

Embedded World No.1 RTOS

2023.10.17

WNRDRVR



DISCLAIMER

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BENEFITS OF USING COMMERCIAL RTOS



Modern



Future proof



Always real-time

**PROVEN IN USE,
HIGHLY RELIABLE,
AND DETERMINISTIC
REAL-TIME
OPERATING SYSTEM**

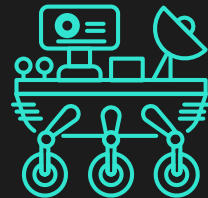


PURPOSE BUILD, VALIDATED, DEPLOYED



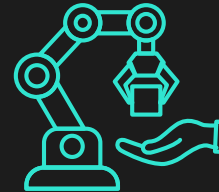
Top supplier of aerospace and defense technology

Relying on Wind River's technology and expertise to achieve world's avionics safety certification for highest levels of criticality in multiple cores



Technology that is out of this world

Playing a central role by providing the core operating system for spacecraft control systems, on Mars.



Leading manufacturer of industrial robots for factory automation

Enabling lower costs and better performance for management of robot, motion sequence and process control



One of largest automotive suppliers for high-endurance race cars.

Cutting development time in half, by leveraging Wind River's software, tools and technical support to develop next generation products

RECIPE FOR MARKET LEADING SUCCESS



Latest technologies



Certifiable



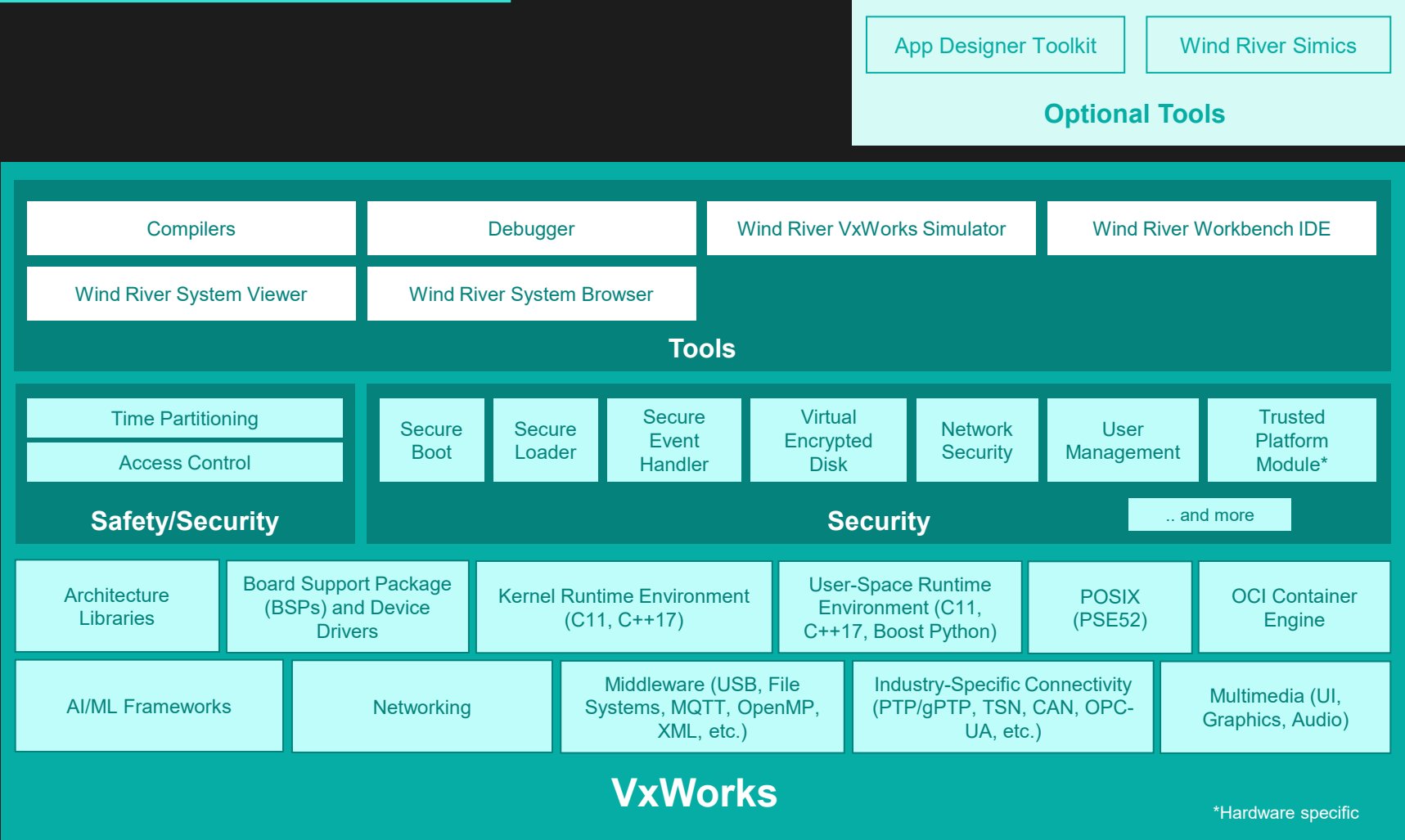
Reliable

TECHNICAL ADVANTAGE

- **Foundational** support for safe, secure and reliable embedded systems
- **Certifiable** for safety: IEC 61508, DO-178C, ISO 26262, IEC 62304
- **Enable** applications that rely on determinism, ultra-reliability, and performance.
- **Comprehensive** collection of Board Support Packages, including customized drivers and routines
- **Flexible** development paradigm with support for mainstream application development frameworks
- **Streamlined** global support under aggressive SLA (Service Level Agreement)
- **Validated** with real-world deployments over multiple vertical market

VxWorks

VXWORKS

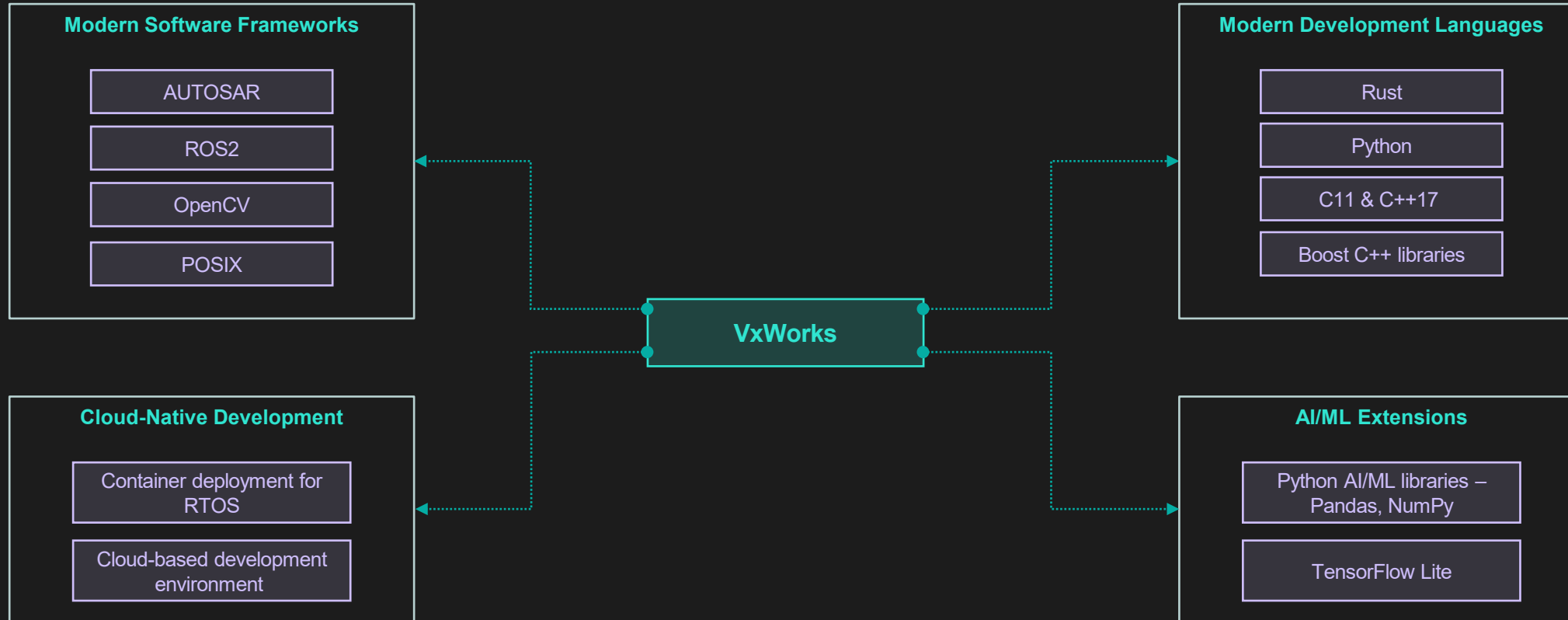


VxWorks features & attributes

VXWORKS MAJOR MILESTONES

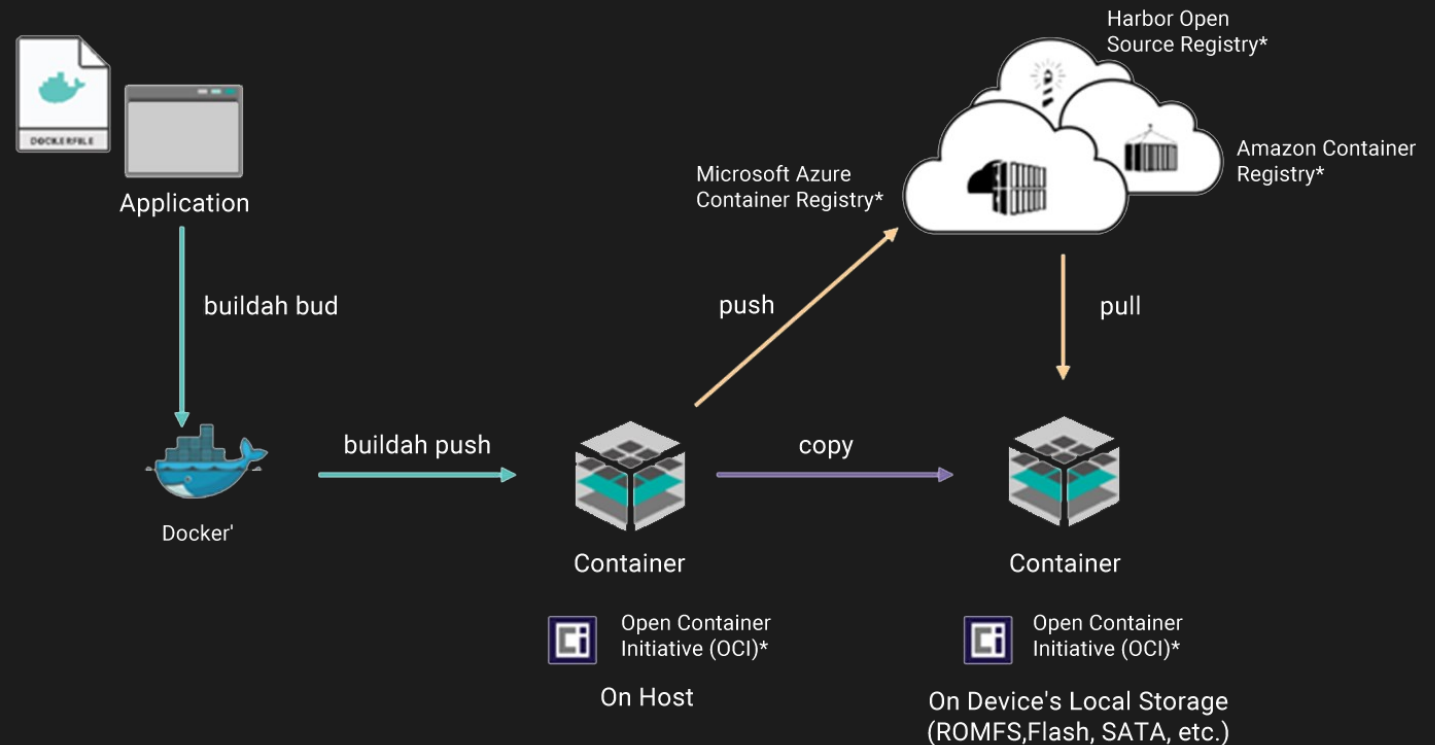
- 1987** • Wind River introduces VxWorks
- 1995** • VxWorks 5 and Tornado IDE (integrated development environment)
- 1997** • VxWorks used for NASA's Pathfinder mission to Mars
- 1999** • Wind River acquires Integrated System Inc. (pSOS)
- 2001** • Wind River acquires Eonic Systems, Virtuosos RTOS which later becomes basis of Zephyr RTOS
- 2004** • VxWorks 6 with real-time processes, Workbench Eclipse IDE
- 2007** • Interpeak network stack integrated with VxWorks, symmetric multiprocessing (SMP) multi-core support added
- 2009** • Asymmetric multiprocessing (AMP) support, VxWorks 653 2.x, VxWorks 6 Cert
- 2010** • VxWorks virtualization (hypervisor)
- 2011** • Intel 64-bit support
- 2014** • VxWorks 7
- 2017** • Arm 64-bit support
- 2018** • OpenCV support, LLVM/Clang toolchain
- 2019** • POSIX PSE52 certification, Boost C++ libraries support
- 2020** • RISC-V architecture support, Python support, Time-Sensitive Networking (TSN)
- 2021** • OCI-compliant container support, AI/ML frameworks
- 2022** • AWS Graviton EC2 support, software bill of materials (SBOM) tools

VXWORKS: A MODERN RTOS FOR NEXT-GEN APPLICATIONS



FIRST AND ONLY OCI CONTAINER SUPPORT IN AN RTOS

- Write better software, faster
 - Support agile software development and deployment
 - Ensure software runs reliably when moved
- Enable software operations and management in the field
 - Develop portable applications
 - Simplify software updates and deployment
 - Use remote container management support
- Container runtime size: **353KB**
(includes all dependencies)



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OVER 60% OF BACKEND DEVELOPERS USE CONTAINERS TO BUILD AND DEPLOY SOFTWARE APPLICATIONS TODAY*

AI/ML TECHNOLOGIES FOR VXWORKS

VxWorks is integrated with key technologies used in artificial intelligence (AI) and machine learning (ML).

- Provides a quick path to developing intelligent systems at the edge
- Enables decentralization of compute power and real-time data processing
- Allows intelligent embedded systems at the edge to process data without transmission delay, significantly reducing the amount of data transmitted
- Results in decreased latency and improved network bandwidth

KEY AI/ML TECHNOLOGIES

PYTHON-BASED AI LIBRARIES

Pandas

Provides data manipulation functions and analysis

Reduces repetitive tasks that come with working with data

NumPy

Enables data manipulation and mathematical operation of large arrays of data

TENSORFLOW LITE

Tools that enable machine learning for embedded devices

MODERN PROGRAMMING LANGUAGE SUPPORT

Developers can achieve greater efficiency using the most popular programming languages with VxWorks.

- Gain greater portability for open source and other software packages.
- Expand the capabilities of your device software by leveraging open source packages.
- Expand hiring options and help address the talent shortage of embedded software developers.
- Continue to reuse existing applications while adding new applications written in other languages.

KEY LANGUAGE SUPPORT

C11 and C++17 standards & Boost libraries

- Still popular for embedded software
- Supporting the latest standards and libraires
- Boost libraries provide advanced C++ templates and math capabilities

Python

- Highly popular due to its easy-to-read code
- Many related libraries for AI and data analytics
- Common skillset for most new developers

Rust

- Static compiled language with an emphasis on safety and security
- Growing quickly in popularity

SOFTWARE FRAMEWORK SUPPORT

Simplify the software development process with domain-specific frameworks.

- Have a common software baseline between different projects.
- Shorten the learning curve, development time, and test and validation effort.
- Gain efficiency and portability, enabling the reuse of software from third parties and open source.
- Expand hiring options and help address the talent shortage of embedded software developers.

POSIX

PSE52 certification

Microsoft Azure IoT SDK

AUTOSAR

- AUTOSAR MCAL Layer
- Partnership with Vector Software

AWS IoT Device SDK

ROS 2

OpenMP

NETWORKING AND CONNECTIVITY

Employ the broad range of communications necessary in a connected world.

- Guarantee real-time communications and packet delivery with TSN.
- Support innovative industrial application with OPC-UA.

NETWORKING PROTOCOLS

IPv4/IPv6 network stack

- IPv4/IPv6 network stack
- RIP, QoS

PTP

- IEEE 1588-2008
- IEEE 802.1AS-2011

Time-sensitive networking (TSN)

- IEEE 802.1AS-rev
- IEEE 802.1Qbv
- IEEE 802.1Qbu

CONNECTIVITY

USB (host, target, and OTG)

SocketCAN /

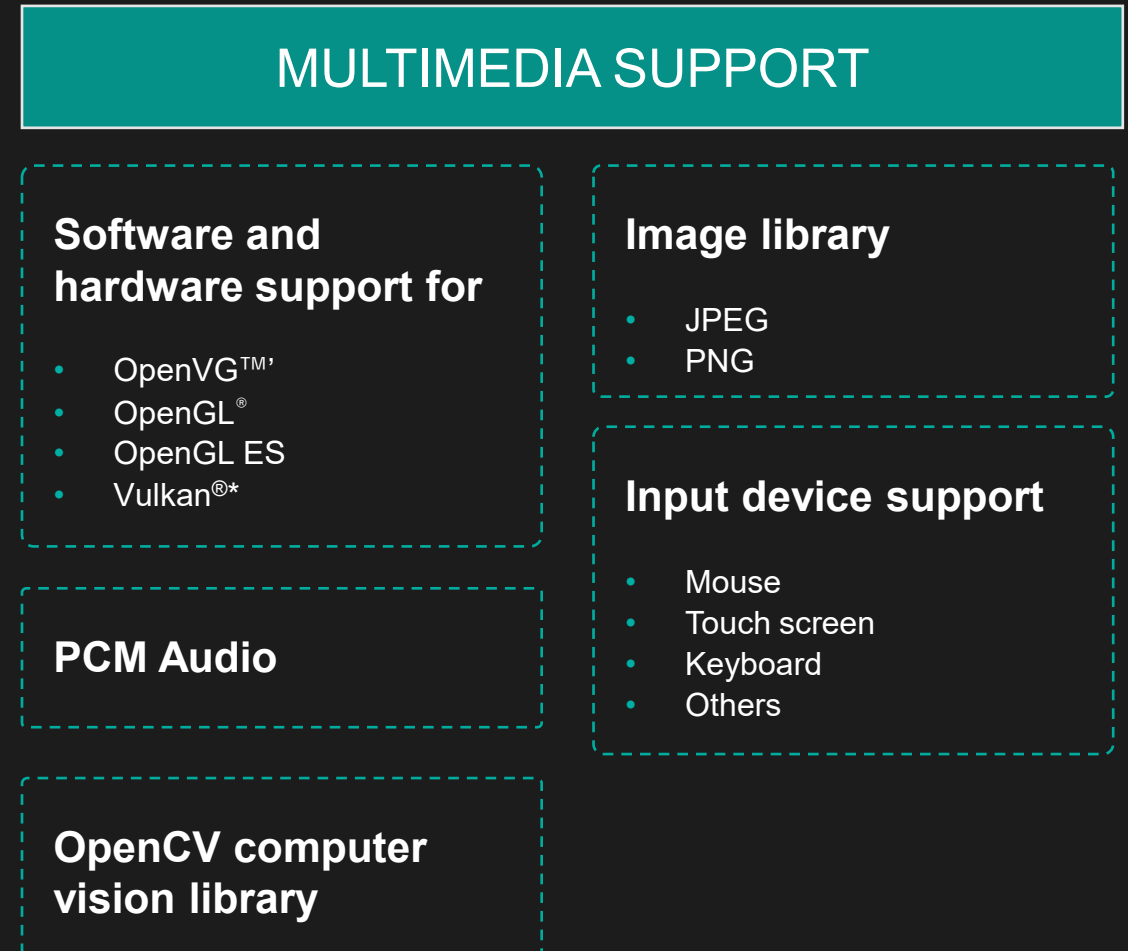
IEEE 1394

OPC-UA

VXWORKS MULTIMEDIA LIBRARIES

Benefit from out-of-the-box graphics and UI support.

- Support for many standard graphic libraries with hardware acceleration
- Support for audio and video industry standards



VXWORKS SECURITY

VxWorks security capabilities secure the device with a foundation of security options to protect code and data.

- From booting operations to power down, these capabilities allow architects to design security into all phases of device operation.
- VxWorks uses an IEC 62443-4.1 based Security Development Lifecycle to ensure the integrity of the VxWorks source code we provide our customers.
- Wind River is constantly monitoring and assessing the Common Vulnerabilities and Exposures (CVE) report against operating systems for applicability to VxWorks.
- The VxWorks Product Security Incident Response Team (PSIRT) addresses threats and communicates with the customer base.

VXWORKS COMPREHENSIVE SECURITY

Secure the device, secure the development,
and address possible vulnerabilities.

Secure boot and digitally
signed applications

Built-in user
access controls

Secure storage options

Kernel hardening and
address sanitizers

Cryptography and
secure network protocols

Leverage hardware
security (TPM 2.0, TSS)

BROAD AND ROBUST HARDWARE SUPPORT

- Access the most extensive range of board support packages (BSPs) in the embedded software industry
- Begin early prototyping with the flexibility of choice

→ BSP query tool: <https://bsp.windriver.com/home>



PARTNERS

Wind River partners encompass the very best companies in the embedded software industry bringing even greater capabilities to the Wind River portfolio of products for developing, deploying, operating, and servicing mission-critical intelligent systems.

→ [Wind River Partner Directory](#)



Platinum

What's next



FUTURE HYPOTHESIS

- VxWorks modularization for functional safety certification
- Deeper hardware integration (NXP, TI, Samsung)
- Security
- TSN
- Multimedia (audio, camera, GPU, NPU)
- Tighter cloud-native integration
- Better POSIX (PSE53)
- Broader standard protocol libraries (e.g. Google protobuf)
- Safety Certification on Intel for HVP

WINDRVR

