VxWorks 653 Multi-core Edition

An integrated modular avionics (IMA) platform enabling workload consolidation of safety-critical and less critical applications.

Aerospace and defense platforms are increasingly mandated to maximize performance while meeting stringent affordability, safety certification, and physical constraints on device size, weight, and power (SWaP). To meet these needs, program and engineering managers have to ensure that the correct applications and architectures are selected right from the beginning of a project.

As technology progresses, the defense industry is gravitating toward using a mixture of powerful hardware platforms and standards-based, open virtualization systems that support unmodified guest OS environments, enabling developers to make use of the platforms' flexibility to extract value across multiple use cases. One example is the consolidation specification for integrated modular avionics (IMA) systems: ARINC specification 653. Use of this internationally accepted specification enables multiple avionics vendors and hosted-function suppliers to safely deploy integrated applications on a shared multi-core hardware platform, while maintaining complete system conformance with rigorous avionics safety standards such as RTCA DO-178C, EUROCAE ED-12C, RTCA DO-254, EUROCAE ED-80, RTCA DO-297, and EUROCAE ED-124.

VxWorks® 653 Multi-core Edition is a safe, secure, and reliable real-time operating system (RTOS). It delivers an ARINC 653–conformant system by providing robust time and space partitioning on the latest hardware platforms to ensure fault containment and the ability to upgrade applications with minimal test and integration demands.

FEATURES AND BENEFITS

- **Affordability:** VxWorks 653 Multi-core Edition employs a modular open architecture and supports robust partitioning that enables suppliers to modify an application that is part of an existing certified system and only retest the scope of the components that have changed, dramatically reducing recertification costs.
- **Independent build, link, and load (IBLL):** VxWorks 653 Multi-core Edition is designed around a multi-supplier, role-based supply chain per RTCA DO-297, which allows application suppliers to asynchronously develop, test, and deliver software applications independently.
- **Multi-core scheduler using hardware virtualization assist:** VxWorks 653 Multi-core Edition enables the virtualization of unmodified guest operating systems, allowing applications to run in parallel on separate cores and virtualization environments, increasing safety, security, robustness, and compute capacity. Benefits include:
  - Reduced bill of materials (BOM)
  - High performance and low jitter due to two-level virtual machine architecture
  - Robust support of multiple levels of safety criticality on a shared compute platform

- **Industry standards conformance:** VxWorks 653 Multi-core Edition lowers upgrade costs by providing high portability across product lines and airborne platforms. It provides:
  - Simultaneous support for ARINC 653 APEX API, VxWorks, POSIX®, FACE™, Software Communications Architecture (SCA), and application programming interfaces (APIs)
  - Support for applications written in Ada, C, and C++
  - Unmodified guest OS support that eases portability for legacy applications mixed with modern, standards-based applications and operating systems
  - Development tools: VxWorks 653 Multi-core Edition reduces development time and cost. Its benefits include:
  - Independent supplier build process, reducing the impact of code changes across multiple development teams
  - Wind River® Workbench development suite based on the Eclipse open tool architecture, enabling wide integration of industry toolchains
  - Wind River Simics® support for system simulation and automation
- **Hardware support and availability:** VxWorks 653 Multi-core Edition supports ARM, Intel®, and Power processors architectures
- **Proven market excellence:** VxWorks 653 Multi-core Edition is built on the VxWorks and VxWorks 653 rich pedigree of single and multi-core development, proven in more than 550 programs delivered by over 350 customers in more than 90 aircraft, including:
  - Airbus Helionix, Airbus MRTT, and Airbus A400M
  - Boeing 787 Dreamliner, Boeing C-130 AMP, Boeing KC-767 tanker, and Boeing P-8 Poseidon (Multi-Mission Maritime Aircraft, or MMA)
  - COMAC C919
  - Lockheed Martin C-130T
  - More than 80 other global aircraft

Development Suite

GNU Compiler	System Viewer
DO-178 and DO-330 Qualified Verification Tools	Wind River Workbench
Integrated Simulator	XML Configuration Suite

Software Partners

Cockpit Design Tools	ARINC 661 Graphics
Ada 95/2005 Compilers for VxWorks	ARINC 664 Compliant Stack
DO-178C Certification Service	Simulation Platform

OS

DO-178C Network Stack (UDP/TCP IPv4)*
VxWorks 653

* Optional

Hardware Partners

COTS Boards

Services

Education and Installation		Platform Customization
System Design	Hardware/Software Integration	Design Service

Figure 1. VxWorks 653 Multi-core Edition

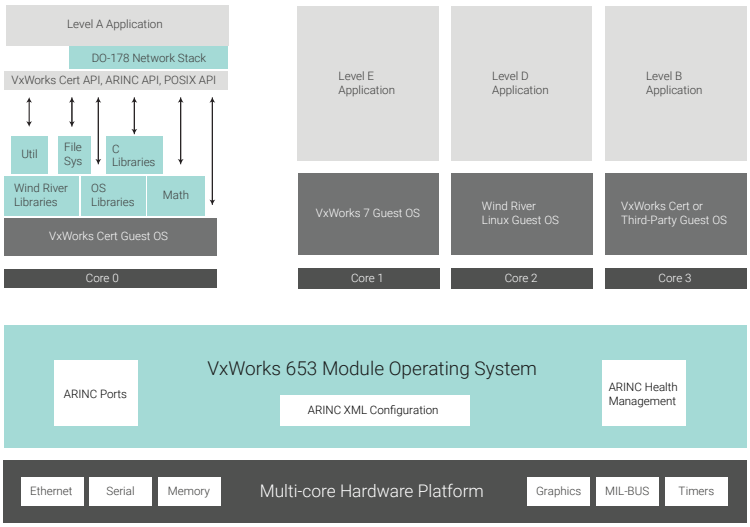

Figure 2. IMA design with VxWorks 653 Multi-core Edition

OPTIMIZED, INTEGRATED DEVELOPMENT SUITE

Wind River Workbench

VxWorks 653 Multi-core Edition includes Wind River Workbench, a fully integrated Eclipse-based open development suite optimized to support design, development, test, and certification of applications to meet RTCA DO-178C and EUROCAE ED-12C DAL A certification. The development suite consists of a project facility to define application resources and an XML configuration tool to easily define the static configuration records required for ARINC 653 partitioned applications.

The VxWorks 653 development suite also offers RTCA DO-330 and EUROCAE ED-215 qualified development and verification tools that assist in the application test for credit and also enable the insertion of new applications into a tested environment without forcing a retest of the entire platform. This facilitates faster deployment of ARINC 653 systems, conserving certification testing resources and significantly reducing the cost of change.

The RTCA DO-330 and EUROCAE ED-215 XML configuration tool, qualified as a development tool, allows developers to make changes to application or system configuration information without rebuilding and retesting the entire system.

VxWorks 653 also enables the RTCA DO-297 and EUROCAE ED-124 IMA Development Guidance and Certification Considerations document, enabling intellectual property and security separation between the platform supplier, the application supplier, and the system integrator, providing a framework for multiple suppliers to provide components to an integrated modular avionics (IMA) platform.

Unique to this platform are three high-performance tools that aid in the deployment of certified applications. These tools:

- Allow developers to measure CPU use by individual applications or all applications
- Report memory usage of various areas of the OS, including heaps, stacks, ports, and health monitoring memory use
- Monitor traffic across sampling and queuing ports

Along with the OS, the interfaces to these tools are qualified under RTCA DO-330 and EUROCAE ED-125 guidelines, enabling testing of the exact deployment environment for certification with minimal testing demands.

Wind River Simics

Simics enables software to run on virtual platforms just as it does on physical hardware. Along with its capabilities for scripting, debugging, inspection, and fault injection, Simics enables users to define, develop, and integrate their systems without the constraints of physical target hardware. Simics provides the access, automation, and collaboration required to enable agile and continuous development practices.

INTELLIGENT LICENSING MODEL

VxWorks 653 Multi-core Edition is available to companies under two Wind River licensing models: (1) Perpetual (paid up front) licensing and (2) Enterprise License Agreement (ELA) subscription-based licensing, which gives businesses unprecedented flexibility in project budgeting and ease in license management across the enterprise. Two modes of production licensing (production license or production license–free) offer the option of capturing license fees in research and development or manufacturing.

PROVEN, RELIABLE PARTNER

The right technology partner can greatly increase your odds of success in a highly competitive marketplace. As the industry leader, Wind River has met and exceeded the requirements of our customers and their markets for more than 35 years, and our technology is found in more than 2 billion global devices. Wind River is positioned to continue our high level of support with established device manufacturers and new companies alike.

COMMERCIAL-GRADE SUPPORT AND SERVICES

VxWorks 653 includes full access to the Wind River worldwide support organization, with 24/7 product support and training available through multiple channels. We also offer a specialized aerospace and defense services practice—a team of Wind River Professional Services engineers with extensive experience in delivering design, integration, and optimization services tailored to the needs of your industry, including creating RTCA DO-178C and EUROCAE ED-12C certification artifacts for board support packages (BSPs) and additional software libraries and modules. VxWorks 653 contains no International Traffic in Arms Regulations (ITAR)–restricted code.

WNDRVR

Wind River is a global leader of software for the intelligent edge. Its technology has been powering the safest, most secure devices since 1981 and is in billions of products. Wind River is accelerating the digital transformation of mission-critical intelligent systems that demand the highest levels of security, safety, and reliability.