The Real-time Operating System for Today’s Advanced Designs

Mentor® Embedded Nucleus® RTOS enables system developers to address the complex requirements demanded by today’s advanced embedded designs. Nucleus brings together integrated software IP, tools, and partner technologies into a single, ready-to-use solution – ideal for applications where a scalable footprint, connectivity, security, power management, and deterministic performance are essential.

Deployed on over three billion embedded devices, Nucleus RTOS is a proven, reliable, and fully optimized RTOS. Nucleus has been used successfully deployed in highly demanding markets with rigorous safety and security requirements such as industrial systems, medical devices, airborne systems, and more. With Nucleus, developers can deploy a scalable, hard real-time, deterministic kernel on a wide selection of processors including MCUs, DSPs, FPGAs, and MPUs.

Product highlights include:

Multicore Support

Nucleus RTOS provides comprehensive multicore support with 32/64 bit solutions for uAMP, sAMP and SMP architectures. The scalability of Nucleus RTOS facilitates its use as the runtime executive on essentially every core on a multicore SoC including Arm® Cortex®-A, Arm® Cortex®-R, Arm® Cortex®-M, and DSPs. As a component of Mentor Embedded’s multicore solutions, Nucleus RTOS complements Mentor® Embedded Hypervisor, Mentor® Embedded Multicore Framework, and Mentor® Embedded Linux® to enable developers to harness the power of today’s advanced multicore system-on-chips (SoCs).

Mentor’s multicore solution provides the industry’s broadest portfolio of runtimes, integrated tools, separation technology, and inter-processor communication solutions (IPC) to manage the operating systems and device resources on complex multicore SoC architectures.

PRODUCT FEATURES:

- Hard, real-time performance
- Fast boot time and sub-microsecond latency for interrupt service and context switching
- Reliable, scalable kernel with a small memory footprint
- Process model for separation in user and kernel space
- Power management APIs for low-power designs
- A full range of integrated modules/services including: industrial protocols, networking, file system, connectivity, and security
- Broad cloud protocol support for your IoT needs
- Fully integrated Eclipse-based development environment with GCC and C++ development tools
- Extensive architecture support including Arm®, MIPS, and PowerPC, and RISC-V

BENEFITS:

Reduce risk

Nucleus is market proven, having shipped in billions of products powered by hundreds of different types of MPUs/MCUs

Faster time to market

Nucleus RTOS is integrated with a robust development environment, feature-rich middleware, and board support packages (BSPs) for leading reference board designs using today’s latest SoCs

Lower production costs

Flexible business models to license Nucleus
Scalability
Nucleus® ReadyStart consists of Nucleus RTOS with middleware, I/O, and graphics packages to provide the system developer the flexibility to easily add or remove components, or to create a tailored executable image with the specific connectivity, networking, storage and user interface packages required to meet the system requirements.

Process Model
The Nucleus process model provides space domain partitioning to isolate software subsystems for added system reliability. This light-weight framework provides isolation using the MMU on Arm® Cortex®-A based cores, or the MPU on Arm® Cortex®-M based processors. Without the overhead of memory virtualization, the Nucleus process model utilizes a linear memory map with protected memory regions that ensure software subsystems cannot access memory regions without specific entitlements. Developers can dynamically reload, restart, and update application and kernel modules without impacting other modules or taking down the system.

Low Power Design
Embedded developers can take advantage of the latest power saving features in today’s processors with the Nucleus Power Management Framework. The Nucleus framework was built from the ground up to provide support for DVFS, sleep modes, deep sleep modes, tick suppression, operating power transitions and more. Developers can utilize the power management framework to write power-aware applications that meet the low-power requirements by calling high-level APIs to control the power state for individual devices or the entire system.

Connectivity and Middleware
Nucleus supports a vast array of connectivity solutions that include optimized USB 2.0/3.0, SDIO 2.0/3.0, Wi-Fi, Bluetooth/BLE, 802.15.4, PCIe, and more. Nucleus middleware solutions include a dual IPv4/IPv6 networking stack, OPC UA, Ethernet/IP, Master EtherCAT, Data Distribution Service (DDS), and more. To meet device security requirements, Nucleus crypto support includes OpenSSL, TLS, and wolfSSL as well as hardware crypto-engine support. The robustness of Nucleus has been proven by passing the rigorous standards associated with GE Digital Achilles Level 1 and 2 certification.

Graphics
With Nucleus, developers can create rich, dynamic and compelling interactive user interfaces for a spectrum of embedded applications. Graphics solutions include the Qt® and other 3rd party commercial graphic packages to provide a UI framework for a range of devices and requirements from rich 3D graphics to UI solutions for resource-constrained MCU targets.

Mentor Embedded Nucleus SafetyCert™ is a complete solution for devices requiring safety certification and regulatory approval. It includes a certified version of the Nucleus RTOS kernel with Nucleus process model support for memory space partitioning, runtime libraries, connectivity middleware, networking, and data storage. Nucleus SafetyCert documentation and artifacts provide clear traceability across the safety lifecycle.

Security
Nucleus security solutions incorporate a range of security technologies to provide support for Arm® TrustZone®, high assurance boot, root of trust, secure storage, and protection for data in transit.

Integrated Sourcery CodeBench IDE
Nucleus ReadyStart includes a complete development environment based on Mentor Embedded Sourcery™ CodeBench with GNU-based GCC/ G++ tools, and Sourcery™ Analyzer to cover every aspect of embedded development, from device bring-up and resource partitioning for multicore devices to application optimization.