

# PikeOS® 5

## Certified RTOS with Hypervisor Functionality

SYSGO is the European market leader in embedded real-time operating systems (RTOS) and has over 25 years of expertise in certifiable software, agile and responsive, with optional long-term support for all of our OS products. PikeOS is a real-time OS including a hypervisor-based separation microkernel designed for the highest levels of Safety & Security. The PikeOS technology has been certified on a wide range of projects by various certification standards including DO-178B/C, IEC 61508, EN 50128, and ISO 26262. It combines a modular, flexible and future-proof architecture with a large variety of certification standards. With this fully European solution customers benefit in terms of reduction of cost, risk and full system certification lead times.

### PIKEOS 5 FEATURES

- RTOS and Type 1 hypervisor with separation microkernel-based hard real-time operating system
- Robust time & resource partitioning
- Shared memory, graphics and audio (BSP dependant)
- Support of OpenGL, OpenCL
- MILS-compliant
- Safety certification according to DO-178B/C, EN 50218, IEC 61508, ISO 26262, IEC 62304
- Security certification according to Common Criteria and Airbus SAR
- Multi-core processor support
- Hardware virtualization, graphic and audio sharing for certain BSP
- Certifiable IP Stack (CIP) and File System (CFS)
- Eclipse based IDE CODEO
- Large software & hardware ecosystem

#### Wide Range of GuestOSs

- Linux (ELinOS), Android™, legacy RTOS, RTEMS, ...
- POSIX, ARINC 653, Java, ADA, ...
- AUTOSAR classic & adaptive, ...

#### Available for

PowerPC, x86, ARM v7 v8, SPARC/LEON v8, RISC-V

### WHAT'S NEW IN PIKEOS 5

#### Security: Common Criteria Approach

- Only required functionalities implemented in kernel mode, while everything else runs in user context
- Both PSSW and kernel are certified

#### Safety: Certifiable to the strictest Standards (pre-certified)

- Such as DO 178C, IEC 61508, EN 50128 and ISO 26262
- PikeOS enables application development following "Safety & Security by Design"

#### Multi-Core Certification

- According to DO-178 C DAL A, EN 50128 SIL 4 and CAST-32A

#### Certifiable (Certification Kits)

- According to highest Safety & Security standards with modular certification kits for Avionics, Industrial Automation, Railway & Transportation, Automotive and Medical
- Including Safety/Security Bulletin with known issues and open problem reports

#### Improved Multi-Core Performance and Power Efficiency

- Quick System calls and
- Reduced Driver access time
- Supporting fine-granular locking for minimum interference and worst case execution time
- Support lock-free kernel drivers
- Support pre-emptive kernel driver

#### More User-centric Approach

- PikeOS qualified toolchain with configuration on single-/multi-core
- Shared memory information monitor
- Graphical view enhancements
  - With CPU load information and VMIT improvements
- Improved user documentation incl. migration guide from PikeOS 4.x to PikeOS 5.x

#### Enhanced Ecosystem via

- New BSPs from NXP, STM or TI
- Added Security solutions
- 3rd party on chip debugger solutions

## PIKEOS 5 CUSTOMER BENEFITS

PikeOS is based on a separation microkernel with the performance of a traditional real-time operating system including hypervisor. The hypervisor provides partitions that can host different applications – from a simple yet highly critical control task to a full-fledged operating system such as Linux or Android™. As a consequence, embedded and IT applications can coexist on the same platform. Complex systems, consisting of multiple devices in the past, can now be consolidated on a single hardware platform. This saves weight, energy consumption and space which additionally leads to a significant reduction of the bill of material:

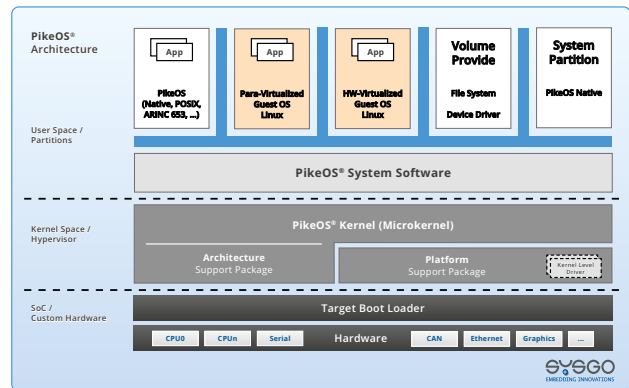
- In Avionics customers can benefit from best in class ARINC 653, Part 1 + Part 2 and ARINC 664
- Quicker and more deterministic multi-core handling via fine-granular locking on kernel-specific threads
- Less export compliance issues: PikeOS is ITAR free
- More flexibility via a broad support of architectures and GuestOS types
- Wide support of Linux open source, via SYSGO's own Linux distribution (ELinOS) or vendor specific or Yocto kernels
- PikeOS offers Safety & Security bulletins/patches. Step by step we enlarge Security add-on technologies, such as TSL, SSL or encryption libraries to help making systems more secure
- PikeOS is currently the only separation kernel certified according to Common Criteria EAL3+

## UNIQUE COMBINATION OF FEATURES

**Virtualization:** Performance optimized para-virtualization on standard CPUs as well as hardware-assisted virtualization on CPUs such as ARM-VE, Intel VT or NXP QoriQ ensure high performance with minimal changes to guest operating systems. Virtualized GuestOSs can either access I/O resources through their native drivers or use a common infrastructure to access device drivers provided by PikeOS. If supported by the CPU, the IOMMU manager protects the platform from malicious DMA transfers initiated by untrusted GuestOSs.

**Safety:** Strict time and resource partitioning of the PikeOS separation microkernel prevents application failures from propagating to any other place in the system. PikeOS is completely developed according to Safety standards such as DO-178B/C, IEC 61508, EN 50128, ISO 26262 or IEC 62304. The related certificates, the certification artefacts and process documentation can be made available as a Certification Kit to SYSGO customers.

**Security:** In addition to the PikeOS multilayer Security architecture which is based on data and application separation and controlled information flow, PikeOS can incorporate communication encryption and binary verification. The PikeOS separation microkernel architecture is fully compliant with the MILS architecture.



**Figure 1:** The PikeOS hypervisor provides multiple, safely isolated partitions, which may contain different applications with their respective operating systems.

**Advanced Scheduling and Timing Support:** PikeOS incorporates a new scheduler combining time and priority driven scheduling. Hard real-time requirements for critical applications are met while still providing best effort scheduling for non-critical tasks. It is possible to switch between multiple pre-configured time partition scheduling schemes to optimize CPU usage based on the platform operating mode.

**Health Monitoring:** PikeOS provides built-in health monitoring functions, which implement all features described in the ARINC 653 standard. Application errors as well as hardware failures are intercepted by the OS and handled according to system and partitions specific configuration. This ensures a predictable system behaviour.

## CODEO DEVELOPMENT & CONFIGURATION TOOL

Developing embedded applications for a partitioned system requires a state of the art cross development tool chain, well designed and easy to use configuration tools, remote debugging with OS awareness (thread states, virtual address mappings, etc.), target monitoring, remote application deployment, and timing analyses tools. With CODEO, the Eclipse-based IDE, SYSGO offers a complete environment for embedded systems covering the whole development cycle from early simulation/emulation tools to software update mechanisms for deployed systems. We also support 3rd party tools promoted via our large ecosystem.

## CUSTOMER SUPPORT & SERVICES

We compliment the customer's use of products by providing in time and qualified support, including on-site consultation as needed. SYSGO has best customer support with support tickets handled mostly direct by engineering. We offer everything from a single day training session up to full product lifecycle support. With actual project requirements as a showcase, developers learn the handling of new tools - if possible with the intended target hardware.

Founded in 1991, SYSGO became a trusted advisor for Embedded Operating Systems and is the European leader in hypervisor-based OS technology offering worldwide product life cycle support. We are well positioned to meet customer needs in all industries and offer tailor-made solutions with highest expectations in Safety & Security. More information at [www.sysgo.com/pikeos](http://www.sysgo.com/pikeos)