

# PikeOS

Today's embedded developers can choose from many well-known RTOS vendors, but ordinary RTOS products have become indistinguishable commodities that no longer focus on innovative technologies. Innovation is critical in providing you with a competitive edge. PikeOS offers all of the capabilities you have come to expect from a leading RTOS, while providing next-generation innovations enabling all of your embedded application goals today and in the future. In addition to all the capabilities you expect such as small footprint, deterministic behavior, and broad middleware, PikeOS goes much further.

## PikeOS at a glance

- Based on separation microkernel
- Strict time and resource partitioning
- Combines paravirtualization and hard real-time
- MILS compliant
- End to end development solution
- Eclipse-based development environment
- Certifiable to safety-critical standards (DO-178B, IEC 61508, and EN 50128)
- Personalities examples
  - Linux – Full User Mode
  - POSIX, ARINC-653, Native
  - $\mu$ ITRON, OSEK, legacy RTOS
- Available for PowerPC, x86, ARM, MIPS and others

## Not just another RTOS

PikeOS offers a platform of the future because it is a powerful and efficient paravirtualization real-time operating system based on a separation microkernel. The PikeOS unique virtualization concept satisfies the new generation of safety-critical requirements (exemplified by Integrated Modular Avionics), security requirements (such as MILS) and supports the more general functionality of software virtualization. PikeOS allows multiple **"Personalities"** (Guest OS and Runtime Environments) to run concurrently.

## Virtualization, Safety, Security

The native design of the unique PikeOS separation microkernel specifically addresses the requirements of safe and secure systems. All drivers, stacks, hard real-time applications and hosted OSs or RTEs reside in separate address spaces with pre-defined I/O access controlled by PikeOS. The paravirtualization capability of PikeOS enables the combination of applications with different safety and security certification levels on one platform.

## End to end development solution

Developing embedded applications that use a partitioned system requires specialized support from the development environment. Embedded developers need guided configuration, remote debugging (often down to the hardware instruction level), target monitoring, remote application deployment, and timing analyses in addition to standard application development features such as compilers and assemblers. With the Eclipse-based CODEO integrated development environment, SYSGO offers a complete environment for embedded development.

*"We had precise criteria for the selection of our supplier: the high quality and the robustness of the technology of course, but also the experience in DO-178B certification, the knowledge of the type of application we develop, and a good track record of performance and commitment in supporting customers. The selection of SYSGO was therefore consistent. Besides, SYSGO was able to demonstrate their competency in assisting us in migrating from a previous solution."*

Mr. Bäcker, Programm Manager at Rheinmetall Defence Electronics

**Unique combination of features**

**Virtualization**

PikeOS incorporates the latest paravirtualization technology, making PikeOS a unique combination of real-time operating system and virtualization environment. PikeOS directly solves issues like hardware convergence, legacy software migration, IP protection and how to use Linux in secure and safety-critical environments.

**Safety**

The strict time and resource partitioning of the PikeOS microkernel prevents application failures from propagating to any other place in the system. PikeOS is completely developed according to the development process requirements of the DO-178B and IEC 61508 specifications. EN 50128 compliant certification artifacts can be easily derived from DO-178B certification artifacts.

**Security**

In addition to the PikeOS multi-layer security architecture and complete I/O access control, PikeOS can incorporate communication encryption and binary verification. The PikeOS separation microkernel architecture is fully compliant with the MILS separation kernel architecture. A formal verification of the kernel to the highest level of CC's EAL is in progress.

**Advanced Scheduling and Timing Support**

PikeOS incorporates a new scheduler combining time and priority driven scheduling. Scheduling schemes can be changed on the fly. A ticker-less timing support is provided as an option.

**Health Monitoring**

PikeOS provides a built-in Health Monitoring Features which implements all features described in the ARINC-653 standard. Failures such as address violations, timing violations, illegal instruction are intercepted by the OS and handled as specified in the system configuration. This adds another layer of determinism without additional application code.

**Choose your Personality**

**Available OSs**

Complete operating systems normally don't require a host OS to run on, nor can they tolerate the presence of another operating system. On PikeOS, however, a host OS can

run in user-space, in non-privileged mode.  
 · Linux (Kernel 2.6) · µITRON  
 · OSEK · Legacy RTOS

**Available Runtime Environments**

Execution runtime environments need an OS host. With PikeOS, they may have their own schedulers, communication and synchronization primitives. Therefore, runtime environments run without losing performance.  
 · POSIX (PSE51, PSE52) · Java (Aicas' Jamaica and Aonix's PERC) · Ada (Aonix's Object Ada and AdaCore's GNATPro) · IData (Quantum 3D) · others

**Available APIs**

Application programming interfaces (APIs) provide an interface that is used to access underlying functionality.  
 · ARINC-653 · PikeOS Kernel API · PikeOS SSW API · others

**Supported Platforms**

· PowerPC · x86 · MIPS · ARM · others

**End to End Development Solution**

**Configure**

The PikeOS system can be configured using PIK, the graphical configuration editor within CODEO. PIK includes a powerful integrity checker that makes it almost impossible to create an invalid configuration.

**Implement**

CODEO offers a comprehensive C/C++ and Java development environment including project management, code browser, configuration management, and many Eclipse plug-ins.

**Assemble**

CODEO for PikeOS incorporates a graphical feature assembler to add and remove partitions, applications and services such as drivers, stacks, and I/O servers.

**Deploy**

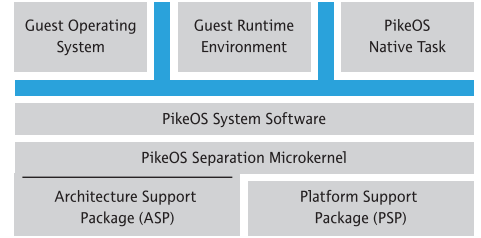
Applications developed with CODEO can be deployed directly on a running PikeOS target.

**Debug**

Any application running on PikeOS can be debugged independently of all other concurrent applications. Several applications can be debugged at the same time.

**Trace**

Application timing behavior can be analyzed,



**Figure 1: PikeOS enables a concurrent and secure execution of different OSs, RTEs and native real-time tasks on a single CPU.**

using the tracing capability incorporated in each partition. Trace points can be filtered, used as triggers, and extended using the graphical trace configuration and visualization editor. Concurrent tracing possible on multiple personalities.

**Monitor**

CODEO also includes monitoring capabilities, enabling users to view kernel objects, threads, task and partition information. If configured, the status of each partition can be changed remotely.

**Emulate**

PikeOS comes with a CPU emulator, which allows to start application development even before the real hardware is available. Due to the modular approach of PikeOS, simulation of I/O channels can be completely transparent to the application. For each of the supported CPU families, a corresponding CPU emulator is available.

**Maintain**

Updates and upgrades can be deployed remotely on PikeOS targets without rebooting the system or physically accessing the hardware.

**Technical Features**

- Up to 63 resource partitions
- Up to 63 time partitions
- 253 priorities · Less than 30 ms boot time
- 150kb RAM · 150kb ROM

**System requirements**

- Linux distribution based on kernel 2.4.20 and later or 2.6 and glibc 2.2.5 and later
- Windows XP SP2 or 2000 SP4 with administrator access for installation
- 1GB free disk space
- 512 MB RAM
- Sun java runtime environment 1.5 or 1.6
- Eclipse ganymede recommended