BUILDING THE INTELLIGENT EDGE FOR SPACE





WIND RIVER BY THE NUMBERS

FOUNDED 1981



COMMERCIAL REAL-TIME OPERATING SYSTEM



COMMERCIAL LINUX



FOR MORE THAN 40 YEARS, WIND RIVER HAS BEEN THE LEADER FOR PROVIDING OPERATING ENVIRONMENTS AND SOFTWARE SOLUTIONS TO THE EMBEDDED AND MISSION-CRITICAL INDUSTRIES.



DISTRIBUTED CLOUD PLATFORM FOR 5G





IN MORE THAN 2B DEPLOYED DEVICES AND SYSTEMS



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WIND RIVER IS A TRUSTED LEADER IN AEROSPACE AND **DEFENSE WITH OVER 600 A&D CUSTOMERS WORLDWIDE AND MORE THAN 750 SAFETY CERT PROGRAMS** ACROSS SPACE, AIR, LAND, MARITIME, AND CYBER DOMAINS.

SELECT SPACE MISSIONS

- ISS Standard Payload Computer
- Mars Perseverance Rover
- Juno Autonomous Satellite
- Astranis Satellite
- Astroscale ELSA-M
- Interface Region Imaging Spectrograph (IRIS)
- Lunar Atmosphere Dust and Environment Explorer (LADEE)
- Mars Odyssey Flight & Mission Computers
- James Webb Space Telescope ISIM
- ARES I & ARES V Launch Vehicles IUA
- Genesis Solar Wind Sample Return
- Mars Curiosity Rover
- Mars Phoenix Lander
- Global Precipitation
 Measurement Mission (GPM)
- SpaceX Falcon 9 Launch Vehicle
- Surrey Satellite Technology Ltd (SSTL) VESTA 3U



KEY DIGITAL TRANSFORMATION CHALLENGES

SOLUTIONS ADDRESS SOFTWARE COMPLEXITY AND CONNECTIVITY TO UNLOCK NEW FEATURES

INDUSTRY CHALLENGES

THREE COMMON ARCHITECTURE SOLUTIONS ENABLE PATH FORWARD



Manage increased software content and complexity



Adopt modern software development practices and tools



Securely leverage increasing connectivity and interfaces



Continuously enhance feature and security over application lifecycle



Manage proliferating data and process at the edge



Edge-to-Cloud Connectivity Platform

- End-to-end DevSecOps platform
- Full traceability of requirements
- Container orchestration



Cloud-Native Software Architectures

- Microservices and containers
- Modularity and updatability
- Scalability and reusability

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Next-Gen Hardware Architectures

- Up-integration of compute
- "Serverization" and mixed criticality
- Optimized data/power distribution



INTEGRATING THE INTELLIGENT EDGE AND THE CLOUD



WNDRVR

WIND RIVER PRODUCT PORTFOLIO



THE WIND RIVER & AWS PARTNERSHIP

- Validated AWS Partner
- Strategic collaboration on product roadmap e.g., DevSecOps, Containers and Gen AI use cases.
- Joint events Space Day, AWS re:Invent, and CES
- Focused GTM across priority industries e.g.
 Aerospace and Defense
- Two available AMIs



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eLxr for AWS x86

The eLxr project is a Debian derivative, open-source collaborative project for cloud to edge deployments, bridging the embedded and enterprise use cases with a robust, reliable, rightsized, real time and resilient approach.



VxWorks for AWS Graviton

VxWorks image loader for Graviton 2. This product requires an existing VxWorks image.

HUMAN EXPLORATION AND OPERATIONS CHALLENGES

- Developing and deploying safe and secure software for HPSC systems
- Spacecraft computational power, connected systems, power efficiency, and resilience
- TSN, power-aware, fault tolerance and recovery, mixed criticality
- Autonomy and AI at the edge, mission assurance



VXWORKS

Built on an upgradable, future-proof architecture to help you rapidly respond to changing market requirements and technology advancements

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Deploy embedded and safety-critical applications on proven software foundation OCI containers, TSN, and multicore support; certifiable to DO-178C DAL A, AI/ML ready Deterministic, priority-based preemptive RTOS with low latency and minimal jitter

Write and deploy better software faster on a modern, future-proof, secure, safety certifiable edge foundation

HELIX VIRTUALIZATION PLATFORM

Safety certifiable, multi-core, multi-tenant platform for **mixed levels of criticality.** HVP consolidates multi-OS and mixed-criticality applications onto a single edge compute software platform, simplifying, securing, and future-proofing designs

Secure Type 1 hypervisor supporting multiple edge platform

High performance and determinism. including for TSN; guest OS in a single certifiable to DO-178C DAL A

Ease portability and consolidation of mixed-criticality systems; SWaP-C optimized

Scalable, consistent, future proof across a broad range of Arm® and Intel® architectures



eLxr PRO

Commercial enterprise Linux offering based on Debian and fully supported by Wind River's 15+ years Linux experience to address the unique needs of cloud-to-edge deployments

Cloud native, enterprise-grade Linux adoption for Cloud to Intelligent Edge

WNDRVR

services, enhanced security, performance tuning services

implementation

Migration,

Technical support with SLAs backed by experts in near-edge Linux use cases





Open, flexible, reliable, secure; optimized for high performance hardware accelerators and critical workloads

WIND RIVER LINUX

Develop, deploy, and operate robust, reliable, and secure embedded solutions running on a Yocto-based, purpose-built Linux operating system.

- Tools to create a supported, purpose-built Linux
- Source code or pre-built binary images
- Extreme customizability

Tuned Linux OS with minimized memory and storage requirements

WNDRVR

Limited attack
surfaces plusCompliance
artifacts that
document
volnerabilityvulnerability
response and
mitigationSource code
origins and
licenses





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WIND RIVER LINUX									
CONTAINER ENGINES AND K8S AGENT									
ISO 9001:2015									
UPSTREAM MODEL									
BSPs									
YOCTO PROJECT									



SIMULATION

Simulation full systems to perform complex system tests while automating test cases, streamline CI/CD with integrated simulation, maintain systems with hardware EOL.



Intel® Simics® for fine grain debug, collaboration, test, development, and config

QEMU for coarse grain simulation Comprehensive: over 100 boards and thousands of parts modeled

Develop, test, integrate, automate anything, anywhere, anytime

STUDIO DEVELOPER IS THE CLOUD-NATIVE SOFTWARE PLATFORM FOR THE INTELLIGENT SYSTEMS WORLD

- » STUDIO IS A CLOUD-NATIVE PLATFORM FOR THE DEVELOPMENT, DEPLOYMENT, OPERATIONS, AND SERVICING OF MISSION-CRITICAL INTELLIGENT SYSTEMS FROM DEVICES TO THE CLOUD.
- » IT ENABLES DRAMATIC IMPROVEMENTS IN PRODUCTIVITY, DEVELOPER VELOCITY, AGILITY, AND TIME-TO-MARKET, WITH SIGNIFICANT ROI.
- THE PLATFORM COMES WITH SEAMLESS TECHNOLOGY THAT INTEGRATES FAR EDGE CLOUD COMPUTE, ANALYTICS, ENHANCED SECURITY, AI/ML CAPABILITIES, AND 5G.

WNDRVR Studio

STUDIO PIPELINES

Studio helps you create automated pipelines to customize your workflows for coding, scanning, assembling, and testing your embedded software project.

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Turn your pipeline into a valuable software asset Easily customize pipelines to meet project needs Create, maintain, and share development pipelines across projects and teams

Increase productivity and get the most out of your development workflows with a one-click process to automate and customize pipelines.

REDUCE QUALITY ISSUES WITH STUDIO TEST AUTOMATION

Studio simplifies and expedites the testing, verification, and validation of embedded OS platforms and embedded applications through cloud-hosted resources.

- Create scale and automation with system simulation
- Test Automation Framework provides ubiquitous access to test resources

Cloud-native testing

Capture and analyze data from all test runs



Solve the scalability challenges of embedded software testing.

STUDIO VIRTUAL LAB

Studio Virtual Lab offers a secured cloud portal to remotely manage and share distributed test environments, including remote hardware labs and modern simulation tools.

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Secure shared access to unlimited testing resources from anywhere Scaling DevOps through simulation Bring your own model

Remove the barriers of limited embedded hardware availability with cloud access to virtual assets.

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STUDIO DIGITAL FEEDBACK LOOP

Gain real-time analytics and insights from combined OS-level and application-specific data to make data-driven decisions and optimize health, performance, and maintenance of assets deployed at the edge.



Device enlistment and management Scalability and performance

Flexibility and configurability

Studio Digital Feedback Loop provides rapid feedback on performance of systems and applications operating at the intelligent edge.

STUDIO OVER-THE-AIR UPDATES

This comprehensive, eSync-compliant OTA manager streamlines secure transport, data encryption, authentication, rollback, and version management, simplifying vehicle software updates and maintenance.

Automated deployment of updates at massive scale Integrated endto-end rolling upgrade solution

In-service and reboot-required updates Reliable, automated delivery of the latest application to your globally distributed production fleet

ADVANCED LIFECYCLE TECHNOLOGIES FOR HPSC

Studio Developer enables High Performance Spaceflight Computing (HPSC) development, deployment, operations, and servicing mission-critical intelligent systems for space.

VxWorks RTOS	HELIX VIRTUALIZATION PLATFORM	eLxr PRO	WIND RIVER LINUX	SIMULATION
The leading certified RTOS in critical infrastructure sectors for more than 30 years. The RTOS behind multiple Mars missions and many other space missions.	Type 1 hypervisor built on the industry-leading VxWorks 653 Helix Platform consolidates and separates multi-OS and mixed- criticality apps on a single platform to future-proof your architecture.	Space-grade Linux with system- level, security, and reinforcements tools. Provides long-term security update strategies for deployed devices. With validated, maintained, and supported source code.	Space-grade Linux with system- level, security, and reinforcements tools. Provides long-term security update strategies for deployed devices. With validated, maintained, and supported source code.	Wind River's full system simulation and Intel Simics® validate your space-ready hardware. You can simulate and run production binaries for any part of your target software stack by leveraging a comprehensive model library for a true digital twin.
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STUDIO PIPELINES	STUDIO VIRTUAL LAB	STUDIO TEST AUTOMATION FRAMEWORK	STUDIO OVER-THE-AIR UPDATES	STUDIO DIGITAL FEEDBACK LOOP
Optimize core flight system development team's efficiency by creating customized software pipelines to automate workflows for building, scanning, testing, deploying, and managing your embedded software tools, projects, and devices.	Eliminate availability and access challenges of RISC-V HPSC hardware with a virtual lab that allows your software team to share distributed test resources of both physical hardware and modern simulation tools.	Reduce the time and cost of testing core flight systems by leveraging a scalable, cloud- centric test automation framework designed to simplify the process of embedded software validation.	Keep space compute devices secure and updated while enabling innovative development with orchestrated, over-the-air software updates to help you manage your fleet of space systems.	Gain real-time analytics and insights from remote space fleets to make important data- driven decisions and optimize health, performance, and maintenance deployed in space.

SECURE SOFTWARE DEVELOPMENT FRAMEWORK

- Wind River complies with Presidential Exec Order 14028 and OMB memoranda M-22-18 and M-23-16
- Wind River adheres to NIST SP 800-218 guidelines for secure software development lifecycle
- Wind River adheres to NIST 800-171: Protecting CUI in Nonfederal Systems and Orgs
- Wind River has filed attestations of compliance with CISA for:
 - VxWorks
 - HVP Cert
 - Wind River Linux
 - Diab

WNDRVR

- Simics® (provided by Intel®)
- Conformance Statements are available to customers upon request
- Wind River is a CVE Numbering Authority (<u>CNA</u>)
 - ISO/IEC 30111: Vulnerability Handling Processes
 - ISO/IEC 29147: Vulnerability Disclosure



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WHAT YOU WILL SEE NEXT

Wind River Studio Developer with cFS

- NASA cFS
- VxWorks
- Studio Pipeline Manager
- Studio Virtual Lab
- Studio Test Automation

Containerized Edge and Platform One, GitLab, and AWS

- Deployable AWS CloudFormation template to provision an EC2 instance of Big Bang
- Containerized VxWorks build using GitLab CI/CD
- VxWorks containerized application updates

Studio Developer and AWS

- Gen Al Scenarios
- Zero Trust Approach
- Hosted on AWS