



Freescale Enablement Solutions



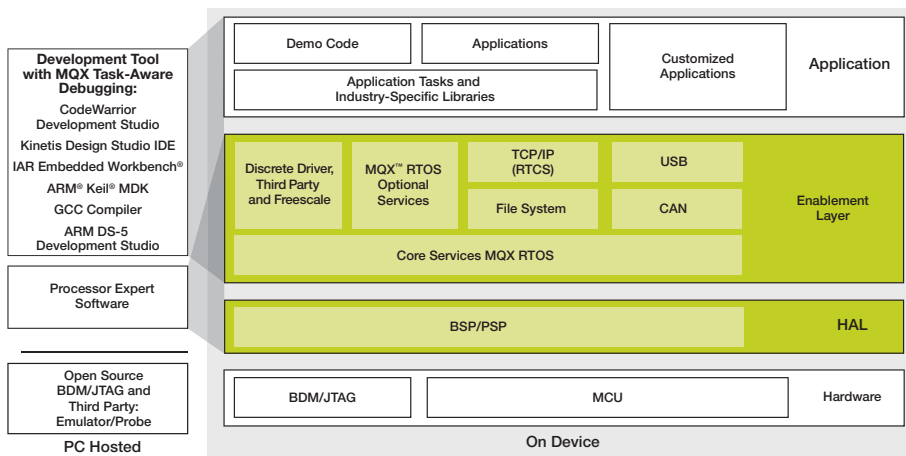
Freescale MQX™ Software Solutions

Complimentary proven RTOS, TCP/IP,
file system and USB

Overview

The increasing complexity of industrial applications and expanding functionality of semiconductors are driving embedded developers toward solutions that combine proven hardware and software platforms. To help accelerate time to market and improve application development success, we offer the MQX real-time operating system (RTOS) with TCP/IP (IPv4) and USB software stacks and peripheral drivers to Kinetis, Vybrid, select ColdFire, and select Power Architecture® MCUs customers at no additional charge. The combination of Freescale MQX software solutions with our silicon portfolio creates a comprehensive source for hardware, software, tools and services.

Comprehensive Freescale Solution



■ Freescale MQX Software Solutions

Reducing Cost, Accelerating Success

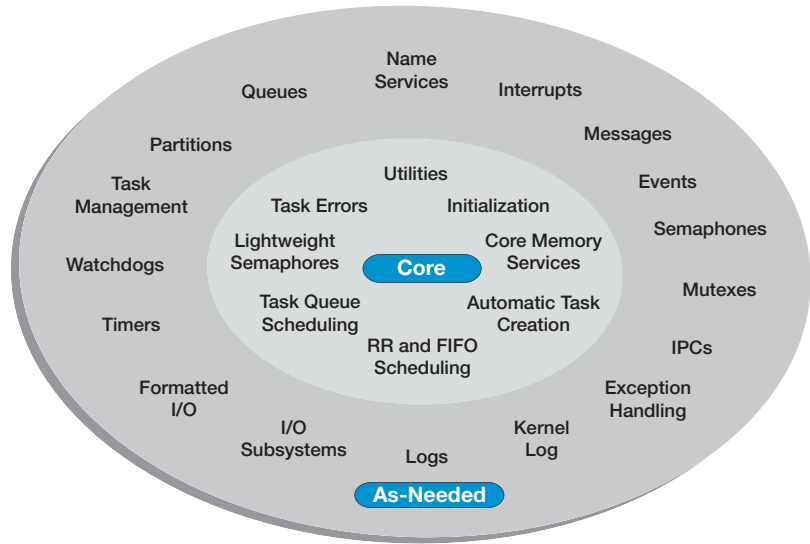
Providing complimentary Freescale MQX software solutions with our silicon products helps to alleviate much of the initial software investment hurdle faced by embedded developers. Comparable full-featured software offerings may cost developers as much as \$95,000 (USD) in licensing fees.

According to recent research, development teams spend approximately 60% of their resources on software. Embedded projects based on 32-bit devices have a greater need for software reuse to manage development costs. The Freescale MQX RTOS and software stacks provide a scalable, reusable platform that works across a wide range of our processor architectures, development tools and third-party software environments.

Freescale MQX is deployed as production-ready source code, including communications software stacks and peripheral drivers, at no additional cost. Freescale MQX is provided with a commercial-friendly software licensing model, enabling developers to keep their source modifications while being able to distribute the required binary code.

Learn more at freescale.com/MQX

MQX RTOS: Customizable Component Set



Full Featured, Proven and Scalable

The MQX RTOS has been the backbone of embedded products based on Freescale silicon for more than 20 years. MQX software deployment spans a broad range of market segments and leading manufacturers worldwide.

The Freescale MQX RTOS offers powerful, preemptive real-time performance with optimized context switch and interrupt time to enable fast, highly predictable response times. Its small, configurable size conserves memory space for embedded applications and it can be configured to take as little as 6 KB of ROM, including kernel, interrupts, semaphores, queues and memory manager. The Freescale MQX RTOS offers a straightforward application programming interface with a modular, component-based architecture that makes it very scalable. Components are linked in only if needed, preventing unused functions from bloating the memory footprint. Plug-ins, such as security, industrial protocols and graphical interfaces from our strong network of partners, can also be added.

Certifiable to Medical and Aerospace Standards

Even for applications that do not require formal certification, the robustness of MQX provides a trusted platform that has been proven in thousands of time-critical, sophisticated applications. For designs that do have a formal certification process to follow, MQX is an excellent choice. Past licensees have certified MQX-based applications to medical specifications (CFR 820.30 Part 21, IEC 60601-1) and the aerospace requirements listed under DO-178b. Safety-critical applications based on MQX include eye surgery equipment, drug injection equipment, radiation dose monitoring equipment, aircraft braking systems and aircraft navigation equipment.

Features and Benefits

Freescale MQX RTOS	
Small code density	<ul style="list-style-type: none"> Context switch and low-level interrupt routines hand-optimized in assembly Can be configured to a memory footprint of 8 KB ROM and 2.5K RAM on ARM Cortex®-M4, including kernel, task applications, LW semaphore, interrupt stack, queues and memory manager
Component-based architecture	<ul style="list-style-type: none"> 25 components—eight core, 17 optional Components are linked in only if needed, preventing unused functions from bloating the memory footprint
Full and lite services	<ul style="list-style-type: none"> Further control of size, RAM/ROM utilization and performance options
Real-time, priority-based preemptive multithreading	<ul style="list-style-type: none"> Threads execute in order of priority Allows high-priority threads to meet their deadlines consistently, no matter how many other threads are competing for CPU time
Optimized for Freescale	<ul style="list-style-type: none"> Optimized assembly code to accelerate key real-time portions of the RTOS such as context switching
Faster development	<ul style="list-style-type: none"> Allows for faster development time by relieving engineers from creating an efficient scheduling system and interrupt handling Use of multiple communication protocols such as USB or TCP/IP
Code reuse	<ul style="list-style-type: none"> Provides a framework with a simple API to build and organize the features across our broad portfolio of embedded processors
Intuitive API	<ul style="list-style-type: none"> Writing code for MQX is straightforward with a complete API and available reference documentation
Fast boot sequence	<ul style="list-style-type: none"> Ensures the application is running fast after the hardware has been reset
Simple message passing between processors	<ul style="list-style-type: none"> Messages can be either from a system/private pool and sent with either an urgent status or a user-defined priority and can be broadcast or task specific For maximum flexibility, a receiving task can be operating on either the same CPU as the sending task or on a different CPU within the same system
Freescale MQX Real-time TCP/IP Communication Suite	
Designed for embedded applications	<ul style="list-style-type: none"> Specifically designed for embedded systems Provides fully compliant feature set of networking stacks and configurable enough to fit into the small memory confines of an embedded devices Tightly integrated with Freescale MQX RTOS device drivers for Ethernet and other access layers
Small configurable memory footprint	<ul style="list-style-type: none"> Implemented as a C library Allows only the features and protocols used by the application to be included in the image Can be configured to take as little as 30 KB of ROM
RTCS protocol support	<ul style="list-style-type: none"> Provided with a large number of standard protocols One product allows real TCP/IP applications without the need to acquire other application-level protocols
IPv6 Ready	<ul style="list-style-type: none"> Optional add-on for IPv6 protocol support Can operate as a Dual IPv4 + IPv6 network stack, or IPv4 only, or IPv6 only IPv6 support can be added with as little as 21 KB of additional ROM code
Advanced networking protocols for RTCS	<ul style="list-style-type: none"> RTCS can be extended to support additional industry-standard protocols, including security, advanced routing/network access, embedded Web server/email support and network management protocols
Very scalable	<ul style="list-style-type: none"> Customizable suite can meet a wide range of application RAM and ROM requirements by selectively choosing only the necessary protocols for your design
Full featured	<ul style="list-style-type: none"> Great flexibility in the way you provide connectivity to your device, ranging from simple application such as Ethernet-Serial to complex gateway systems
Support for standard protocols and sockets	<ul style="list-style-type: none"> RTCS not only provides application layer protocols but is a complete OSI model solution that spans data link to application layer standard protocols
Freescale MQX File System	
Designed for embedded applications	<ul style="list-style-type: none"> Provides full MS-DOS compatible file system that is configurable to fit into small memory footprint Brings support for desktop PC features such as long file names, multiple disk volumes and directory handling to embedded systems
Portability and modularity	<ul style="list-style-type: none"> The MFS FAT file system provides a portable, compatible implementation of the MS-DOS file system and library of file system functions File system functions are separated from the device driver functions, allowing for increased modularity Supports different types of storage media Trivial file system is a simple read only file system used to avoid the need of MFS in HTTP
Freescale MQX USB Host/Device Stack	
Designed for embedded applications	<ul style="list-style-type: none"> Specifically designed for adding USB functionality to embedded systems Provides fully compliant USB 1.1 and 2.0 feature set of stacks and drivers
Small configurable memory footprint	<ul style="list-style-type: none"> Designed to fit in a small (<10 KB RAM) and with code size of <32 KB
Supports a variety of class functionality	<ul style="list-style-type: none"> Supports personal health care device class (PHDC), human-interface device (HID), mass storage device (MSD), communications device class (CDC), audio class, On-The-Go USB 2.0 standard supplement and PHDC USB.org standard classes

Freescale MQX Real-Time TCP/IP Communication Suite

The Freescale MQX real-time communication suite (RTCS) is a fast, efficient and low-footprint embedded Internet stack that supports a rich set of standard TCP/IP protocols. It comes complete with a number of application layer protocols such as Telnet, FTP, SNMP v1 and SNMP v2. A number of optional protocols and products are also available from Freescale or third parties. The scalability of the Freescale MQX RTCS allows developers to easily define the feature set needed to accommodate a variety of ROM and RAM memory budgets.

IPv6 Ready

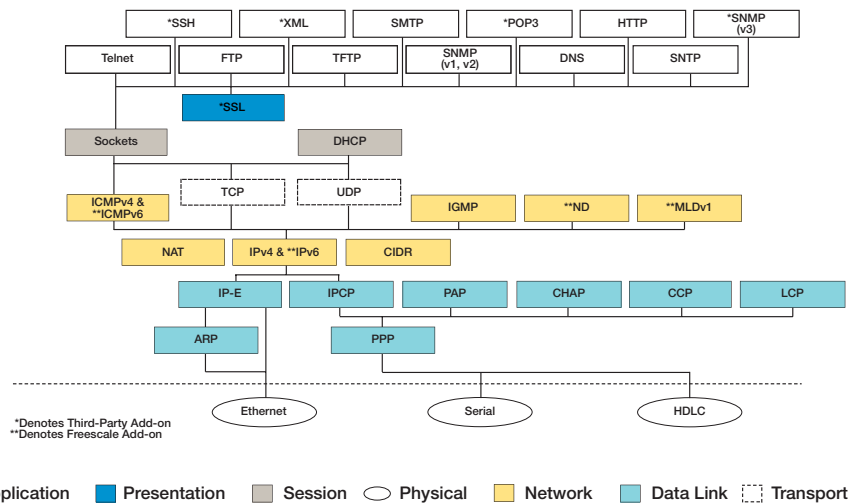
Get ready for IPv6 with the IPv6 protocol add-on for MQX RTCS. With this new optional add-on available for purchase from Freescale, the network stack can be configured for IPv4 only, IPv6 only, or dual (IPv4 + IPv6) operation. With dual IPv4 + IPv6 operation, embedded products will be ready for the worldwide transition to the next generation of the Internet (IPv6), but retain support for the Internet of today (IPv4). MQX RTCS with IPv6 leverages the existing IPv4 code base as much as possible so the memory footprint of adding IPv6 is minimized. Starting with about 21 KB of additional ROM code, embedded products can be IPv6 ready.



The IPv6 protocol add-on is IPv6 Ready Logo (Phase-2) Certified for Core IPv6 protocols as a Host. It supports stateless auto-configuration, network auto-discovery and the massive address extensibility that IPv6 provides. RTCS protocols that currently support IPv6 include IPv6, ICMPv6, ND, TCP/UDPv6, Sockets, SMTP Client, HTTP Server, MLD Discover, FTP Server, FTP Client and DNS Resolver. Additional protocols may be supported in the future, such as DHCPv6 and Telnet, but are not available at this time.

See freescale.com/MQX/ipv6 for details and pricing.

MQX Real-Time TCP/IP Communication Suite



Freescale MQX Add-On Software

The majority of what customers need is provided complimentary with MQX software. However, Freescale and a number of partners offer additional products, training, support and design services. These include middle software such as security stacks, industrial network and field bus protocols, Ethernet and safe file systems. There are also a number of graphics solutions like PEG, Qt or emWin software. Tools like OS changer provide an easy way to reuse applications on MQX software from other RTOS systems.

MQX™ Lite RTOS

Freescale MQX Lite RTOS is a very light MQX kernel for resource-limited MCUs. Initially targeted at the Kinetis L family, applications can run with less than 4 KB RAM. It is a true subset of the proven and professionally developed MQX RTOS, allowing for easy upward code migration. MQX Lite RTOS is now available as a configuration option of MQX RTOS for Kinetis software development kit (SDK), so application developers can now use MQX Lite within the Kinetis SDK software framework for drivers and middleware.

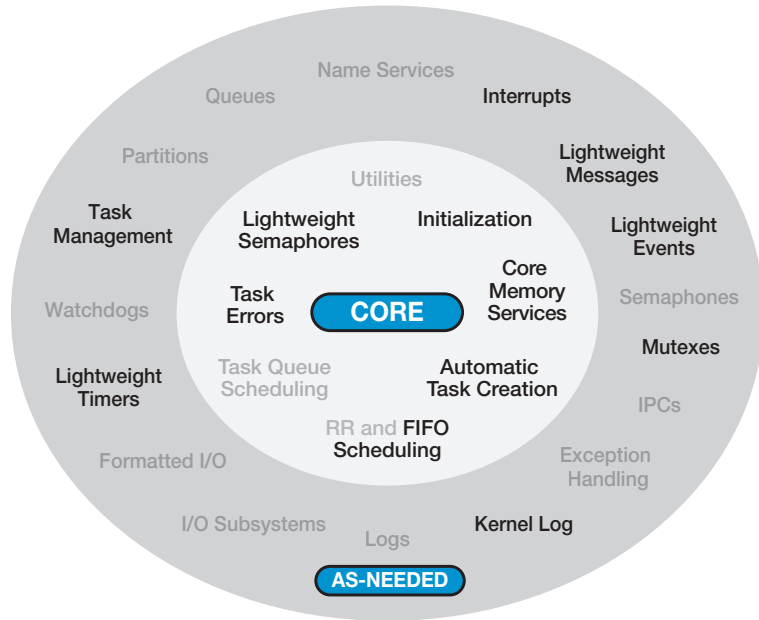
Availability

MQX Lite RTOS is available within the following Freescale software offerings:

- MQX RTOS for Kinetis SDK v1.1 and later
- Processor Expert software, Microcontrollers driver suite: Supports IAR, Keil and GCC compilers/build chains
- CodeWarrior Development Studio V10.3 and later

Learn more at freescale.com/MQX/lite

MQX Lite RTOS Functionality



Features and Benefits

Easy to configure	<ul style="list-style-type: none"> • Configurable options: Set name of task function, priority, stack size (all the same parameters as an MQX task)
Easy to add to existing application	<ul style="list-style-type: none"> • Get started in minutes
Very lightweight	<ul style="list-style-type: none"> • Minimal app ("Hello" task, idle task, interrupt stack), less than 4 KB RAM • Optimized for resource-limited MCUs like Kinetis L family
I/O capability	<ul style="list-style-type: none"> • Take advantage of the broad spectrum of peripheral drivers available in Processor Expert or in the Kinetis SDK • Access libraries/stacks such as USB stack software
Real-time, priority-based preemptive task switching	<ul style="list-style-type: none"> • Threads execute in order of priority • Allows high-priority threads to meet their deadlines consistently, no matter how many other threads are competing for CPU time
Programming model allows upward code migration	<ul style="list-style-type: none"> • MQX Lite RTOS is a true subset of the full MQX RTOS • Code built with MQX Lite RTOS will easily move to the full MQX RTOS

MQX RTOS for Kinetis SDK

Freescale MQX RTOS for Kinetis SDK is the latest evolution of the proven and professionally developed Freescale MQX software solutions for Kinetis MCUs. It is built on top of the software development kit (SDK) for Kinetis MCUs, leveraging the flexible and extendable peripheral drivers found within the SDK. Freescale MQX RTOS for Kinetis SDK provides the essential extensions of the Kinetis SDK framework for connected and intelligent embedded products. Application developers can use standard MQX RTOS components such as the multi-tasking scheduler, communication stacks, and file system with Kinetis SDK libraries and peripheral drivers.

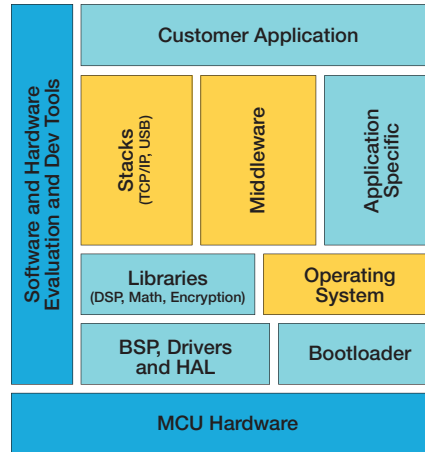
The Kinetis SDK and MQX RTOS are integral parts of the comprehensive system of software and development solutions designed to simplify and accelerate your embedded application development.

Features

- All available components of MQX software solutions are pre-integrated and tested with the Kinetis Software Development Kit (SDK):
 - MQX Lite RTOS (optional configuration)
 - MQX RTOS
 - MQX Real-Time TCP/IP Communication Suite
 - MQX File System
- Same API as traditional MQX RTOS kernel and services
- I/O capability provided by Kinetis SDK peripheral drivers
- Builds on common software framework for Kinetis MCUs to enhance flexibility and extendibility

Learn more at freescale.com/MQX/ksdk

MCU Software Taxonomy



■ MQX RTOS for Kinetis SDK

MQX Version Comparison

	MQX RTOS 4.x	MQX Lite RTOS	MQX RTOS for Kinetis SDK
Mechanism Delivery	Traditional installer with full source	Processor Expert (PEX) component	Archive file with full source and PEX components
I/O Drivers	MQX peripheral drivers; PEX driver optional	PEX drivers only	Kinetis SDK drivers
Configurability	User selects needed services from full or lightweight versions	Reduced services only; lightweight options only	User selects needed services from full or lightweight versions
I/O capability	Kernel, TCP/IP stack, USB stack, file system, middleware. Includes own peripheral drivers.	Kernel only. Peripheral drivers provided by PEX.	Kernel, TCP/IP stack, USB stack, file system, middleware. Peripheral drivers provided by Kinetis SDK.
Components	Kinetis K Series, Vybrid, select ColdFire, select Power Architecture	Kinetis L Series, Kinetis K Series, select Kinetis E Series	All Kinetis MCUs supported by Kinetis SDK

Complimentary Freescale MQX BSPs

Hardware/Board Support Package**	Recent Releases				MQX RTOS for Kinetis SDK v1.1	MQX RTOS for Kinetis SDK v1.2
	4.0.2	4.1	4.1.1/4.1.2	4.2		
VBYRID						
TWR-VF65GS10_A5	√	√	√	√		
TWR-VF65GS10_M4	√	√	√	√		
EVB-VF522R3_A5			4.1.2 only	√		
EVB-VF522R3_M4			4.1.2 only	√		
KINETIS						
TWR-K20D50M	√	√	√	√		
TWR-K20D72M	√	√	√	√		
TWR-K21D50M	√	√	√	√		√
TWR-K21F120M	*	√	√	√		√
FRDM-K22F		*		√	√	√
TWR-K22F120M		*		√	√	√
TWR-K24F120M				√	√	√
TWR-K40X256	√	√	√	√		
TWR-K40D100M	√	√	√	√		
TWR-K53N512	√	√	√	√		
TWR-K60D100M	√	√	√	√	√	√
TWR-K60F120M	√	√	√	√		
TWR-K60N512	√	√	√	√		
FRDM-K64F		*	√	√	√	√
TWR-K64F120M		*	√	√	√	√
TWR-K65F180M				√		√
TWR-K70120M		√	√	√		
FRDM-KL25Z						√
FRDM-KL26Z						√
FRDM-KL27Z						√
FRDM-KL43Z						√
TWR-KL43Z48M						√
FRDM-KL46Z					√	√
TWR-KV10Z32M					√	√
TWR-KV31F120M					√	√
TWR-KV46F150M						√
FRDM-KW24						√
MRB-KW01						√
TWR-KW24D512						√
USB-KW24D512						√
i.MX						
i.MX 6SX SABRE-SDB		4.1-i.MX 6SoloX only				
COLDFIRE V1						
TWR-MCF51JF	√	√	√			
COLDFIRE V2-V4						
TWR-MCF51JF	√	√	√	√		
M52259DEMO	√					
M52259EVB	√					
TWR-MCF52259	√	√	√	√		
TWR-MCF54418	√	√	√	√		
POWER ARCHITECTURE						
TWR-PXD10	√	√				
TWR-PXS20	√	√				
TWR-PXS30	√	√				
TWR-PXN20	√	√				

* Standalone release available

** Evaluation hardware is typically available for super-set devices in a microcontroller sub-family. BSPs for super-set device hardware are typically very relevant to all other devices in the sub-family.

Premium Support for MQX Software Solutions

Features	Standard Support	Premium Support			Add-on
Access to Moderated Online Community	√	√			<ul style="list-style-type: none"> • Sensor Fusion • Additional OS • IPV6 • GPU Source Code • PEG
Report bugs for fix in public releases	√	√			
Dedicated engineering resource	-	√			
Managed Private Portal	-	√			
Support Type	Community or SR	Private Portal			
Hot Fixes	-	√			
Initial Response Time	-	1 business day			
Total hours of Support Time	-	50	100	200	
Support plan term	-	Up to 12 months			Automatically renews with your support contract
Purchase Model Price		See website for pricing			

MQX Support Options

Community Support

Freescale makes available a variety of MQX support options based on your design needs. MQX community support comes free of charge with the download of MQX Software Solutions and includes access to code examples, application notes, online video training, and a moderated online community. MQX Community support helps you evaluate and get started with MQX RTOS.

<https://community.freescale.com/community/mqx>

Premium Support

When you need commercial-grade support, you can purchase premium support from Freescale for MQX Software Solutions. Premium support enables access to a private support portal, shortened response times, phone support, and early access to software releases and bug fixes. Premium support packages are available for purchase with a download of the latest Freescale MQX release. [freescale.com/premiumsupport](https://www.freescale.com/premiumsupport)

Professional Engineering Services

Engineering services are also available through Freescale and include software development services and onsite support and training services. Engineering service requests are individually evaluated on a first-come-first-served and project scope basis. To request Freescale MQX engineering services, please contact your local Freescale sales or FAE resources.

Learn more at: [freescale.com/engservices](https://www.freescale.com/engservices)

For more information about the Freescale MQX platform, please visit [freescale.com/MQX](https://www.freescale.com/MQX)

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