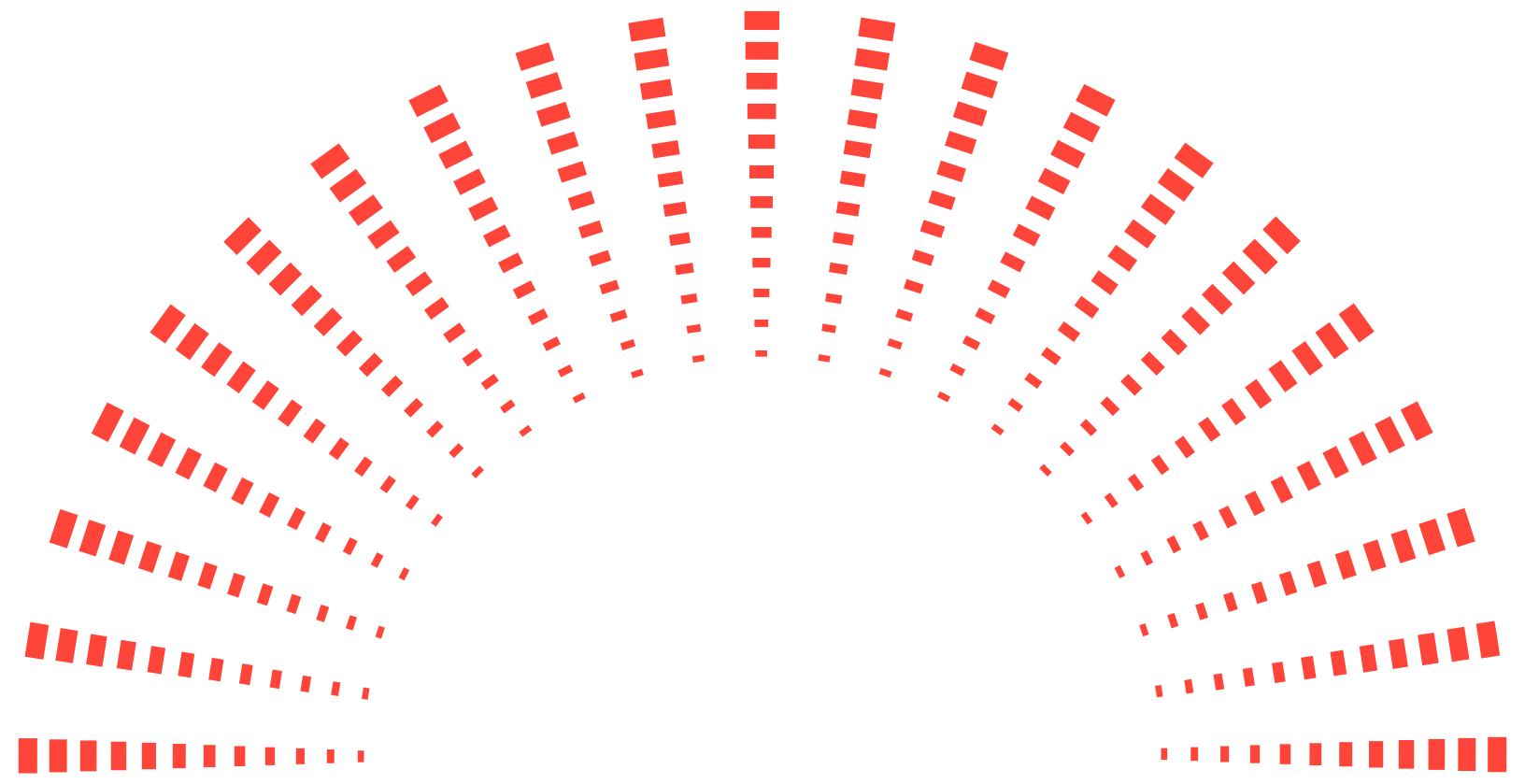


Solution Guide

QNX Solutions for Rail

Foundational Software
for Tomorrow's Rail Systems



How QNX is Transforming the Rail Industry

300+

Million Mission-Critical
Systems

100%

Success Rate in Achieving
Safety Certification

40+

Years Building Trusted
Embedded Software

Rail transportation is growing rapidly as trends such as urbanization, green energy, digitalization and autonomous rail technology drive demand for modern and smart railway systems. Functional safety and cybersecurity are top of mind as new software-defined rail systems are developed and communities and rail companies reimagine mass transit.

Increased ridership and the demands of freight paired with aging infrastructures are driving investments to refurbish signaling systems, railyards, wayside systems, operations control centers and rolling stock. Costly maintenance of analog and legacy hardware, often from manufacturers long out of business, is creating opportunities for new software-driven infrastructures, as is the migration to green, sustainable energy technologies.

Automated safety systems, such as Rail Control systems, Positive Train Control (PTC), Automatic Train Operation and fully autonomous rapid transit monitored by remote operation control centers are increasingly part of the solution. These systems are supported by modern sensors and software solutions retrofitted to railway tracks and signaling systems to provide additional safety mechanisms for the locomotives and rolling stock, the tracks and the public.

Intelligent, automated software-defined systems are the foundation of railway digitalization; they enable advanced

efficient control, communication, monitoring, maintenance and response in rail networks. At the same time, safety requirements loom large, as do cybersecurity challenges due to increased connectivity, automation and Internet of Things (IoT) integration. Regulatory compliance is increasing at the same time manufacturers need to control the lifetime cost of equipment that must run reliably, securely and safely for decades.

QNX works closely with its rail partners to deliver the expertise and technologies needed to help them adapt and thrive in this changing environment. QNX provides robust, safe and secure embedded software solutions that are trusted throughout the global rail industry and beyond. We help rail manufacturers and suppliers like you develop safe and secure systems with lower costs over long product lifecycles. A foundation of QNX software can maximize reliability, increase system longevity and ease maintenance.

Addressing Continually Evolving Rail Business Challenges



**Accelerate
Safety
Certification**



**Strengthen
Cybersecurity**



**Manage Mixed
Criticality**



**Establish
Reliability**



**Easily Port Your
Software**



**Reduce Cost of
Ownership**

Why Leading Rail Manufacturers Choose QNX

QNX helps rail manufacturers and suppliers to overcome many challenges at once. The same QNX operating system that enables rail companies to build in functional safety and cybersecurity also helps them to improve reliability, simplify safety certification and reduce costs over the lifetime of rail systems.

At the heart of QNX is the microkernel QNX® OS 8.0. The microkernel architecture minimizes downtime and cyberattack surfaces through isolation and separation mechanisms. Device drivers and system services run alongside applications, separated from one another and the kernel. Running all OS services outside of kernel space enables highly available, fault-tolerant designs—the failure of one application or service will not crash the kernel, other services or other applications. Building on QNX software can help you to develop more resilient and reliable systems.

The QNX OS 8.0 also improves design flexibility. QNX-based systems are easier to develop, debug, configure, reconfigure and expand than are systems based on any monolithic kernel. With a microkernel architecture, the QNX OS 8.0 scales from single core to multicore to

high-performance computing platforms seamlessly. If a system has a very limited capability and functionality, the microkernel design can jettison excess services to fit in a very small footprint with very little memory.

Additionally, with the QNX® Hypervisor and its safety variant, the QNX® Hypervisor for Safety, you can contain entire systems with their OSs as guests in hypervisor virtual machines. This means that you can port legacy code built on different OSs (e.g., Android™, Linux®) onto new SoCs and run them concurrently with your latest product. You can also implement new features or upgrade entire systems in virtual machines, confident that the new code won't affect other systems, including safety-critical systems, running on the SoC.

QNX safety services and functional safety training are available to help you successfully navigate your next certification project. We offer trusted expertise in safety and cybersecurity standards, such as IEC 61508, the basis for industry standards, and rail-specific standards, such as EN 50128 for communication, signaling and processing systems and software for railway control and protection systems and EN 50657 for rolling stock applications and software on board rolling stock.

Accelerate Safety Certification

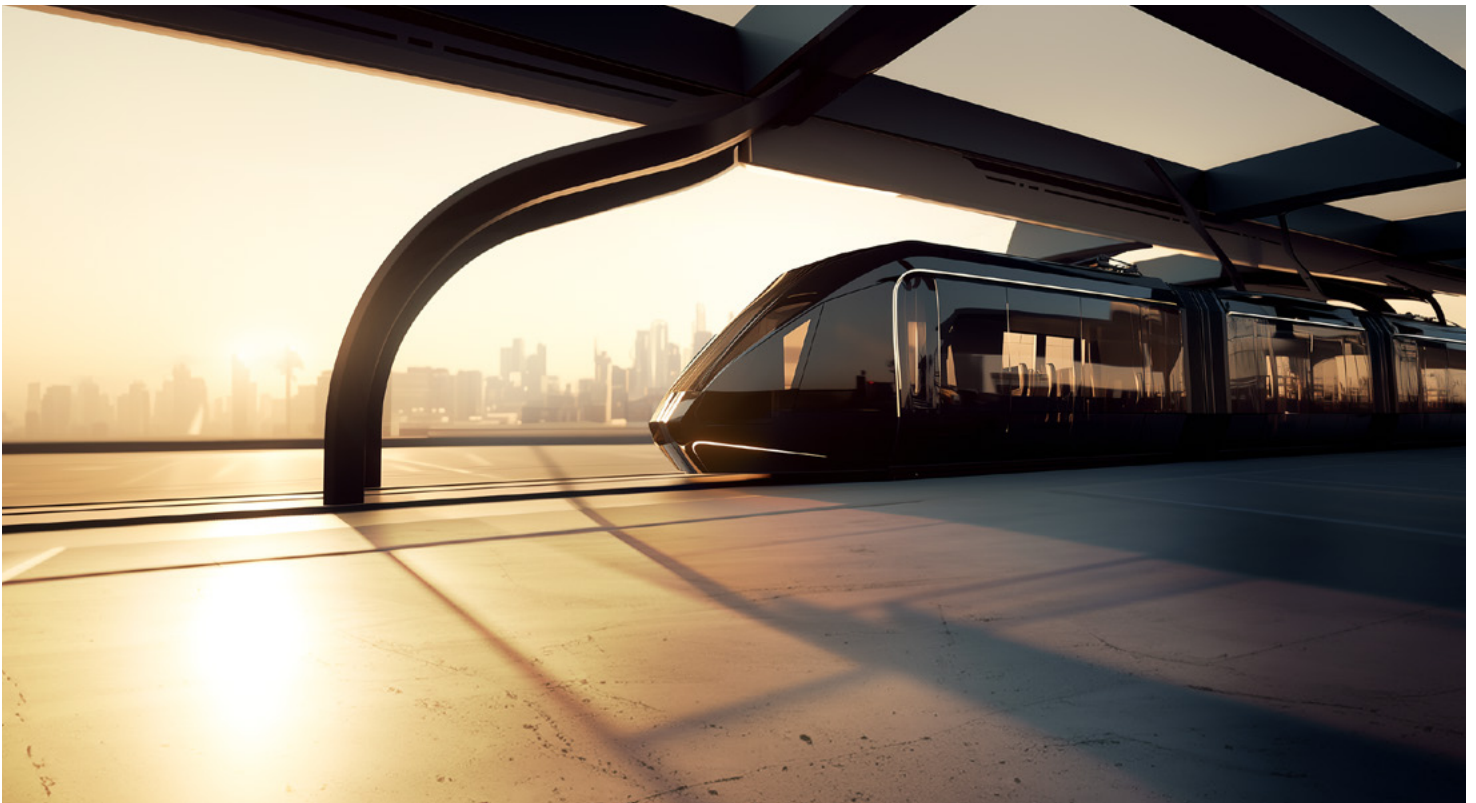
Safety is a grave concern for the rail industry and regulators worldwide. Certifying a rail system to industry standards like IEC 61508, EN 50128 or EN 50657 is time-consuming and costly—and an almost impossible task with an open-source OS, such as Linux. The use of a safety pre-certified OS or hypervisor greatly simplifies your development and testing effort and shortens overall system certification processes. QNX solutions help developers build safe systems that deliver real-time performance.

Using pre-certified software and hardware components reduces the scope, risk, length and cost of rail system certification to any safety standard. QNX solutions are built with a focus on safety, cybersecurity and the real-time determinism needed for safe rail systems. The QNX OS for Safety and the QNX Hypervisor for Safety are pre-certified for use in applications requiring SIL 3 of the IEC 61508 and can be used in systems certified to SIL 4 of the EN 50128, and EN 50657 railway standards. It is also applicable to various other standards.

Strengthen Cybersecurity

Train and signaling systems are increasingly integrated and connected—and at risk of cyberattack. A cybersecurity breach can put drivers, passengers and the public at risk. With the industry's most advanced and secure embedded RTOS for mission-critical systems, the QNX OS 8.0 and the QNX Hypervisor provide a layered approach to security that won't hamper functionality or performance.

Building and maintaining a secure system requires a reliable and secure OS, secure over-the-air (OTA) software updates, a secure supply chain and managed public key infrastructure (PKI) authentication. The QNX OS 8.0 reduces the attack surface by running all services outside of the kernel space, and provides multi-layered protection with system-wide security policies, path trust, fortified functions, access controls, security tooling and separation and isolation mechanisms. BlackBerry® Jarvis®, our software composition analysis solution, can help you to uncover and remediate software vulnerabilities in components from across your supply chain without having to access source code.





Establish Reliability

Highly available, robust software systems for rail require a fail-proof foundation over a long product lifecycle. Rail equipment needs to boot quickly, run precisely, eliminate system crashes and ensure that the highest-priority tasks run first. A deterministic microkernel RTOS provides the foundation that rail systems need to deliver the reliability expected by customers today and into the future.

The QNX OS 8.0 microkernel architecture facilitates software component updates. Because drivers and services run outside the kernel space, they can be added and upgraded with minimal impact on the kernel and the system. Similarly, if drivers and services are not safety-critical and thus outside the scope of safety-certifications, changes to them will require less work to ensure the functional safety of critical components and the overall system.

In short, the QNX microkernel architecture offers both innate reliability and a clear, low-cost strategy for upgrades that make it ideal for systems that require long-term reliability and maintainability.

Manage Mixed-Criticality

Rail systems often need to run safety-critical software concurrently and isolated from non-safety-critical software, such as legacy code and open source applications. Such mixed-criticality systems require a mechanism to ensure the isolation and separation of these systems. This isolation and separation can be achieved either by running each system on its own hardware platform or by using a virtualization solution to consolidate them both on a single system-on-a-chip (SoC).

The QNX Hypervisor and QNX Hypervisor for Safety enable designers to run multiple OSs and their applications as guests in virtual machines on a single SoC. These products leverage the latest Armv8 and x86-64 hardware virtualization extensions to enable developers to run diverse OSs with different criticality levels and functional safety requirements on one SoC while maintaining optimal performance.



Easily Port Your Software

Reusing application and driver code across devices and product lines can enable you to deliver new product introductions faster and drive more revenue. Committing your own resources to the development and maintenance of an OS based on an open source distribution, such as Linux, drives up costs. In contrast, QNX manages all OS maintenance and updates for you.

What's more, with the QNX Hypervisor, you can develop new code on the QNX OS 8.0 and run Linux and Android on the same SoC. If your system is safety-critical, you can use the QNX Hypervisor for Safety and use the hypervisor's safety-certified virtual machines to isolate non-safety systems from your safety-certified systems.

Rail system developers can migrate and manage legacy and Linux code by porting it to QNX. The QNX® Software Development Platform (SDP) is POSIX-compliant, so you can easily port any software from Linux at any phase of the software development lifecycle. Rail developers ramp up quickly on QNX software because it looks and feels like Linux and uses familiar tools, such as the Eclipse-based QNX Momentics® IDE and the GNU compiler collection (gcc).

Reduce Cost of Ownership

Less downtime and maintenance, coupled with the availability of long-term customer support, can significantly reduce total cost of ownership. The development resources your company devotes to internal OS or hypervisor maintenance add up year after year, making an open-source foundation impractical for systems with long lifecycles.

QNX helps rail manufacturers and equipment owners reduce costs and downtime for embedded systems that run for decades. When you use the QNX OS 8.0, QNX Hypervisor solutions across product lines, you gain the flexibility of being able to build drivers and other software components once and use them across the business.

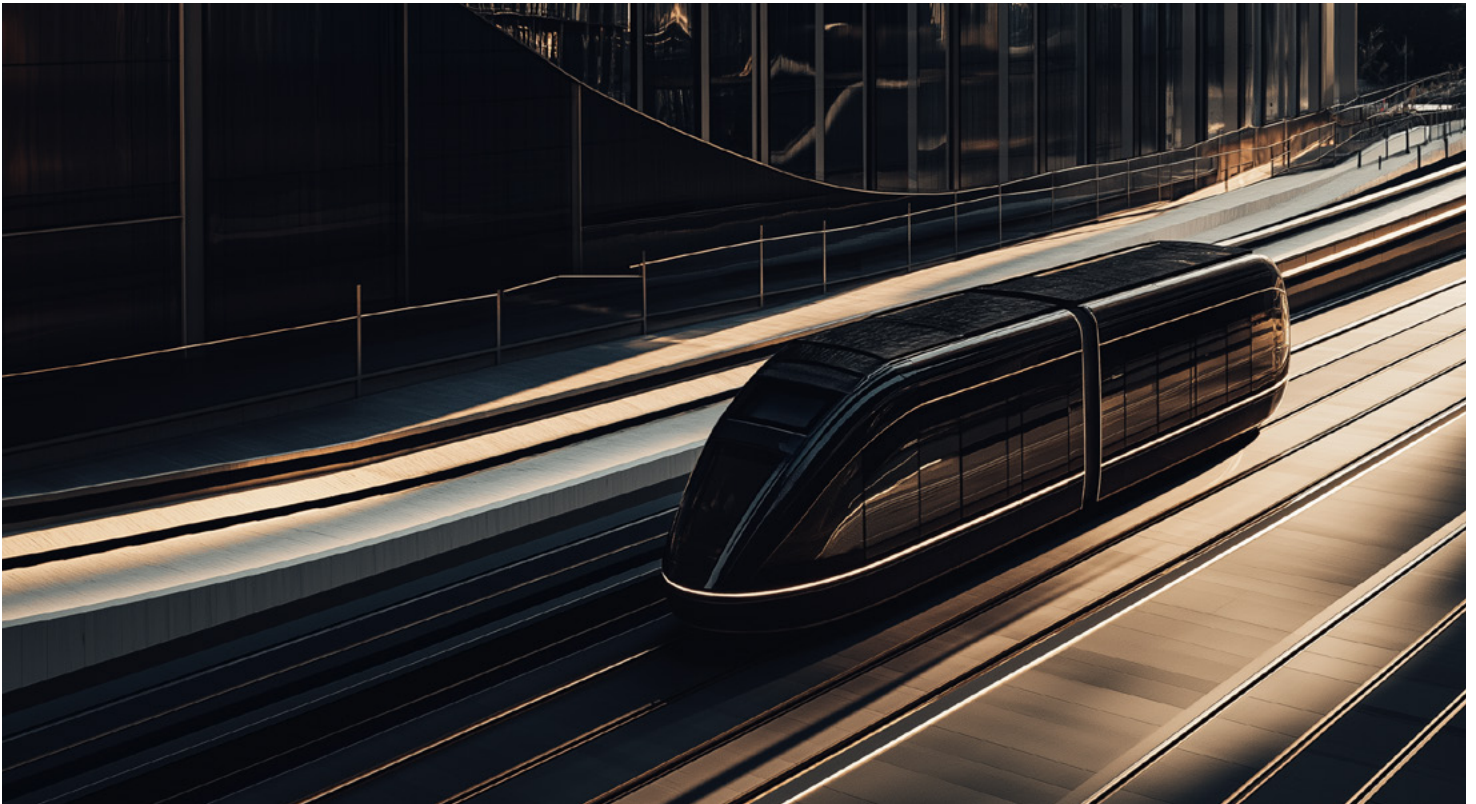
Board Support

Board support packages (BSPs) and engineering services, including specialized safety and security services, streamline development timelines. QNX Board Support Packages (BSPs) provide an abstraction layer of hardware-specific software that facilitates the implementation of the QNX OS 8.0 on a given board.

The extensive QNX BSP library includes BSPs for SoCs manufactured by leading hardware manufacturers. In addition, the QNX OS 8.0 supports applications using a wide selection of Arm and x86 GPUs.

Learn more about our library of BSPs →

Since 1980, thousands of companies have deployed the QNX real-time operating systems to ensure the ideal combination of performance, security and reliability in mission-critical systems.



Trusted Solutions for The Rail Industry

Railway technology companies globally trust QNX for a broad range of embedded systems where failure isn't an option.

QNX provides time-tested and trusted foundation software, including a deterministic microkernel real-time operating system (RTOS) and a hypervisor, along with their safety-certified variants, and other safety-certified products such as QNX Black Channel Communications Technology, middleware, and cybersecurity solutions—all purpose-built for embedded systems. We have the experts to provide the software, support and professional services you need to build better embedded systems. With some embedded software providers, you are on your own after the software is delivered. But when you choose QNX, we back up our products with top-quality support from our extensive knowledge base, best-in-class documentation and expertise from the developers and engineers who built the QNX products you use. Industry experts guide you in areas such as embedded security

and functional safety. We partner with you at every step, from the inception to the launch of your embedded system. We are successful only when you are successful.

QNX software solutions add value to rail companies that are developing a wide variety of railway management systems, subsystems and rolling stock.

QNX Support & Services



Proven Experience

Thousands of person-years in development, support and integration.



Service Excellence

100% success at meeting OEM start of production (SOP) deadlines.



Global Footprint

Regional experienced teams in US, EMEA and APAC.



Commitment

Dedicated, dependable and trusted staff.

Professional Services Expertise



Hardware

Prototyping, board support packages, driver development/customization, system optimization, fast boot, hypervisor support.



Porting & Integration

Linux/Android hypervisor guests, middleware integration, open-source porting/integration, legacy OS migration.



Safety & Security

Functional safety services, safety cases, hazard and risk analysis, penetration testing, security best practices, safety and security training.



Application

UI/UX design/development, application development, protocol development, middleware design and development, application stack design, application profiling and optimization.



Training

QNX offers hands-on, instructor-led training, online or in-person, using real-world examples to equip development teams with essential skills.



Consulting

Architectural reviews, on-site consulting (long/short term), cloud architecture integration, expert consultation, service retainers.

Learn more about our professional services and service packages →

Foundation Products/Initiatives



QNX Software Development Platform 8.0

QNX Software Development Platform (SDP) 8.0 is the foundational development platform for the next generation of mission and safety-critical systems merging unprecedented performance with unparalleled security and reliability—without compromise. It features our next-generation QNX Operating System built on a future-ready architecture designed to maximize silicon advancements thanks to our advanced microkernel design.

Learn more →

<https://blackberry.qnx.com/en/products/foundation-software/qnx-software-development-platform>



QNX Hypervisor

An embedded virtualization solution with a microkernel architecture so multiple OSs (Android, Linux, QNX) can safely operate on the same system-on-a-chip (SoC).

Learn more →

<https://blackberry.qnx.com/en/products/foundation-software/qnx-hypervisor>



QNX Advanced Virtualization Frameworks

Make use of our diverse set of industry-standard, hardware-independent frameworks to enable guest operating systems to share hardware and software services such as graphic displays, acoustic environments, touchscreens, media storage devices, video streams and cameras. The QNX® Advanced Virtualization Frameworks provide extended capabilities to the QNX Hypervisor.

Learn more →

<https://blackberry.qnx.com/en/products/foundation-software/qnx-hypervisor/advanced-virtualization-frameworks>



QNX Accelerate

QNX® Accelerate is an initiative that makes cloud-enabled versions of our foundational products available. This reduces embedded software development cycles and improves time-to-market.

Learn more →

<https://blackberry.qnx.com/en/products/accelerate>

Safety-Certified Products



QNX OS for Safety

Built on the same microkernel architecture as the QNX® OS 8.0, the QNX OS for Safety is pre-certified to ISO 26262 ASIL D and to IEC 61508 SIL 3. Easily port Linux-based prototypes to the QNX Real-Time OS (RTOS) and get all the documentation and support you need for certification.

Learn more →

<https://blackberry.qnx.com/en/products/safety-certified/qnx-os-for-safety>



QNX Hypervisor for Safety

This real-time microkernel hypervisor provides the reliability and performance of the QNX OS and allows multiple OSs to safely operate in isolation and in parallel on the same system-on-a-chip (SoC). It is the first embedded hypervisor pre-certified to ISO 26262 ASIL D and to IEC 61508 SIL 3.

Learn more →

<https://blackberry.qnx.com/en/products/safety-certified/qnx-hypervisor-for-safety>

Security Solutions



QNX Cybersecurity

For more than 40 years, QNX has provided safe and secure embedded software solutions for automotive, industrial controls, robotics, medical devices, and other mission-critical applications. QNX cybersecurity is built on a strong culture, product excellence, and an ecosystem that enhances the company's security capabilities.

Learn more →

<https://blackberry.qnx.com/en/products/security/qnx-security>

Rail Functions



QNX Cabin

QNX® Cabin is a hardware-portable, pre-integrated digital cockpit software reference implementation that provides a development framework for designing digital cockpit systems. By increasing software portability and supporting cloud-first development, QNX Cabin helps reduce development costs and accelerates time-to-market.

Learn more →

<https://blackberry.qnx.com/en/products/automotive/qnx-cabin>



QNX Platform for ADAS

QNX® Platform for ADAS is a foundation for building ADAS and automated driving applications. The modular, sensor/processor-agnostic framework allows for code to be written once and re-used. Optimized for automotive silicon and compatible with a variety of processing cores.

Learn more →

<https://blackberry.qnx.com/en/products/automotive/qnx-adas>



QNX Multimedia Suite

The QNX® Multimedia Suite is middleware delivered with the QNX Software Development Platform. It can be implemented as an independent standalone system or fully integrated with other QNX products, including the QNX Platform for ADAS.

Learn more →

<https://blackberry.qnx.com/en/products/automotive/multimedia>



QNX Sound

QNX® Sound is a holistic software environment that lets you design the next generation of vehicle audio with a holistic software environment that manages the entire vehicle soundscape.

Learn more →

<https://blackberry.qnx.com/en/products/automotive/qnx-sound>

About QNX

QNX, a division of BlackBerry Limited, enhances the human experience and amplifies technology-driven industries, providing a trusted foundation for software-defined businesses to thrive. The business leads the way in delivering safe and secure operating systems, hypervisors, middleware, solutions, and development tools, along with support and services delivered by trusted embedded software experts. QNX® technology has been deployed in the world's most critical embedded systems, including more than 255 million vehicles on the road today. QNX® software is trusted across industries including automotive, medical devices, industrial controls, robotics, commercial vehicles, rail, and aerospace and defense. Founded in 1980, QNX is headquartered in Ottawa, Canada.

Learn more at qnx.com →

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