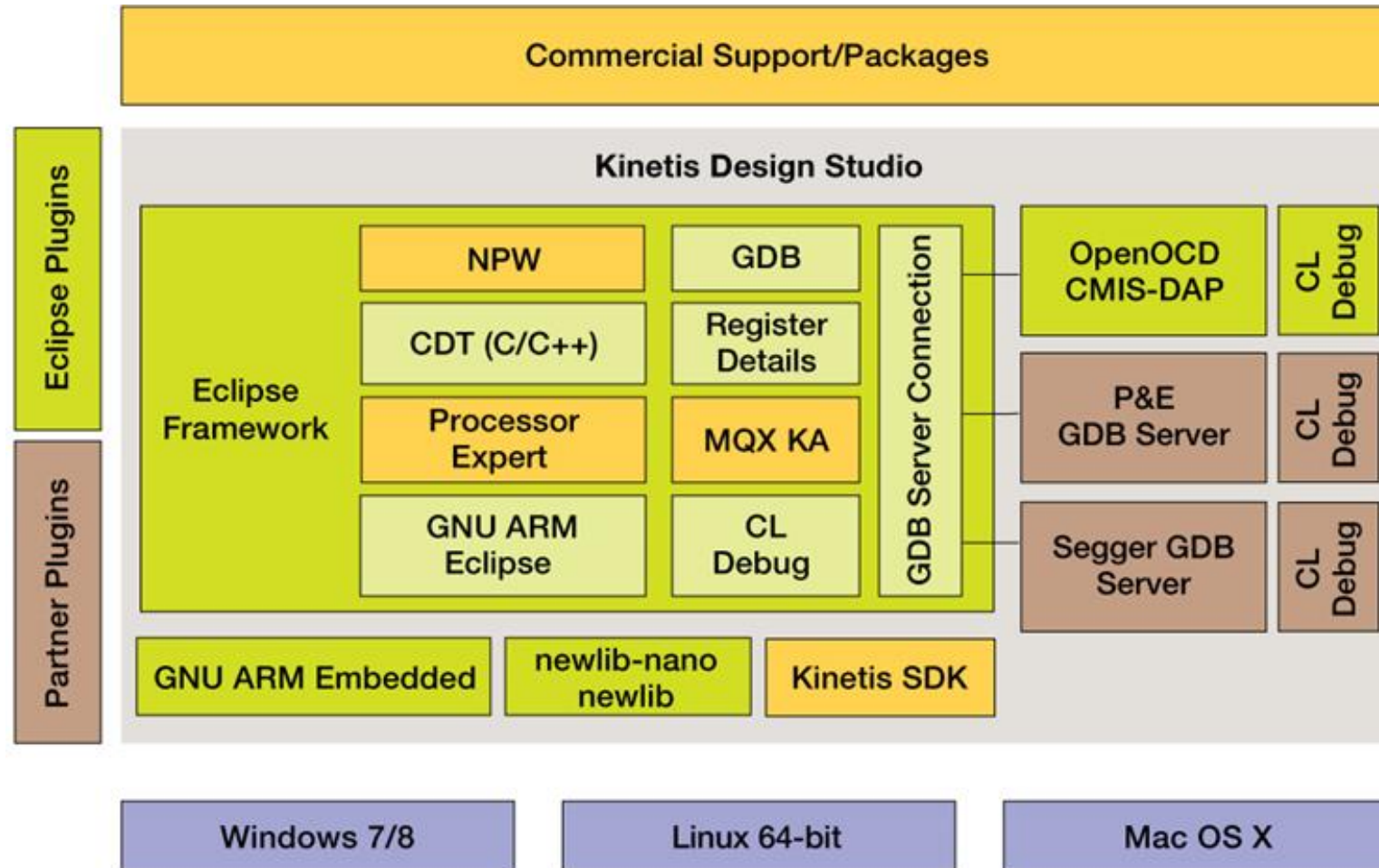
Kinetis Design Studio

Product Features:

- A free of charge and unlimited IDE for Kinetis MCUs
- A basic IDE that offers robust editing, compiling and debugging
- Based on Eclipse, GCC, GDB and other open-source technologies
- Includes Processor Expert with Kinetis SDK integration
- Supports all existing Kinetis devices via Processor Expert and new project wizard
- All new Kinetis devices will also feature the Kinetis SDK with Processor Expert configurability
- Code Generation for GNU, IAR and Keil
- Host operating systems:
 - Microsoft Windows 7/8/10
 - Linux (Ubuntu, Redhat, Centos) (64bit)
 - Mac OS X and Segger J-Link
- Support for SEGGER, P&E and OpenSDA/CMSIS-DAP debugger targets
- Support for Eclipse plug-ins including RTOS-awareness (i.e. MQX, FreeRTOS)
- Commercial upgrade path: Somnium DRT



Kinetis Design Studio – Block Diagram



ARM® mbed™ Platform for NXP Freedom Development Platforms

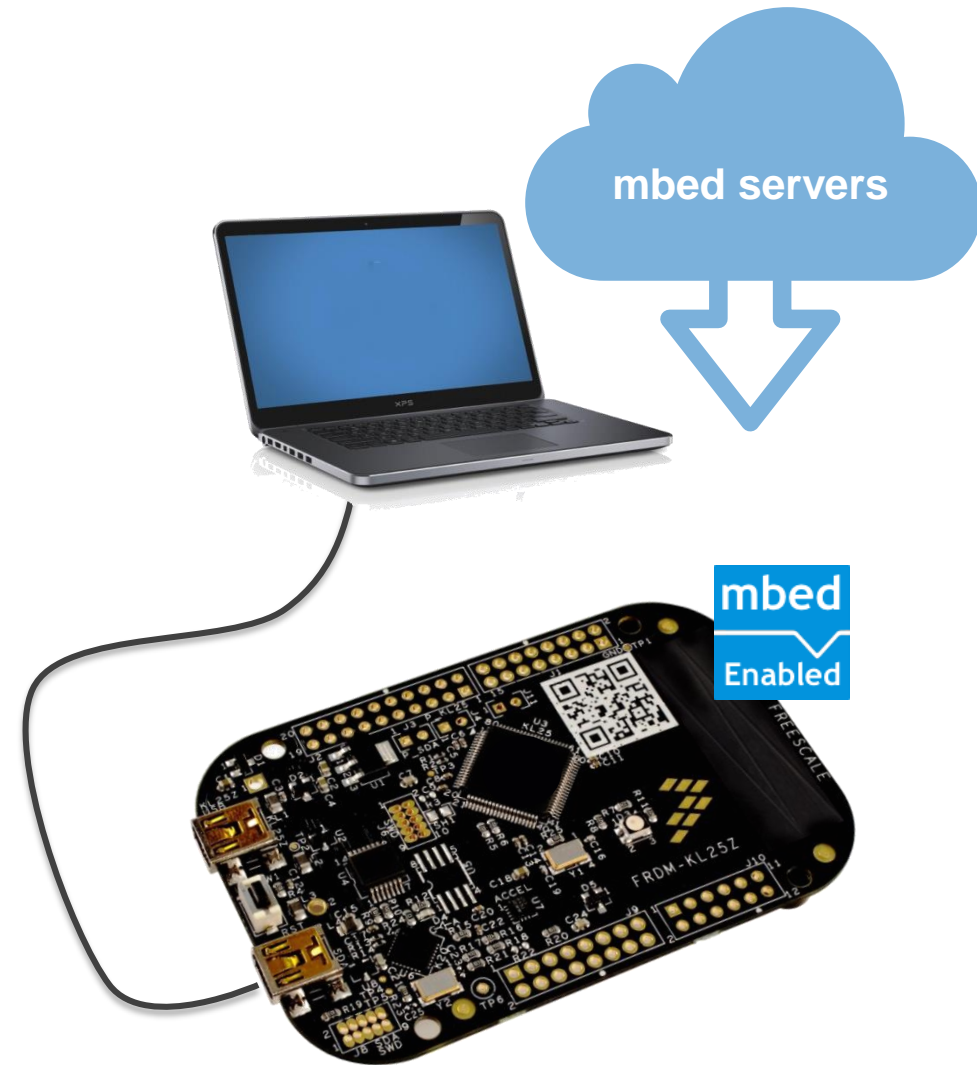
Tool for Rapid Prototyping with ARM Microcontrollers

Web-based Development:

- Online IDE
- Software Libraries
- Robust Community

OpenSDA on Freedom Development Platforms running mbed interface:

- Serial Communications
- Flash Programming
- Run-control debug

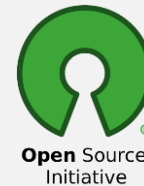
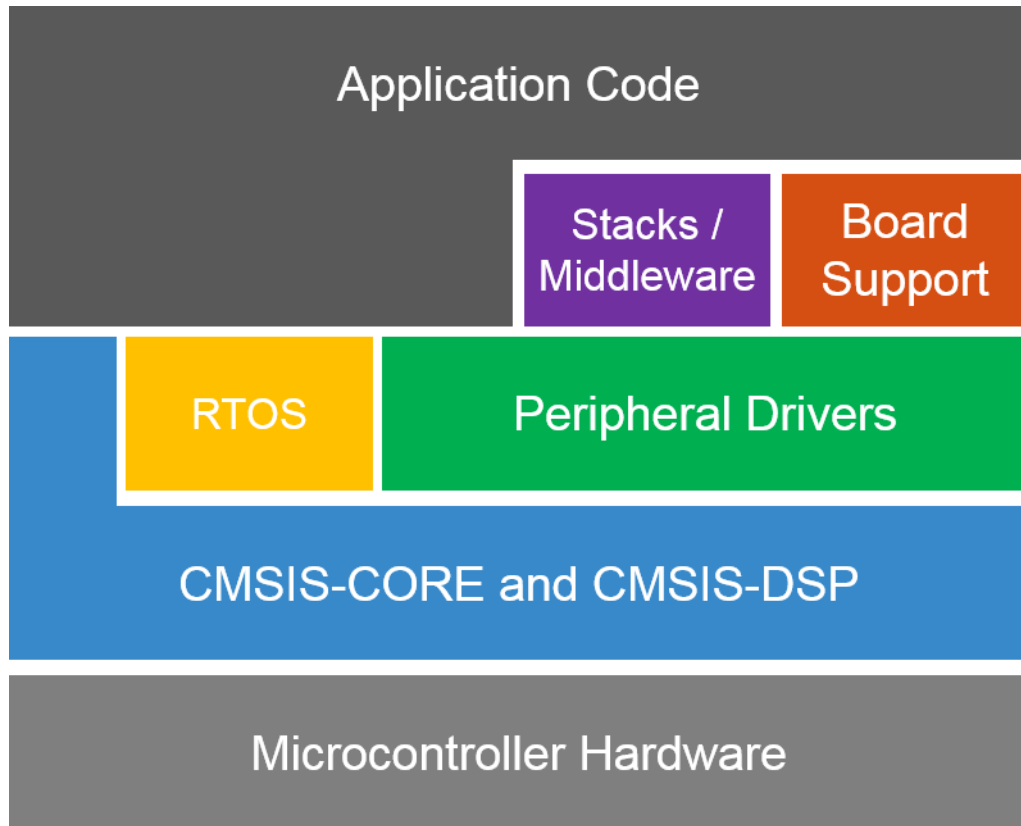


KINETIS SOFTWARE DEVELOPMENT TOOLS



Kinetis Software Development Kit v2.x (KSDK v2)

The software framework and reference for Kinetis MCU application development



Architecture:

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

Integrated RTOS:

- FreeRTOS, Micrium uC/OS-II & -III
- RTOS-native driver wrappers

Integrated Stacks & Middleware

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

Reference Software:

- Peripheral Driver usage examples
- Application Demos
- FreeRTOS usage demos

License:

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

Toolchains:

- KDS, IAR, Keil, Atollic, GCC w/ CMake

Quality

- Production grade software
- MISRA 2004 compliance
- Checked with Coverity Static Analysis tools

Kinetis SDK v2 – 2016 GA Schedule for Launched Devices



Release 1 – Jan 27th

First wave of Kinetis K & L

- FRDM-K22F, TWR-K22F120M
- TWR-K21F120MA
- FRDM-K64F and TWR-K64F120M
- TWR-K65F180M
- TWR-K81F150M and FRDM-K82F
- FRDM-KL43Z and TWR-KL43Z48M
- FRDM-KL27Z

Release 2 – Target: Early June

Remaining K & L plus KM34

- FRDM-KL02Z
- FRDM-KL03Z
- FRDM-KL25Z
- FRDM-KL26Z
- FRDM-KL46Z
- TWR-K60D100M
- TWR-K21D50M
- TWR-K24F120M
- TWR-KL82Z72M and FRDM-KL82Z
- TWR-KM34Z75M

Release 3 – Target: July

Kinetis V devices

KSDK v1.3 and v2 Available via *SDK Builder*: www.nxp.com/KSDK

Kinetis SDK v2 – Toolchain Support



Kinetis
Design Studio

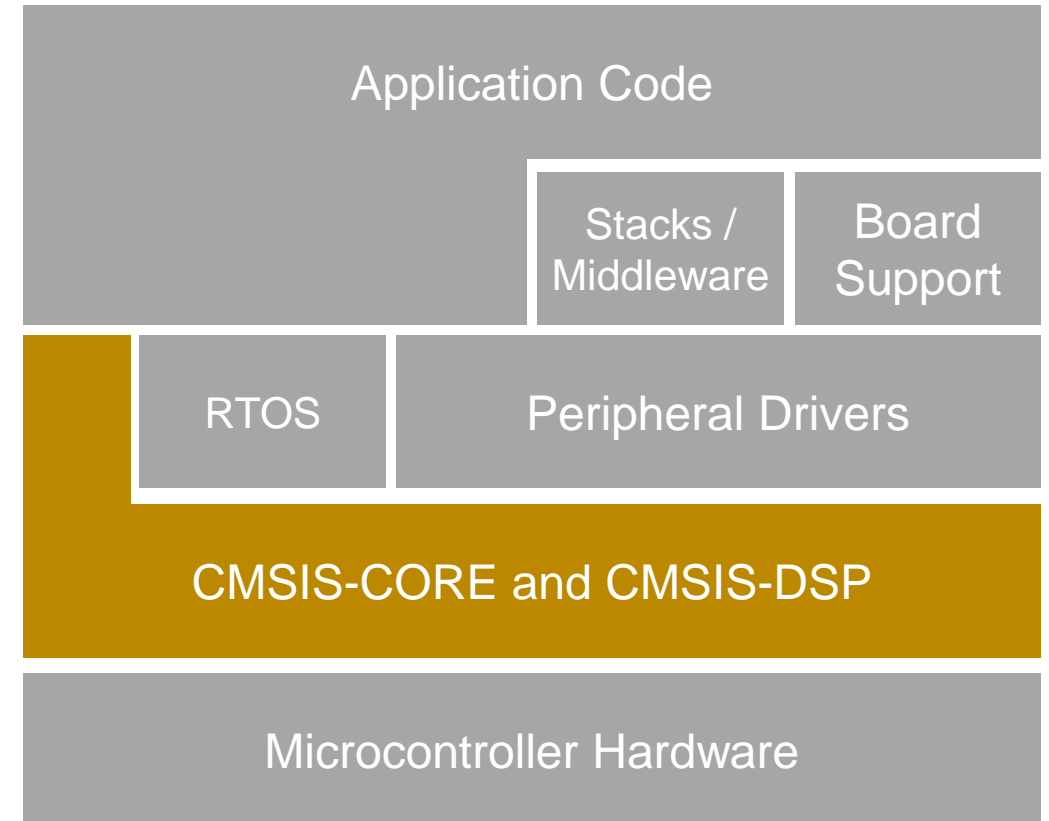
ARM® KEIL®
Microcontroller Tools



(Kinetis Design Studio project importer)

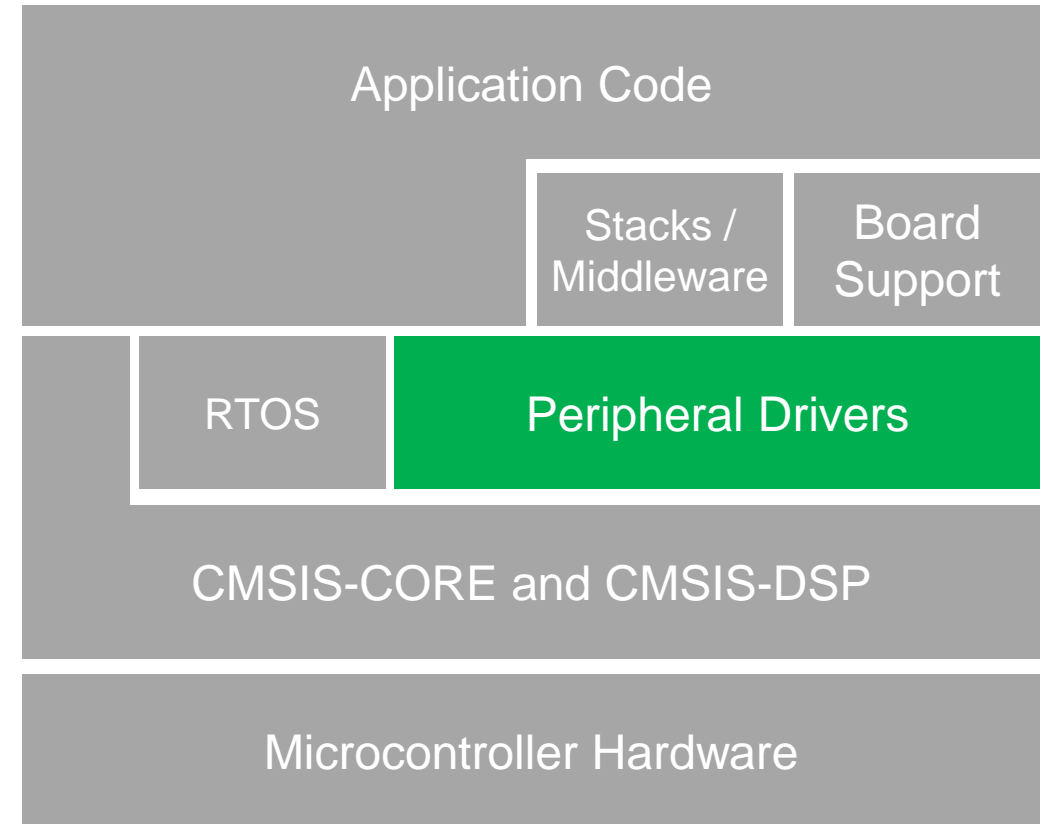
Kinetis SDK v2 – CMSIS Device Support

- CMSIS-CORE provides a standard for a basic run-time system and user access to the core and the peripherals:
- Hardware Abstraction Layer (HAL) - definitions for the SysTick, NVIC, FPU registers, and core access functions
- Standardized MCU header file format – common register/bit access methods, system exception and interrupt naming
- Standard methods for system initialization – for example, the [SystemInit\(\)](#) function for essential system configuring
- Intrinsic functions used to generate CPU instructions that are not supported by standard C functions
- CMSIS-DSP is a suite of common signal processing functions including math, filters, matrix, transforms, motor control, statistical, and interpolation functions



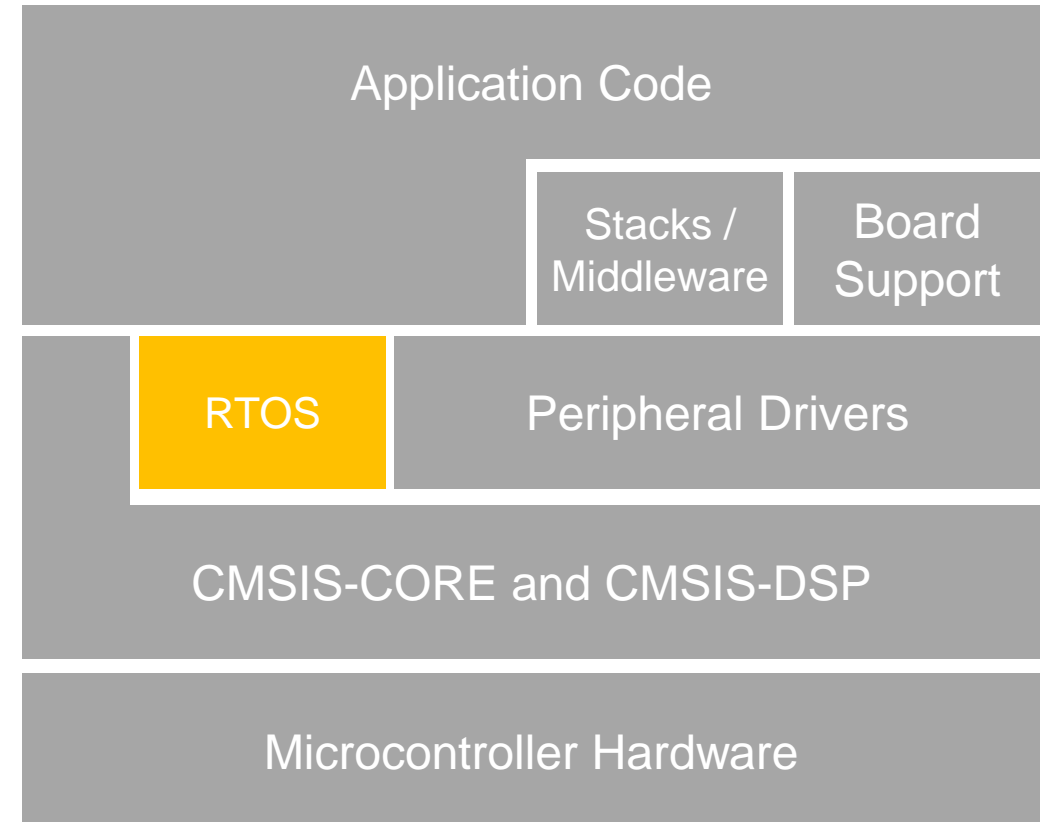
Kinetis SDK v2 – Peripheral Drivers

- High-level info about Peripheral Drivers will go here and include details such as:
 - Single driver for each peripheral
 - Full peripheral coverage for each MCU
 - All drivers include low-level functional APIs
 - Communication peripheral drivers feature transactional APIs
 - Non-blocking, interrupt based
 - Communication peripheral drivers also have optimized RTOS wrapper drivers
 - Uses native RTOS APIs – no operating system abstraction



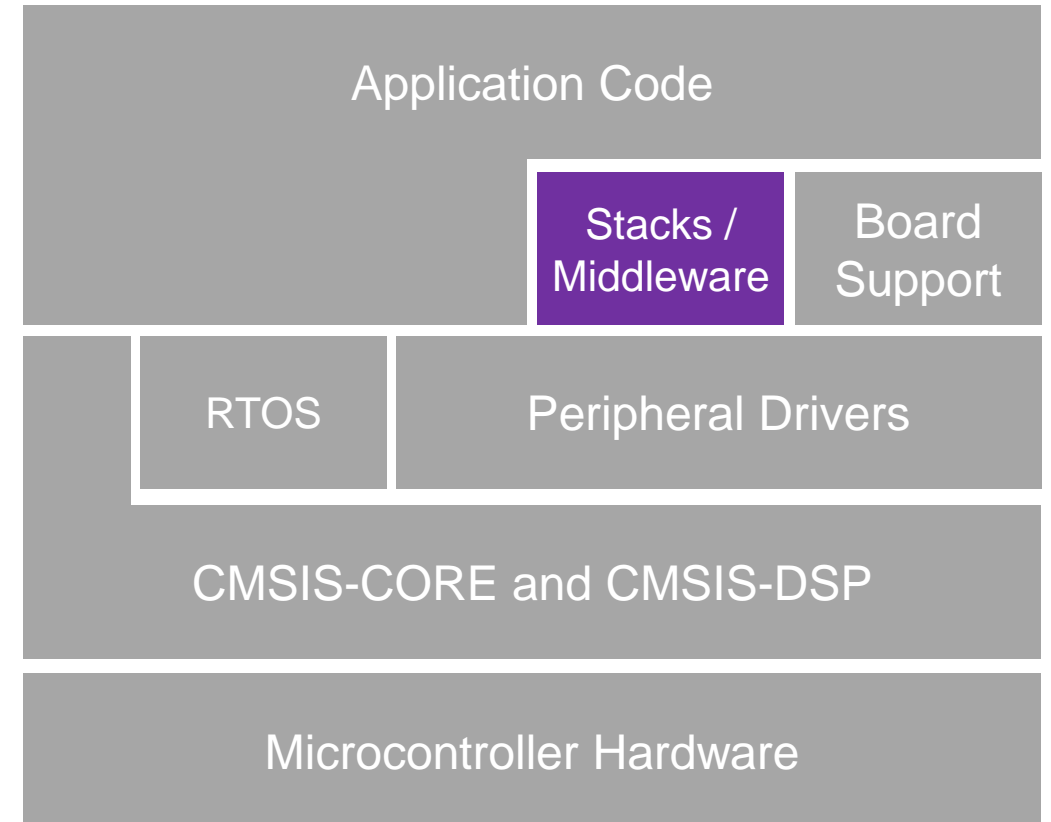
Kinetis SDK v2 – RTOS Options

- FreeRTOS, uC/OS-II, uC/OS-III kernels pre-integrated
- Focus on FreeRTOS with
 - Demonstration applications
 - RTOS Usage examples
- RTOS examples include:
 - freertos_dsipi
 - freertos_event
 - freertos_generic
 - freertos_hello
 - freertos_i2c
 - freertos_mutex
 - freertos_queue
 - freertos_sem
 - freertos_swtimer
 - freertos_tickless
 - freertos_uart
 - ucosiii_hello
 - ucosii_hello

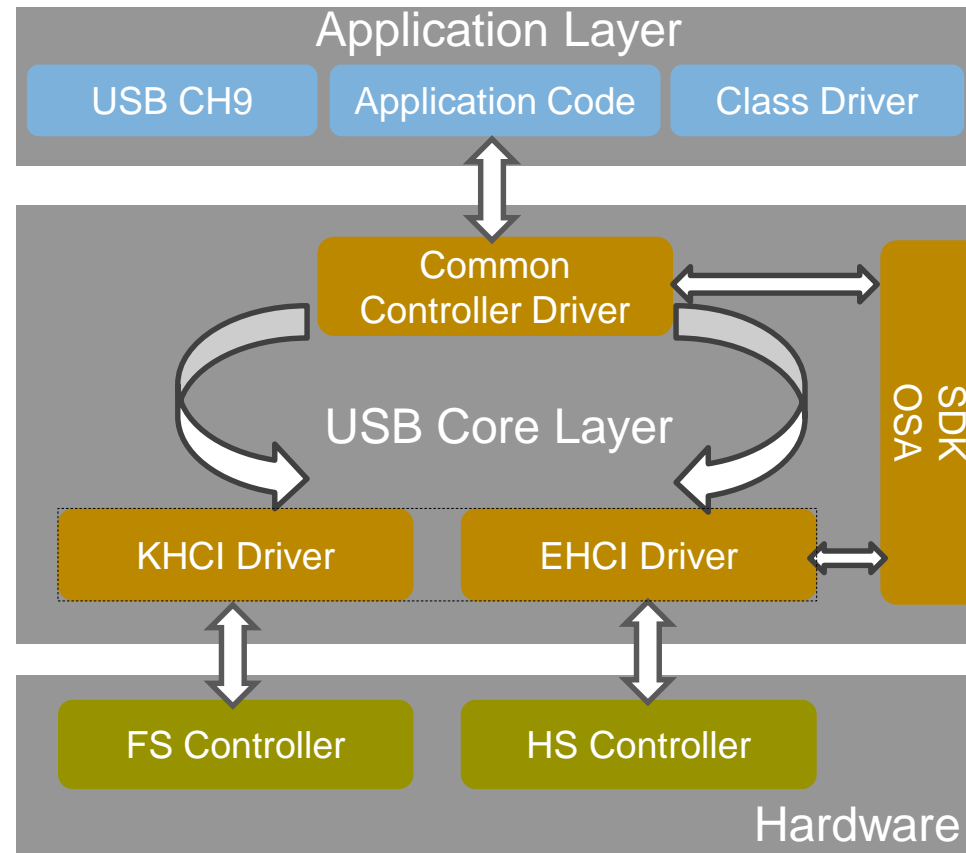


Kinetis SDK v2 – USB Stack

- KSDK USB Stack is a comprehensive, open-source device and host stack. It supports baremetal and RTOS application, multiple class implementations, several demo applications.
 - 70+ demo applications that support extensive features including:
 - 7 device classes with 3 composite examples
 - 5 host classes with USB hub support
 - Full-speed and high-speed under USB 2.0 specs
 - High quality stack, ready for production use
 - USB-IF certification on both FS and HS
 - Optimized for code size - down to 6K flash and 2K RAM – and performance among competition
 - Device demos have “Lite” versions that are even smaller in code size



USB Demo Examples



Note: OTG demos will be enabled in by KSDK 2.0 Release 4

USB Demo Examples

	Class	Demos	“Lite” Apps	RTOS
Host Class	HID	Mouse, Mouse+Keyboard	No	FreeRTOS, uC/OS-II & III
	CDC	COM port	No	FreeRTOS
	MSC	UFI/SCSI U-disk, FATFS	No	FreeRTOS
	Audio	Speaker	No	FreeRTOS
	PHDC	Weight scale manager	No	FreeRTOS
Device Class	HID	Generic, Mouse	Yes	FreeRTOS, uC/OS-II & III
	CDC	Virtual com	Yes	FreeRTOS
	MSC	RAMdisk	Yes	FreeRTOS
	Audio	Generator, Speaker	Yes	FreeRTOS
	Video	Virtual camera, FlexIO	Yes	FreeRTOS
	PHDC	Weight scale	Yes	FreeRTOS
	Composite	HID Mouse+Keyboard, HID+Audio, CDC+MSC	Yes	FreeRTOS

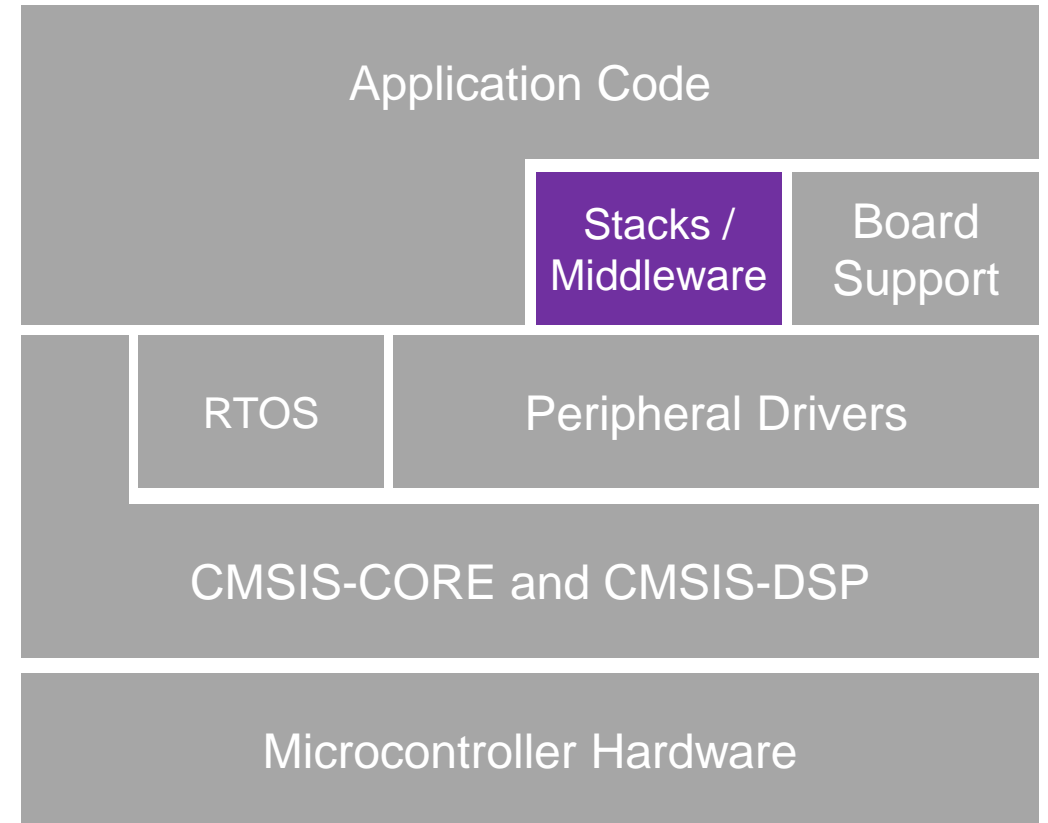
Kinetis SDK v2 – FatFS

FatFS is a generic FAT file system module for small embedded systems. Features include:

- ANSI C compliant and completely separated from disk I/O layer
- Windows compatible FAT file system
- Very small footprint
- Various configuration options
 - Multiple volumes (physical drives and partitions)
 - Long file name support in ANSI/OEM or Unicode
 - RTOS support
 - FAT sub-types: FAT12, FAT16 and FAT32.

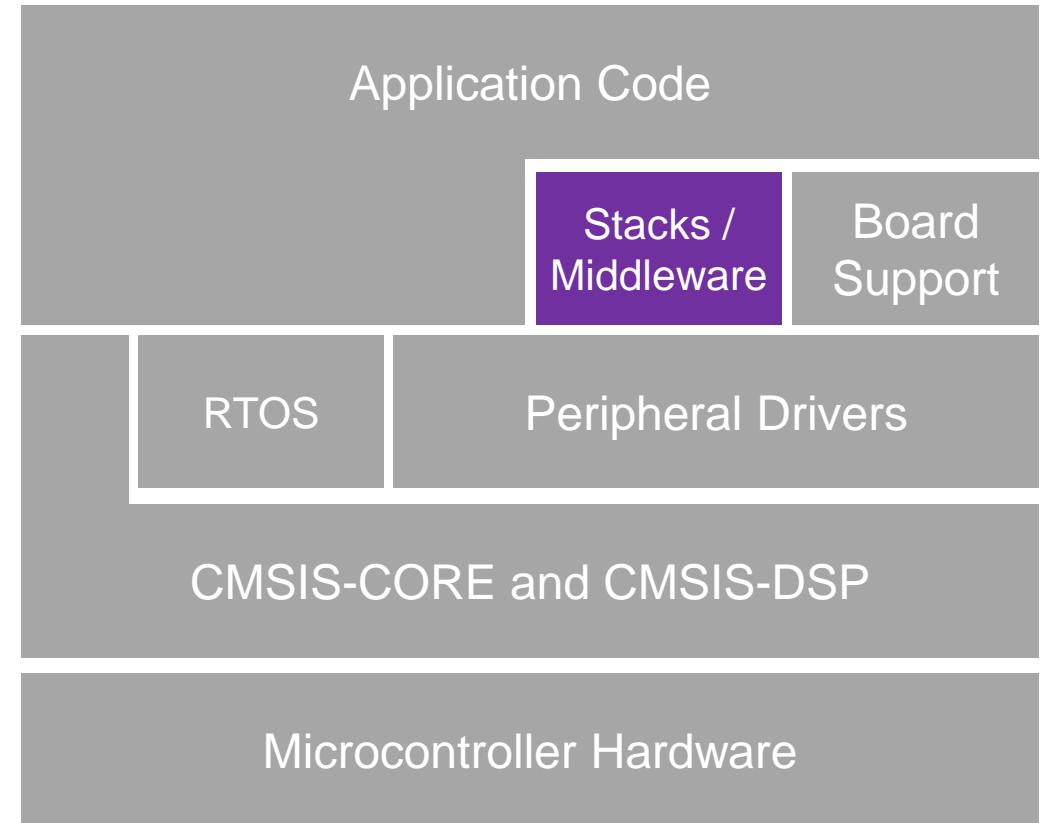
Available demos:

- sdcard_fatfs
- usb_host_msd_fatfs (baremetal & FreeRTOS)



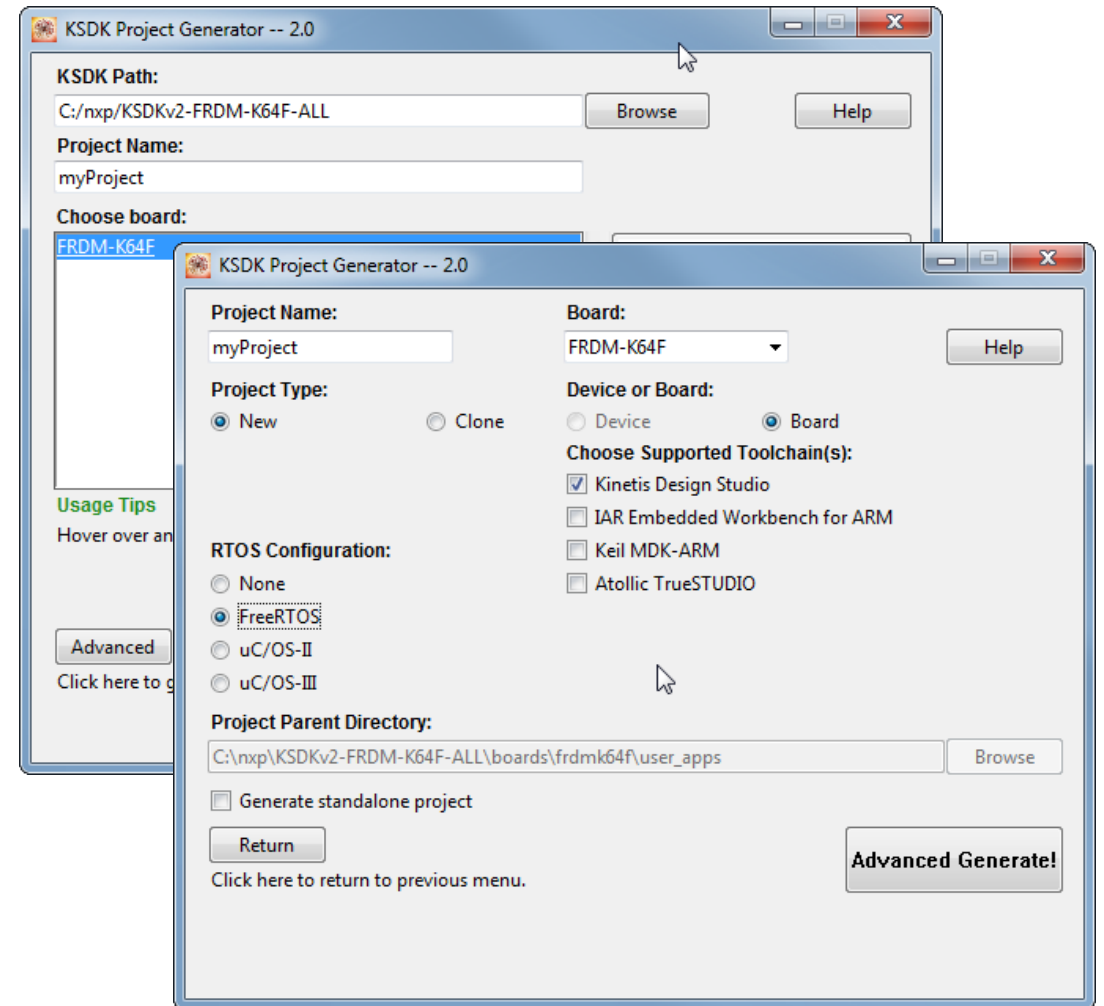
Kinetis SDK v2 – lwIP

- lwIP – the lightweight Internet Protocol
- A full scale TCP/IP stack for embedded systems
- lwIP supports the following protocols:
 - ARP
 - DHCP
 - IPv4 and v6
 - ICMP
 - TCP
 - IGMP
 - UDP
 - PPP
 - DNS
 - PPPoE
 - SNMP
- Example applications include:
 - lwip_httpsrv
 - lwip_ping
 - lwip_tcpecho
 - lwip_udpecho



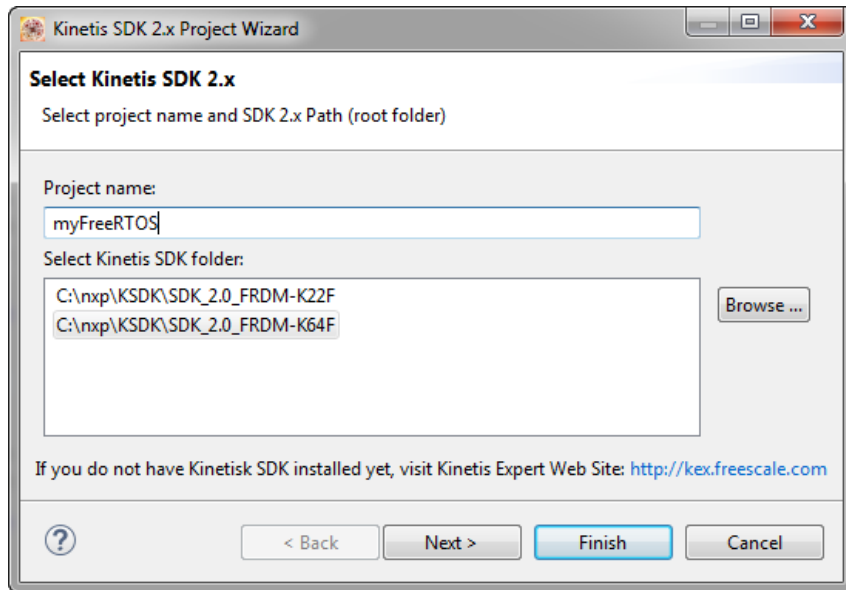
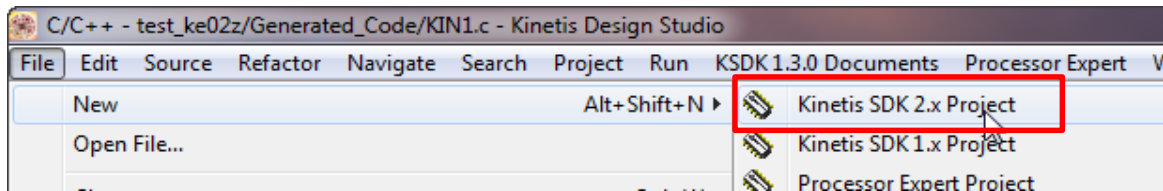
Kinetis SDK v2 – Project Generator

- Supports KSDK v1.2, v1.3 and v2.0
- Quick Generate of development board based KSDK projects
- Create new or clone existing projects using Advanced mode
 - Device or development board based
 - Linked to KSDK installation or standalone
 - RTOS support
 - KDS, IAR, Keil MDK, and/or Atollic TrueSTUDIO IDE projects
 - Advanced Generate of KSDK 'demo_apps' Clones

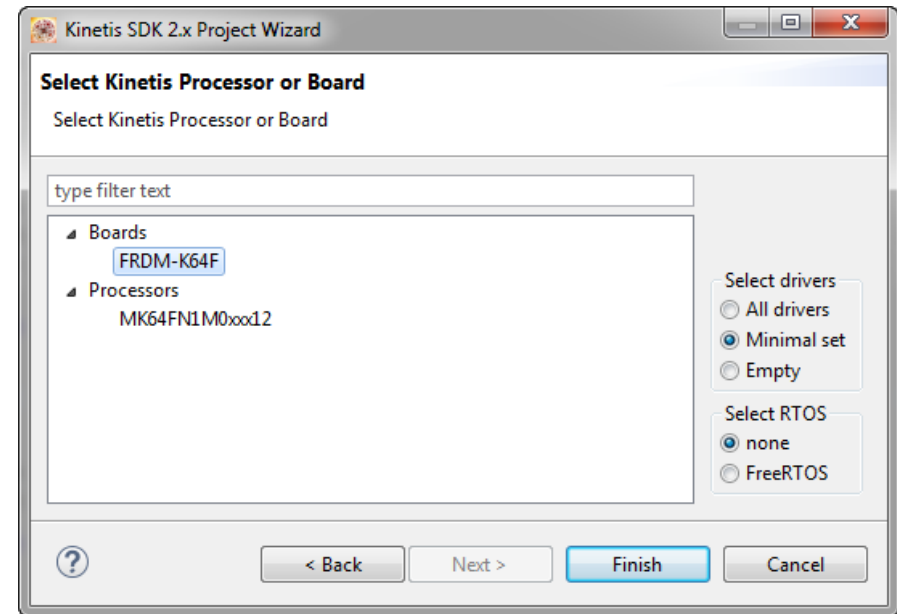


Using KSDK v2 with Kinetis Design Studio (KDS)

- Dedicated Project Wizard to create projects for Kinetis SDK v2
- Multiple SDK folder support
- Data driven by SDK manifest XML file



- Selection of
 - Device: Board or Device
 - Drivers: none, minimal or all
 - RTOS: FreeRTOS, μ COS-II/III
- Manifest controlled



<https://community.freescale.com/docs/DOC-329662>

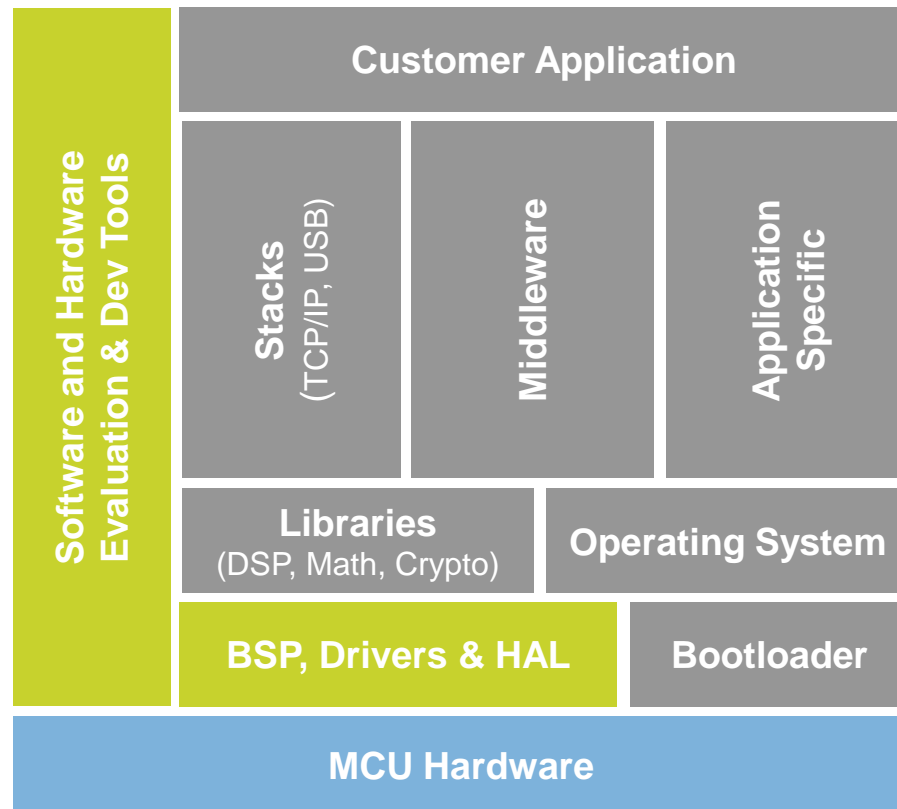
Kinetis SDK v2 – Documentation Updates

- New Kinetis SDK Getting Started Guide
 - Updated for new project structure and file layout
- New Kinetis SDK 2.0 API Reference Manual
 - Also available online at <http://kex.freescale.com/apidoc/2.0/>
- Kinetis SDK 2.0 Transition Document
 - Details on changes between KSDK 1.3 and KSDK 2.0, as well as migration to FreeRTOS

Kinetis Expert (KEx) System Configuration Tools



Integrated configuration and development tools for Kinetis MCUs.



Kinetis Expert is a suite of evaluation and configuration tools that helps guide users from first evaluation to production software development. The tools are available in online and desktop editions.



SDK Builder packages custom SDKs based on user selections of MCU, evaluation board, and optional software components.



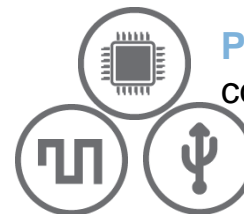
Project Generator creates new or clones existing SDK projects.



Power Estimation tool provides energy and battery-life estimates based on a user's application model

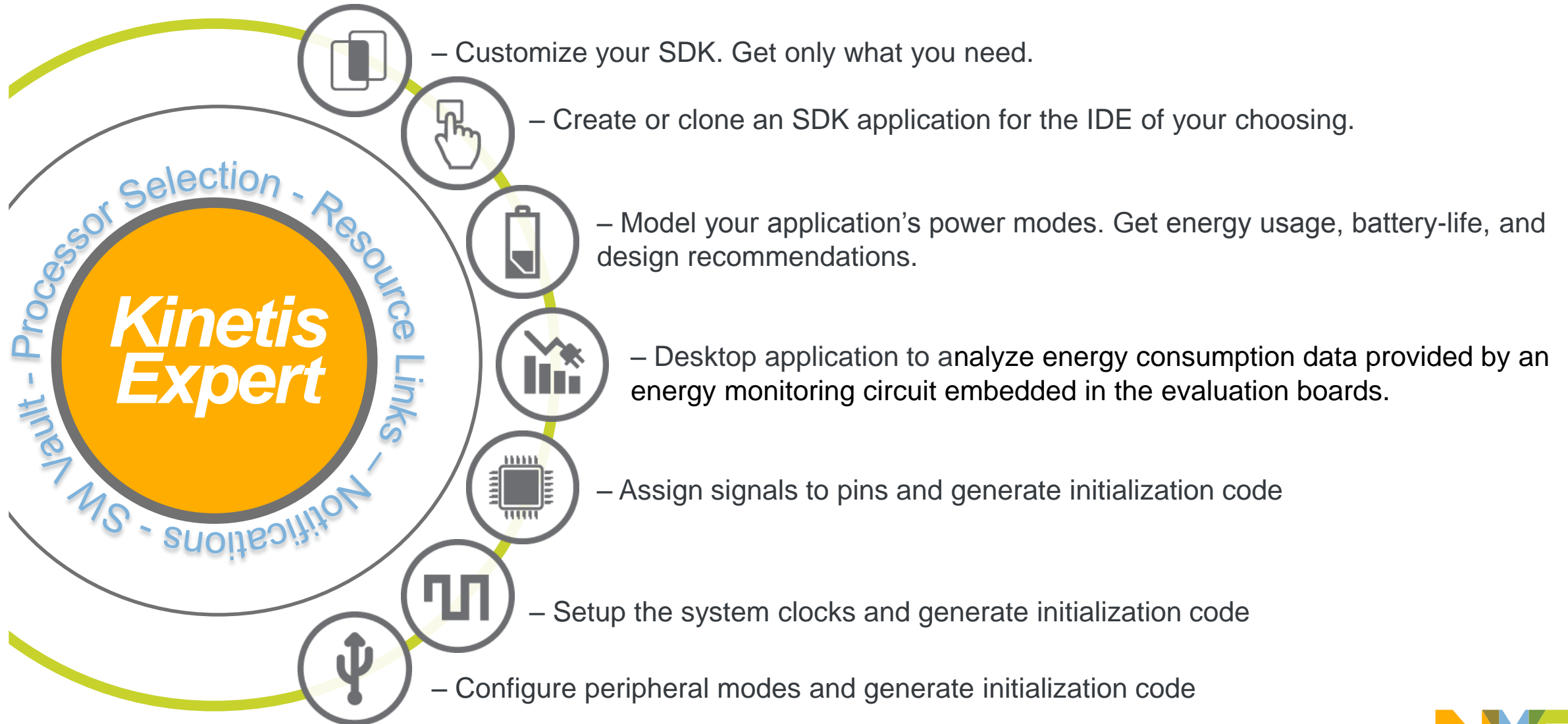


Power Analyzer measures and displays energy consumption data

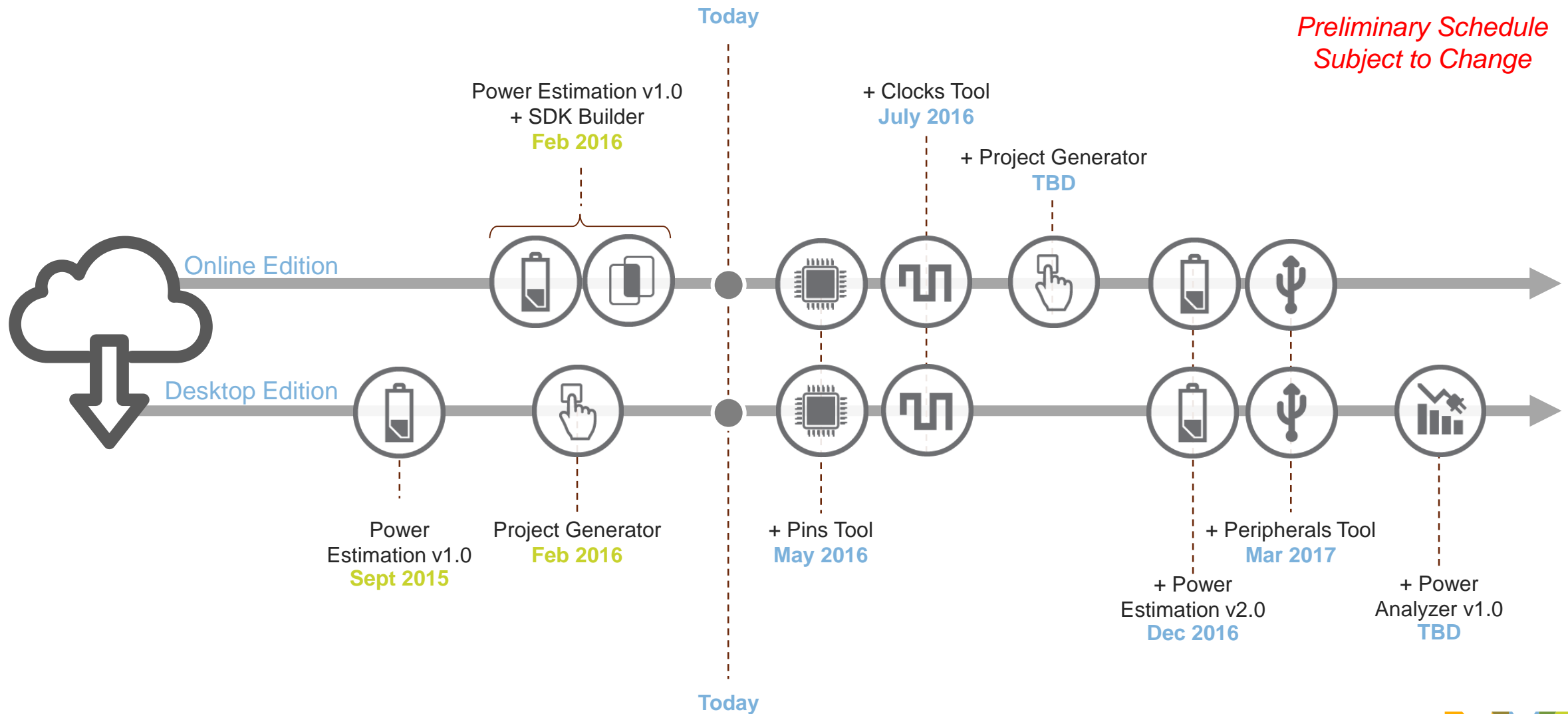


Pins, Clocks, and Peripherals tools generate initialization C code for custom board support.

Kinetis Expert (KEx) System Configuration Tools



Kinetis Expert (KEx) – Milestones



Kinetis Power Estimation Tool



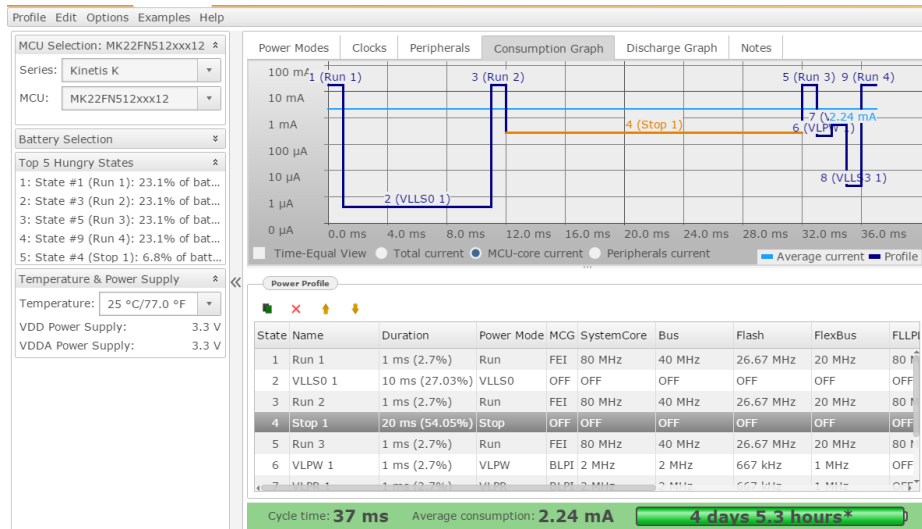
Estimate and optimize your system's power consumption



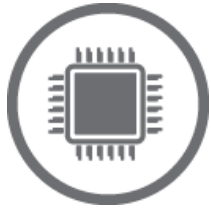
Helps you design for efficient use of energy

Product Features

- Part of the Kinetis Expert suite of system configuration tools
- Online and Desktop versions available now
- Models application states and estimates the power profile
- Provides immediate energy consumption & battery life estimations
- Generates consumption and battery discharge graphs
- Provides ability to save & load profiles and generate reports
- Local and online versions to be available
- English & limited Chinese language support
- Backed by real power measurement data
- Quickly evaluate which Kinetis MCU fits your use-case and power budget
- Accelerates learning curve for advanced power management features
- Ideal tool for developing wearable and other battery-operated applications.



Kinetis Expert Pins Tool



Easy-to-use muxing and pin assignments for Kinetis MCU's

#	Peripheral	Signal	Route to	Direction	Slew rate	Open dra..	Drive str
1	ADC0	SE, 1	[23] ADC...Input	n/a	n/a	n/a	n/a
2	ADC0	SE, 2	[3] ADC0...Input	Fast	Disabled	Low	

Product Features:

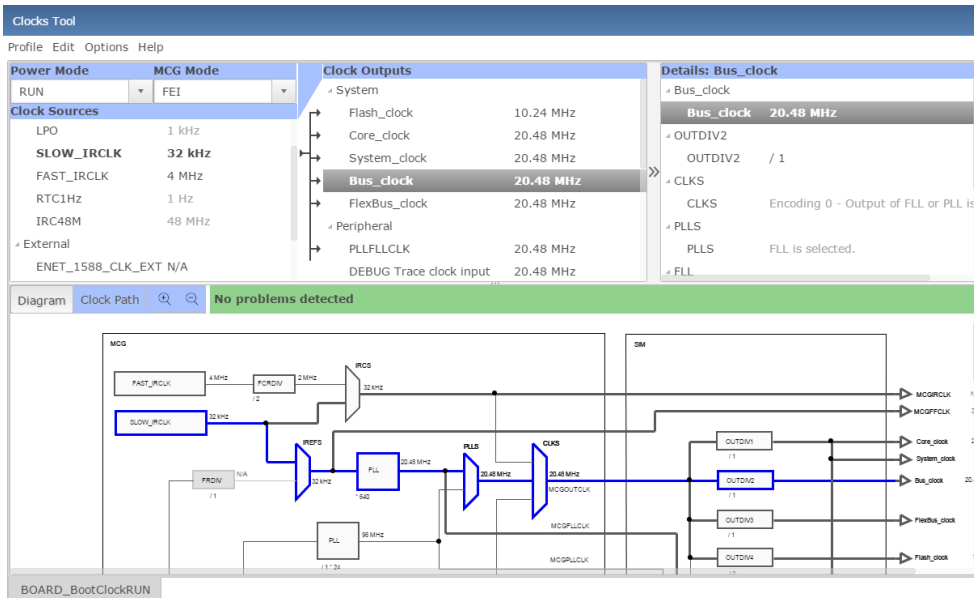
- Part of the Kinetis Expert suite of system configuration tools
- Online and Desktop editions planned for release in May 2016
- Muxing and pin configuration with consistency checking
- ANSI-C configuration code
- Kinetis SDK support
- Graphical processor package view
- Multiple configuration blocks/functions
 - Selection of Pins and Peripherals
 - Package with IP blocks
 - Routed pins with electrical characteristics
 - Registers with configured and reset values
 - Source code for C/C++ applications
- Documented and easy to understand source code
- Report generation
- Integrates with any compiler and IDE



Kinetis Expert Clocks Tool



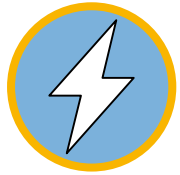
Easy-to-use clock configuration for Kinetis MCU's



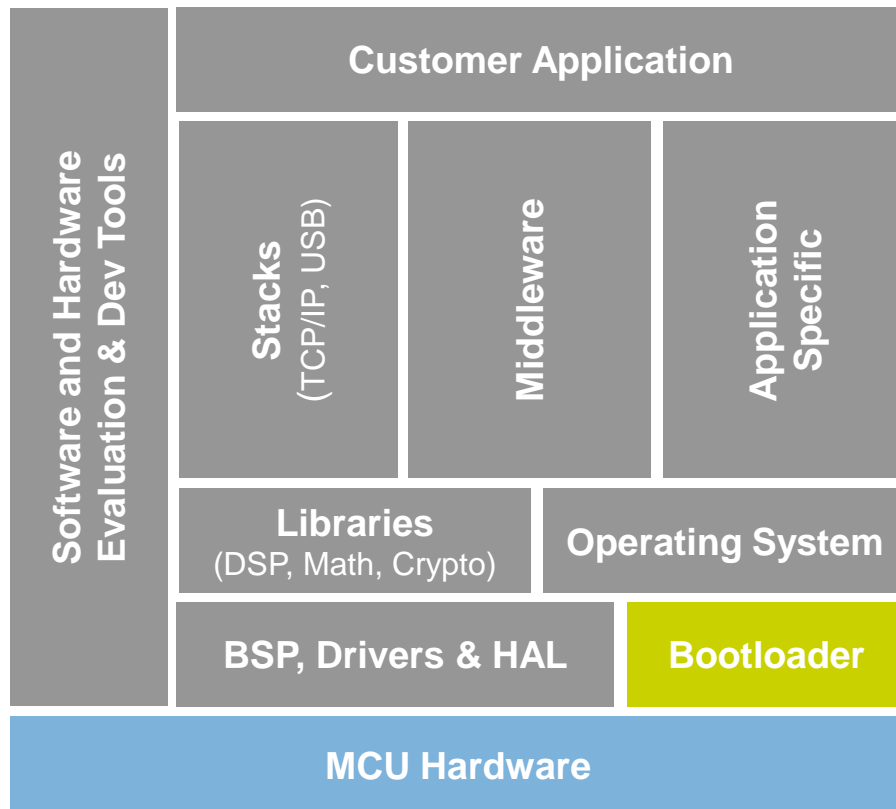
Product Features:

- Part of the Kinetis Expert system configuration tools
- Online and Desktop editions planned for release in July 2016
- System clock configuration with consistency checking
- ANSI-C initialization code
- Kinetis SDK v2 support
- Graphical clock diagrams
- Multiple configuration blocks/functions
- 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
- Integrates with any compiler and IDE

Kinetis Bootloader (KBOOT)



Flash programming over a serial connection: program, erase, verify



Kinetis Bootloader v2

Architecture

- Based on startup, header files and low-level peripheral drivers from KSDK v2
- Common packet-based protocol for all peripherals, compatible across v1 and v2

Complimentary Tools

- GUI host tools supported on Windows
- Command-line host tools on Windows, Mac OS and Linux
- Source code included in release packages

Reference Software

- Application Demos
- ROM flash driver usage example

License

- BSD 3-clause for startup and bootloader core stack

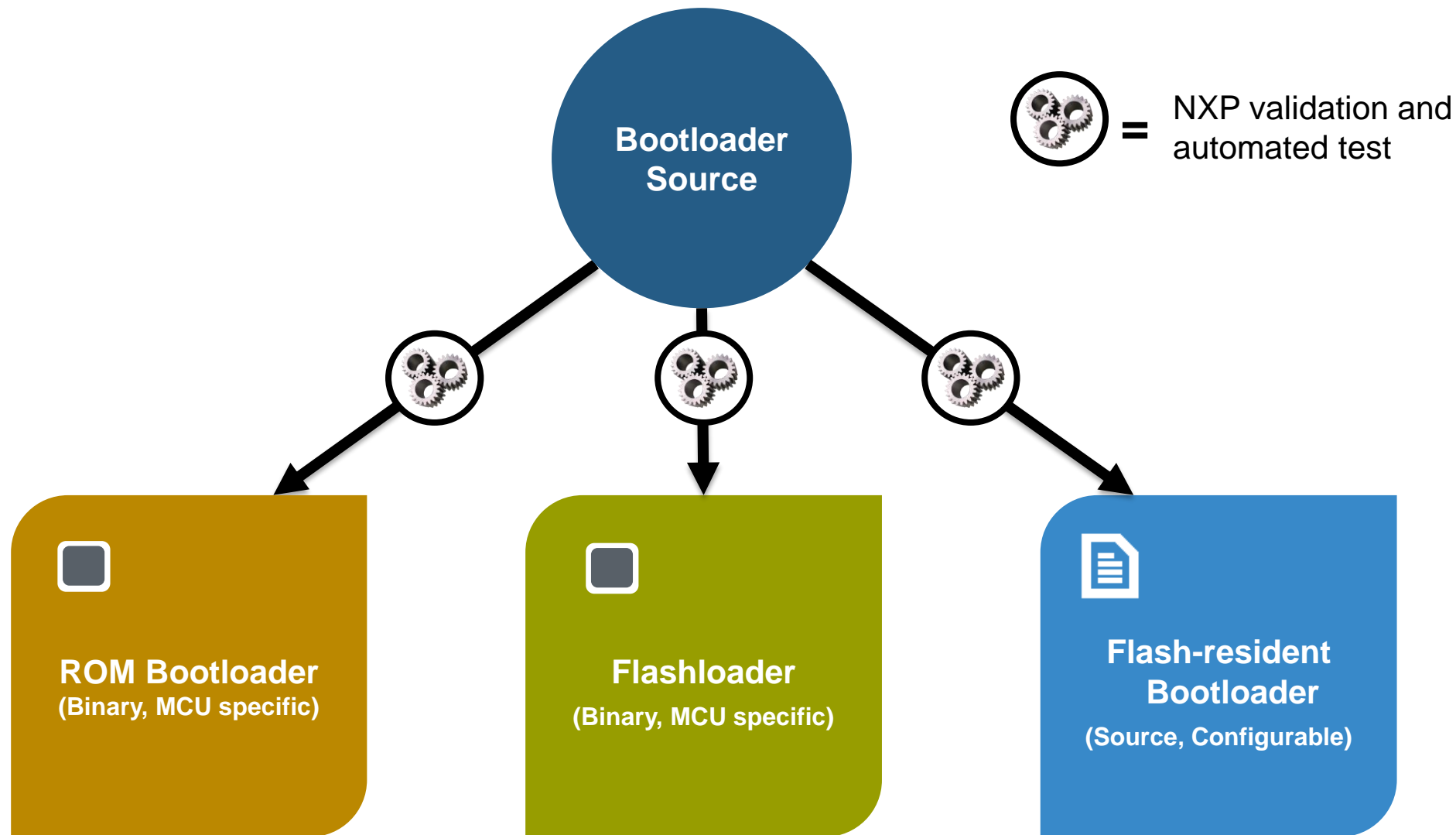
Quality

- Production grade software
- Embedded components checked with Coverity Static Analysis tools

IDE Support

- KDS, IAR, Keil

Kinetis Bootloader Configurations



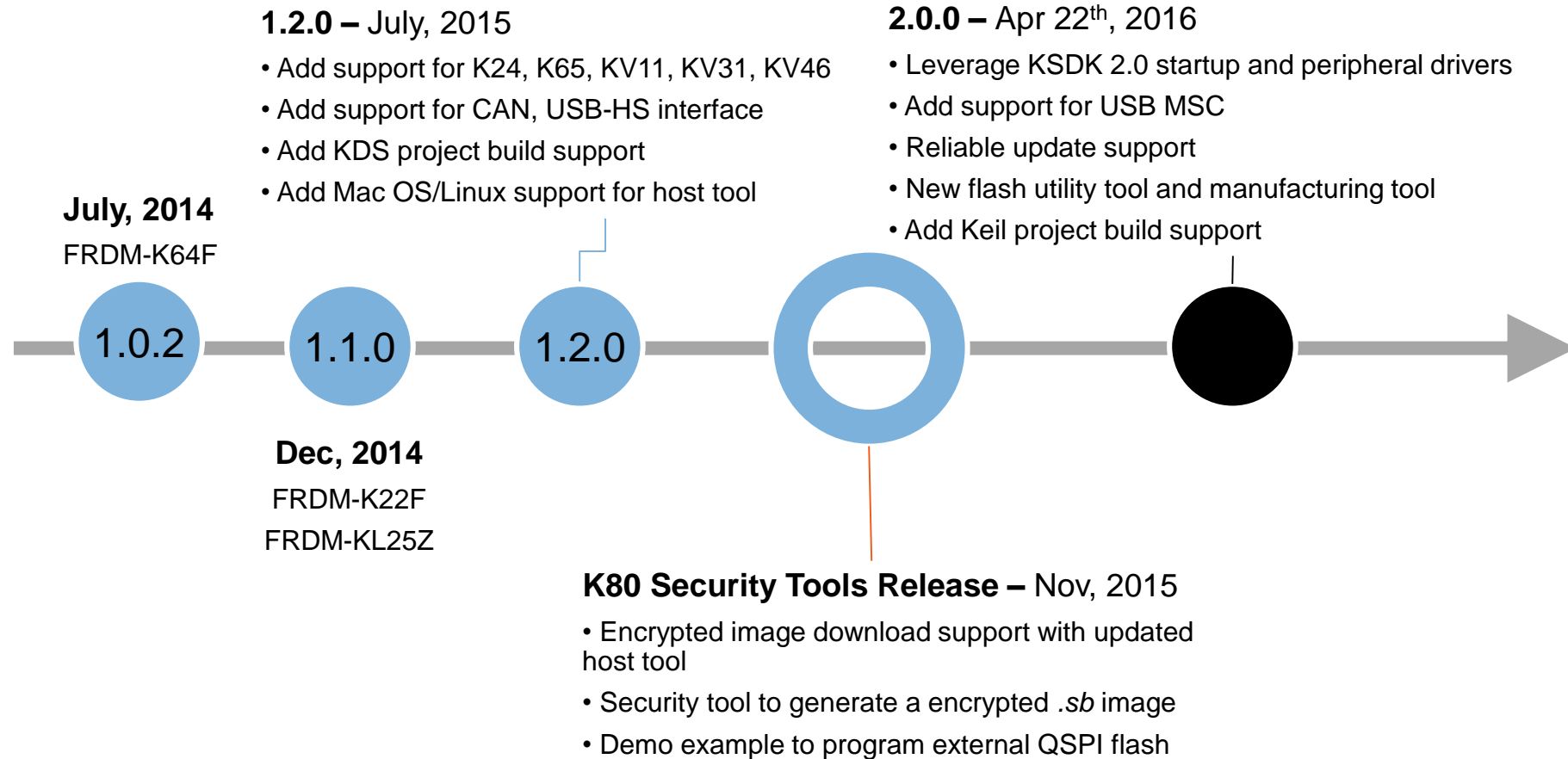
Bootloader Configuration Comparison

Bootloader Configuration	ROM Bootloader	Flashloader	Flash-resident Bootloader
Use Case	Factory Flash Programming & Field Update	Factory Flash Programming	Field Update
Delivery Mechanism	Binary preprogrammed in ROM by NXP	Binary preprogrammed in flash by NXP	Source code provided in major release
Supported Devices	All Kinetis Devices with a boot ROM	Select Kinetis Devices without a ROM*	Select Kinetis Devices*
Clock Configuration	Configurable by user	Configured by NXP to a default setting	Configurable by user
Feature	Can run at system startup or callable from user application	Always run at system start-up	Can run at system startup or callable from user application
	Can jump to user application after peripheral timeout	Overwritten by user application	Can jump to user application after peripheral timeout

*List of supported devices on www.nxp.com/kboot



Kinetis Bootloader Release Schedule



All Supported Devices – KBOOT v1.2

- Flash-resident Bootloader Project/Source Code
 - K24F, K63F and K64F MCUs via the FRDM-K64F and TWR-K64F120M
 - K22F 100MHz/120MHz and K02F MCUs via the FRDM-K22F and TWR-K22F120M
 - KL25Z MCUs via the FRDM-KL25Z and TWR-KL25Z48M
 - K26F, K65F and K66F MCUs via the TWR-K65F180M
 - K24F 120MHz 256KB flash MCUs via the TWR-K24F120M
 - KV11Z, KV10Z MCUs via the FRDM-KV11Z and TWR-KV11Z128M
 - KV30Z, KV31Z MCUs via the TWR-KV31F120M
 - KV4xZ MCUs via the TWR-KV46F150M
- ROM Bootloader
 - KL03Z, KL13Z and KL33Z MCUs
 - KL17Z, KL27Z and KL43Z MCUs
 - K8xF MCUs
- Flashloader
 - K02F and K22F 100MHz/120MHz MCUs,
 - K24F 256KB flash MCUs
 - K26F, K65F and K66F MCUs
 - KV11Z, KV10Z MCUs
 - KV30, KV31 MCUs
 - KV4x MCUs

Kinetis Bootloader v2.0 Changes

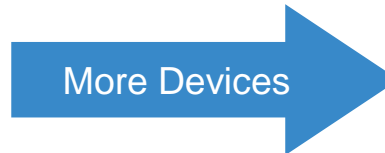


Supported devices:

- FRDM-K64F and TWR-K64F120M
- FRDM-K22F and TWR-K22F120M
- FRDM-KL25Z and TWR-KL25Z48M
- TWR-K65F180M
- TWR-K24F120M
- FRDM-KV11Z and TWR-KV11Z128M
- TWR-KV31F120M
- TWR-KV46F150M

Toolchain - IAR, KDS

Serial interface - UART, I2C, SPI, CAN, USB HID

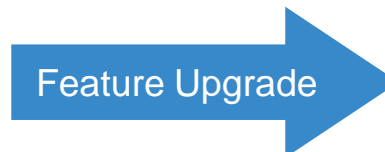


All v1.2 devices supported plus:

- FRDM-K82F and TWR-K80F150M
- FRDM-KL82Z and TWR-KL82Z72M
- FRDM-KL28Z and TWR-KL28Z
- FRDM-K66F
- FRDM-KV31F
- TWR-KV58F220M
- MAPS-KS22F256
- More new devices

Toolchain - add support for Keil

Serial interface – add USB device MSC



Add reference software for select devices:

- Embedded host application to demo I2C, SPI and CAN programming
- Demo to program encrypted image onto external flash
- Reliable update w/ backup image

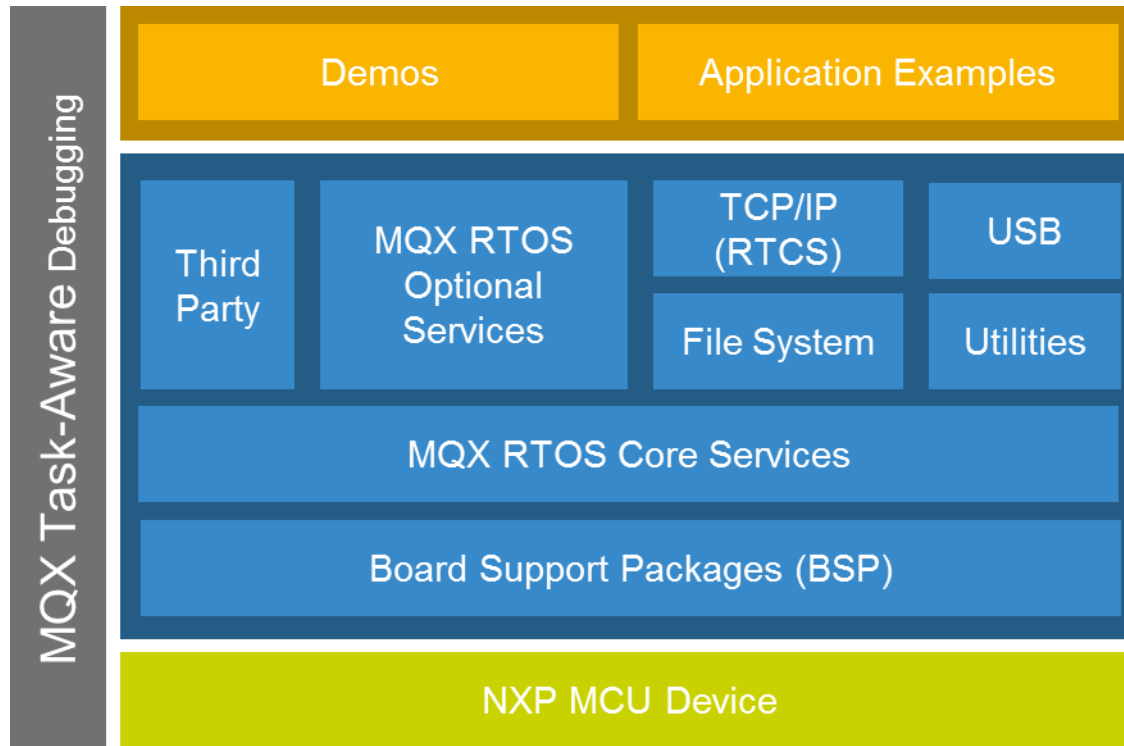
MQX SOFTWARE SOLUTIONS



NXP MQX™ Software Solutions



Production-grade RTOS software platform



MQX RTOS Kernel

- Deterministic multi-tasking preemptive scheduler
- Extensive inter-task synchronization, message passing, and much more

MQX Real Time TCP/IP Communication Suite (RTCS)

- Broad networking protocol support (TCP,UDP, ICMP, HTTP, DHCP, FTP, Telnet)
- Optional IPv6 package available

MQX File System (MFS)

- Embedded FAT file system compatible with FAT-12, FAT-16, and FAT-32 file systems

MQX USB Host/Device Stack

- USB 1.0/2.0; low-/full-/high-speed

Board Support Packages (BSPs)

- Pre-configured MQX RTOS kernel, stacks, middleware and peripheral drivers for NXP evaluation hardware

Status

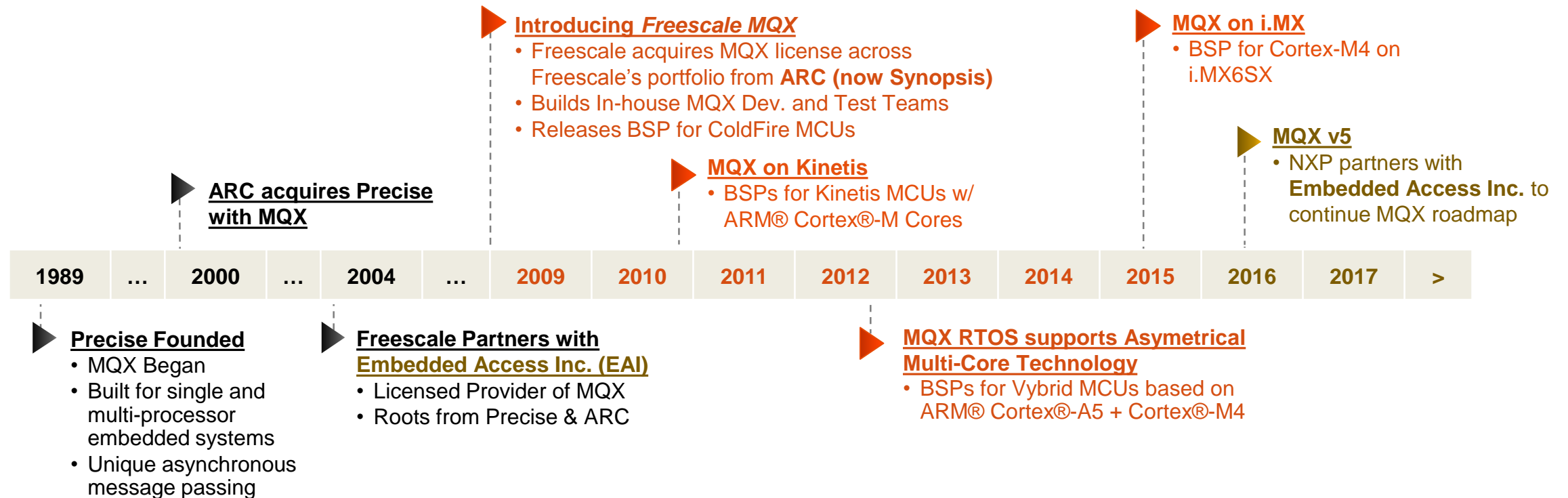
- v4.1 for i.MX6SX (May 2015)
- v4.2 (May 2015) latest v4 release with new device support
- v4 is feature set frozen, supported and maintained by NXP
- v5 to offer continued roadmap under commercial license

History of MQX – Proven: 20+ Years in the Marketplace

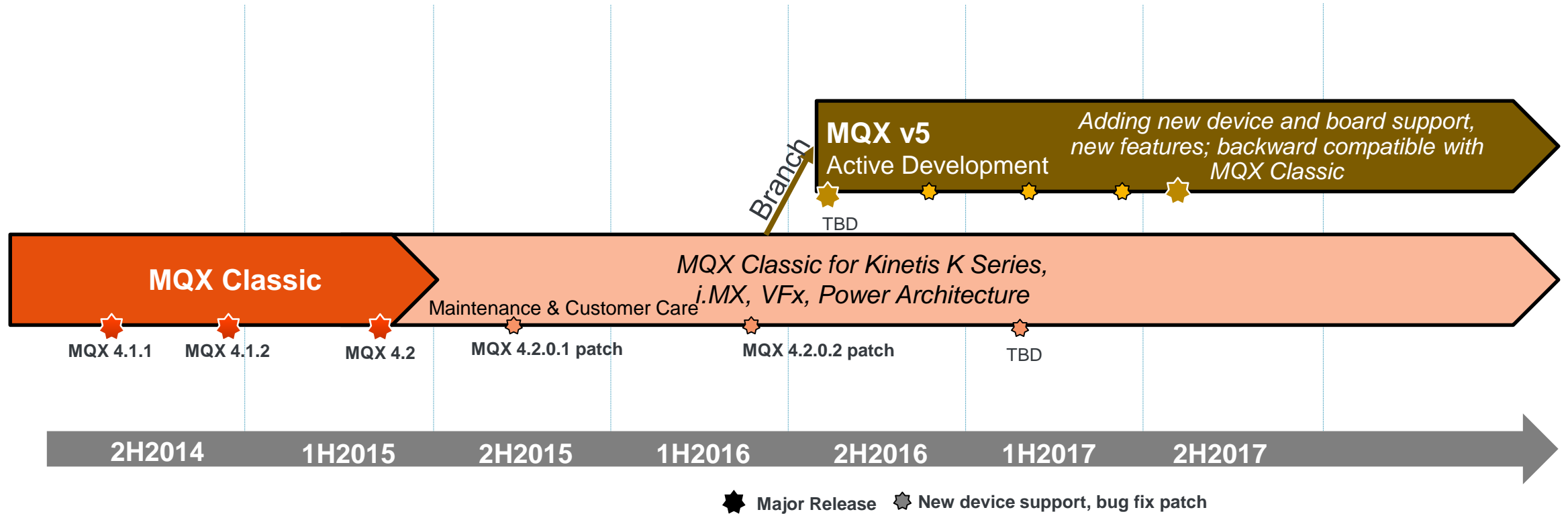
- Used in millions of products in medical, industrial, and defense markets from Fortune 500 companies.
- NXP holds a broad license to MQX software across its portfolio.

▶ MQX Classic Milestones

▶ MQX v5 Milestones



MQX Classic and v5 Roadmap



MQX Changes – Continuing as Low-Cost Enablement



Porting & Maintenance

- ✓ Port, maintain, and enhance classic MQX RTOS
- ✓ Avoid driver API changes
- ✓ Maintain backwards compatibility
- ✓ Easy migration to newer versions

Roadmap

- ✓ Continued partnership with Embedded Access
- ✓ MQX pre-ported to new Kinetis devices

Technical Support

- ✓ MQX Community
- ✓ Professional Support packages

Business Model

- Low-cost commercial solution

MQX Classic - Support and Maintenance

- MQX v4.x support continues uninterrupted
 - Supported by NXP FAEs, Community, and Professional Support
- MQX v4.x is feature-set frozen
 - No new features to be added
 - No new devices to be added to MQX v4.x
 - Critical (Severity 1 & 2) bugs will be fixed in periodic releases
 - MQX v4.2.0.2 patch planned for Q2 2016

NXP MQX Software Solutions – Product Comparison Chart

	MQX Classic	MQX v5
Features	Full-feature RTOS kernel, TCP/IP and USB stacks, file system, shell utility, peripheral drivers, board support packages and more. Feature set is frozen.	Same complete MQX Classic solution; backward compatible with MQX v4 with new features added and new MCU and MPU device support.
Supported devices	Various Kinetis, i.MX, ColdFire, and VFxxx devices. See Release Notes for details. No additional device support planned.	Ongoing support for Kinetis and i.MX device roadmaps and select devices also covered by MQX Classic. Other processors available on request
Support and Maintenance	<ul style="list-style-type: none"> • Free support in the MQX Community • Professional support available • Occasional maintenance releases with bug fixes 	<ul style="list-style-type: none"> • Free support in the MQX Community • Professional support available • Periodic maintenance and new feature releases. First year of maintenance included in License fee.
Price	No license fees or maintenance fees	One-time License fee starting at \$6,000 USD. Annual maintenance options. Royalty-free. See www.nxp.com/mqxv5 for details.

NOTE: *MQX Lite* and *MQX for Kinetis SDK* are not recommend for new designs.

MQX v5 Pricing

MQX LICENSE	LICENSE FEE (\$USD)	ANNUAL MAINTENANCE FEE (\$USD)	LICENSE GRANTS
Single Product License	\$6,000	\$3,500	<ul style="list-style-type: none">MQX with a NXP processor in a specific customer product
Product Family License	\$15,000	\$8,750	<ul style="list-style-type: none">MQX with a NXP processor in a family of similar customer products that all provide the same functionality
Multi-Product Family License	\$30,000	\$17,500	<ul style="list-style-type: none">MQX with different NXP processors within a customer product family, orMQX with a NXP processor within multiple customer product families

Note: License fees include first year of maintenance

Online Training: Essentials of QX RTOS Application Development

15-session online course with videos, lab-guides and software examples

Course Outline

- [Session 1: MQX Architecture and Initialization \(20 min\)](#)
- [Session 2: Designing for a Multi-Tasking Environment \(15 min\)](#)
- [Session 3: Task Management and the Scheduler \(21 min\)](#)
- [Session 4: Synchronization and Message Passing \(17 min\)](#)
- [Session 5: Introduction to Drivers \(28 min\)](#)
- [Session 6: Interrupts \(15 min\)](#)
- [Session 7: Light Weight Events \(15 min\)](#)
- [Session 8: Light Weight Timers \(17 min\)](#)
- [Session 9: Light Weight ADC Driver \(18 min\)](#)
- [Session 10: Logging \(23 min\)](#)
- [Session 11: I2C Driver \(18 min\)](#)
- [Session 12: Semaphores \(20 min\)](#)
- [Session 13: Memory Services \(20 min\)](#)
- [Session 14: The Shell \(15 min\)](#)
- [Session 15: Time Services \(15 min\)](#)



KINETIS APPLICATION SPECIFIC SOLUTIONS



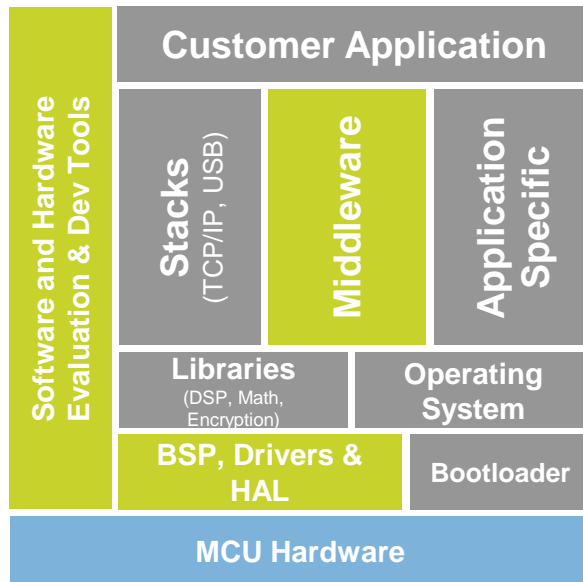
PEG Graphics Software



Flexible graphics software targetable to Any RTOS, Any LCD



WYSIWYG Editor and Code Generator with Image Conversion and Font Creation



Product Features

- Graphical user interface (GUI) solutions for embedded devices:
 - PEG Lite – Basic GUI, free on NXP
 - PEG Plus – Professional GUI, flexible framework
 - PEG Pro– Higher performance GUI development
- Meets widely varying power, performance and memory requirements.
- Flexible PEG hardware drivers are capable of targeting any RTOS or OS and interfacing with any display type supported by the processor.
- PEG WindowBuilder development tool automatically generates C++ source code that is ready to be compiled and linked into any application.
- New driver development and device ports are release under support engagements.

PEG Graphics Suite Comparison

PEG Lite

Free on NXP Silicon, Basic UI Widgets, Minimal Set of Predefined Elements

PEG Plus

Customizable UI Widgets, Full Set of Predefined Elements

PEG Pro

Higher Color Depth, Effects, Customizable UI Widgets, Full Set of Predefined Elements

Color Depth	Monochrome to 65K High Color	Monochrome to 16.7M True Color	65K High Color to 16.7M True Color with Alpha
Custom Bitmap Elements	Buttons and Images	← ...adds Widgets and Animation →	
Predefined Widgets	Text Button, Checkbox, Radio, Progress Bar, Slider, Dial, Scroll, Combo Box,plus, Windows, Charts, Spreadsheet, Tables, Tabs, Menu and Status Bars,adds gradients and transparency effects
Multilingual Support	Dual Language	← Full Multi-lingual →	
Anti-Aliasing	← Simple Anti-Aliasing →		True Anti-Aliasing
Window Builder	Full WYSIWYG editor with integrated Font Capture and Image Converter		
Additional Features		Runtime themes/skins, Runtime image decoding	...adds Swipe detection, Alpha blending
Starting Cost (10K Runtime License)	\$5,000 (Free on Freescale silicon)	\$7,000	\$7,500

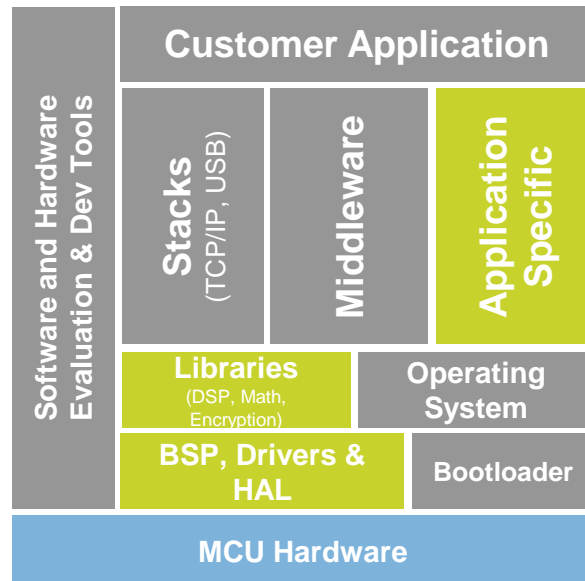
NXP Touch Software



Integrated touch solution, allowing reduced system complexity



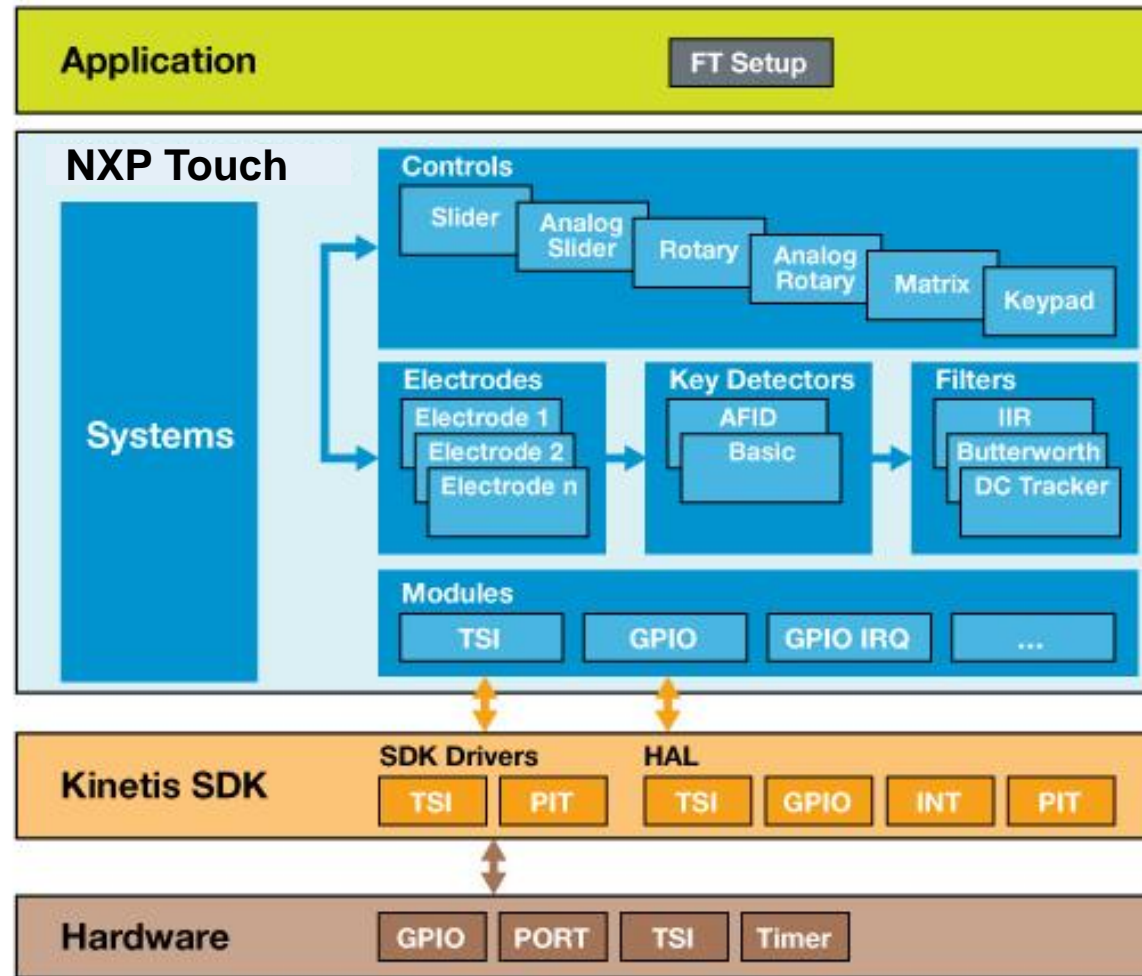
Innovative features such as noise filtering, advanced detection algorithms, and water tolerance



Product Features

- New modular architecture optimized for 32-bit Kinetis Microcontrollers
- Support for Kinetis MCUs with Touch Sensing Interface (TSI) capabilities and GPIO
- Easy integration with:
 - MQX RTOS
 - Kinetis SDKv1.2 & v1.3
 - Processor Expert
- Advanced Filtering and Integrating Detection (AFID)
- Signal Adaptive Filtering Algorithm (SAFA) for improved noise EMC immunity and responsiveness.
- TSI Noise mode
- Water tolerant
- Proximity and shielding electrode(s)
- Analog decoder algorithms

NXP Touch Software Block Diagram



NXP Software Development Kit (SDK) for HomeKit

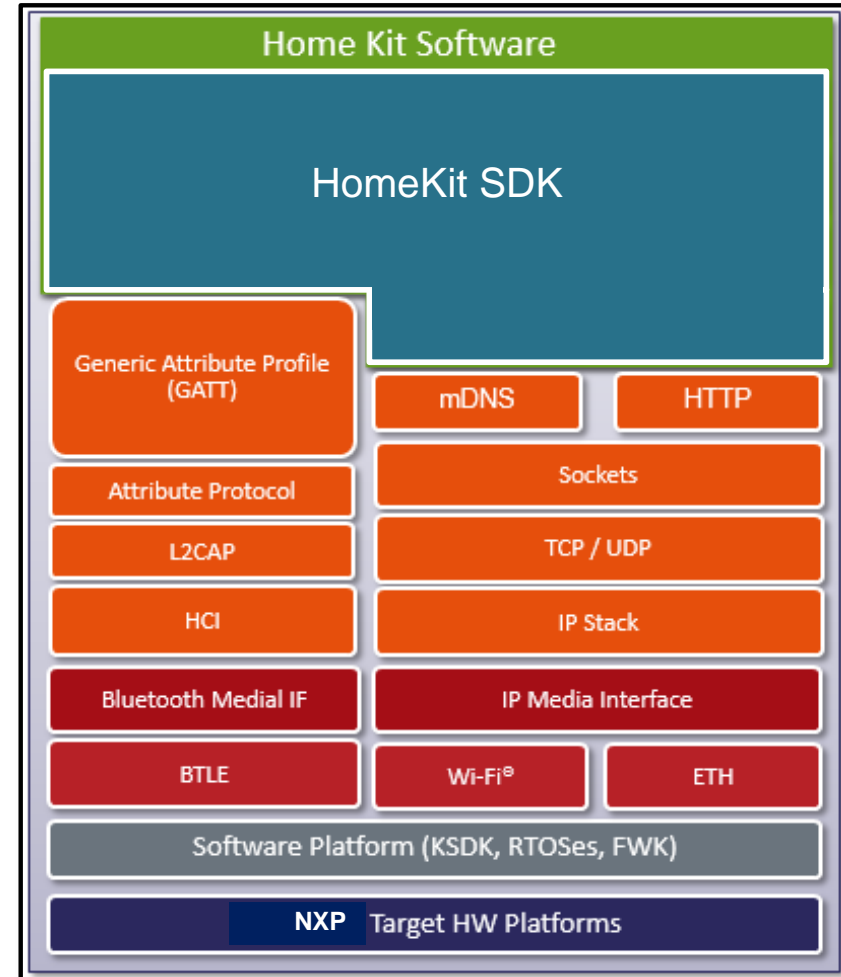


HomeKit Accessory Protocol software including communication protocol stacks

Targeted Applications



- HomeKit accessories (end-points):
 - Lightning, power outlets, thermostats, security, door locks, sensors, smoke detectors, garage doors,
- HomeKit Bridges



NXP Software Development Kit (SDK) for HomeKit

Key Features

- Support for iOS 9
- Easy to setup Configuration
- User API independent of communications transport
- Low level API to Code Adaptors
- Support for defined Accessories
- Built in Firmware update support
- Support for Bluetooth Smart 4.0 (BLE):
- Support for IP transport (Wi-Fi® and wired Ethernet):
- \$499 download includes:
 - Unlimited production license
 - Two hours of Professional Support
- Available Professional Support and Professional Services

Target Availability

- HomeKit BLE for Kinetis MCUs: Mar 2016
- HomeKit Wi-Fi for Kinetis: TBD
- HomeKit BLE and Wi-Fi for i.MX: TBD

Supported Products

Host MCU/MPU (* with Ethernet)	Connectivity		OS
Kinetis K ARM Cortex-M4 MCUs (min. 64 KB SRAM, 512 KB Flash) K22, K24, K64*, K66*	Wi-Fi®	Qualcomm QCA4002	No OS, Free-RTOS
	BLE	Kinetis KW30/40	
i.MX 6 Series* ARM Cortex-A9/A7 Applications processors	Wi-Fi®	All supported by the BSP	Linux
	BLE	Kinetis KW30/40	

KINETIS HARDWARE DEVELOPMENT PLATFORMS



Tower System Modular Development Platform

Product Features

- Modular and Expandable
 - Controller modules provide easy-to-use, reconfigurable hardware, can be used stand-alone
 - Interchangeable peripheral modules add functionality and make customization easy
 - Open-source hardware and standardized specifications promote customization
 - >80 modules to choose from
- Speeds Development Time
 - Open source hardware and software allow quick development with proven designs
 - Integrated debugging interface allows for easy programming and run control via standard USB cable
- Cost Effective
 - Sold individually and in complete kits, typically starting at \$69 USD.
 - Tool re-use through interchangeable modules eliminates need to purchase redundant hardware

Freedom Development Platforms

Product Features

- Low cost (starting at \$12.95 USD)
- Designed in an industry-standard compact form factor (Arduino R3)
- Easy access to the MCU I/O pins
- Integrated open-standard serial and debug interface (OpenSDA)
- Compatible with a rich-set of third-party expansion boards

Software and Support

- Rich ARM ecosystem includes Keil, IAR, SEGGER, mbed and more
- NXP MQX™ Lite RTOS: Very light MQX kernel for resource-limited MCUs that allows applications to run with less than 4 KB RAM
- Processor Expert software and embedded components
- mbed-enablement through the built-in USB flash programming interface (OpenSDA)

OpenSDA: Open-Standard Serial And Debug Adapter

- OpenSDA – integrated debug circuit, bridges serial and debug communications between a USB host and an embedded target processor
- Features a mass storage device bootloader, for easy loading of various OpenSDA applications
 - Flash programmers, run-control debug interfaces, serial-to-USB converters
 - P&E Multilink interface provides run-control debugging and compatibility with IDE tools
 - SEGGER™ OpenSDA firmware makes OpenSDA compatible to J-Link Lite
 - mbed interface application provides connection to mbed online tools and supports a virtual serial port, CMSIS-DAP, and a mass-storage programming interface
- CMSIS-DAP interface (stand alone): New ARM standard for embedded debug interface

Kinetis Freedom Getting Started – Out of the Box (OOBE)

Simplified process for customers of all levels to get up and writing code quickly

FRDM-K64F: Freedom Development Platform for Kinetis K64, K63, and K24 MCUs ☆

Overview Getting Started Documentation Downloads Buy / Specifications Training & Support

Jump to

- 1.1 Attach the USB Cable
- 1.2 Run the Out-of-Box Demo

Quick Reference


- [-] Chip Documents
 - Datasheet
 - Reference Manual
- [+] Errata
- [-] Board Information
 - User's Guide
 - Schematic
 - Board Files
 - Symbols and Footprints
 - OpenSDA
- [+] Errata
- [-] Software
 - [+] Kinetis SDK
 - [+] Kinetis Bootloader
- [-] Support
 - Application Note
 - Support

Buy

1. Plug it in! 2. Get Software 3. Build, Run 4. Create

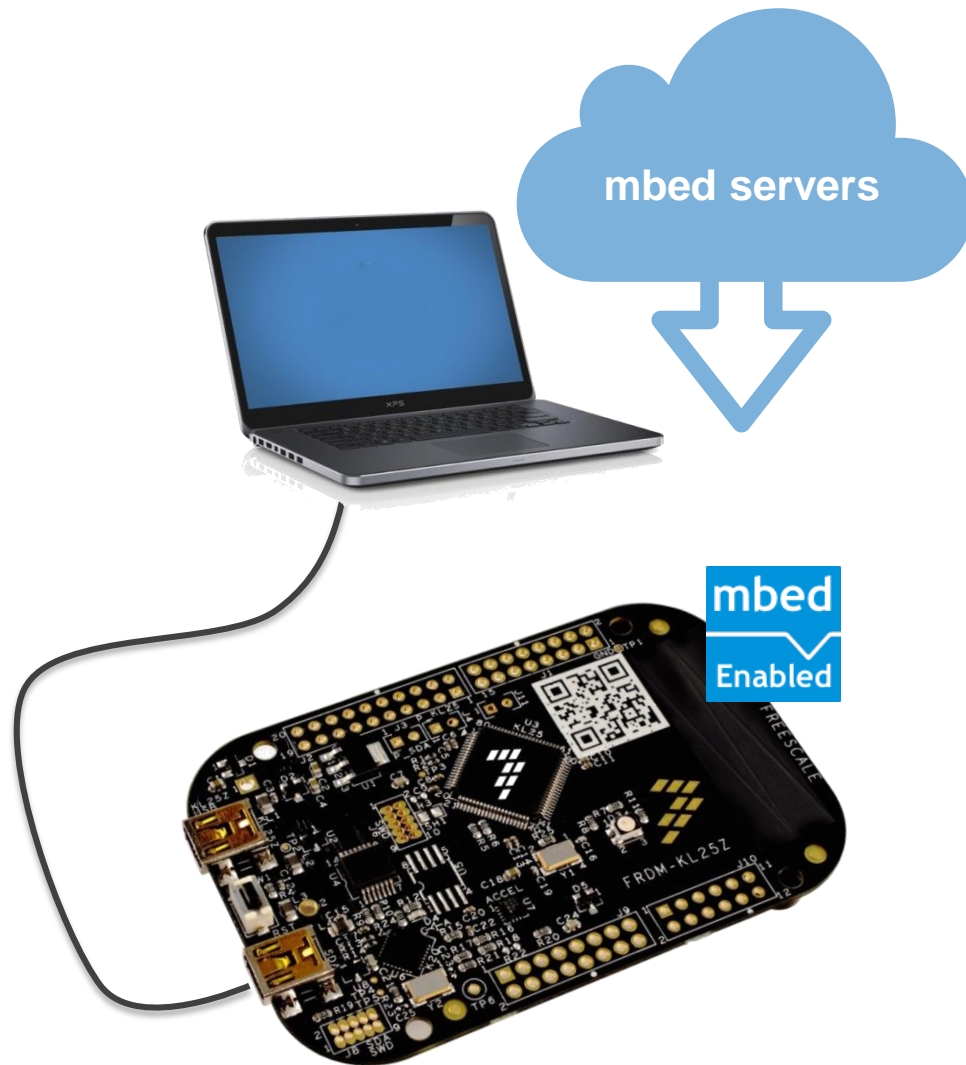
Let's take your FRDM-K64F for a test drive! You have the choice of watching the sequence in a short video or following the detailed actions list below.

Get Started with FRDM-K64F Development Platform - How To



1.1 Attach the USB Cable

ARM® mbed™ Platform for NXP Freedom Development Platforms



Tool for Rapid Prototyping with ARM Microcontrollers

Web-based Development:

- ✦ Online IDE
- ✦ Software Libraries
- ✦ Robust Community

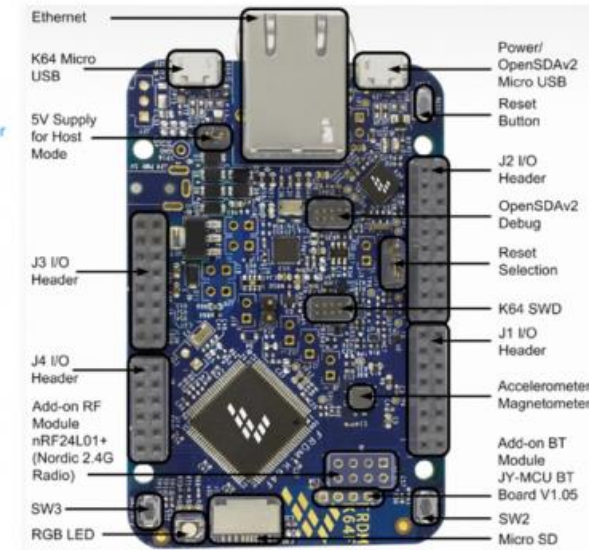
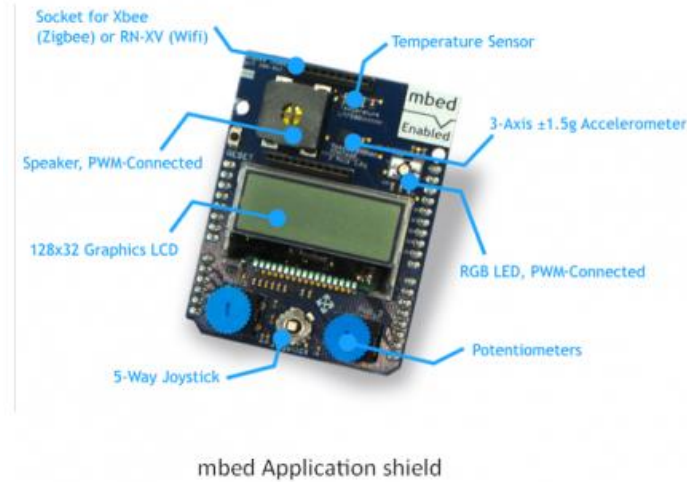
OpenSDA on Freedom Development Platforms running mbed interface:

- ✦ Serial Communications
- ✦ Flash Programming
- ✦ Run-control debug

FRDM-K64F now Microsoft Azure Certified for IoT

- www.azure.com/certifiedforiot
- Certified NXP hardware
 - The [NXP FRDM-K64F](#) development board is now Microsoft Azure Certified for Internet of Things (IoT) products
- Microsoft Azure IoT Suite
 - Developers using the FRDM-K64F board will have access to and guided instructions for using the Microsoft Azure IoT Suite software development kits (SDK) published on [Github](#)
- ARM® mbed enabled
 - Libraries have been tested on the FRDM-K64F and can be used with [ARM mbed applications](#) through the ARM mbed developer website
- Seamlessly integrate embedded endpoints with Microsoft's Azure cloud computing platform (over half of fortune 500 companies use Azure today).

ARM mbed IoT Starter Kit – Ethernet Edition for IBM Internet of Things Foundation



FRDM-K64F Freedom Development Platform

<http://www.element14.com/community/docs/DOC-74945/l/arm-mbed-iotinternet-of-things-starter-kit#cdocuments>

ARM's Strategy for mbedOS / mbed 3.0

- ARM is committed to provide a complete IOT ecosystem:
 - Embedded solution with state of the art OS, security (trusted zone and crypto libraries), low power and leading connectivity
 - Cloud system via mbed Device Server for application data and device management
 - Mobile Apps to commission, control and monitor the devices in the network
 - Extensive community made of Partners, Developers, Services, Products and Students and Fresh grads via large Universities programs
- Very focused long term view for the next 10 years+ to become the IOT platform for Microcontrollers (eg. Linux for MPUs)
- mbedOS is ARM's biggest software effort ever

NXP is a lead partner!

- **FRDM-K64F** is first board enabled by mbedOS
- MCR20A radio support recently added to mbed.
- More device support coming soon (based on KSDK)



PROFESSIONAL SUPPORT AND SERVICES

Professional Support and Services

Accelerating Time to Market

- Professional Support
 - Fast answers: Prioritized response to customer questions - 1 business day
 - Direct access to Expert Knowledge: Managed, secure, confidential portal
 - Staffed by experienced, knowledgeable resources
 - Hot Fixes: Direct resolution
- Professional Services
 - Customer Specific Board BSP Porting
 - Extend BSP to Meet Customer Application Needs
 - Optimize Drivers and Subsystems Based on Product Use Cases
 - Integrate Freescale and Partner Software Solutions
 - Application Specific Testing & Debugging of Low Level Drivers
 - Maintenance and Support
 - Demos and Proof of Concept Projects
 - Schematic & Layout Review

Supported Software Platforms

- Android™
- Linux®
- MQX
- AUTOSAR
- And more

Professional Support Subscriptions

- 50 / 100 / 200 hour options
- Flexibility: Customize the support package to meet your platform needs

Professional Engineering Services

- Expert Engineers Provide SOW Based Services with Customer Specific Milestone Deliverables



SECURE CONNECTIONS
FOR A SMARTER WORLD

ATTRIBUTION STATEMENT

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