Complete,
production-grade
RTOS software suite

NXP® MQX™ Software Solutions

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, NXP offers the MQX real-time operating system (RTOS) with TCP/IP (IPv4 / IPv6) and USB software stacks and peripheral drivers for select Kinetis®, i.MX, VFx and ColdFire® devices, as well as NXP products built on Power Architecture® technology. The combination of MQX software solutions with our controller and processor portfolio creates a comprehensive source for hardware, software, tools and services.

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.

We offer our proprietary MQX RTOS through a low-cost software licensing model, enabling developers to keep their source modifications while being able to distribute the required binary code.

Learn more at **www.nxp.com/MQX**.

FULL-FEATURED, PROVEN AND SCALABLE

NXP's MQX RTOS has been the backbone of embedded products in a wide range of applications for more than 20 years.

Our MQX RTOS offers:

‣ Speed and highly predictable response times through powerful, preemptive real-time performance with optimized context switch and interrupt time

‣ Scalability through a straightforward application programming interface with a modular, component-based architecture

‣ Memory space conservation through a small, configurable size (as little as 6 KB of ROM, including kernel, interrupts, semaphores, queues and memory manager) and components that are linked in only if needed.

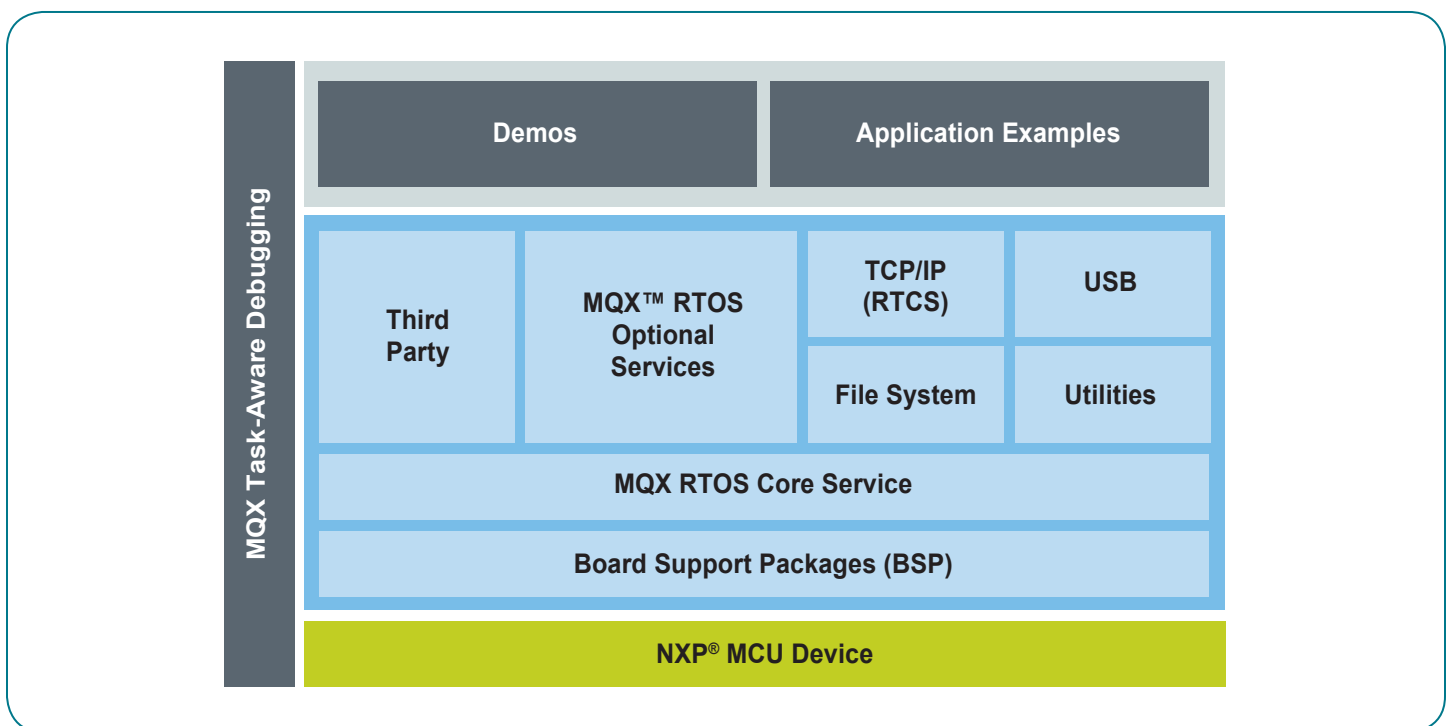‣ Full-featured plug-ins, such as security, industrial protocols and graphical interfaces, from a network of partners.

MQX RTOS: CUSTOMIZABLE COMPONENT SET
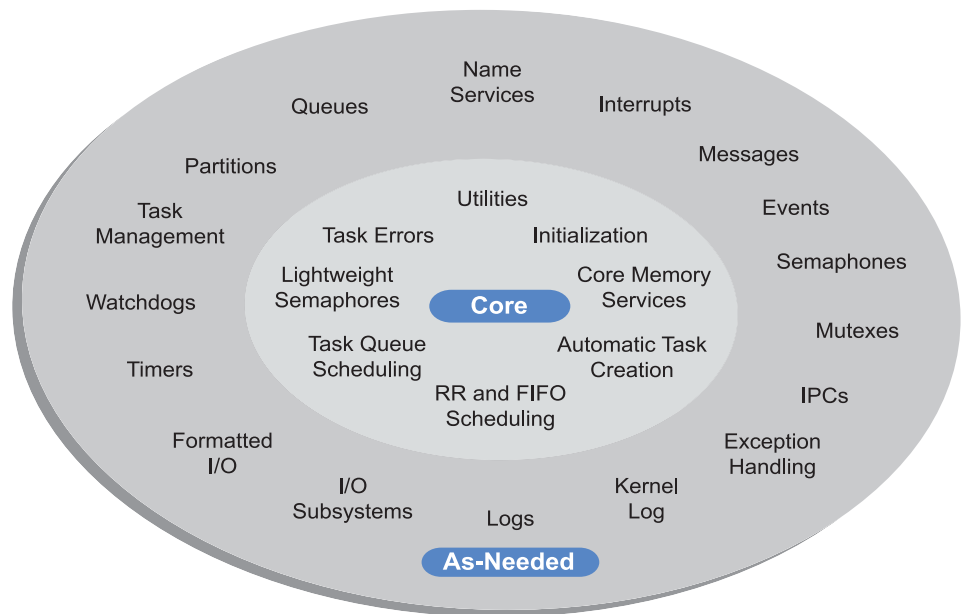
CERTIFIABLE TO MEDICAL AND AEROSPACE STANDARDS

Even for applications that do not require formal certification, the robustness of our proprietary MQX RTOS 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, our proprietary MQX RTOS 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 our proprietary MQX RTOS include eye surgery equipment, drug injection equipment, radiation dose monitoring equipment, aircraft braking systems and aircraft navigation equipment.

OUR COMPREHENSIVE PROPRIETARY SOLUTION

MQX SOFTWARE SOLUTIONS FEATURES AND BENEFITS

MQX™ RTOS

Small code density	• 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 the ARM® Cortex®-M4 core, including kernel, task applications, LW semaphore, interrupt stack, queues and memory manager
Component-based architecture	• 25 components—eight (8) cores, 17 optional • Components are linked in only if needed, preventing unused functions from bloating the memory footprint
Full and lite services	• Further control of size, RAM/ROM utilization and performance options
Real-time, priority-based preemptive multithreading	• 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 proprietary solutions	• Optimized assembly code to accelerate key real-time portions of the RTOS such as context switching
Faster development	• 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	• Provides a framework with a simple application programming interface (API) to build and organize the features across our broad portfolio of embedded processors
Intuitive API	• Writing code for MQX is straightforward with a complete API and available reference documentation
Fast boot sequence	• Ensures the application is running fast after the hardware has been reset
Simple message passing between processors	• Messages can be from a system or a 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

MQX Real-time TCP/IP Communication Suite

Designed for embedded applications	• 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 our proprietary MQX RTOS device drivers for Ethernet and other access layers
Small configurable memory footprint	• 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	• 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	• 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	• 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	• 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	• 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	• RTCS not only provides application layer protocols but is a complete OSI model solution that spans data link to application layer standard protocols

MQX File System

Designed for embedded applications	• 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	• 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

MQX USB Host/Device Stack

Designed for embedded applications	• 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	• Designed to fit in <10 KB RAM and with code size of <32 KB
Supports a variety of class functionalities	• 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

MQX REAL-TIME TCP/IP COMMUNICATION SUITE

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 proprietary and third-party protocols and products are also available. The scalability of our proprietary 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 IPv6 compatibility with the IPv6 protocol add-on that is included with MQX RTCS. With this optional add-on the network stack can be configured for IPv4 only, IPv6 only, or dual (IPv4 + IPv6) operation. 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 compatible.
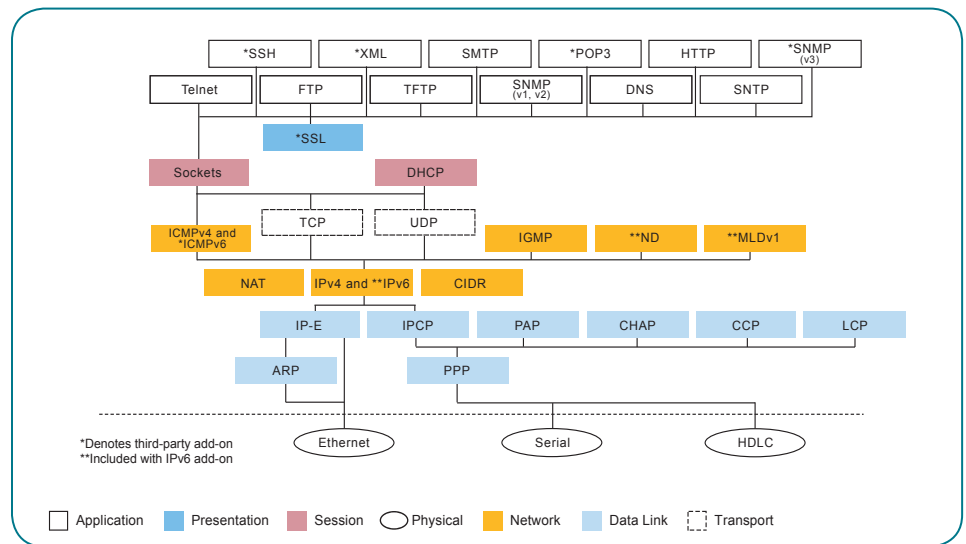
The IPv6 protocol add-on is IPv6 Ready Logo Certified for Core IPv6 protocols as a host. It supports stateless auto-configuration, network auto-discovery and the massive address extensibility that IPv6 provides. RTCS protocols that currently support IPv6 include IPv6, ICMPv6, ND, TCP/UDPv6, Sockets, SMTP Client, HTTP server, MLD, 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.

The IPv6 add-on can be provided for use on MQX Classic (version 4.x) through the purchase of an MQXv5 license.

Contact **mqxsales@nxp.com** for details.

MQX REAL-TIME TCP/IP COMMUNICATION SUITE

FEATURES AND BENEFITS

Features	Benefits
Easy to configure	• Configurable options: Set name of task function, priority, stack size (all the same parameters as an MQX task)
Easy to add to existing application	• Get started in minutes
Very lightweight	• 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	• 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	• 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	• 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 ADD-ON SOFTWARE

A number of our industry partners offer additional products, training, support and design services to extend the capabilities of MQX. These include middleware 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.

MQX V5

MQX v5 is a continuation of the MQX Classic product available under low-cost commercial licensing terms. MQX v5 is backward compatible with MQX Classic and includes additional protocols (such as IPv6, REST, and MQTT), improvements to key drivers, ehnanced robustness, updates to the I/O subsystem, ports to new and existing processors, bug fixes, and more.

See **www.nxp.com/mqxv5** for details and pricing.

MQX BOARD SUPPORT PACKAGES (SUPPORTED OUT OF THE BOX)

Hardware/Board Support Package**	4.0.2	4.1	4.1.1/4.1.2	4.2	5†
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		√	√	√	√
TWR-K80F150M					√
Others available on request†					√
i.MX					
i.MX 6SX SABRE-SDB		4.1-i.MX 6SoloX only			√
i.MX 7Dual: SABRE Board for Smart Devices based on i.MX 7Dual					√
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.

† Anticipated list of out-of-the-box processor support. Support for all other NXP processors available on request.

MQX CLASSIC (V4.X)

Previously released versions of MQX RTOS are now called MQX Classic and include all versions up to MQX v4.x. This software remains available for free download, but does not include support for the latest Kinetis MCUs and i.MX processors. (see MQX v5). Active development of the MQX RTOS continues by NXP with MQX v5. Learn more about MQX Classic (v4.x) at **www.nxp.com/mqxclassic**.

MQX SUPPORT OPTIONS

Community Support

We make 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 our proprietary MQX RTOS.

https://community.nxp.com/community/mqx

Professional Support

When you need commercial-grade support, you can purchase our Professional support package for our proprietary MQX Software Solutions. professional support enables access to a private support portal, shortened response times, phone support, and early access to software releases and bug fixes. Professional support packages are available for purchase.

www.nxp.com/prosupport

PROFESSIONAL SUPPORT FOR MQX SOFTWARE SOLUTIONS

Features	Standard Support	Professional Support			Add-on
Access to moderated online community	√	√			
Report bugs for fix in public releases	√	√			• Sensor fusion • Additional OS • GPU source code • PEG®
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				

Professional Engineering Services

Engineering services are also available 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 our MQX engineering services, please contact your local sales or FAE resources.

www.nxp.com/proservices

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