Solution Brief

Avionics
Software Framework

LYNX MOSA.ic for Avionics Drives Next-Generation Aerospace Development

The LYNX MOSA.ic for Avionics framework helps developers reduce development and certification costs with multicore processing and exceptional security

LYNX SOFTWARE TECHNOLOGIES

The avionics industry continues to evolve rapidly. Today's avionics solutions need to provide higher performance with more capabilities. Computers and display processors need to process information quickly to drive multiple systems and display multiple screens simultaneously without jeopardizing the safety of the flight. As the industry adapts and updates its technology, it is becoming increasingly important to stay up to date on the latest trends and regularly improve processors and technology. And as these changes have been made, the necessary airworthiness certification process for these technologies has become more challenging. Lynx Software Technologies, using Intel® processors, is helping developers meet the challenge with the LYNX MOSA.ic for Avionics development platform.

The challenge: Designing avionics systems to meet rigid certification specifications

In the past, avionics platforms were designed as separate computer hardware systems for each application with individual CPUs and GPUs. Not only are these individual systems inefficient by today's technology standards, their individual enclosure types can have a significant impact on the aircraft's design. Limits on hardware weight can prevent newer technology or multiple applications from being used alongside the older technology, making it difficult for airborne platforms to innovate and be up to date with the latest technology.

The avionics industry has begun to transition away from the use of single-core processors to the use of multicore processors. Multicore processors can deliver higher performance and can help minimize size, weight, and power (SWaP). Although the use of multicore processors improves many aspects of avionics solutions, it also creates challenges. For example, the increase in cores provides more data processing, but interference paths rise exponentially as core counts rise. And airworthiness certifications are required by the Federal Aviation Administration (FAA) and European Union Aviation Safety Agency (EASA) for airborne digital systems developed using software and electronic hardware. The increase in cores and interference paths makes certification for these systems more challenging than for systems with single-core processors.

Avionics developers need to provide documentation as to how their systems will perform under various conditions. This can be difficult since the inner workings are often considered proprietary and only known by the silicon vendor. Without this information, it can be very difficult to establish an application's worst possible performance and deterministic response. Developers may also struggle to guarantee mitigation of all potential failure conditions. These problems can create platform dependencies that can impact performance and cause architecture challenges. Supporting modern airworthiness certification is also expensive—costing millions of dollars simply to test a modest set of features to meet Design Assurance Level C (DAL C).

The solution: LYNX MOSA.ic for Avionics speeds system design and facilitates certification

LYNX MOSA.ic for Avionics is a development and integration platform founded on the lightweight hypervisor LynxSecure. LynxSecure is a separation kernel developed according to DO-178C DAL A standards and supports ARINC 653 architecture requirements. LYNX MOSA.ic embodies the Department of Defense strategy of the Modular Open Systems Approach (MOSA). The platform is specifically designed for open flexibility, enabling real-time developers to efficiently realize their design goals on inherently complex hardware/software platforms.

Simplify the use of avionics applications deployed on multicore processors

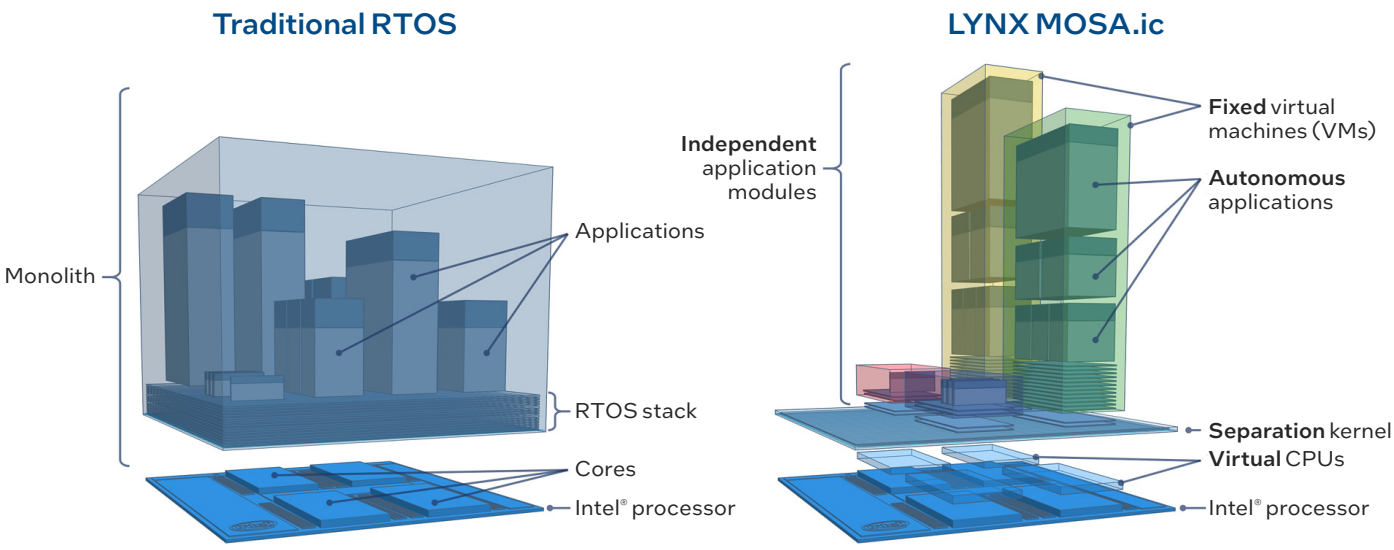
LYNX MOSA.ic for Avionics has an advanced architecture that can help lower the effort, cost, and risk of developing, certifying, and maintaining safety-critical avionics applications on multicore processors. This is due to the way it leverages multicore processors to simplify software stack complexity while making rapid development and integration options possible. These capabilities make it possible to provide better application portability properties and overcome performance thresholds.

This solution also reduces software stack dependencies and minimizes complexities between different applications by decomposing monoliths into highly modularized architectures. This helps give solution evaluators the ability to validate security and safety. These features reduce the time necessary to debug, unlock design options, improve real-time performance predictability, and increase the speed of system integration to meet deadlines. All these important features help to significantly decrease the cost that typically comes with implementing an avionics solution.

Facilitating the certification process

Lynx is delivering major new avionics programs to set new standards in compute capacity and high-availability platform design for autonomous flight control. With these new programs, Lynx has achieved DO-178C DAL A airworthiness standards for the LYNX MOSA.ic platform hosted on Intel® processor platforms with Intel® Ethernet network controllers.

LYNX MOSA.ic takes advantage of Intel® Virtualization Technology (Intel® VT) to construct virtual machines (VMs) by mapping memory, peripherals, interrupts, and DMA to processor cores, resulting in near-zero overhead during context switches. This deep level of virtualization minimizes software stack complexity, while separation maximizes software security. The platform has achieved DO-178C DAL A airworthiness certification, and its compartmentalized framework enables customers to reuse existing certifications for the DO-178C OS (via AC 20-148), with only new software modules needing to be certified. This facilitates the path to certification and reduces development costs and time to deployment.



Built on LynxSecure

The LYNX MOSA.ic for Avionics development and integration platform is founded on the LynxSecure separation kernel hypervisor. The technology was designed to satisfy real-time high-assurance computing requirements in support of the NIST, NSA Common Criteria, and NERC CIP evaluation processes used to regulate military and industrial computing environments. With LynxSecure there is no system configuration change after startup. This means no hardware remapping, device assignment, memory allocation, or changes to security or scheduling policies. Guest software CPU cycles are guaranteed, the system is secure, and communication between guest operating systems is highly regulated. Regulated communication means that the guest operating system will not be able to access LynxSecure memory. LynxSecure also has 20,000 lines of certifiable source code that ensure an accelerated and cost-reduced path to system airworthiness certification.

Modular framework

LYNX MOSA.ic is a software framework for building and integrating complex multicore safety- and security-critical systems using independent application modules. Its elegant, modular architecture enables developers to reduce development cycles when creating, certifying, and deploying robust platforms for manned and autonomous systems.

In traditional RTOS (real-time operating system) platforms, hardware control, real-time scheduling, and application runtime services are integrated into a common stack servicing all applications on all CPU cores. Using LYNX MOSA.ic allows system architects to subdivide systems into smaller, independent stacks that include only the dependencies required. This partitioning protects the system from damage by the applications. Applications are given least-privilege access so they only get access to the system resources they absolutely need—nothing more. With systems becoming highly interconnected, this approach increases the immunity of systems to cyberattack.

Lynx Software Technologies and Intel: A partnership driving innovation in avionics

LYNX MOSA.ic supports 11th Generation Intel® Core™ i7 processors. The Intel Core i7 processor extends the performance range supported by this Lynx solution so customers can use the same technology across different platforms to address a variety of problems and performance points. And Intel offers documents to help with DAL certification on specific Intel Core i7 processors.

11th Gen Intel Core i7 processors provide the powerful performance needed in avionics subsystems. With up to eight cores, 16 threads, and 8 MB to 12 MB of cache, these processors deliver the performance needed for heavy workloads. The hyperthreading feature allows improvement in the parallelization of computations, enabling each core to do two things simultaneously to improve the multitasking capabilities of the system.

Intel® Turbo Boost Max Technology 3.0 delivers up to 5.0 GHz frequencies. When combined with the 11th Gen Intel® Core™ microarchitecture, it delivers a performance boost over the previous generation. The processors also feature 20 PCIe 4.0 lanes direct to the CPU for blazing-fast storage. In addition, the integrated Intel® Iris® Xᵉ graphics processor provides reduced SWaP, a critical consideration for avionics subsystems.

The Intel Core i7 processor provides faster and better processing power with stable and responsive performance. Developers can tune, overclock, and more with the full suite of Intel® Adaptix™ technologies. Intel® Speed Optimizer offers simple, instant overclocking with one click, and Intel® Dynamic Tuning Technology taps machine learning for adaptive performance. AI and Deep Learning (DL) instruction sets are included as well, with Vector Neural Network Instructions (VNNI) and support for the Intel® Distribution of OpenVINO™ toolkit.

Other benefits of 11th Gen Intel Core processors include:

Multiple real-time workloads with minimal jitter: The combination of the 11th Gen Intel® Core™ processor and Intel® Iris® Xᵉ graphics performance is complemented with hardware-based acceleration to simultaneously handle multiple compute-heavy tasks. This orchestrated system maximizes hardware resources efficiently for near-real-time, multiworkload performance with minimal jitter.

Accelerated AI inferencing: 11th Gen Intel Core processors deliver accelerated AI inferencing in parallel with other core functions. AI and deep learning inferencing can run on up to 96 graphic execution units (EUs) on the CPU with VNNI, which condenses three Advanced Vector Extensions (AVX) instructions into one.

Built-in hardware-based security: Intel provides security at the platform boot level, security for data at rest on the platform, and security for data in flight. New security features such as Intel® Total Memory Encryption (Intel® TME) complement the capabilities of Intel® Boot Guard.

LYNX MOSA.ic also uses Intel VT-enabled multicore processors to unlock rapid development and integration and to simplify software stack complexity. Lynx and Intel are leading the way in the modernization of avionics software platform design conventions through landmark design wins in military and aircraft programs.

Conclusion

Today's avionics technologies need to work quickly, be adaptable, and be able to support multiple systems simultaneously in near-real-time. Due to these requirements, the industry has transitioned from using mainly single-core processors to using multicore processors. This change enhances processing, but can make it more complicated and costly to achieve the necessary certification required for avionics solutions.

Lynx Software Technologies' product LYNX MOSA.ic for Avionics helps solve these problems by building and integrating complex multicore systems using independent application modules. Its architecture enables developers to reduce development cycles when creating, certifying, and deploying robust platforms for manned and autonomous systems. A modular framework simplifies the use of avionics applications deployed on multicore processors, eases the certification process, and eliminates system configuration after start-up.

Lynx is partnered with Intel, and LYNX MOSA.ic supports 11th Gen Intel Core i7 processors. This partnership extends the performance range so customers can use the same technology across numerous platforms to address different problems.

About Lynx Software Technologies

Lynx Software Technologies provides certified avionics RTOS (Real-Time Operating Systems) solutions based on open standards, such as POSIX, ARINC, and FACE, that allow reusability of certified code and systems. Lynx's commercial-off-the-shelf POSIX hard-real-time partitioning operating system, LynxOS-178, is approved as an FAA Reusable Software Component (RSC). LynxOS-178 was developed and certified to FAA DO-178C DAL A safety standards. And the LynxOS 7.0 RTOS and LynxSecure separation technologies are designed to provide the highest levels of security without compromising performance.

lynx.com

Learn more

11th Generation Intel Core i7 processors

Compared to 8th Gen Intel® Core™ processors, 11th Gen Intel Core processors deliver higher levels of performance for computing, new core and graphics architectures, AI-based performance boosts, faster wireless and wired connectivity, and advanced tuning features.[1]

Get the details ›

LYNX MOSA.ic for Avionics

LYNX Software Technologies' LYNX MOSA.ic for Avionics solution enables multiple-core use on a microprocessor for time- and space-partitioned safety-critical computing. LYNX MOSA.ic has been verified for compliance with DO-178C/ED-12C Design Assurance Level A (DAL A) for avionics applications.

Learn more ›

intel + LYNX SOFTWARE TECHNOLOGIES

1. Not all features are available on all SKUs

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