

Wind River VxWorks Cert Platform

Wind River VxWorks Cert Platform enables safety critical systems developers access to Wind River's commercial off-the-shelf (COTS) platform for delivering applications that must be certified to the stringent requirements of software safety standards. These include RTCA DO-178B, EUROCAE ED-12B ("Software Considerations in Airborne Systems and Equipment Certification") and IEC 61508 (functional safety of electrical/electronic/programmable electronic safety-related systems [E/E/PES]). With VxWorks Cert Platform, developers can take full advantage of technological advances in microprocessors that the VxWorks COTS real-time operating system (RTOS) enables, with the assurance that they will have a strong operating system foundation to meet the most demanding safety certification standards.

Safety in the Avionics Market

The avionics market has a history of success using standard commercial microprocessors for a variety of flight-critical applications that can directly affect aircraft safety and reliability. To ensure that airborne systems contain a consistent high quality to meet the demands of a variety of safety criticality levels, the global aerospace community

developed the RTCA DO-178B and EUROCAE ED-12B airborne avionics standards to provide guidance on creating, certifying, and deploying these devices. These specifications are now uniformly enforced by a wide range of commercial aviation control organizations, including the U.S. Federal Aviation Administration (FAA), the European Aviation Safety Agency (EASA), Transport Canada, and others.

The aviation community reviewed input from every aerospace manufacturer in the world to create this standard that specifies 66 objectives that describe recommended software life cycle and testing guidelines for the aviation industry. Wind River's DO-178B and ED-12B COTS Certification Evidence DVD contains a complete certification package that meets these stringent objectives and therefore enables our customers faster time-to-market and gives equipment manufacturers a competitive advantage in the ability to leverage additional, ready-made technology from Wind River partners.

Safety in the Medical and Industrial Markets

IEC (International Electrotechnical Commission) 61508 is internationally recognized as the standard for software

functional safety in industrial systems. Wind River's IEC 61508 Certification Evidence DVD includes a safety manual and safety certificate indicating that the VxWorks Cert 6.6 RTOS is certified to the stringent standards of IEC 61508 Software Integrity Level (SIL) 3. The medical, railway, nuclear systems, and automotive markets have all produced safety certification standards derived from IEC 61508.

The certification of VxWorks Cert 6.6 ensures that our customers meet safety requirements of certification boards while leveraging Wind River's extensive

VxWorks Cert Platform Components and Hosts

Included Components

- Wind River Workbench 3.2
- VxWorks 6.6 RTOS
- VxWorks Cert 6.6
- GNU Compiler 4.1.2
- Wind River Compiler 5.6.0
- MPC 8349E reference BSP (PowerPC 603 architecture, PowerPC e300 core)
- Curtiss-Wright SVME/DMV-183 certifiable BSP (PowerPC 604 architecture, PowerPC e600 core)
- IDP945 reference BSP (Intel Core 2 Duo, 945 Chipset)

Optional Components

- TCP/UDP/IPv4 network stack with multicast
- Workbench plug-in for on-chip debugging

Supported Hosts

- Windows XP Professional, Windows Vista (Business and Enterprise), Windows 7
- Solaris 10
- Red Hat Enterprise Linux, Workstation 4 and 5
- Red Hat Fedora 9 and 11
- OpenSUSE Linux 11.0 and 11.1
- Novell SUSE Linux Enterprise Desktop 10 SP2 and 11
- Ubuntu Desktop 8.04 and 9.04

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partner solutions. Our customers reduce risk with our safety solution and have the competitive advantage of getting products to market faster.

Integrated Development Environment

VxWorks Cert Platform includes the award-winning Wind River Workbench development suite. Wind River Workbench is an Eclipse-based collection of tools designed to accelerate time-to-market for developers building devices with VxWorks 6 real-time operating systems. From hardware and board initialization to application development, Workbench offers deep capability across the development process in a single integrated environment, with complete platform integration, including powerful tools for debugging, code analysis, and test. Based on the Eclipse framework, Workbench can be extended through in-house, third-party, open source, and commercial plug-ins.

In addition to the Workbench Eclipse-based environment, VxWorks Cert Platform provides a full-featured command-line build system and debugging tools for developers who prefer this type of environment. These command-line tools can be easily integrated into a customized build system. The Workbench development environment helps reduce development costs and manage code complexity, eases tool integration, and enables standardization on a common development foundation across the enterprise.

Leveraging the Power of VxWorks 6

VxWorks Cert Platform includes a full commercial version of the VxWorks 6 RTOS as an integral part of the development package. This enables the use of a standard VxWorks 6 development environment, including the Wind River run-time analysis tools: Simulator, System Viewer, and Source Analyzer.

Development Suite

Wind River Workbench	
Wind River Compiler	Workbench Debugger
GNU Compiler	Host Shell
On-Chip Debugging*	VxWorks Simulator

Software Partners

Java	OpenGL Graphics
Certification Services	Simulation Platforms
Design Tools	Ada

Operating System and Middleware

IEC 61508 SIL3 Certification Evidence*	DO-178B Level A Certification Evidence*
Safety-Certified Network Stack (TCP/UDP/IPV4)*	
VxWorks Cert 6.6	
*Optional	

Hardware Partner

COTS Boards

Services

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

Figure 1: Wind River VxWorks Cert Platform

The certified VxWorks Cert 6.6 RTOS includes more than 480 kernel mode APIs and 150 user mode APIs selected from VxWorks 6, all of which are fully deterministic and deployable under guidelines outlined in the DO-178B and IEC 61508 safety standards. These include cache, clock, event flag, interrupt, memory management, message queue, ring buffer, semaphore, signal, and task management calls, along with a wide array of C and C++ library functions.

With VxWorks Cert 6.6, developers enjoy the following advantages:

- VxWorks 6 code does not need to be modified. All common system calls used in development environments can be immediately transitioned into a safety-certifiable environment.
- This system call commonality drives a minimal learning curve for developers already familiar with VxWorks 6 because the Workbench development environment and VxWorks 6 calls are the same in both uncertified and certified configurations.

- VxWorks Cert 6.6 is a COTS product, with the full leverage of COTS components: standardized usage, significantly lower costs, open toolchains, and shared certification evidence for rapid acceptance by safety certification boards.

VxWorks Cert 6.6 supports both C and C++ development. Many parts of the standard C libraries are in the kernel mode and user mode APIs, including parts of the error codes, math functions, string functions, utilities, and input/output functions. Developers can make use of object-oriented programming using the VxWorks Cert C++ language subset, which includes basic C++ constructs such as classes, inheritance, namespaces, polymorphism, and virtual functions.

User mode application support introduced in VxWorks Cert 6.6.2 brings VxWorks 6 real-time processes (RTP) to a safety-certifiable environment. The VxWorks Cert 6.6 RTP API subset allows

applications to take advantage of memory protection, thus simplifying software integration between parallel development groups.

Contact your local Wind River sales representative for complete details on our VxWorks Cert 6.6 APIs and on the VxWorks Cert 6.6 C++ feature subset.

DO-178B Certification Evidence DVD

VxWorks Cert Platform is backed by the industry's most comprehensive set of certification artifacts, which support all RTCA DO-178B and EUROCAE ED-12B Level A requirements. Wind River's DO-178B and ED-12B COTS Certification Evidence DVD contains all of the required DO-178B Level A documentation, the software vulnerability analysis document, full source code, tests, code and test reviews, all test results, and full object-level code coverage listings. All files are fully hyperlinked to enable rapid traceability analysis of certification data, from the requirements, design, source and binary code, and test cases, using a simple browser. This certification evidence DVD, the review of piles of printed and individual computer-based certification artifacts at locations distant from your engineering teams or certification authorities is no longer required.

This hyperlinked evidence contains more than 40,000 files including the following:

- Plan for Software Aspects of Certification (PSAC)
- Software Quality Assurance Plan
- Software Configuration Management Plan (SCMP)
- Software Development Plan (SDP)
 - Software requirements standards
 - Software design standards
 - Software coding standards
- Software Verification Plan (SVP)
- Software Requirements Specification (SRS)
- Software Design Document (SDD)
- Version Description Document (VDD)
- Traceability Matrix
- Software Development Folder
 - Design reviews
 - VxWorks 6 source files
 - VxWorks 6 binary files
 - Code reviews
 - Test reviews

- Functional tests
- Coverage results (object level)
- Software Accomplishment Summary (SAS)
- Software Vulnerability Analysis (will be required by DO-178C)

This certification evidence can also be used, without modification, in related safety certification efforts, such as RTCA DO-278 ground-based systems certifications, for instance.

IEC 61508 Certification Evidence DVD

VxWorks Cert Platform supports all IEC 61508 SIL 3 requirements. The fully hyperlinked IEC 61508 Certification Evidence DVD enables rapid traceability analysis of certification data, from the requirements, design, source and binary code, and test case phases, using a simple browser. This DVD eliminates the need to review printed and individual computer-based certification artifacts. It includes the VxWorks Cert IEC 61508 Safety Manual and all required IEC 61508 SIL 3 documentation. The certification package also contains the TUV certificate for VxWorks Cert Platform.

This certification evidence can also be used in related IEC 61508 safety certification efforts, such as the CENELEC (European Committee for Electrotechnical Standardization) railway application standards, for example.

The certification package includes the following pieces of evidence:

- IEC 61508 safety certificate for VxWorks Cert 6.6
- Safety Manual for VxWorks Cert 6.6

- Safety Plan for VxWorks Cert 6.6
- Software Quality Assurance Plan (SQAP)
- Software Configuration Management Plan (SCMP)
- Software Development Plan (SDP)
- Software Requirements Standard (SRStd)
- Software Design Standard (SDStd)
- Software Coding Standard (SCStd)
- Software Verification Plan (SVP)
- Functional Safety Management Plan (FSMP)
- Software Test Plan (STP)
- Software Plans Addendum (SPA)
- Software Requirements Specification (SRS)
- Software Vulnerability Analysis (SVA)
- Software Design Document (SDD)
- Software Configuration Index (SCI)
- Software Life Cycle Environment Configuration Index (SECI)
- Software Development Folder (SDF)
- Requirements Traceability Document (RTD)
- Qualification documents for tools used in certification process (structural coverage analysis, automated link verification tool, traceability tools)
 - Tool Operational Requirements Document (TOR)
 - Tool Qualification Document (TQD)
 - Tool Operational Requirements Document (TOR)
 - Tool Qualification Document (TQD)
- Artifact Verification of Traceability
- Link Verification of Traceability

Wind River Cert Network Stack

Wind River Cert Network Stack is an embedded TCP/UDP/IPv4 network stack that can be used in conjunction with VxWorks Cert Platform. This network stack has complete certification

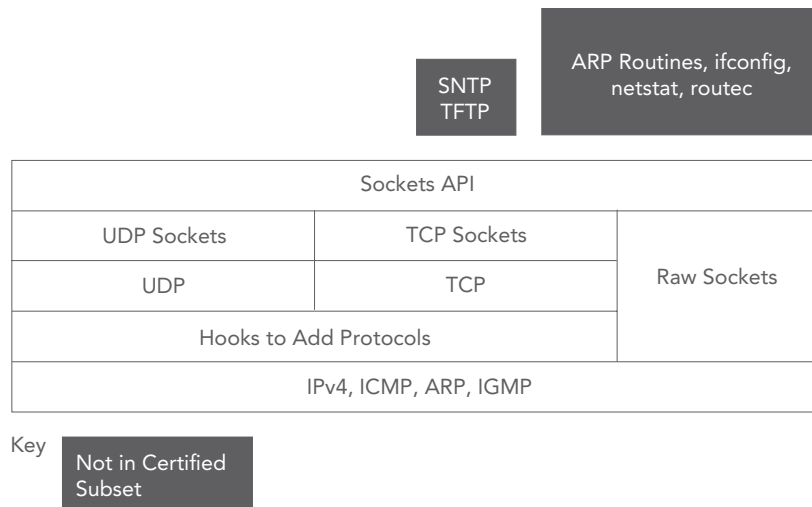


Figure 2: Certified network stack

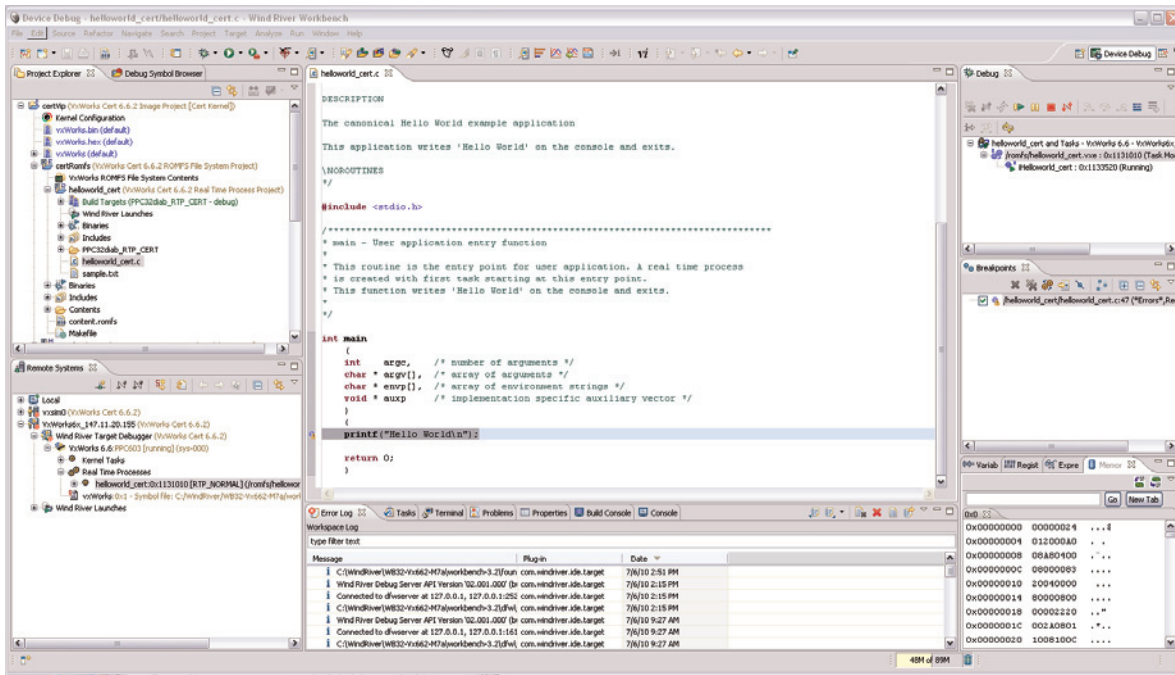


Figure 3: Wind River Workbench

evidence, available for DO-178B at the highest level, Level A, and for IEC 61508 SIL3. This network stack uses the same APIs as Wind River’s networking stack and supports the BSD sockets API (datagram, stream, and raw sockets), enabling the easy migration of networking software from VxWorks and Linux platforms.

Wind River Workbench 3.2

Provided as part of the VxWorks Cert Platform, Wind River Workbench supports application development based on the full-featured VxWorks 6 kernel. This allows for optimization and testing, using the full power of Workbench’s industry-leading tools and techniques. It provides developers with a very rich programming and debugging environment. Using the full-featured VxWorks 6 kernel for application development allows the use of all of the standard Workbench tools for VxWorks 6 development, including the VxWorks Simulator and the Workbench analysis tools such as System Viewer, Code Coverage Analyzer, Data Monitor, Memory Analyzer, and Performance Profiler. As the project moves into certification test and deployment, a subset of the standard VxWorks 6 tools are available that allow developers to

debug applications built with the certification kernel and perform final testing and integration on the deliverable system hardware.

For VxWorks Cert 6.6 projects that use the certified kernel, Workbench includes the following features.

Eclipse

Because of its openness, capability, and strong community support, Eclipse was chosen as the framework for the Wind River Workbench development suite. The Eclipse 3.4 framework supplies the necessary infrastructure to graphically and functionally integrate the components of Workbench. Open, extensible, and backed by a strong community of commercial and open source developers, the Eclipse framework provides a wide range of additional integrated functionality.

Project System

The Workbench project system allows developers to organize and manage the primary components in a device software development project, including source files and target systems. VxWorks 6 projects of different types can be created for configuring and building kernel images and board

support packages (BSPs) as well as both kernel module and RTP application projects that use VxWorks 6 and either C or C++. By design, Workbench enables users to manage multiple projects simultaneously.

Workbench allows easy transition between non-certified and certified application projects by providing build specifications for either environment. This allows the user to simply rebuild the same project with either the standard or certified version of the VxWorks 6 kernel.

Build System

The Workbench build system specifies the tools, options, and parameters to use when building VxWorks 6 software projects, enabling developers to set build parameters easily from the project level down to the individual file level. The build system allows for use of simple global build-setting, fine-grained control at the level of an individual file, and everything in between.

Command-Line Project Build System

In addition to the Workbench build system, a full-featured command-line build system is provided for developers who prefer this type of environment. Using

GNU make, Tcl libraries, and VxWorks-specific tools, developers can configure VxWorks 6 source and build VxWorks 6 images as well as develop applications and libraries using command-line build facilities. These command-line tools can be easily integrated into a customized build system.

Wind River Compiler and Wind River GNU Compiler

Wind River Compiler is the default C compiler for building the VxWorks Cert 6.6 kernel, RTPs, libraries, BSPs, and applications in Wind River Workbench. This compiler's optimization capabilities are based on and extend the industry-hardened Diab compiler technology, and it produces robust, tight, fast-executing code.

Wind River GNU Compiler is based on the Free Software Foundation (FSF) distribution of the GNU compiler. Wind River has optimized a standard version of this compiler specifically for use with VxWorks 6.

Both compilers are included and supported as part of Wind River Workbench for VxWorks Cert 6.6 for application development.

Workbench Debugger

Workbench Debugger addresses the needs of developers involved with hardware bring-up, firmware/driver/BSP development, and application development. It provides more capability than the GNU debugger (GDB) or other basic source-level debuggers. These capabilities can be extended further with Wind River's on-chip debugging solutions. In combination, these tools provide the necessary functionality for hardware bring-up, device driver/BSP debugging, kernel debugging, and application software debugging.

Workbench Debugger provides extensive browsing and inspection capabilities on objects in the target platform. This awareness of VxWorks Cert 6.6 objects allows for an enhanced debugging experience that allows greater insight and productivity when debugging.

VxWorks Simulator 6

VxWorks Simulator 6 is a complete prototyping and simulation tool for VxWorks 6 applications. VxWorks Cert 6.6 static kernel modules (SKM) can run on the VxWorks Simulator. It enables you to develop and test significant portions of your cert kernel modules earlier in the development cycle, before hardware is available. It can also lower your development cost by allowing developers to share fewer hardware targets, enabling host-based development.

Host Shell

The Host Shell provides a command-line debugging interface that allows you to invoke both VxWorks Cert 6.6 and application module subroutines. The Host Shell executes on the development host, not the target; but it enables you to spawn tasks, read from or write to target devices, and exert full control over the target. Because the Host Shell executes on the host system, you can use it with minimal intrusion on target resources.

Wind River Workbench On-Chip Debugging

The Workbench development environment provided with VxWorks Cert Platform can be enabled for on-chip debugging. When using VxWorks Cert 6.6, the target debug agent must be removed before final certification. In this situation, Wind River Workbench On-Chip Debugging is the optimal debugging solution. Wind River's on-chip debugging capability, along with Wind River ICE, Wind River Trace, or Wind River Probe hardware, provides system-level debugging capability when debugging with a target debug agent is not possible. On-chip debugging provides developers with complete system-level control of their environments at all times, enabling more efficient and effective hardware bring-up, firmware development, and device driver and BSP generation.

Partner Ecosystem

Wind River's world-class partner ecosystem ensures tight integration between our core technologies and those of the premier hardware and software companies we've chosen to complement our solutions. Our partners help extend the capabilities of Wind River's development and run-time platforms by offering out-of-the-box integration and support for key technologies. Our customer support team is trained to troubleshoot partner technologies in use with Wind River products, making ours the most comprehensive and best-supported partner ecosystem in the embedded software industry.

Professional Services

Wind River Professional Services, a CMMI Level 3-certified organization, enables you to reduce risk and focus on development activities that add value and differentiate your design. As part of our comprehensive solution, Wind River offers industry-specific services practices, with focused offerings that help you meet strict market deadlines while keeping development costs down. Our experienced team delivers device software expertise that solves key development challenges and directly contributes to our clients' success. Backed by our commercial-grade project methodology, Wind River Professional Services include the following:

- Requirements discovery and definition
- BSP and driver optimization to include certification projects
- Software system and middleware integration
- Application and infrastructure development
- Hardware and field-programmable gate array (FPGA) design for prototyping or market-ready systems

Typical project times range from two to four man-weeks for driver and BSP implementation, to one man-month to one man-year for hardware design or extensions to an existing software solution, to multi-man-year programs

that bring customer concepts to reality through design, creation, and system test and verification. Professional Services has extensive experience with safety-critical systems for both the avionics and industrial markets and has implemented both hardware and software solutions for these markets and continues to work with standards organizations to establish the next-generation platforms.

Installation and Orientation Service

With proper installation and orientation of the VxWorks Cert Platform you won't waste time solving easily avoidable problems before you begin your next development project. Wind River offers an Installation and Orientation Service to ensure your project starts on time and without hassle by delivering the following:

- **Onsite installation:** Guided install on your hardware and host platform, along with a sample build process, demonstrations, and examples of customizations
- **Hands-on orientation:** Architecture, development file system, adding open source packages, porting drivers, addressing design issues
- **Advice:** Introduction to Wind River support channels and processes, additional services, project review, and consultation

The Wind River Installation and Orientation Service will expedite your path to productivity, allow you to rest assured that we have eliminated a common source of user error, and help you realize all of the platform's potential.

Education Services

Education is fundamentally connected not only to individual performance but to the success of a project or entire company. Lack of product knowledge can translate into longer development schedules, poor quality, and higher costs. The ability to learn—and to convert that learning into improved performance—creates extraordinary value for individuals, teams, and

organizations. To help your team achieve that result, Wind River offers flexible approaches to delivering product education that best fits your time, budget, and skills development requirements.

Personalized Learning Program

Wind River offers a unique solution to minimize the short-term productivity drop associated with the process of adopting new device software technology and to optimize the long-term return on investment in a new device software platform. The Wind River Personalized Learning Program delivers the right education required by individual learners to accomplish their jobs. The program identifies work-related skill gaps, generates development plans, materials, and learning events to address these skill gaps, and quantifies the impact of the development activities for each individual user.

This programmatic, focused, and project-friendly approach to skills development results in a significant increase in the personal productivity of your team members, improved efficiency in the processes they employ, and faster adoption of the technology you have purchased. The Personalized Learning Program delivers improved business performance; customers have reported a return-on-investment ranging from 18 percent to 80 percent over a traditional training approach.

Consult your local Wind River sales representative for more information on the Personalized Learning Program.

Public Courses

Wind River's public courses are scheduled for your geographical convenience. They are conducted over one to five days, using a mixed lecture and interactive lab classroom format that leverages the experience of Wind River instructors and other course participants. Courses provide a fast,

cost-effective way for students to become more productive in Wind River technology. Benefits of public courses include the following:

- A conceptual introduction that orients students to the subject matter
- A selective examination of the details, focusing on the most commonly used areas or on areas with which users tend to be least familiar
- Personal guidance and hands-on application of individual tools and course concepts
- The chance to grasp device software concepts, as well as the fundamental issues involved in real-time design
- The knowledge needed to develop device drivers, perform hardware porting, or develop applications
- Answers to specific questions about topics addressed in the course

Consult your local Wind River sales representative for course schedules and fees.

Onsite Education

If you have a large project team or a number of new users, you may benefit from custom onsite education. Instructors will consult with you and, based on the workshop series curriculum, determine which topics should be included and emphasized. This type of education offers an opportunity for one-on-one discussions with our instructors about your specific project needs, technical requirements, and challenges—all in the comfort of your own office.

The following are some advantages of onsite education:

- Your entire team gains a common knowledge base.
- It helps ensure that knowledge and skills will transfer from the classroom to your workplace.
- Use of your location saves employees travel expenses and time away from the office.

Consult your local Wind River sales representative for further information about onsite education.

Support Services

Wind River Customer Support, a Support Center Practices (SCP)–certified organization, provides full maintenance and support for VxWorks Cert Platform, delivered through Wind River’s Online Support (OLS) website and our worldwide technical support team. While under subscription, customers receive both maintenance updates and major upgrades.

Visit Wind River Online Support at www.windriver.com/support for fast access to a comprehensive knowledge base with a robust search feature for locating product information and manuals by keyword, author, published date, document type, language, and solution category.

Additional support features, including proactive email alerts covering particular technologies, platforms, or product patches and technical tips for common problems, are available for all customers on subscription. OLS visitors can also access a community of developers to discuss their issues and experiences.

Customer Support will provide bug fixes following the process outlined in Wind River’s Customer Support User’s Guide (CSUG), available at www.windriver.com/support/resources/csug.pdf.

Customers with a valid support or subscription agreement are eligible for all updates and major upgrades of VxWorks Cert Platform free of charge. If customers cannot update to a new version but need critical parts of the update applied to an older version of the product, Wind River Professional Services can be engaged to backport the required functionality on a case-by-case basis.

If you cannot find the information you need through Online Support, contact our global support team for access to the industry’s most knowledgeable and experienced support staff.

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