



VXWORKS FOR AUTOMOTIVE

Proven in Hundreds of Safety-Critical Projects Across Multiple Industries and Certification Standards

AUTOMOTIVE CHALLENGES

- Maintain high reliability despite growing complexity
- Reduce space, weight, cost, and power consumption
- Lower the cost of safety certification
- Deliver real-time performance
- Implement comprehensive cybersecurity
- Increase computing flexibility and performance

WHY VXWORKS

- Secure software isolation
- Smaller, lower-cost systems through workload consolidation
- Off-the-shelf certification evidence
- Time- and space-based application separation and isolation
- Integrated, world-class security capabilities
- Support for a wide variety of processors security capabilities

AUTOMOTIVE INDUSTRY SNAPSHOT

The automotive industry is evolving at a rapid pace as vehicles become more connected and autonomous, requiring higher levels of computing power to run a growing number of software applications. Electronic systems are also growing more complex as a result of the need to maintain freedom from interference among system functions without sacrificing system performance, integrity, and scalability. Car manufacturers and suppliers face a difficult challenge in ensuring that system integrity is maintained, but they must also be mindful of the impact of their design choices on the cost of the vehicle system. With the rising focus on electrification in the vehicle, this balance becomes more complicated, as system weight and power consumption will have an increasingly critical impact on the vehicle's ability to deliver value to end consumers.

With safety as the foundation, modern and forward-looking software architectures can help the industry address these challenges, leading to increasing levels of value for drivers.

What is safety in autonomous vehicle software? The answer to this question is evolving in the industry in real time. As we enter the era of artificial intelligence in the car, the state of the art in conventional safety (e.g., fixed-function systems that can be independently certified to meet the standard of functional safety best practices) is being redefined by learning systems that can be validated against a nominal standard of performance to ensure that data inputs are properly converted into vehicle outputs in predictable and deterministic ways.

With technology in more than 100 million automobiles, Wind River® brings together software, technologies, tools, and services to help carmakers intelligently unify, simplify, and maintain software systems. Wind River continues to invest heavily in its VxWorks® real-time operating system (RTOS) to add new features and maintain its very high level of security, safety, and reliability. VxWorks delivers hard real-time performance, determinism, and low latency along with the scalability required for vehicle applications. It is the world's most widely used commercial RTOS with more than 30 years in the field and more than 2 billion deployments.

VXWORKS: PIVOTAL TO SUCCESS

Protect Safety-Critical Code from Compute-Hungry Features

Automotive designers need to ensure that compute-intensive applications, such as advanced driver assist systems (ADAS) with artificial intelligence, do not compromise the reliability and determinism of other safety-critical functions. Designed to meet this challenge, VxWorks enforces time and space partitioning, which can isolate safety-critical and non-safety-critical code, helping to prevent performance issues due to unintended interactions between applications. In the kernel, VxWorks also provides the assurance of independently certified components such as its market-leading network stack. This combination of flexibility- and safety-oriented components offers developers the optimal blend of resiliency and performance that is needed to tackle the next generation of automated compute functions.

Reducing the Number of Systems Through Workload Consolidation

The proliferation of CPUs in vehicles is partly due to the deployment of a dedicated control platform for each new feature, which is an inefficient use of computing hardware

given today's high-performance multi-core CPUs. Virtualization and workload consolidation enable multiple control operations to run on a single platform, thus reducing the number of vehicle systems and the associated hardware and maintenance cost. VxWorks deployed with the Wind River Helix™ Virtualization Platform brings together the market-leading safety RTOS with Wind River Linux and Wind River development tools. This is the industry's first virtualization platform that can be configured dynamically (for advanced general compute) or statically (for safety-oriented compute) and used to develop workload consolidation solutions throughout the vehicle.

Save Time and Money with a Pre-certified RTOS

Industries like automotive that are developing safety-critical applications face new challenges in ensuring predictable performance with multi-core processors. This makes it important to design certification into the development process to lower the overall cost and time. Experienced in this area, Wind River offers a comprehensive portfolio of software, tools, and expertise to help automakers and their suppliers build safe, secure, and certifiable intelligent systems while lowering costs and speeding the development of new capabilities, including:

- Autonomous driving
- ADAS
- Digital cluster solutions
- Telematics
- In-vehicle infotainment (IVI)

VxWorks is certified for ISO 26262 Automotive Safety Integrity Level (ASIL) D, backed by certificates issued by independently accredited certification authority TÜV SÜD.

Deploy RTOS with Proven Real-Time Performance

Real-time performance and reliability are crucial for safety-critical applications such as ADAS and autonomous vehicles, which require deterministic and low-latency

performance. One of the ways VxWorks achieves real-time performance is by separating the core kernel from protocols, applications, and other packages, thus allowing the core to execute in a more predictable fashion. For instance, the enhanced scheduler implements time partitioning to ensure that an application gets a predetermined number of CPU cycles (Figure 1), and space partitioning isolates user-mode application memory from kernel-mode memory, thus protecting the RTOS.

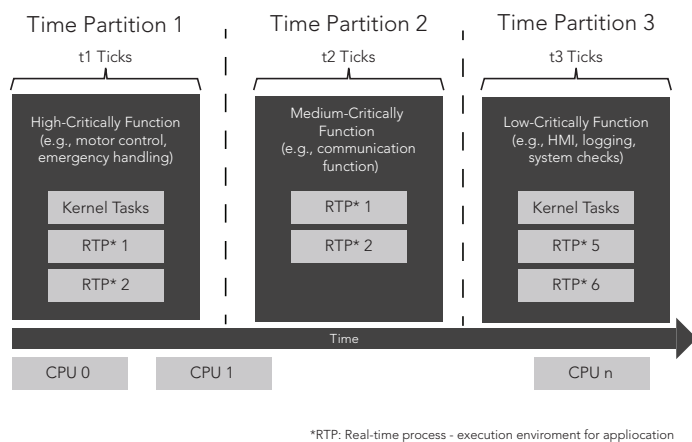


Figure 1. VxWorks time- and space-partitioning scheduler

Safeguard Systems and Data from Malware Attack

Connected vehicles with a growing number of IVI and autonomous driving features are potentially more vulnerable to outside interference, whether accidental or with malicious intent. To better protect vehicles, automotive application developers can take advantage of VxWork’s comprehensive, built-in security capabilities that safeguard devices and data during boot-up, app execution, data transmission, idle, and power down. Developers can implement protection at every stage of operation by implementing secure boot, Trusted Platform Module (TPM), data encryption, kernel hardening, and many other VxWorks features.

Optimize Designs with a Choice of Processors

Car manufacturers and suppliers need the flexibility to choose from a wide variety of processors in order to optimize the cost performance of features based on numerous factors, including the target vehicle category (e.g., from economy to luxury). Together with Wind River ecosystem partners, VxWorks has an extensive list of board support packages, providing early prototyping, cost savings, and flexibility of choice. With VxWorks, development teams can select processors from a variety of architectures and vendors, such as PowerPC, Intel®, Arm®, Arm-based solutions, NXP, Renesas, Xilinx, and others.

TRUSTED SOFTWARE SOLUTIONS

VxWorks and its tools suite provide automotive developers with a complete solution for developing advanced and innovative solutions. With more than 30 years of experience building safe and secure embedded systems, Wind River is well versed in satisfying the real-time requirements of the automotive industry and enabling the next generation of computing and software technologies.

