



Embedded Solutions to drive the Digital Transformation



SYSGO at a Glance

SYSGO is an independent entity from the THALES group and Europe's No 1 in safe & secure operating systems. Since 1991, SYSGO has expertise in embedded devices and is one of the pioneers in embedded Linux. The main markets are Aerospace & Defense, Railway, Automotive, and Industrial Automation, where we are active with professional services mainly in customer systems that are following various certification standards.

Our RTOS & Hypervisor PikeOS is well-known in the market as a reliable and certifiable operating system including virtualization and multi-core support.

Our solutions significantly reduce cost, space, weight, time-to-market for our customers. We guarantee a reliable, long-term supported operating system as basis for their innovative products.

SYSGO offers long-term support for devices that need to run more than 20 years. As an European company, our products have no export restrictions and are ITAR free.

→ www.sysgo.com/about-us

The Industrial World: Past vs. Today

Industrial automation covers a whole range of technologies and manufacturing methods. Some of those change rapidly, others keep their current state. This can even be seen in small factories: Old, sturdy machines are standing beneath leading edge new laser cutters. This mixture is not really a problem, since the older machinery is typically reliable and replacing it with a modern version would cost the owner a fortune.

The software world is ticking in a way faster cycle and does not really match to existing infrastructures. In the past, the industry solved that problem by means of PLCs (programmable controller). It allows to keep a software installation that matches to the machine. In fact, the operating system and the middleware stays at the same version, while the user just programs the machine in a high level interpreter language, often with a graphical interface. This abstraction is very useful and keeps many business running for a very long time.

However, there are few issues related with that approach:

- Safety norms are changing over the years. This can make the old software framework obsolete.
- Older software and operating systems can be bound to a certain hardware configuration often. Computer hardware is outdated quickly.

We have to concentrate on the competitive edge in a tight market place. Users of industrial automation systems demand ever increasing capabilities coupled with tight cost control to enhance their production and competitive margins.

New Requirements in the Industry 4.0

Industrial equipment includes increasingly complex software systems with heterogeneous requirements: Measuring and control devices, graphical user interfaces, and communication stacks. Managing and integrating these very diverse components efficiently requires a modern approach to electronics product development. Today, the use of embedded virtualization designed for Safety and Security in combination with Linux relieves software developers from unnecessary expenditures and gives them opportunity to focus on developing competitive products.

- Distributed systems depend on software being moved between software systems with different processor architecture. Today, the x86 processors are no longer dominating the market.
- Smaller and cheaper control systems are needed to respond faster and in a more economical way to react on request from the market.
- Industrial robots and humans are working side-by-side and modern Safety mechanisms are required to avoid injuries. These may comprise processors running in lockstep mode or any other measures known from the Automotive, Railway or even Avionics markets.
- With factories running in 24/7 mode, high availability also has become an important issue. This also includes reconfiguration of existing software and hardware in very little time.

PikeOS RTOS & Hypervisor

The PikeOS Separation Kernel Version 5.1.3 is currently the only Separation Kernel worldwide that holds a Common Criteria EAL5+ certification for its separation performance.

→ www.sysgo.com/pikeos



PikeOS in Industrial Automation

PikeOS provides a modular system architecture allowing various applications to run simultaneously on a single hardware. A safe and efficient integration of electronics in industrial systems is reached via virtualization technology.

PikeOS bases on a small, certifiable micro-kernel upon which a hypervisor provides separate partitions for resource and function needs. Thanks to strong separation of the partitions with different Security and/or Safety applications and varying criticality levels, real-time or non real-time can run in a mixed criticality environment.

PikeOS was already applied in different industrial applications, such as a virtual or safe PLC platform, Industrial Automation 3D Safety camera system, touch pad for household appliances, high voltage switch gear monitoring, IIOT with data diode, Docker applications or updates of the IOT framework at runtime.

Customer Voice

"Historically, it's been difficult to maintain technology based on ageing hardware platforms. PikeOS allows us to make choices that fit today's needs while knowing that our investments are secured for the future."

Werner Ganahl

CEO at
Gantner Instruments

Virtualization & Integrated Linux

Since Industrial Automation applications consist of various components with different requirements for criticality and Safety, a trustable infrastructure provides a competitive advantage in development, certification, and long-term maintenance. The foundation of PikeOS is a small, certifiable micro-kernel, upon which a virtualization infrastructure provides the ability to house diverse resource and function needs into safe individually separated partitions.

PikeOS provides a broad variety of guest operating systems (such as ELinOS, SYSGO's own industrial grade embedded Linux distribution incl. real-time capabilities) to support diverse Industrial Automation application criticalities from graphics to time-critical measurement systems, safety-critical control functions and containerized applications / services deployment (such as Docker). Thanks to separation technology, Linux applications and proprietary intellectual property can be divided into separate partitions.

Certified according to IEC 61508

In terms of Safety requirements, PikeOS is the best certification solution for three reasons: Small size, criticality partitioning, and unparalleled company support for the certification process.

Because PikeOS is built to meet highest certification needs, the partitioning concept makes it possible for applications of various levels of criticality to be certified to their individually required safety levels while running securely in parallel on the same hardware platform. Furthermore, SYSGO is a competent and reliable partner when it comes to documentation, requirements and tests.

Security is just as important

Today, operations may require connectivity and communication between machines, computers and/or controllers. Therefore, Security measures have to be taken. Among other tasks, PikeOS and its hypervisor can include partitions that are able to fulfill system supervision, command and control operations as well as decoding beacons.

Additionally, PikeOS can be the foundation of a secure gateway that builds a route of trust and allows secure software updates „over the air“. Communication is assured by means of a Transport Layer Security (TLS) library. Cryptography and Storage are also supported. The gateway's network Intrusion Detection System (IDS) is located within a separate partition that monitors the network traffic. PikeOS can also resolve licensing issues by means of SW isolation.

May it be requirements for the Common Criteria (Information Technology), Security (ISO 15408), IEC 62443 for Industrial Control Systems, EDSA (Embedded Device Security Analysis) or J3061 in Automotive: We know how to meet all necessary requirements with a component-based software design.

Customer Benefits

- High flexibility provides independence from suppliers in the choice of HW / SW
- Partitioning provides the basis for a pragmatic Linux strategy
- Applications of various levels of criticality are separated from one another in distinct partitions

Use Cases

PLC and Edge / Cloud Computing, High Availability Systems, Connected Machines, Customer-on-Demand and Customization Request, Robotics, AI and Machine Learning.



Industrial Automation-based Customers

- Baumüller
- Bucyrus / Caterpillar
- Gantner
- Gatso Meter
- Görlitz
- ICA Chip
- Kongsberg
- Meyn
- Putzmeister
- Stäubli
- SWARCO

Miele relies on ELinOS from SYSGO for new Generation of Household Appliances

ELinOS, the Embedded Linux from German developer SYSGO, serves as the technical basis for Miele's new Generation 7000 line of household appliances. The two companies are thus continuing their long-standing and successful cooperation. ELinOS is already being used in the Generation 6000, first introduced in 2015, primarily for its innovative operating concept with a touchpad.

→ www.sysgo.com/miele

Terex O&K to choose PikeOS for its Excavator Product Line

Terex O&K has selected the PikeOS virtualization technology for driver assistance systems of its excavators. SYSGO succeeded in the selection process with its innovation solution that allows the reuse of legacy code in new projects together with new technologies.

→ www.sysgo.com/excavator

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Secure Factory Automation

The continuing technological advancement that is enabling decreasing costs and greater compactness of devices make it possible to connect and control more physical elements in the industrial environment today. This is enabling industrial engineers to monitor processes with greater accuracy and drive OEE (Overall Equipment Effectiveness). At the same time separate operational technology (OT) systems are merging with enterprise IT infrastructure. However, this greater connectivity also brings more threats from malicious digital actors.

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