IntervalZero

**Product**Brief

February 2025

# MaxRT eRTOS

## Overview

IntervalZero's MaxRT eRTOS product provides a standalone, embedded Real-Time Operating System (RTOS) with tools and utilities for building and executing real-time programs. eRTOS enables application components or modules that require deterministic and high-speed response times. With ERTOS, you can use a single, low-cost platform to satisfy a full range of real-time and embedded application requirements.

The systems will typically be headless, and the HMI will be hosted on a remote PC or device.

eRTOS is based on RTX64. It supports multiple processes and threads running on multiple cores on an SMP system. eRTOS real-time APIs are source code compatible with RTX64.

The eRTOS scheduler enables embedded real-time applications to directly access the 512GB of addressable physical memory. This is critical to modern-day real-time systems and represents a gigantic leap from the 4GB physical memory limit of traditional 32-bit systems.

## Determinism

- Guaranteed Precision – set timer periods down to 1 microsecond, and Interrupt Service Thread (IST) latencies of less than 10 microseconds
- Scalability – one scheduler is used across all processors. Symmetric multiprocessing (SMP) aware scheduler utilizes both priority-driven and pre-emptive algorithms to ensure critical thread context switches; and yields to threads of high priority occur in the sub-microsecond range

## Control

- eRTOS supports hardware platforms with up to 64 processors
- Full control of real-time process threads with the ability to load balance as needed. eRTOS provides the ability to set thread and interrupt affinities

## Simplify

- Use commercial off-the shelf (COTS) target system; no special hardware required
- Use one development environment - Visual Studio 2019, and 2022
- Use common languages (C/C++) for real-time applications
- No driver model to follow; real-time process can talk directly to hardware
- Use standard IPC communication between real-time processes (events, mutexes, and semaphores)
- Use shared memory between real-time processes for sharing of data

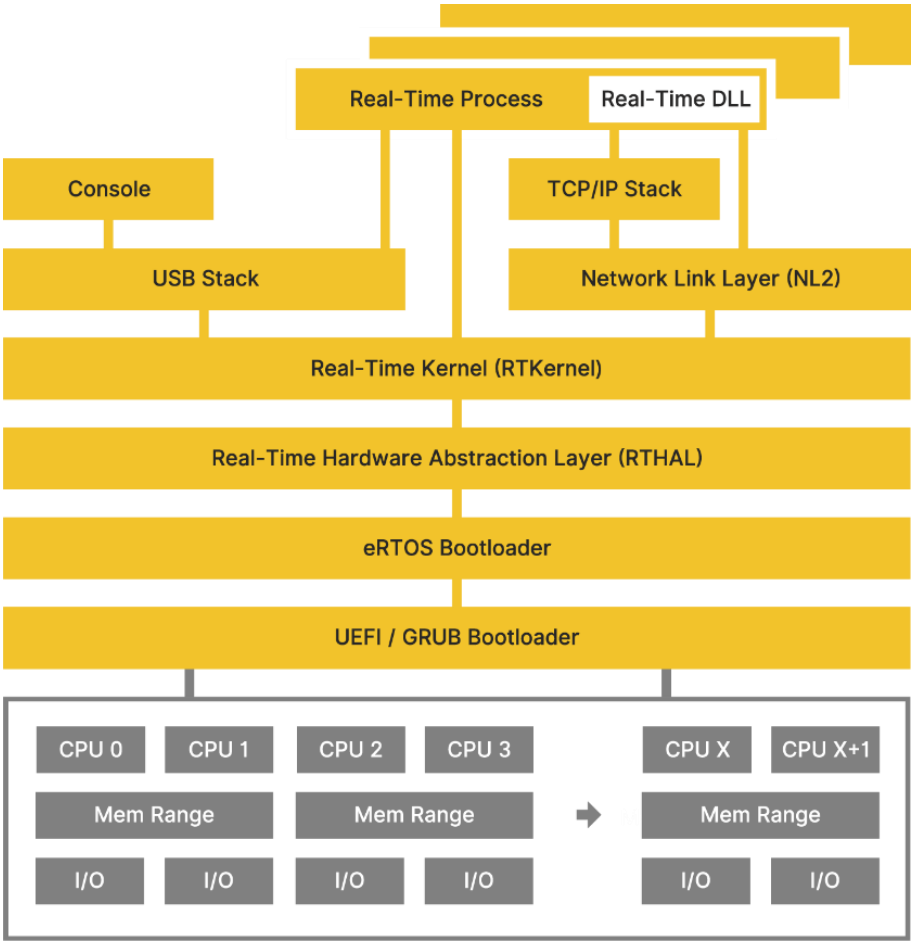
## Reduce Costs

- Eliminate proprietary controller and communications cards
- Improved asset utilization: Take advantage of underused multi-core capacity
- Reduced manufacturing costs and fewer physical parts

## Improve Efficiency

- Eliminate some inventory costs and reduce maintenance costs
- Field upgrades are accomplished through software download rather than board replacement
- Develop a real-time application which is source code compatible with other editions of the MaxRT product family (wRTOS, vRTOS)

## Architecture



Key Features

**Real-time Runtime**

- Scalable from 1 to 64 real-time processors
- SMP support, SMP aware scheduler utilizes both priority-driven and pre-emptive algorithms to ensure critical thread context switches; and yields to threads of high priority occur in the sub-microsecond range
- Configurable thread and interrupt affinity
- Configurable timer period
- X2APIC support
- Ability to attach to line-based and message-based (MSI/MSI-X) interrupts
- Deterministic memory allocation
- Structured exception handling
- Support for processor features TCC, RDT, MBA, CAT
- Support for SSE/SSE2/SSE3/SSE4/AVX/AVX2/AVX-512/AMX
- USB support (Keyboard & Mass storage)
- Ability to set search paths for process creation and loading of DLLs
- Dynamic-link library support through DLLs, which can be loaded implicitly or explicitly
- Inter Process Communication
    - Objects available: events, mutexes, and semaphore
    - Data sharing through shared memory
- Network Link Layer (NL2) and NIC drivers support
    - Uses Network Interfaces to access queues
    - Supports direct use of physical queues or logical queues to allow multiple applications to access the same physical queue
    - Time Stamping support
- Tools and Utilities
    - Activation and Configuration – activate subsystem components and configure RTSS cores
    - Console – allows users to run commands and displays application print messages
    - SRTM – view system timer to timer handler response on a given core
    - ProcessorHybridInfo – displays information about processors
    - RtMSpaces – displays information about Memory spaces
    - RtObjects – displays information about objects

**Software Development Kit**

- Headers and libraries for application development
    - Real-time API (RTAPI)
    - Real-time NL2 API
    - Real-time NIC Driver API
- Microsoft Visual Studio 2019, and 2022 support
    - Templates for application and dll development
    - API Code snippets
    - C-Runtime support
    - Remote debugger support via launch within Visual Studio
    - Remote attach support
    - Sample source to show basic concepts

**Product Documentation**

- Documentation consisting of installation and user guides, API references, and details on real-time programming concepts

## Additional Purchasable Features

**TCP/IP Stack**

The TCP/IP Stack provides the following networking capabilities to eRTOS:

- TCP/UDP/IP networking for eRTOS processes
- Support for IPv4 and IPv6
- Winsock support
- RAW Sockets
- MAC layer filtering
- Utilities (RtArp, RtIpConfig, RtPing, and RtRoute)