Railway Solutions
PikeOS®: EN 50128 certified RTOS & Hypervisor
As an independent entity from the THALES group, SYSGO is the European #1 in safe & secure operating software for the “Internet of Things”. SYSGO has 25 years of expertise in embedded devices and is one of the pioneers in embedded Linux. The RTOS PikeOS is well known in the market as a stable and reliable OS that includes virtualization technology.

Customer survey results show that SYSGO has market leading experience and knowledge in customer support for devices that need to run more than 20 years. The main vertical markets are automotive, aerospace & defense, railway and industrial, where SYSGO is not only active with its products, but also with professional services mainly in customer systems that are following various certification standards.

With SYSGO solutions customers reduce costs, time to market and have a reliable, long term supported operating system as basis for innovative products.

**Highest Requirements meet Time-to-Market Demands**

The globalization of the economy requires fast and efficient transportation of goods and people from A to B without compromising on system Safety.

Using Communication Based Train Control Systems (CBTC) this can be achieved by making a more efficient use of the available infrastructure. The European Train Control System (ETCS) was designed in order to harmonize the different/incompatible train control systems, used within Europe.

This innovation for the European rail infrastructure ideally uses the concept of modularity, which gives rail operators the flexibility to combine the required software/hardware infrastructure from several vendors.

Usage of pre-certified COTS software and hardware components will speed up time-to-market and lower development and certification costs. Furthermore, a holistic architecture shall respect Safety and Security required for future rail infrastructure.

All of the above-mentioned aspects require a robust real-time operating system (RTOS) platform to allow applications to run in a safe and secure manner, meeting standards like EN 50128 (Safety) and IEC 62443 (Industrial Cyber Security). With PikeOS, developers have access to a hard real-time hypervisor-based on a separation kernel, which is certified to the highest SIL-level of the EN 50128 standard.

**The Railway Industry in the Future... an Outlook**

Future train control systems will take advantage of the available infrastructure, but at the same time it is desirable to reduce the number of devices required for the train control (on-board, on-rail and wayside) in order to save costs.

New regulations are reducing the difficulties of mixing vendor proprietary systems, in order to use flexible Commercial-Off-The-Shelf (COTS) open standard solutions. Today it is possible to use compatible software and hardware allowing the Railway operator to mix/exchange components from different vendors at any time.

The Railway Safety standards EN 50126, EN 50128 and EN 50129 mandate a complex development process to achieve Safety. Statistics show, that the overall number of incidents has already decreased in the last two decades. In order to achieve a further rise of Safety, the Railway industry will face huge costs. To lower the development and certification costs, Railway equipment manufacturers focus on using pre-certified COTS software and hardware components. This will speed up the development cycle and mitigate the risk for Safety devices, lower overall certification costs and lead to mitigation of risk.

Current processor architectures combine a huge set of functionality into one chip (System on Chip, SOC) or even include multiple (heterogeneous) processors on one silicon die (Multi Processor SOC, MPSOC). This complexity requires a new approach for the Safety evaluation because a component-based evaluation of the hardware is more or less impossible.
Multi-core systems even face the challenge, that their real-time behaviour is not fully predictable due to interference caused by shared CPU resources.

Railway infrastructures are heavily relying in networking technology. As a replacement for Multifunction Vehicle Bus (MVB) and Wire Train Bus (WTB) (Industrial) Ethernet solutions have found their way into the train and even way-side appliances. As networking infrastructure is commonly subject to hacker attacks (e.g. STUXNET) security for safe operation is a high demand for networked railway infrastructure.

The Answer: PikeOS®
Proven Platform for a Safe & Secure Operation

PikeOS is a modern RTOS-based on hypervisor technology. Its safe and secure virtualization (SSV) features allow multiple operating system APIs, called GuestOS, to run concurrently on one machine.

For this CBTC railway project, PikeOS Native and POSIX Guest OS are considered. The PikeOS microkernel architecture allows to be used in cost sensitive, resource constrained devices as well as large, complex systems. Typically, PikeOS can be used for onboard and ground parts of the same distributed system, as it is the case with this CBTC railway project.

PikeOS® at a Glance

- Hard real-time hypervisor (based on a separation kernel), pre-certified to the highest level of the EN 50128 standard.
- A unique approach to control the interference channels of shared resources on a multi-core System-on-a-Chip (SOC).
- By using a pre-certified PikeOS and a pre-certified BSP (Board Support Package), your development team can focus on developing and certifying the safety application.
- Available on several processor architectures including x86, ARM, PowerPC and gives the development team the freedom to choose the most appropriate (COTS) hardware.

PikeOS has been certified by TÜV Süd according to the Safety standards IEC-61508 SIL 3 and EN 50128 SIL 3/4. Since 2019 the PikeOS hypervisor is also certified according to Common Criteria EAL3+.
Read more ➔ www.sysgo.com/common-criteria

"We are very impressed by SYSGO's innovative products, in particular their EN 50128 certified RTOS PikeOS and its EN 50128 Certification Kit, which provides a safe & secure embedded virtualization solution - perfectly suited to the new challenges of the railway industry."

Erich Ruprecht, CEO
RDCS Informationstechnologie GmbH

Railway Use Cases

Brake & Traction Control System
Highest assurance meets time-to-market demand
• One SW-platform for all applications
• Consolidation of functionalities
• Safe use of Linux

Train Control System
Concurrently enabling flexibility, scalability and obsolescence
• Pre-certified system, yet extendable or updatable
• Concurrent use of Soft-PLC and POSIX
• Consolidated functionalities

Train Screenboard/Driver Display
Managing the complexity ahead
• Graphical UI and real-time
• Allow mixed-criticality
• Safe GPU sharing

Train & Wayside Communication
Pave the way to 5G and mixed-critical communication
• Certified security for CBTC
• Allow secure predictive maintenance
• Increase serviceability through secure OTA

➔ www.sysgo.com/railway
SAFe-VX
Turnkey-Ready Development Platform

SAFe-VX Platform for partitioning-critical and non-critical application code in independent time and memory spaces.

SYSGO and Kontron present SAFe-VX, a turnkey-ready developing suite, providing fully representative hardware and a complete toolchain for software development, which is integrated into the Eclipse-based IDE CODEO.

www.sysgo.com/safe-vx

HASELNUSS
Security for Railway

For the next generation railway signaling infrastructure, there is a trend to use COTS hardware as the computing elements and open network for the communication.

The main role of SYSGO in the HASELNUSS project is to provide the separation kernel, which will be part of the MILS core for integrating the safety critical application together with security enhancing applications on one hardware platform. SYSGO will provide support for the secure boot, measured boot, and secure update with functionality.

www.sysgo.com/haselnuss

Samsung, SYSGO and PikeOS®

Communication-Based Train Control (CBTC)

SYSGO’s PikeOS has been chosen for the CBTC (Communications Based Train Control) railway system by a South Korean consortium led by SAMSUNG SDS. The complete system complies with safety standard EN 50128 SIL 4 and PikeOS is the certified RTOS (Real-Time Operating System) platform for both ground and on-board components.

CBTC is a wireless-based train control system that accurately detects the location of a train by exchanging information, including exact position, speed, travel direction and braking distance, in real time via continuous two-way communication between ground and train (board).

In the modern CBTC systems this information enables the way-side equipment to define the points on the line that must never be passed by the other trains on the same track. These points are communicated to make the trains automatically and continuously adjust their speed while maintaining the safety and comfort requirements.

More information can be found on our website:

⇒ www.sysgo.com/railway

Latest news, articles and whitepapers:

⇒ www.sysgo.com/newsletter