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 railway, aerospace & defense, automotive and Industry 4.0, 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.

**SYSGO and PikeOS®**

Whereever Safety & Security matters

PikeOS is a European market leading safety critical hard real-time operating system (RTOS), certifiable for highly critical safety and security applications. PikeOS has proven its maturity in many projects, which have been certified for various operational platforms in railway, aerospace and defense, automotive and Industry 4.0.

PikeOS is a European product and is not subject to any US export restriction or ITAR restrictions.

SYSGO is part of the Thales group of companies working as an independent entity within Thales, but with excellent financial backing for very large projects.

PikeOS is purpose built for certification to the highest level of safety and security standards. Therefore, PikeOS development follows a strict quality process fulfilling the requirements of DO-178B/C, IEC 61508, EN 50128 and ISO 26262.

The software development process meets SPICE Level 3 and the overall company process successfully passed the ISO 9001:2015 certification every year.

PikeOS hypervisor separation micro-kernel technology offers a proven and certifiable concept using robust partitioning, which is used to isolate safety critical applications from non-safety critical application.

This ability to allow Multiple Independent Levels of Safety/Security (MILS) is used to...

- isolate critical from non-critical applications
- isolate GPL code from our customer's intellectual property
- secure data by keeping data at rest
- manage hardware obsolescence

The PikeOS safety and security concept is based on the separation of time and resources, as well as a hypervisor-based separation microkernel to ensure strict partition management, resulting in a robust and secure platform for multiple levels of partitions.

The PikeOS implementation is protected by various SYSGO patents. PikeOS is industry proven on various railway safety certificates up to a SIL 4 certificate for EN 50128 using multi-core processors.

SYSGO offers its customers proven certification expertise from 20 years of certification projects.

SYSGO offers PikeOS as a COTS product with additional certification services. Customers will receive a full set of product services to realize and finish certification projects in time and in budget.

Accelerate the development of your railway safety system by using project proven safety and security concepts!
Railway Industry

Challenges

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 built in order to harmonize the different/ incompatible train control systems, used within Europe.

This innovation for the European rail infrastructure shall ideally use the concept of modularity, which gives rail operators the flexibility to combine the required software/hardware infrastructure from several vendors. Usage of pre-certified/ validated COTS software and hardware components will speed up time to market and lower development and certification costs. Furthermore a holistic architecture shall consider safety and security required for future rail infrastructure.

PikeOS® for Railway Industry

Future train control systems will make more use of the available infrastructure, but at the same time reduce the number of equipments required for the train control (on-board, on-rail and wayside). The new regulations are reducing the difficulties of allowing many vendor proprietary systems, in order to use flexible Commercial Off the Shelf (COTS) open standard solutions. In an ideal world, software and hardware components would be compatible, allowing the railway operator to mix components from different vendors.

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 decreased in the last two decades. However, higher safety is costing the railway industry much more. In order 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 for safety devices and lower the overall certification costs.

Actual 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 behavior is not predictable due to interference caused by shared CPU resources.

Railway infrastructures are heavily using 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 (see STUXNET) security for safe operation is a high demand for networked railway infrastructure.

The answer: PikeOS®

- A hard real-time hypervisor (based on a separation kernel), which is 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 SOC. PikeOS has been certified to SIL 4 on an Intel i7 multi-core processor.
- By using a pre-certified PikeOS and a pre-certified BSP, your development team can focus on developing and certifying the safety application.
- PikeOS is available on several processor architectures including Intel, ARM, NXP and gives the development team the freedom to choose the most appropriate (COTS) hardware for the project.
- Already evaluated for the certification up to EAL 6 of the Common Criteria (IEC 15408) security standard.
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.

PikeOS is a modern RTOS-based on hypervisor technology. Its safe and secure virtualization (SSV) features allow multiple operating system APIs, called Guest OS, to run concurrently on one machine, like e.g. an avionics ARINC-653 application together with Linux or Android. 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 board and ground parts of the same distributed system, as it is the case with this CBTC railway project.

PikeOS is certified to avionics standard DO-178B, is MILS compliant, and is currently involved in various security standard CC's EAL certification projects. PikeOS has been certified by TÜV Süd according to safety standards IEC-61508 SIL 3 and EN 50128 SIL 3/4.

More information can be found on our website:

www.sysgo.com/railway