



## Vision Machine Learning

Digitization as Key to Future Technologies

### PikeOS RTOS & Hypervisor

## Proven Platform for a Safe & Secure Operation

The digitization of rail is the key to future technologies that will make the environmentally friendly means of transport fit for future tasks and attractive as a mobility service. Many technologies can be adopted from Avionics and, thanks to the ground advantage, even simpler and better designed.

These include cabin management systems for adapting seats to the wishes of the passenger, for example, as well as lighting and ergonomic controls. Infotainment systems provide passengers with access to the Internet, magazines, films and train connection information.

In addition, clusters provide technical functions that ensure functional safety as well as cyber security. Secure gateways provide network and Internet access, location data is processed and sent, and sensor data is processed to provide immediate and long-term Safety information that ensures high functional Safety. Interaction with Wayside train monitoring systems plays a special role in this.

## SOLUTION

With the combination of PikeOS, PikeOS for MPU and a system-on-a-chip module (SoC) from the i.MX8 series from TQ Systems, such as the TQMa8MPxL (version: TQMa8MPQL-AA), embedded systems for the railroad can be realized in a convenient way. The TQMa8MPxL offers Safety functionality for the highest demands, machine learning hardware support, and outstanding vision processing performance. This can be used, for example, to collect optical data from obstacles and process it using machine learning in such a way that, in the long-term, insights can be gathered that make rail travel even safer by detecting patterns at an early stage on which appropriate measures can be initiated. One as well as several applications can run in parallel per core. This makes it possible to run an it-secure gateway on another core in a functionally safe manner.

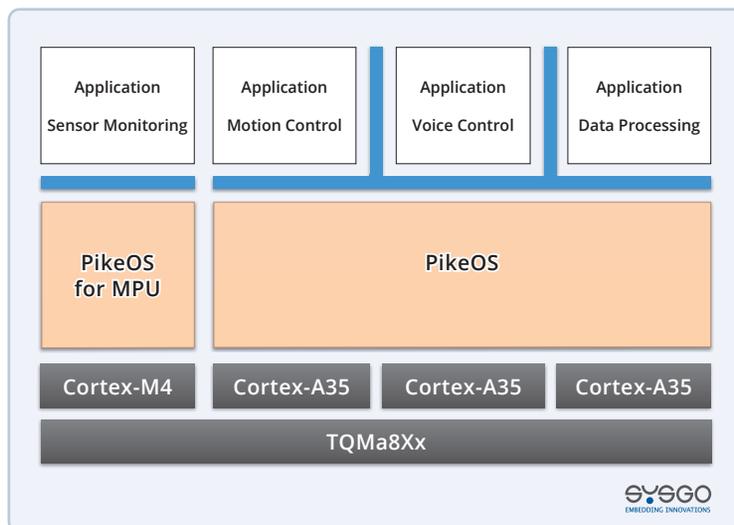
The real-time operating system and hypervisor PikeOS provides the basis for separating applications in the embedded system in a functionally safe manner in space and time. Functional Safety can be achieved via SYSGO's Certification Kits, which are available for the Railway Safety Standards EN 50128, EN 50657 for PikeOS to reach

the highest Safety level SIL 4. PikeOS is pre-certified against EN 50128 and EN 50657. With its pre-certification against the Common Criteria Security standard at level EAL 5+, the PikeOS Separation Kernel (ver. 5.1.3.) also offers the highest level of Cyber Security.

On customer request after appropriate adjustment by means of Board Support Package, PikeOS for MPU can run on the microcontroller (Arm Cortex-M7), which is located on the heterogeneous TQMa8Xx, as a safely separated partition. PikeOS for MPU takes over important tasks, where one prefers a microcontroller over a CPU for reasons of higher-level Safety or manageability, among other things. This can be for example the deterministic processing of large amounts of data.

With the integrated development environment CODEO such embedded systems, which make highest demands on Safety, determinism or real-time and consolidation, can be created within one tool. PikeOS and PikeOS for MPU do not require a large toolchain, but find a common roof on the Eclipse-based IDE CODEO.

## PIKEOS SOFTWARE ARCHITECTURE



**TQMa8MPxL**

The TQMa8MPxL offers Safety functions, machine learning support and image processing for embedded systems in railway technology.

### About TQ Systems

As a technology service provider and electronics specialist, the TQ Group implements customized, innovative solutions for various industries – from development to production and other services to product lifecycle management. One focus is embedded processor technology: whether x86, Arm, QorIQ Layerscape or Power Architecture – the goal is to provide the latest processor technology in the form of embedded modules, SBCs, industrial PCs, modular solution platforms and finished systems. More information at [www.tq-group.com](http://www.tq-group.com)

### About SYSGO

Founded in 1991, SYSGO became a trusted advisor for Embedded Operating Systems and is the European leader in hypervisor-based OS technology offering worldwide product life cycle support. We are well positioned to meet customer needs in all industries and offer tailor-made solutions with highest expectations in Safety & Security. More information at [www.sysgo.com/railway](http://www.sysgo.com/railway)