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Safe Computing Development Platform

SAFe-VX-DEV

Vital Computing Development Platform for
Safety-critical Systems in Railway Applications

SIL4 Certifiable

3U VPX

10 GbE LAN

Made in France

Safety-critical Computer Based on Qualified 3U VPX Building Blocks

Certifiable Architecture up to SIL4

Compact Half 19" Modular Platform

For Wayside or Rolling Stock Applications

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Introduction

The SAFe-VX-DEV development platform for safety computing is a half 19" platform based on VPX 3U building blocks.

It can be integrated in safety architecture certifiable up to SIL 4 and specifically designed for safety-critical rolling stock or wayside applications. It is well suited for the control of all safety-related functions in wayside applications as well as in new trains and also for the refurbishment of trains.

Thanks to its modularity and VPX standard openness, it is easy to tailor the SAFe-VX to the required I/O subset and environmental conditions. It is also possible to build an all-in-one safe control system plus non-vital processing safely separated through strict partitioning when running PikeOS RTOS from SYSGO acting as an hypervisor.

Interfacing to existing train communication is achieved through Ethernet links or optional fieldbuses.

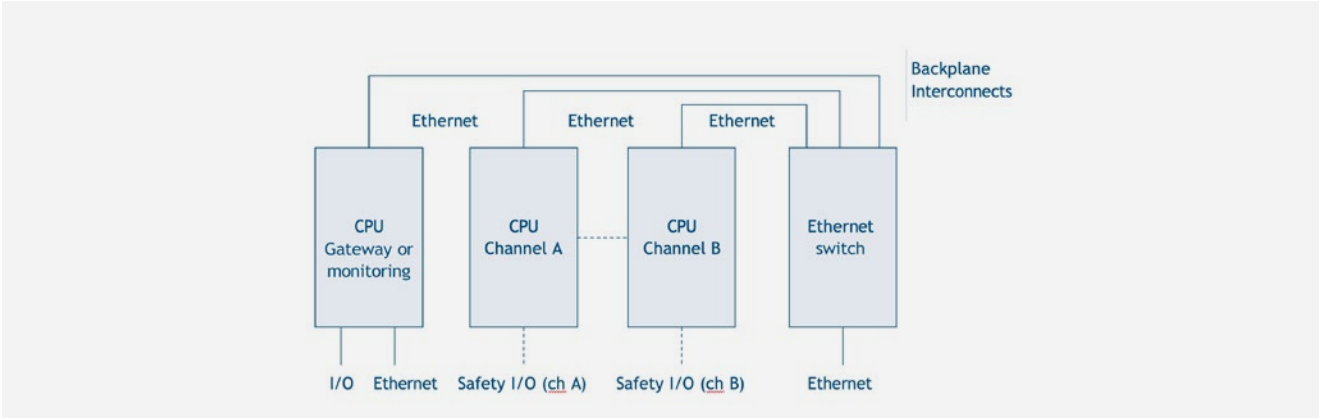
The versatility and the segregation of the tasks and the application allow critical and non- critical partitions to cohabit without jeopardizing the safety, enabling train operators to run several applications on a single platform needed for example in Data Analytics, Artificial Intelligence or Autonomous Trains.

The total cost of ownership is dramatically decreased through an easy maintenance of standard components. Longer operating life is achieved by the modularity and the longevity of the VPX architecture, designed for long term programs, and for partial technology refresh with a minimum impact on applications.

Platform Architecture

The base configuration (SAFe-VX-DEV) is a redundant one, including three identical VPX processor modules, interconnected by a ten or one Gigabit Ethernet switch module through a backplane. SAFe-VX does not present any single point of failure. Due to its modular architecture, SAFe-VX offers a high level of flexibility in terms of CPU, storage and I/Os. The other major building blocks like the PSU and the fan trays can be offered with redundancy.

In the simplest implementation, all boards are sharing the same Power Supply Unit. The boards are electrically isolated from each other by the backplane design in order to guarantee the absence of common root cause of failure. When needed, two SAFe-VX can be used in parallel to reach the expected availability at SIL4 level.



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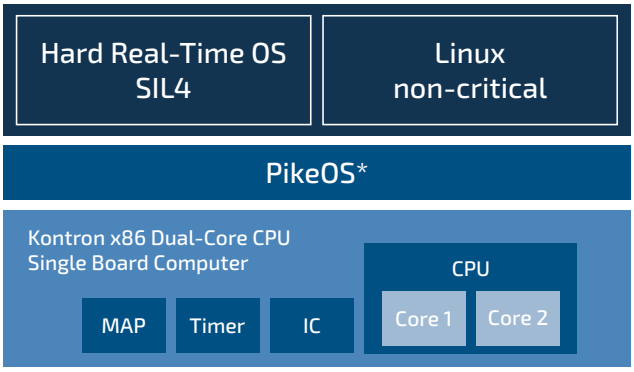
Software Architecture

Several options are possible for software architecture. Since SAFe-VX is an open modular platform, customer can chose the final software implementation depending on its application or preferences. For example it can be based on standard Linux distributions, or real time OS such as QNX , PikeOS or other.

Below is a typical use case for a key customer using PikeOS on a safety SIL 4 platform. PikeOs is a well-established embedded SIL 4 RTOS from Kontron's software partner SYSGO. PikeOS acts as a hypervisor partitioning the critical and non-critical application code in independent time and memory spaces. The critical part of the application runs under the PikeOS hard real-time partition whereas all complex non-safety related code can run in a Linux partition, as depicted in the figure below.



*PikeOS Separation Kernel & System Software

The main software characteristics ensuring the safety of the SAFe-VX platform for the case of PikeOS are the following:

- Verification of proper BIOS initialization
- The firmware allows the OS to inject ECC errors for testing purpose
- Power-on built-in tests (PBIT) during the OS initialization including ECC error injection test
- Continuous built-in tests (CBIT) including temperature monitoring
- Memory regions protection against unexpected access from I/O controllers
- Modular update capability: OS, application
- Application safety library including heartbeat, voting, watchdog
- Eclipse Development tools:
  C compiler, debugger, performance monitor

More information on Sysgo webpage:
https://www.sysgo.com/pikeos

Accelerate Safety Artifacts Generation

Safety Oriented by Design

Achieving safety case assessment is the primary objective of this railway safety program. Through SAFe-VX and Kontron support services, you can accelerate the generation of your safety artefacts. Kontron's quality processes certified according to ISO 22163 and EN 9100 provide a solid foundation for safety-oriented design. The rigor and design detail of these processes enable the adaptation of COTS products to meet specific requirements, as well as the chassis that addresses critical safety considerations. The process foundation is enforced by Kontron's experience in designing robust, safety-critical systems for key stakeholders in the railway and defense sector.

How Can We Help You?

By transparency on our design process, and by building safety documentations like Failure mode analysis (FMECA), MTBF reports and other documentations, this help will accelerate artefacts generation.

Cyber Security

In addition, cybersecurity vulnerabilities can become critical if safety systems are compromised by corrupted software. Kontron's security solutions help protect the supply chain from sub-element board production to system integration in railway applications. This is the right approach to ensure that running railway systems remain secure and unaltered.

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Accelerate the Move from Development to Deployment

An efficient transition from a development platform to targeted deployment platforms for a certified SIL4 system is essential for achieving optimal time-to-market and cost efficiency.
The development platform is cost-effective, ideal for labs, and enables rapid project initiation with short delivery times. The targeted platforms, built as specified to meet environmental constraints with specific physical I/O, and VPX backplane, will maintain binary software compatibility with the development system for seamless integration.

Physical Implementation

The three CPU boards (channel A, channel B and gateway or monitoring) are Kontron x86 3U VPX modules. When CPU architecture dissimilarity is required, one of the two Channel A/Channel B boards could be also ARM-based.

SAFe-VX-DEV platform configuration:

- 11th Gen Intel® Core™ processor for AI*, CVGIP*, DSP* workloads
- 12-28 W Quad Core™ processor, Enhanced AI, AVX-512, 32 GByte w ECC
- 16 GByte DDR4 with ECC
- Ethernet: 2xEthernet 1000Base-KX or 10GBase-KR on the rear backplane, 2x1000Base-T on front (Optionally 2x10G Base-SR)
- Extended Life Cycle and up to 15-year Silicon Reliability
- Reliability

Whatever the chosen version, the CPU boards design includes safety-oriented attributes including:

- Monitoring of temperatures and internal/external power supplies
- ECC protected memory with capability to inject error for testing
- 2 µs granularity precision watchdogs, cause of reset register
- Software verifiable master clock frequency
- Clean unexpected power interruption mechanism
- Dedicated memory for permanent history logs
- One onboard SSD (SATA / PCIe) per CPU board
- CPU configuration optimized for deterministic behavior
- Thermal Throttling Disable option

The Ethernet switch board is also a 3U VPX module with the following features:

- 1G or 10G Ethernet switch
- Backplane 1000Base-KX or 10GBase-KR and 1xfront 1G Base-T RJ45 ports + optional 50G QSFP cage
- Port mirroring and port redirection capability

Long Term Support

Program lifetime management is supported over long periods thanks to Kontron solid background in obsolescence management.

- EoL management with early notice warranty
- Last time buy packages are offered
- Long lifetime program is supported for 25+ years
- Tech refresh minimizing requalification cost: Blade VPX modular architecture allows fit/form/function upgrades of building blocks, providing the same electrical, mechanical and thermal specifications, with state-of-the-art silicon technology

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Why Chosing Kontron

Kontron is a preferred partner of major computer suppliers with early access to new technology and silicon. Kontron offers the best technology in terms of performance and low dissipation computers to provide the best trade-off and the longest lifetime.

Kontron provides its technology to several customers in Transportation, all driven by similar requirements in terms of performance/consumption, rugged environment, lifecycle, reliability, and competitiveness.

Kontron platforms are designed to make customization faster, system integration easier and reduce time to market while shrinking maintenance and support costs over the entire lifetime of the program.

Kontron is already the key supplier of Vital Computer Platforms for Rail Control solutions. With several thousands of VPX platforms deployed in the field, in Safety Critical operation, excellent on-time delivery records and high-quality level, recognized by key customers, Kontron provides the best solution allowing customers to drastically cut down the Total Cost of Ownership.

Ordering Information

Article	Part Number	Description
SAFE-VX-DEV-200000	1075-8517	Half 19'' Vital Computing Platform for Lab Development based on 3U VPX building blocks: › 3x Processing Units (one can be used as Gateway or monitoring unit) 1x 10 Gigabit Ethernet Switch CPU boards configuration: › 11th Gen Intel® Core™ processor, 16 GByte DDR4 with ECC, 256 GByte › SSD with 2 x GbE, 1x Serial ,1x USB on front per CPU › Switch boards with 1x front 1G Base-T RJ45 ports + optional 50G QSFP cage Pre-installed Linux Fedora 64bits distribution on each CPU board

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More Information

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