Automotive Solutions

PikeOS®: Certified RTOS & Hypervisor in Series Production
Automated Driving starts with Safety

Car manufacturers face the challenges of integrating a flood of electronic components, reducing development and production costs, and reacting quickly to environmental and public requirements, while still ensuring the safety and security of the entire system. A certification for ISO 26262 raises demands for intelligent and extensible system architectures.

The increasing number of software applications and assistance systems means that automotive electronics require similar safety architectures to those used in aviation. PikeOS is a hypervisor that can host various software packages in individual partitions and control communication and data flow between the applications and the hardware.

Manage automotive Complexity with Safe and Secure Virtualisation

PikeOS provides a modular software architecture integrating multiple applications on a single hardware platform. PikeOS provides both, a full Real-Time Operating System (hard RTOS) and a virtualization and partitioning system designed to support the special requirements of automotive applications. The core of our PikeOS platform is a small, certifiable separation-kernel, providing a virtualization infrastructure with the ability to house diverse resource and function needs into safe individual partitions.

Because automotive applications range from non-critical infotainment systems to highly critical control functions in the car (ADAS), PikeOS accordingly provides a broad variety of GuestOS: from POSIX to Linux and Android to AUTOSAR or GENIVI. Thanks to strict separation technology, applications of different criticality levels, different security levels, real-time or non-real-time (using time partitioning) can run concurrently in a mixed critical environment on a single standard hardware platform.

PikeOS: Hypervisor and RTOS

PikeOS is based on a microkernel with the performance of a traditional real-time operating system. This includes a hypervisor that 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. Customers can start with a platform development using RTOS and later add hypervisor functionality for their certification needs by using the same code base.

As a consequence, safe and un-safe 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 cabling and reduces the Bill of Material. The PikeOS Hypervisor runs on x86 as well as ARM, PowerPC or MIPS and can easily be adapted to other CPU architectures.

Safety and Security incl. Certification

The PikeOS Hypervisor itself is certified according to the ASIL-B standard, thus providing the foundation for mission-critical systems with both, functional safety and IT Security requirements. Since 2017 SYSGO has a joint venture with Vector Informatik and jointly develops an adaptive AUTOSAR solution certifiable to ASIL-D.
The safeguard mechanisms are essentially based on two principles: strict separation of applications by time and resource partitioning and control of the communication channels. The individual applications that comprise the overall system can represent different levels of criticality. For secure systems PikeOS can provide secure boot mechanisms and can build a root of trust for the applications. Due to the protection mechanisms provided by PikeOS, the certification according to industry specific safety and/or security standards can be made separate for each application - a key feature to keep cost under control.

Since beginning 2019 PikeOS is certified according to common criterial EAL 3+ and used as reference separation kernel by some authorities.

**PikeOS in Automotive Electronics**

The PikeOS hypervisor was specifically designed for the development of software in embedded systems with certification requirements. The PikeOS architecture forms the basis for certification and official approval of critical systems according to standards for functional safety and IT security.

*Fast Boot:* By using PikeOS plus the hypervisor we can demonstrate how to boot a system in ~30 msec and bring up the Linux applications after that.

PikeOS has been used for many years as a basic software in aircraft electronics to reduce the number of ECU (electronic control units) and thus the complexity of the overall system. The increasing number of software applications and assistance systems in cars also require analogical system architectures, similar to an airplane. With PikeOS, system software vendor SYSGO is supplying a hypervisor that creates separate private partitions for different software applications and controls communication and data flow between the applications and the hardware.

This enables the integration of applications of different criticality on one hardware platform. Any necessary certification according to standards for functional safety (eg ISO 26262) or IT security (e.g. Common Criteria) can be created separately for each application. Features like Secure Boot and Secure Update enhance security of the entire system even when updates for individual components of the software landscape have to be launched.

**ISO 26262 and SEooC Concept**

The ISO 26262 is an international standard that defines the safety lifecycle of electrical, electronic and software-based components in passenger cars. Based on the IEC 61508 the ISO 26262 reduces the risk of dangerous operational situations and defines security measures that reduce the risk of downtime. To meet the requirements of ISO 26262, PikeOS is optionally offered with an Automotive Certification Kit. This Certification Kit includes an "ISO 26262 Part 6 compliant PikeOS hypervisor" and a set of development and testing documentation.

Furthermore, additional safety information can be provided, to achieve ISO 26262-compliant systems. Important components of this Certification Kits are a Safety Manual with guidelines for the use of PikeOS in safety critical design of systems, as well as a safety case with characteristic functional safety requirements in accordance with the necessary Automotive Safety Integrity Levels (ASIL).

**PikeOS for Automotive**

Automotive applications today go beyond the actual vehicle. In particular, reliable communications are needed to ensure smooth mobility.

The use of PikeOS resolves a wide array of challenges at the same time:

- PikeOS enables integration of a large number of electronic devices onto a single hardware platform.
- Strict separation of applications into secure partitions allow authorized access only and avoids mutual interference.
- Applications of various levels of criticality and security are safely separated from one another and certified separately.
- PikeOS can host AUTOSAR, GENIVI, Android, POSIX or other guest operating systems.
- High scalability and hardware in-dependence secures return on investment.
- And PikeOS allows legacy code re-use.
REFERENCE #21: Magna, SYSGO and PikeOS

PikeOS in Series Production: Assisted Parking

Several OEMs are using 360-degree view systems (for assisted parking) of the latest generation on the road, based on SYSGO’s PikeOS Hypervisor.

The safe and secure hypervisor technology is used to combine the integrated camera system and vehicle information system on the same hardware. The new platform is the basis for further joint customer projects and can be used for the next generation of autonomous vehicles.

Full control of the tools is a key factor in efficient software development. We compliment your use of our products by providing qualified support, including on-site consultation as needed.

REFERENCE #39: MAN, SYSGO and PikeOS

Hypervisor Technology for Cars in Mass Production:

MAN Telematics Unit

PikeOS is used in OpenSynergy’s COQOS and applied in a telematic system of MAN by adding an Autosar and Linux partition. It handles the interfacing to the vehicle buses and hosts software components developed by the OEM. The communication between the server backend and the telematics and fleet management functions is implemented on a virtualised Linux partition, simplifying the development of this complex software.

More information can be found on our website:

www.sysgo.com/automotive

Vector Informatik GmbH and SYSGO join forces for AUTOSAR Adaptive

Vector Informatik GmbH, located in Stuttgart (Germany) and SYSGO AG have founded a joint venture for the development of embedded software. The aim of the cooperation is to create an integrated software platform consisting of the AUTOSAR adaptive basic software MICROSAR and the real-time operating system PikeOS.

www.sysgo.com/vector

SYSGO is participating in the Automotive Grade Linux Project

SYSGO is joining forces with the Linux Foundation to actively participate in their Automotive Grade Linux (AGL) project. In this open-source project, renowned automotive manufacturers and suppliers will work alongside hardware and software manufacturers to develop and implement a completely open software stack for the connected car.

www.sysgo.com/agl-project