**Real-time Operating Systems (RTOS)**

# **Popular RTOS of 2022:**

**VxWorks: (Closed Source)**

The World’s Leading Real-Time Operating System for the Intelligent Edge For nearly 35 years, VxWorks has been used to ensure the security, safety, and reliability you need to design and build mission-critical embedded systems that simply must work.

* **LICENSE**: Proprietary
* **PLATFORMS**: ARM, IA-32, Intel 64, MIPS, PowerPC, SH-4, StrongARM, xScale
* **LINK**: <https://www.windriver.com/products/vxworks>

**FreeRTOS: (Open Source)**

Developed in partnership with the world’s leading chip companies over a 15-year period, and now downloaded every 170 seconds, FreeRTOS is a market-leading real-time operating system (RTOS) for microcontrollers and small microprocessors. Distributed freely under the MIT open-source license.

* **LICENSE**: MIT
* **TARGET USE**: Embedded
* **PLATFORMS**: ARM, AVR, AVR32, ColdFire, ESP32, HCS12, IA-32, Cortex-M3-M4-M7, [Infineon XMC4000](https://en.wikipedia.org/wiki/Infineon_XMC4000), MicroBlaze, MSP430, PIC, PIC32, Renesas H8/S, [RISC-V](https://en.wikipedia.org/wiki/RISC-V), RX100-200-600-700, 8052, STM32, [TriCore](https://en.wikipedia.org/wiki/TriCore), [EFM32](https://en.wikipedia.org/wiki/EFM32)
* **LINK**: <www.freertos.org>

**Mbed OS: (Open Source)**

Arm Mbed OS is a free, open-source IoT operating system that includes all the necessary features to develop IoT products. The OS includes everything you need to develop smart, connected products on Arm Cortex-M based hardware, including machine learning capabilities, security, connectivity stacks, an RTOS kernel and drivers for sensors and I/O devices.

* **LICENSE**: Apache License
* **TARGET USE**: Microcontrollers, Internet of Things, Wearables
* **PLATFORMS**: 32-bit ARM Cortex-M
* **LINK**: [mbed.com](2nd.PNG)

**EmbOS: (Closed, available to customers, free object code for non-commercial use)**

embOS is a priority-controlled RTOS (real-time operating system). It is designed to be the foundation for developing embedded applications and is continually developed since 1992. embOS is available for all popular cores, compilers and development tools and has been deployed in several billion devices in a range of application areas.

* **LICENSE**: Proprietary
* **TARGET USE**: embedded, industrial, IoT, safety-critical
* **PLATFORMS**: ARM7/9/11, ARM Cortex-A/R/M, AVR, AVR32, C16x, CR16C, ColdFire, H8, HCS12, M16C, M32C, MSP430, NIOS2, PIC18/24/32, R32C, R8C, RISC-V, RL78, RH850, RX100/200/600/700, RZ, SH2A, STM8, ST7, V850, 78K0, 8051
* **LINK**: <www.segger.com/embos.html>

**INTEGRITY RTOS: (Closed source)**

INTEGRITY uses hardware memory protection to isolate and protect embedded applications. Secure partitions guarantee each task the resources it needs to run correctly and fully protect the operating system and user tasks from errant and malicious code, including denial-of-service attacks, worms, and Trojan horses.

* **LICENSE**: Proprietary
* **TARGET USE**: embedded
* **PLATFORMS**: ARM, XScale, Blackfin, ColdFire, MIPS, PowerPC, x86
* **LINK**: [www.ghs.com/products/rtos/integrity.html](http://www.ghs.com/products/rtos/integrity.html)

**LynxOS: (Source code available)**

LynxOS has been deployed in millions of embedded devices and has operated reliably for 30+ years across multiple safety and security-critical embedded markets. It is a tried-and-true approach for hosting applications on a Unix-like OS model wherein all resources and application services are centrally managed by a common kernel and is best-suited for working with hardware architectures that predate virtualization.

* **LICENSE**: Proprietary
* **TARGET USE**: embedded
* **PLATFORMS**: Motorola 68010, x86/IA-32, ARM, Freescale PowerPC, PowerPC 970, LEON
* **LINK**: [www.lynx.com/products/lynxos-178-do-178c-certified-posix-rtos](http://www.lynx.com/products/lynxos-178-do-178c-certified-posix-rtos)

**SCIOPTA: (Closed, source available)**

The SCIOPTA architecture is specifically designed to provide excellent real-time performance and small size. Internal data structures, memory management, interprocess communication, and time management are highly optimized. SCIOPTA is a pre-emptive real-time kernel. Interrupts can be serviced at any time, even inside the kernel. SCIOPTA is a message-based real-time operating system.

* **LICENSE**: Proprietary
* **TARGET USE**: embedded, safety-related
* **PLATFORMS**: ARM, Cortex-M0-M3-M4, Cortex-R4, -A5, -A7, -A9, -A53, XScale, Renesas RX100, RX200, RX600, RX700, PowerPC, ColdFire, HCS12, M16C, Windows (simulation), Aurix TC2xx, BlackFin BF52x, BF70x
* **LINK**: [www.sciopta.com](http://www.sciopta.com/)

**RTX Keil: (Open Source)**

The Keil RTX is a royalty-free, deterministic real-time operating system designed for ARM and Cortex-M devices. It allows you to create programs that simultaneously perform multiple functions and helps to create applications which are better structured and more easily maintained. Royalty-free, deterministic RTOS with source code.

* **LICENSE**: Apache 2.0
* **TARGET USE**: embedded
* **PLATFORMS**: ARM
* **LINK** :<https://www2.keil.com/mdk5/cmsis> , <http://arm-software.github.io/CMSIS_5/RTOS2/html/rtx5_impl.html> ,<https://arm-software.github.io/CMSIS_5/RTOS2/html/functionOverview.html>, http://arm-software.github.io /CMSIS\_5/RTOS2/html/index.html

**PikeOS: (Closed Source)**

PikeOS offers a separation kernel-based hypervisor with multiple partitions for many other operating systems and applications. It enables you to build smart devices for the Internet-of-Things (IoT) according to the quality, Safety and Security standards of your industry. Due to its separation kernel approach, PikeOS is the first choice for systems which demand protection against Cyber-Security attacks.

* **LICENSE**: Proprietary
* **TARGET USE**: embedded, safety-related
* **PLATFORMS**: ARM, Cortex-M0-M3-M4, Cortex-R4, -A5, -A7, -A9, -A53, XScale, Renesas RX100, RX200, RX600, RX700, PowerPC, ColdFire, HCS12, M16C, Windows (simulation), Aurix TC2xx, BlackFin BF52x, BF70x
* **LINK**: [www.sciopta.com](http://www.sciopta.com/)

**TizenRT: (Open source)**

Tizen is an open and flexible operating system built from the ground up to address the needs of all stakeholders of the mobile and connected device ecosystem, including device manufacturers, mobile operators, application developers and independent software vendors (ISVs). Tizen platform is commercialized on smart TVs, smartphones, wearable devices (Gear S, Gear Fit), and smart home appliances.

* **LICENSE**: Apache 2.0
* **TARGET USE**: embedded
* **PLATFORMS**: ARM
* **LINK**: [github.com/Samsung/TizenRT](https://github.com/Samsung/TizenRT)

**RT-Thread: (Open Source)**

RT-Thread is also considered as an IoT platform with its rich middle-tier components and great hardware and software ecosystem, with almost every key basic component required for IoT devices, such as network protocols, file systems, low power management, etc. It supports all mainstream compiling tools such as GCC, Uses a unified interface to access the hardware peripherals.

* **LICENSE**: Apache 2.0
* **TARGET USE**: embedded
* **PLATFORMS**: ARM, ARM Cortex-M0-M3-R4-M4-M7, IA-32, AVR32, Blackfin, nios, PPC, M16C, MIPS (loongson-1b-1c, PIC32，xburst), MicroBlaze, V850, unicore32,
* **LINK**:  [www.rt-thread.org](http://www.rt-thread.org/)

**TI-RTOS: (Open Source):**

TI-RTOS accelerates development schedules by eliminating the need to create basic system software functions from scratch. TI-RTOS scales from a real-time multitasking kernel - TI-RTOS Kernel - to a complete RTOS solution including additional middleware components, device drivers and power management. TI-RTOS and TI's ultra-low-power MCUs combine to enable developers to design applications with much longer battery life.

* **LICENSE**: BSD
* **TARGET USE**: embedded
* **PLATFORMS**: Mostly Texas Instruments: MSP430-432, C2000-5000-6000, TI's ARM families (Cortex M3-4F-R4-A8-A15), SimpleLink Wireless CC2xxx-CC3xxx
* **LINK**: [www.rt-thread.org](http://www.rt-thread.org)

**SafeRTOS: (Source code & Design Assurance Pack available)**

SAFERTOS® is a pre-certified safety Real Time Operating System (RTOS) for embedded processors. It delivers superior performance and pre-certified dependability, whilst utilizing minimal resources. SAFERTOS® is tailored to your specific processor/compiler combination, and delivered with full source code and our Design Assurance Pack (DAP) . The DAP gives you complete transparency over the full Design Life Cycle, and illustrates the exceptional high quality of our RTOS product.

* **LICENSE**: BSD
* **TARGET USE**: embedded, safety-critical
* **PLATFORMS**: Same as FreeRTOS
* **LINK**: <https://www.highintegritysystems.com/safertos/>

**Apache Nuttx : (Open Source)**

NuttX is a real-time operating system (RTOS) with an emphasis on standards compliance and small footprint. Scalable from 8-bit to 32-bit microcontroller environments, the primary governing standards in NuttX are Posix and ANSI standards. Additional standard APIs from Unix and other common RTOS’s (such as VxWorks) are adopted for functionality not available under these standards, or for functionality that is not appropriate for deeply-embedded environments (such as fork ()).

* **LICENSE**: Apache License 2.0
* **TARGET USE**: Embedded systems
* **PLATFORMS**: ARM, AVR, AVR32, HCS12, LM32, MIPS, RISC-V, SuperH, Xtensa, x86, x86-64, Z80
* **LINK**: <nuttx.apache.org>

**Open Source RTOS**:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **RTOS** | **License** | **Target Uses** | **Platforms** | **Official Websites** |
| AdAstra-RTK | BSD 3-clause | Embedded | [Cortex-M3](https://en.wikipedia.org/wiki/ARM_Cortex-M3)-M4-M7-H7, [STM32](https://en.wikipedia.org/wiki/STM32) | [adastra-soft.com](http://adastra-soft.com/) |
| Arm OS | Apache 2.0 | Embedded | Cortex-M, Cortex-R, Cortex-A | [os.mbed.com](https://os.mbed.com/) |
| Atomosher | BSD | Embedded | [AVR](https://en.wikipedia.org/wiki/Atmel_AVR), STM8, [ARM](https://en.wikipedia.org/wiki/ARM_architecture), MIPS | [atomthreads.com](http://atomthreads.com/) |
| BRKos | MIT | Embedded | Freescale Kinetis (ARM Cortex-M4), NXP ColdFire V1, Freescale HCS08, ST STM32F4xx (ARM Cortex-M4F), NXP LPC11xx (ARM Cortex-M0), NXP LPC176x (ARM Cortex-M3), Renesas RX600 (RX62N), Texas Instruments MSP430, Texas Instruments Stellaris LM3S8968 (ARM Cortex-M3), Texas Instruments Stellaris LM4F120H5QR (ARM Cortex-M4F), Atmel ATMEGA328/128 and Microchip PIC18 | [github.com/brtos/brtos](https://github.com/brtos/brtos) |
| ChibiOS/RT | Mixed, GNU GPL or proprietary | embedded, small footprint | x86, [ARM7](https://en.wikipedia.org/wiki/ARM7), [ARM9](https://en.wikipedia.org/wiki/ARM_Cortex-A9), Cortex-M0-M3-M4, [PowerPC e200z](https://en.wikipedia.org/wiki/PowerPC_e200), STM8, STM32, AVR, MSP430, ColdFire, [H8S](https://en.wikipedia.org/wiki/H8S) | [www.chibios.org/dokuwiki/doku.php](http://www.chibios.org/dokuwiki/doku.php), [sourceforge.net/projects/chibios](http://sourceforge.net/projects/chibios) |
| Contiki | BSD | Embedded, WSN | MSP430, AVR, ARM | [www.contiki-os.org](http://www.contiki-os.org/) |
| CooCox CoOS | BSD | General purpose | STM32, NXP LPC1000, TI LM3S8962, Nuvoton NU1xx, Holtek HT32 | [www.coocox.org/CoOS.htm](http://www.coocox.org/CoOS.htm) |
| Distortos | Mozilla | Embedded | [ARMv6-M](https://en.wikipedia.org/wiki/ARMv6-M) architecture ([ARM Cortex-M0](https://en.wikipedia.org/wiki/ARM_Cortex-M#Cortex-M0), [ARM Cortex-M0+](https://en.wikipedia.org/wiki/ARM_Cortex-M#Cortex-M0+), [ARM Cortex-M1](https://en.wikipedia.org/wiki/ARM_Cortex-M#Cortex-M1)): [STM32F0](https://en.wikipedia.org/wiki/STM32#STM32_F0), [STM32L0](https://en.wikipedia.org/wiki/STM32#STM32_L0); [ARMv7-M](https://en.wikipedia.org/wiki/ARMv7-M) architecture ([ARM Cortex-M3](https://en.wikipedia.org/wiki/ARM_Cortex-M#Cortex-M3), [ARM Cortex-M4(F)](https://en.wikipedia.org/wiki/ARM_Cortex-M#Cortex-M4), [ARM Cortex-M7(F)](https://en.wikipedia.org/wiki/ARM_Cortex-M#Cortex-M7)): [STM32F1](https://en.wikipedia.org/wiki/STM32#STM32_F1), [STM32F4](https://en.wikipedia.org/wiki/STM32#STM32_F4), [STM32F7](https://en.wikipedia.org/wiki/STM32#STM32_F7), [STM32L4](https://en.wikipedia.org/wiki/STM32#STM32_L4) | [distortos.org](http://distortos.org/) |
| dnx RTOS | GNU GPL, modified GPL, BSD | Embedded(Unix-like) | ARM Cortex-M3, STM32 | [www.dnx-rtos.org](http://www.dnx-rtos.org/) |
| Drone OS | Apache 2.0/MIT | Embedded | ARMv7-M, ARMv8-M, RISC-V | <https://www.drone-os.com/> |
| DSPnano RTOS | Mixed, open source and commercial | MCU, DSC, DSP SoC | R8C, M16C, PIC24, dsPIC33 | [www.rowebots.com/products/dspnano](http://www.rowebots.com/products/dspnano) |
| DuinOS | Modified GNU GPL | general purpose | AVR (Arduino) | [code.google.com/p/duinos](https://code.google.com/p/duinos) |
| eChronos | CSIRO BSD MIT | Embedded | ARM Cortex-M3 - M7 | <https://ts.data61.csiro.au/projects/TS/echronos/> |
| eCos | Modified GNU GPL | Embedded | ARM-XScale-Cortex-M, CalmRISC, 680x0-ColdFire, fr30, FR-V, H8, IA-32, MIPS, MN10300, OpenRISC, PowerPC, SPARC, [SuperH](https://en.wikipedia.org/wiki/SuperH), V8xx | [ecos.sourceware.org](http://ecos.sourceware.org/) |
| ERIKA Enterprise | GPL and GPL linking exception | Embedded | ARM7, ARM Cortex-M, ARM Cortex-A (on Jailhouse hypervisor), Hitachi H8, Altera Nios2, Microchip dsPIC (including dsPIC30, dsPIC33, and PIC24), Microchip PIC32, ST Microelectronics ST10, Infineon C167, Infineon Tricore, [Freescale](https://en.wikipedia.org/wiki/Freescale) PPC e200 (MPC 56xx) (including PPC e200 z0, z6, z7), Freescale S12XS, EnSilica eSi-RISC, AVR, Lattice Mico32, MSP430, [Renesas](https://en.wikipedia.org/wiki/Renesas_Electronics) RX200, x86-64 (on Jailhouse hypervisor) | [www.erika-enterprise.com](http://www.erika-enterprise.com/) |
| FreeOSEK | GNU GPLv3 | Embedded | Cortex-M4, MIPS, MSP430, SPARC LEON3 | [github.com/ciaa/Firmware](https://github.com/ciaa/Firmware) |
| Frosted | GNU GPL | embedded, POSIX compliant, unix-like | ARM Cortex-M | <https://gitlab.com/insane-adding-machines/frosted> |
| IntrOS | MIT | embedded, small footprint | ARM Cortex-M, STM8, AVR8 | [github.com/stateos/IntrOS](https://github.com/stateos/IntrOS) |
| iRTOS | GNU LGPL | Embedded | AVR, ARM7 | [irtos.sourceforge.net](http://irtos.sourceforge.net/) |
| Lepton | Mozilla | Embeddable | [ARM9](https://en.wikipedia.org/wiki/ARM_Cortex-A9) (ATMEL AT91SAM9261, AT91SAM9260), ARM7 (ATMEL AT91SAM7x, AT91SAM7SE, AT91M55800), CortexM3 (ST STM32F103, Texas Instrument Stellaris) et CortexM4 (Freescale Kinetis) | [github.com/lepton-distribution/lepton](https://github.com/lepton-distribution/lepton) |
| MicroC/OS-III | Apache 2.0 | Embedded | ARM7-9-11/Cortex-M1-3-4-A8/9, AVR, HC11/12/S12, ColdFire, Blackfin, MicroBlaze, NIOS, 8051, x86, Win32, H8S, M16C, M32C, MIPS, 68000, PIC24/dsPIC33/PIC32, MSP430, PowerPC, SH, StarCore, [Renesas](https://en.wikipedia.org/wiki/Renesas) RX100-200-600-700, RL; STM32, | [micrium.com/rtos/kernels](http://micrium.com/rtos/kernels) |
| OSA | BSD | Embedded | PIC10-PIC24, AVR 8-bit, STM8 | [wiki.pic24.ru/doku.php/en/osa/ref/intro](http://wiki.pic24.ru/doku.php/en/osa/ref/intro) |
| Quest | Apache 2.0 | embedded / mixed-criticality | x86 | [www.questos.org](http://www.questos.org/) |
| RIOT | GNU LGPL | Embedded | ARM, MSP430, AVR, x86, RISC-V | [www.riot-os.org](http://www.riot-os.org/) |
| silRTOS | Free | Embedded | ARM, [Cortex-M3 -A9 -11MP](https://en.wikipedia.org/wiki/ARM_Cortex-M3), [Blackfin](https://en.wikipedia.org/wiki/Blackfin), MIPS, AVR | [spanidea.com/products.php](http://spanidea.com/products.php) |
| Stratify OS | Modified GNU GPL Modified GNU GPL | Embedded | ARM Cortex-M3, M4 | [stratifylabs.co/Stratify-OS](http://stratifylabs.co/Stratify-OS) |
| Trampoline Operating System (OSEK and AUTOSAR) | GNU GPLv2 | Embedded | Arduino Uno (AVR - ATMega), Arduino Mega (AVR - ATMega), XPlainedPro (Cortex-M0+), Raspberry Pi 2 Model B (Cortex-A7), Olimex LPC-L2294-1MB (ARM7 - NXP LPC2294), Teensy31 (Cortex-M4), XPC56XX EVB + XPC56XL MINI-MODULE (PowerPC - MPC564xL), ZedBoard (RISC-V - PULPino), STM32F4DISCOVERY (Cortex-M4 - STM32F40x), Nucleo-32 (Cortex-M4 - STM32F30x), Cortex-M3 - SmartFusion2, virt-V7 (builds a firmware with TrampolineRTOS that can be used as a guest on the hypervisor XVisor) | [github.com/TrampolineRTOS/trampoline](https://github.com/TrampolineRTOS/trampoline) |
| Xenomai | GNU GPLv2 | General | x86, x86-64, PowerPC, ARM, Analog Devices Blackfin BF52x, BF53x, BF54x and BF56x | [www.xenomai.org](http://www.xenomai.org/) |
| RTEMS | modified GNU GPL | Embedded | ARM, Blackfin, ColdFire, TI C3x/C4x, H8/300, x86, 68k, [Milkymist](https://en.wikipedia.org/wiki/Milkymist) SoC, MIPS, Nios II, PowerPC, SuperH, SPARC, [ERC32](https://en.wikipedia.org/wiki/ERC32), LEON, Mongoose-V | [rtems.com](http://rtems.com/) |
| Zephyr | Apache 2.0 | Embedded | [ARM](https://en.wikipedia.org/wiki/ARM_architecture) ([Cortex-M0](https://en.wikipedia.org/wiki/ARM_Cortex-M0), [-M3](https://en.wikipedia.org/wiki/ARM_Cortex-M3), [-M4](https://en.wikipedia.org/wiki/ARM_Cortex-M4), [-M23](https://en.wikipedia.org/wiki/ARM_Cortex-M23), [-M33](https://en.wikipedia.org/wiki/ARM_Cortex-M33), [-R4](https://en.wikipedia.org/wiki/ARM_Cortex-R), [-R5](https://en.wikipedia.org/wiki/ARM_Cortex-R), [-A53](https://en.wikipedia.org/wiki/ARM_Cortex-A)), [x86](https://en.wikipedia.org/wiki/X86), [x86-64](https://en.wikipedia.org/wiki/X86-64), [ARC](https://en.wikipedia.org/wiki/ARC_(processor)), [RISC-V](https://en.wikipedia.org/wiki/RISC-V), [Nios II](https://en.wikipedia.org/wiki/Nios_II), [Xtensa](https://en.wikipedia.org/wiki/Tensilica), [SPARC](https://en.wikipedia.org/wiki/SPARC) | [www.zephyrproject.org](http://www.zephyrproject.org/) |