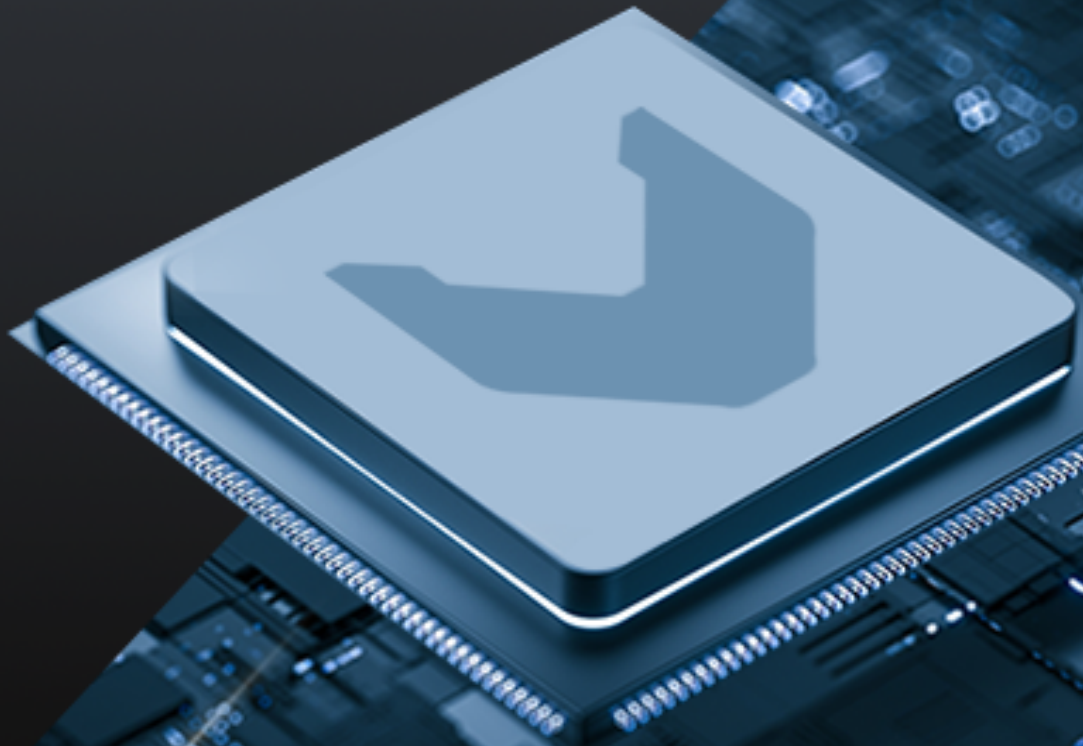




CoreSuite 2.0

Safety-Critical Graphics & Compute for
the Mission-Critical Edge



Integrating GPU accelerated embedded graphics and compute into advanced safety-critical edge processing devices can add project risk due to the high level of complexity and effort. De-risk your safety-critical system integration with Lynx CoreSuite 2.0, a graphics processor enablement platform currently being used in safety-critical visualization and autonomous environments worldwide.



CoreSuite 2.0 is a framework of hardware accelerated visualization and computational libraries, along with supporting tools, that have been designed from the ground up for deployment and certification in safety-critical edge computing environments. It can be used with a range of graphics processors and system-on-chip (SoC) devices with graphics cores that include:

- AMD E9171 discrete graphics processors
- Intel 11th Gen SoCs with Iris Xe graphics cores
- NXP i.MX8 SoC processors with VeriSilicon Vivante GPU Cores
- Arm Mali-G78AE GPU cores (silicon provided by Arm partners)

Lynx CoreSuite 2.0 supports leading OS and RTOS platforms, including DDC-I Deos, Green Hills Software Integrity, LynxOS-178, QNX OS, SYSGO PikeOS, Wind River VxWorks, Windows, Linux, etc.

CoreSuite 2.0 is available for the generic PowerPC, Arm or x86 instruction set architectures.

Why CoreSuite 2.0?

Certification-Ready for Aerospace, Automotive, and Industrial Applications

CoreSuite 2.0 is built on technology originally developed by Core Avionics & Industrial, which was acquired by Lynx. Developed over two decades from the ground up for safety-critical environments, Lynx products are flying in military and commercial aircraft worldwide and are certifiable to DO-178C Design Assurance Level A, one of the most stringent standards for safety-critical reliability in the world. CoreSuite 2.0 can be provided with the full suite of certification evidence required to meet the following standards:

- DO-178C, up to Design Assurance Level A
- JSF SEAL Level 1 (for the F-35 Joint Strike Fighter aircraft)
- ISO 26262, up to ASIL D

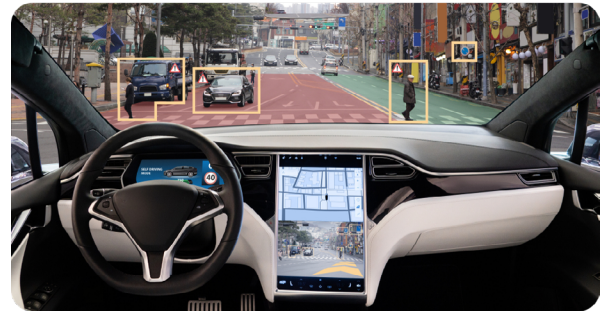
Graphics and GPU Compute

CoreSuite 2.0 has built-in support for both graphics and compute. It uses the Khronos conformant Vulkan SC API as a foundation layer that serves as an abstraction to the hardware acceleration device. CoreSuite 2.0 provides a framework that includes libraries and supporting tools that are the necessary building blocks for enabling state-of-the-art visualization HMI, video capture, compositing, advanced compute capabilities and AI inferencing accelerated by commercial grade and FuSa GPU devices.

Graphics

Applications can deliver high-performance visuals such as 3D synthetic vision with rich textures that enhance situational awareness in aircraft, vehicles, or other operator-controlled systems. One can also 2D graphically display critical information such as system performance and health data. CoreSuite 2.0 includes:

- Support for safety-critical applications using the native Vulkan SC API, which provides more direct access to the GPU hardware and facilitates low-overhead, highly customizable use cases. It also provides other important benefits such as a unified compute and graphics API as well as multi-thread/multi-CPU core support.
- Support for mixed integrity heterogeneous environments with non-critical applications running in parallel to safety-critical ones.
- Support for legacy applications based on OpenGL SC 1.0 and OpenGL SC 2.0.
- A powerful suite of 2D and 3D capabilities, as well as external video processing and compositing, in a certifiable safety-critical package.
- GPU health monitoring that provides feedback to the application to facilitate responsive error detection and mitigation.



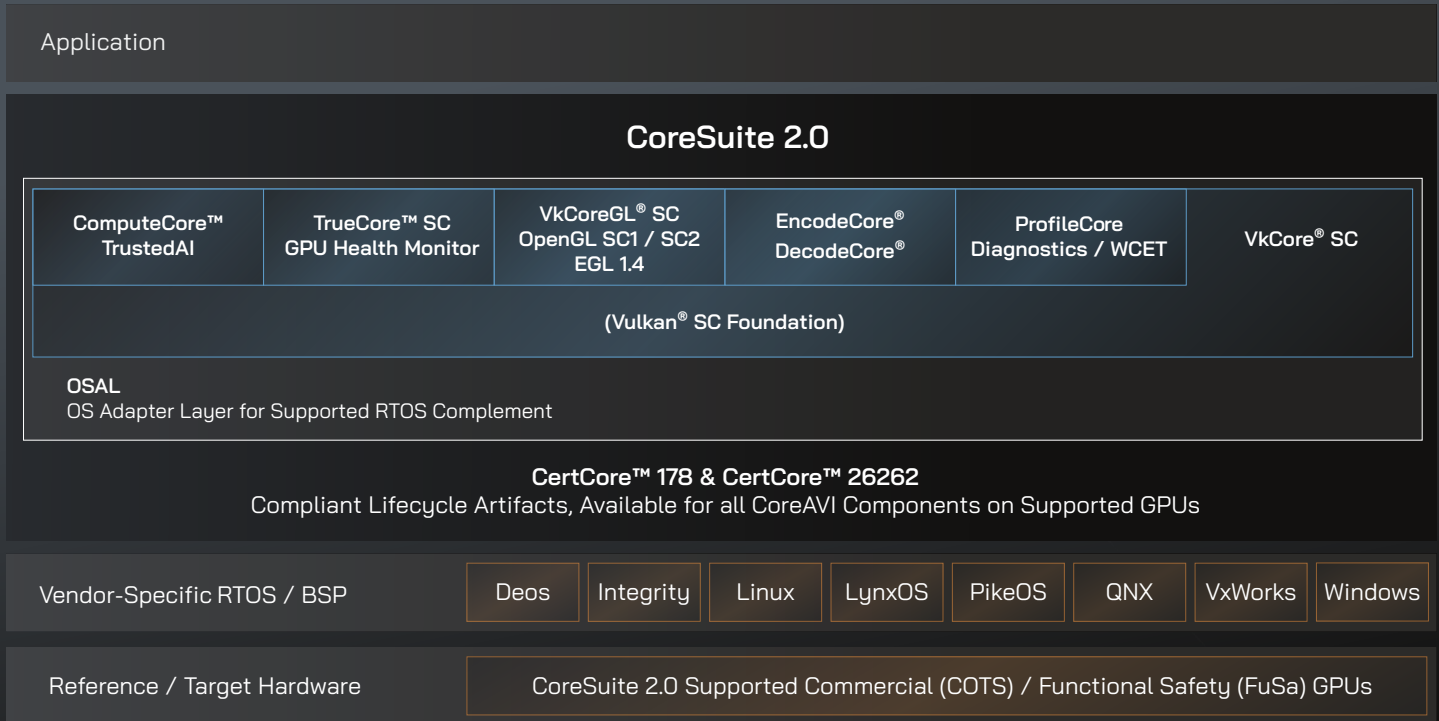
GPU Compute

Thanks to the power of GPU-based computing and the Vulkan SC API, resource constrained embedded computing devices can use the Lynx ComputeCore/TrustedAI libraries and supporting tools to carry out advanced computer vision, neural network inferencing, and artificial intelligence tasks directly within the edge device. This toolset is compatible with and designed to seamlessly integrate with TensorFlow, PyTorch, Caffe, ONNX and other popular neural network modeling tools and frameworks. CoreSuite 2.0 includes:

- The BLAS Library (Basic Linear Algebra Subprograms): Offers routines that provide standard building blocks for performing basic vector and matrix operations.
- The FFT Library (Fast Fourier-Transform): Supports 1D, 2D and nD FFT algorithms, which are heavily leveraged for data-intensive signal and image processing use cases
- The NN Library (Neural Network): Is based on the Khronos NNEF (Neural Network Exchange Format) specification and is designed to import trained neural networks and perform inferencing.

A rich complement of sample applications and supporting algorithms are included. These simplify the integration, adoption, and migration from non-safety critical instances of CUDA®, OpenVINO™, ROCm™, and OpenCL™ APIs, to Lynx's certifiable safety-critical libraries.

CoreSuite 2.0 Components



- VkCore® SC** – A conformant implementation of the Khronos Group Vulkan SC open standard API, with pre-integrated support for a target GPU. VkCore SC facilitates the deployment of a graphics processor in safety-critical (“SC”) embedded computing applications. It is the hardware abstraction foundation layer on top of which the other CoreSuite 2.0 libraries operate. The VkCore SC library can be used independently or in conjunction with other CoreSuite 2.0 components.
- VkCoreGL® SC1/SC2** – A conformant implementation of the Khronos Group OpenGL SC 1.0 and 2.0 APIs. VkCore SC1/SC2 supports legacy applications that require OpenGL. These libraries are built on the top of the Vulkan VkCore SC foundation layer. They provide a highly optimized implementation of OpenGL SC 1.0 and 2.0 that allows an application to leverage available advancements in graphics acceleration technologies.
- TrueCore™** – A GPU safety monitor that continuously verifies the integrity of GPU graphics generation and/or the GPU compute pipeline and reports processing failures to the application. Runs graphics and compute tests that over time provide coverage of the full Vulkan SC pipeline.
- ComputeCore™** – GPU Compute libraries that enable applications to leverage the graphics processor for computer vision, neural network inferencing, and artificial intelligence tasks. Includes software modules for Basic Linear Algebra Subprograms (BLAS), Fast Fourier Transformations (FFT), and Neural Network inferencing.
- ProfileCore** – A GPU performance profiling suite. ProfileCore enables optimal application execution and resource usage by facilitating WCET (Worst-Case Execution Time) assessment and validation.

- **EGL 1.4** – Handles graphics context management, surface/buffer binding, rendering synchronization, and enables high-performance, accelerated, mixed-mode 2D and 3D rendering using other Khronos APIs. EGL 1.4 includes the video capture and compositing extensions required for content sharing across independent applications.
- **CertCore™178/CertCore™ 26262** – Options include certification evidence packages for DO-178C up to DAL A, and ISO 26262 up to ASIL D.
- **EncodeCore®/DecodeCore®** – Enables video encoding and decoding using H.264 (MPEG-4/AVC), H.265 (HEVC), and other video codecs. Implements a low-latency design synchronized with the graphics and compute pipelines.
- **OSAL (Operating System Abstraction Layer)** – Enables the abstraction of CoreSuite 2.0 libraries from the details of the underlying operating system, facilitating modularity and OS portability without impacting the CoreSuite 2.0 product libraries.

Deployments

Airbus UpNext Program

Lynx ComputeCore libraries are used to automate boom refueling in the Airbus UpNext program.

“Bringing state-of-the-art GPU compute capabilities to our product portfolio will allow us to evolve and create new capabilities that put us on the forefront of military aviation technology.” - David Pérez Amenabar, Air Refueling Software Innovation Manager at Airbus Defence & Space



NASA X-59 Quesst Low-Boom Flight Aircraft

VkCore SC will be used by NASA to help develop and deploy NASA’s “windowless cockpit eXternal Vision System (XVS),” which replaces the pilot’s front window view with leading-edge sensor display technology. This includes utilizing Vulkan capabilities to enable advanced synthetic vision, object detection, and various sensor fusion capabilities.

“Working with CoreAVI gives us an opportunity to build the latest in safety-critical graphics and computing technologies into the X-59.” - Trey Arthur, Aerospace Engineer at NASA

F-35 JSF Lightning II

Lynx Software Technologies and Core Avionics & Industrial are providing key technologies to support the development of the next generation Panoramic Cockpit Display Electronic Unit (PCD-EU) for the F-35 Joint Strike Fighter. This development is a key element of the of the “Technology Refresh 3” (TR3) modernization program led by Lockheed Martin.



UH-60 Blackhawk

The US Army and Core Avionics & Industrial Inc. (“CoreAVI”) collaborated on the Crew Mission Station (CMS) technology demonstration program for UH-60 Blackhawk aircraft. The CMS is the first known implementation of the display management services as defined in Future Airborne Capability Environment (FACE) Technical Standard (TS) Edition 3.0.

Seize the Edge

Lynx Software provides the most comprehensive suite of GPU accelerated graphics and compute enablement solutions certifiable to safety-critical standards. Our products are built on modular architectures using open standards, which allows you to avoid vendor lock-in that can happen with proprietary solutions. And since we support a range of graphics processors and are constantly adding more, it provides supply chain freedom. In a world where risk and uncertainty are a constant, CoreSuite 2.0 provides a straight and clear path to the program and mission success of your graphics and compute solution.

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