LynxElement®

A High-Assurance, Certifiable Unikernel Runtime for Aerospace and Defense Systems

A unikernel defines the foundation of embedded risk management by controlling exactly what code executes, how resources are allocated, and how interference is prevented. LynxElement delivers deterministic, secure, and certifiable systems by removing unnecessary OS services, dynamic behavior, and hidden scheduling effects. This enables faster development, predictable certification, and long-term software reuse for mixed-criticality, multicore aerospace and defense (A&D) platforms.

Designed for Modern Multicore A&D

Modern aerospace and defense systems require unmatched determinism and security on complex multicore processors, but traditional monolithic RTOSs add risk and complexity. LynxElement is the first POSIX-compatible unikernel for high-assurance systems, delivering deterministic behavior, reduced attack surface, and scalable certification on modern multicore platforms.

Purpose-Built OS for Each Application

A unikernel is a single-address-space OS containing only the services an application needs, reducing complexity and attack surface. LynxElement runs each application in a lightweight, isolated environment and is part of the LYNX MOSA.ic™ framework for next-generation mission-critical systems.

Minimal Services, Maximum Security

Unlike traditional real-time operating systems, LynxElement does not include background services, dynamic drivers, or competing processes. This architecture minimizes context switching, simplifies timing analysis, and significantly reduces the system attack surface. LynxElement is POSIX- and FACE-API compatible, enabling reuse of existing software assets. It can be deployed standalone on bare metal or as an isolated workload atop LynxSecure™, alongside LynxOS-178™, embedded Linux, or other environments. Multiple unikernel instances can share a CPU core.

Combination of Modularity and Reuse

Lynx is the only vendor to pair a formally constrained separation kernel with a production-grade unikernel component model purpose-built for certifiable MOSA (Modular Open Systems Approach) systems, delivering a unique combination of modularity, portability, and reuse that other architectures cannot replicate. Unlike monolithic RTOS architectures designed for single-core systems, LynxElement's minimal footprint and configuration reduce multicore interference points by orders of magnitude.

LYNX

Key Benefits and Architecture

LynxElement provides secure, deterministic, and modular OS services, maximizing efficiency, simplifying certification, and enabling software reuse across multicore platforms.

Key benefits include:

- **Deterministic and Multicore-Ready:** Fixed resource allocation and static configuration eliminate hidden schedulers and minimize multicore interference points, enabling repeatable real-time behavior that monolithic RTOS architectures struggle to achieve on modern multicore platforms.

- **Minimal and Independent:** Single-address-space unikernel with no host OS dependencies, reducing complexity, attack surface, and certification effort.

- **Mixed-Criticality Enablement:** Multiple LynxElement instances can run concurrently as isolated workloads under LynxSecure, supporting RTOS, Linux, and bare-metal applications.

- **Reduced Certification Effort:** Predictable execution and minimal runtime simplify timing analysis, evidence collection, and verification.

- **Airworthiness Support:** Designed to support DO-178C DAL A and MIL-HDBK-516C certification with specific architectural features addressing CAST-32A and AC 20-193 multicore interference mitigation requirements.

- **Maximum Hardware Utilization:** Support across Intel® and Arm® processors, with direct CPU and peripheral access for optimized performance on mission-critical platforms.

- **Reduced Attack Surface:** Statically linked libraries and drivers prevent common runtime exploits, improving cyber resilience.

- **Modular Architecture:** Compatible with IMA and MOSA-aligned systems for reuse and incremental modernization.

Primary Use Cases

LynxElement is built for mission- and safety-critical systems where determinism, security, and a minimal footprint are essential. Its unikernel architecture creates tightly scoped, certifiable components with clear resource boundaries, simplifying timing analysis, reducing attack surface, and enabling long-term software reuse. These features make it ideal for the following use cases:

- **Deterministic Real-Time Workloads:** Tightly constrained applications requiring repeatable timing behavior.

- **Security-Focused Components:** Lightweight unikernel deployment for IDS, VPN, and protocol handlers in place of full Linux/RTOS environments.

- **Command vs. Payload Separation:** Isolate mission-critical control logic from higher-risk payload software deployed under LynxSecure.

- **Reusable Softawre Modules:** package certifiable components that can be reused across programs.

- **AI and ML Workloads:** Run AI/ML applications as isolated unikernel instrances to preserve determinism while protecting sensitive data and certified functions.

Ready to revolutionize your mission-critical systems?

Contact Lynx today to learn more about how LynxElement delivers deterministic, secure, and certifiable embedded systems for multicore aerospace and defense platforms.

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