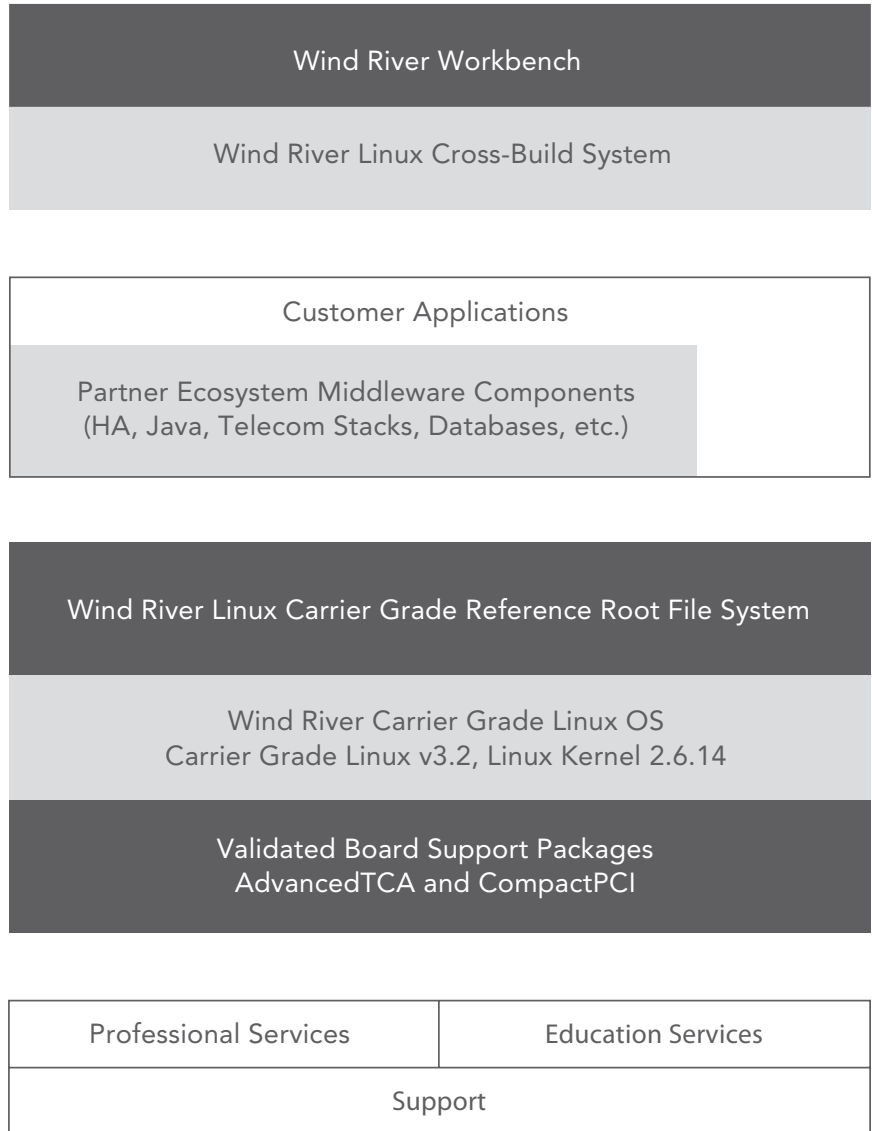


## Wind River Platform for Network Equipment, Linux Edition

Wind River Platform for Network Equipment, Linux Edition, is a commercial-grade Linux solution for device development and deployment. The platform contains a fully tested and validated Linux distribution based on Linux 2.6 kernel technology. At its core is an open cross-build system, leveraging “pristine-source” packages and managing individual patches to transparently build the Linux run-time distribution for a specific device.

The platform combines a high-performance, preemptible kernel environment with powerful networking applications, file systems, management, and security features. Platform for Network Equipment offers the right combination of integrated and validated open-source software with the flexibility your company needs to maintain a competitive edge. In addition, Wind River Device Management products provide a powerful, enterprise-wide infrastructure that enables development, test, and field engineering teams to collect and aggregate data to diagnose and repair faults in running software at every phase in the device life cycle, from design through end of life.

Platform for Network Equipment is registered with The Linux Foundation Carrier Grade Linux specification version 3.2. The platform supports boards designed for the PICMG Advanced Telecommunications Computing Architecture (ATCA) specification, as well as boards for the emerging MicroTCA architecture. Platform for Network Equipment is particularly well-suited for developing the control and management system software in 3G wireless infrastructure systems and



Platform for Network Equipment, Linux Edition, components

IMS, WiMAX elements, fixed-mobile convergence, softswitches, media gateways, DSLAMs, cable modem head-ends, and multi-service switches.

## Included in Platform for Network Equipment

*Note: Some of the features listed in this document are architecture- and board-specific, and not all features described are supported on all boards. Please contact Wind River for details on supported enhancements for your chosen processor or board.*

### The Kernel and Run-Time

Version 2.6.14 of the Linux kernel is the foundation of Platform for Network Equipment. It contains support for a variety of hardware devices, file systems, networking protocols, security features, and management capabilities. This latest kernel version, which includes the following standard features, is ideal for developing connected, secure, high-performance, reliable devices:

- New O(1) scheduler: Enables scheduling to be done in deterministic and constant time slices; reduces the complexity of previous schedulers, allowing it to scale better under the heavy workloads introduced by multitasked and multithreaded applications; and provides for CPU affinity on SMP systems
- Preemptible kernel and improved I/O system, with new I/O system scheduler and additional removals of big kernel locks (BKLs): Improves the responsiveness of Linux
- Fast user-space mutexes (futexes): Improves performance of event serialization of multiple processes or threads by checking from user space whether blocking is necessary; performs the system call to block the thread only when required
- Improved kernel threading model and implementation of the Native POSIX Thread Library (NPTL) in the Linux kernel: Can boost performance of heavily multithreaded applications

- New support for POSIX signals and POSIX high-resolution timers (HRTs): Signals cannot be lost, can carry information as an argument, and can be sent from one POSIX thread to another; HRTs can control the scheduling of tasks with higher precision
- Module subsystem and new kernel objects (kobject): Improves system stability; provides better hardware recognition, management, and control; enables hot-plug devices and a new system file system (sysfs) to access device information easily
- File system optimizations: Provides improvements for read-ahead, write-back, and manipulation of small files and support for extended attributes and POSIX-style access controls
- Highly improved networking: Includes full IPv6 support based on the USAGI IPv6 stack project and IPsec protocol, supporting various SHA and DES algorithms; additional improvements made for multicast, including MLDv2 and IGMPv3 support and stable VLAN support
- Support for the Stream Control Transmission Protocol (SCTP): Provides a reliable, message-oriented, multiplexed transport protocol
- Network file system support: Includes support for NFSv4, for more secure authentication; plus intelligent locking and NFS performance improvements
- Modularized kernel security system: Allows different security modules with user capabilities

In addition to the standard Linux kernel features, Platform for Network Equipment provides many other features essential for Linux distribution. These enhancements include various patches and packages developed by the open-source community, such as:

- Hardware-specific patches from silicon vendors, or separately maintained architecture-specific Linux kernel trees: Adds or improves the kernel for supported processors and boards

- Development tools–related patches from the open-source community or Wind River: Enables or improves the integration of Wind River’s cross-development tools for debugging, system analysis, and profiling; tools include support for Linux kernel configuration, user space configuration, and debugger core file analysis
- Conditional real-time performance and scheduling-related patches from the open-source community (PREEMPT\_RT): Improves system call preemption latencies, interrupt response latencies, context switch latencies, and priority promotion/inheritance for mutexes to enhance robustness of the kernel on selected boards
- Security-related patches from the open-source community
- Networking-related patches from the open-source community: Enables the latest IPv6, IPsec, and Mobile IPv6
- Small-footprint root file system based on BusyBox
- Simulated deployment: It is now possible to simulate target deployment on selected boards via QEMU; this supports application development and debugging, without the necessity of bringing up a physical board
- Applications can be prelinked on ARM, Intel x86, Intel XScale, and PowerPC boards

### Extended Carrier-Grade Features

Wind River has implemented more than 200 unique kernel patches that provide support for Carrier Grade features beyond the Carrier Grade Linux specification. Most of these features resulted from Wind River’s deployment of Platform for Network Equipment with existing equipment providers who require features not found in standard Linux.

Enhanced features in Platform for Network Equipment 1.5 include:

Name	Description
OOM protection	Provides per-process protection from the Linux out-of-memory (OOM) killer
Process state change notification	Allows processes to receive state change notification from other processes
Persistent memory framework	Implements persistent memory infrastructure for storing panic and crash dump information
GET_ARRAY_REBUILD_INFO call to the md RAID driver	Implements an md RAID driver fix
Support for EXAR XR17C152 in the 8250 PCI serial driver	Supports the EXAR XR17C152 serial device
qdisc control/stats	Network traffic queue control and statistics information
Per-socket stats	Detailed statistics provided to user space on a per-socket basis
Notification of TOD changes	Provides an interface for processes to be notified when the system clock is changed
Per-call support for nested alternate signal stacks	Supports nesting alternate signal stacks when inside a signal handler
Root file system mount delay	Adds a kernel boot parameter that specifies a number of seconds to delay before attempting to mount the root file system
fastcall fixes for i686 targets	Bug fix for usage of the fastcall compiler directive on x86 targets
Reset instead of halt	Directs the kernel to perform a reboot in situations where it would normally halt the system
NFS uninitialized stat fixes	Bug fix for certain statistics in NFS structures being returned while uninitialized
E1000 driver fix	Fixes known bugs in the e1000 driver
Bonded Ethernet statistics	Provides aggregate statistics for bonded Ethernet devices
Linux history buffer for PPC and PPC64	Provides system (crash, panic, etc.) history buffer
Software watchdog	Implements a software watchdog feature
High-resolution time stamps	Provides high-resolution time stamps
Serial BMC driver for XScale	Implements the serial BMC driver
vBMC and IPMI/HPI fault infrastructure	Implements the virtual BMC driver and the IPMI fault infrastructure
Serial IPMI driver for specific ATCA boards	Supports the serial IPMI interface on these specific boards: Motorola ATCA7101, ATCA6101, and F101
Fault detection drivers	Provides fault detection drivers for these specific boards: XScale, ATCA6101, ATCA7101, ATCA717, ATCA F101, and PrPRMC-280
Event notification	Implements an event notification system using the new AF_MERCURY address family

## Open-Source Packages and Applications

Platform for Network Equipment provides a broad list of supported open-source packages (see Appendix A). Every package is delivered in prebuilt binary RPM packages and source based on a pristine source, as received from the open-source community. Also included, if required, are individual transparent patches applied during build time by the user.

Support for some packages can be processor-, board-, or host OS-dependent. Packages that Wind River does not include with Platform for Network Equipment can be integrated by users or may be available via Wind River Online Support.

Please check with your Wind River sales representative to determine which packages are supported for your individual project requirements, or to get support for additional packages.

## Run-Time and Host Technical Specifications

### Run-Time System

- Linux 2.6.14 kernel
- GNU glibc 2.3.6 C library
- O(1) scheduler with SMP CPU affinity
- Preemptive kernel
- Robust mutexes and priority inheritance futexes
- RT\_PREEMPT real-time kernel enhancements
- Native POSIX Thread Library (NPTL)
- Fast user-space mutexes (futexes)
- High-performance file systems (ext2, ReiserFS, XFS)
- Journaling file systems (ext3)
- Full-featured IPv4/IPv6 platform with updated USAGI IPv6 and Mobile IPv6 features
- Networking protocols and applications, including BGP, DHCP, FTP, HTTP, NFSv4, NTP, RARP, RIP, OSPF, PPP, PPPoE, SCTP, Telnet, TFTP, and VLAN
- Network management through SNMP v1/v2c/v3
- Network security through SSL, SSH, firewall, updated IPsec
- Small footprint BusyBox root file system
- Wind River SNMP, CLI, Web Management Suite (*optional*)
- Wind River Advanced Networking Technologies (*optional*)

### Host Development Tools

- Optimized GNU GCC 3.4.4 cross-toolchain
- Wind River Linux cross-build system
- Wind River Workbench 2.6
  - Eclipse framework
  - Project System
  - Build System
  - Editor
  - Source Code Analyzer
  - Wind River GNU Compiler
  - Workbench Debugger
  - Target debug agents for Linux
  - Configuration tools
    - Linux Kernel Configuration Tool
    - Linux User Space Configuration Tool
  - Shell environments
  - Wind River System Viewer
  - Wind River ScopeTools
    - Wind River StethoScope
    - Wind River MemScope
    - Wind River ProfileScope
    - Wind River CoverageScope
- IPL Cantata++ for Wind River Workbench (*optional*)
- Wind River Workbench, On-Chip Debugging Edition (*optional*)
- Workbench On-Chip Debugging Hardware (*optional*)
  - Wind River ICE
  - Wind River Probe
  - Wind River Trace
- Wind River Network Management SDK (*optional*)

### Platform Developer Host Support\*

- Red Hat Enterprise Linux (Workstation 3, Update 5; Workstation 4, Update 2) for the Intel x86 platform
- SUSE Linux Enterprise Server 9.3 and 10 for the Intel x86 platform

### Application Developer Host Support\*

- Red Hat Enterprise Linux, Workstation 3 and Workstation 4
- Novell SUSE Enterprise Linux 9 and 10
- Solaris 8 and 9
- Windows 2000 and XP

*\* Although Wind River Linux may run successfully on other Linux distributions and versions, Wind River has not certified the product on them.*

Additional platform-specific target run-time packages include:

- The Service Availability Forum's (SA Forum) Application Interface Specification (AIS): openais implements a production-quality implementation of the SA Forum's AIS, including support for cluster membership, checkpointing, and an event service.

- SA Forum's Hardware Platform Interface (HPI): openhpi provides a modular mechanism for adding and managing new hardware and device support easily.
- Intelligent Platform Management Interface (IPMI): openipmi allows full access to all IPMI information on a server, abstracting it to a level that makes it easy to use. openipmi consists of a device driver that goes into the Linux kernel, along with a user-level library that provides a higher-level abstraction of IPMI.
- High-speed, reliable, message-oriented communication service mechanism (Transparent Interprocess Communication, or TIPC).

## The Linux Foundation Carrier Grade Linux Specification

Carrier Grade Linux (CGL) is at the center of the telecommunications and networking industries' move to open architectures. The initiative started with the vision that communication services can be delivered using open-standard, carrier-grade platforms. A Linux kernel with carrier-grade characteristics is an essential building block of platforms and architectures. Since its formation, the CGL working group has produced three versions of a specification to define these required capabilities.

Wind River Platform for Network Equipment meets the emerging needs of telecommunications companies by registering (disclosing publicly) how the platform addresses the requirements, as cited in the Carrier Grade Linux Requirements Definition. The CGL 3.2 Requirement Document was released on February 14, 2006, and Wind River publicly registered Platform for Network Equipment. Please visit [www.windriver.com](http://www.windriver.com) for the most current disclosure of compliance with the Carrier Grade Linux specification.

In the distribution for Platform for Network Equipment, Wind River has implemented a robust and hardened version of the CGL specification. To drive standardization, Wind River is committed to adopting mature open-source technology as it becomes available. However, some open-source implementations of the CGL requirements are not yet in a fully stable state, or are likely to be

dropped from the specification in the future. Therefore, Platform for Network Equipment initially supports most—but not all—requirements. Unsupported requirements will be considered for support in a future release of the platform.

Appendix A includes packages unique to Platform for Network Equipment. Many are included to provide compliance with the Carrier Grade Linux specification or add functionality commonly requested in a Carrier Grade Linux platform. These packages provide specialized value on top of Platform for Network Equipment.

### Host Environment

Platform for Network Equipment's host environment has three key components: First, Wind River's unique Linux cross-build system, which enables developers to build from "pristine-source" code directly from the open-source community. Developers can configure and customize the pristine source to create the specific distribution source code they need, which can then be used as the basis for a project.

The second key component is the Wind River Workbench development suite, a rich set of tools for the complete development cycle, from board bring-up and debug to BSP and application development.

The final component is a complete set of open-source host tools that complement the development environment. See Appendix B for a list of host packages provided in Wind River Linux 1.5.

### Wind River Linux Cross-Build System

The Wind River Linux cross-build system provides maximum flexibility for developers who need to customize their Linux environment. The cross-build system supports an open-source development paradigm and allows users to standardize on one common Linux build system across the organization. Users have visibility into the Linux distribution on a pristine-source and individual patch level, enabling them to apply updates more easily and integrate new patches as delivered by the community. The cross-build system is based on open-source development tools with transparent build scripts and configuration files, and it

includes a state-of-the-art, supported, and maintained GNU toolchain for all supported processor architectures.

### Templates and Product Layers

The Wind River Linux cross-build system supports automated generation of the Linux root file system on the development host, based on prebuilt binary RPM packages or from source. Users can define builds for multiple device projects (such as different boards or root file systems) from the same source tree based on templates.

The cross-build system uses these templates as object-oriented representations of board and platform data. These templates enable developers to define common variables, packages, or kernel configurations in a higher-level template from which other templates can be derived. Some patch enhancements to the mainline kernel—such as real-time and robust mutex enhancements—are provided as feature templates and can be excluded easily at project configuration time to create a kernel source tree more closely aligned with the mainline kernel.

Wind River Linux supports the use of product layers and their integration with the customized templates feature of the Wind River Linux cross-build system, which enhances the ability to customize builds and boards without disturbing the installed product. Customized layers are embedded in the build environment to simplify development. This gives customers and other third parties a segmented, manageable means of providing packages, patches, BSPs, templates, and so on as layers to augment the core product.

There are two ways to add packages to a customized build environment: the classic method and the rpmbuild method. The latter uses an RPM spec file, along with a greatly simplified makefile, to drive package compilation and installation. This method can use either an SRPM package or standard source packages.

### Wind River Workbench

Wind River Workbench is an Eclipse-based collection of tools that assists developers building devices with Wind River Linux. Workbench offers the only end-to-end, open standards-based collection of tools for device software design, development, debugging, test, and management. Workbench enables organizations to standardize on a common environment for device software development, enabling developers to be more efficient. Among many other benefits, Workbench offers:

- Best-in-class capability at each phase of the development process, including hardware bring-up, firmware development, application software development, advanced visualization, system diagnostics, and test
- Broad availability to support increased standardization across projects
  - Multiple-target OS support, including support for VxWorks and Wind River Linux
  - Target processor support for ARM, ColdFire, IA/Pentium, MIPS, PowerPC, Renesas SuperH, and XScale processors
  - Plug-in architecture that enables additional target OS, target processor, and target connection support to be added
- An extensible framework, based on Eclipse, to seamlessly integrate third-party and in-house plug-ins for total customization and scalability

Workbench addresses the challenges developers and project teams face by increasing productivity, enabling collaboration between hardware and software developers, and meeting diverse development needs across an enterprise. The suite includes the following features:

### Eclipse Framework

Open, extensible, and backed by a strong community of commercial and open-source developers, Eclipse was chosen as the framework for Wind River Workbench. The Eclipse 3.2.1 framework supplies the necessary infrastructure to enable integration of Workbench components. In addition, Eclipse provides developers who use Workbench with a wide range of integrated functions.

Commercial development tool providers (such as Borland, Hewlett-Packard, and IBM) and an active developer community provide value-add plug-ins that can be used to extend the capabilities of Workbench. These include Eclipse-integrated configuration management (CM) systems and editors, which offer simple plug-in integration with Workbench through standard Eclipse interfaces.

More information on Eclipse and available third-party plug-ins\* is available from the “Community Projects and Plug-Ins” section of the Eclipse website, among other resources:

[www.eclipse.org](http://www.eclipse.org)  
[www.eclipse-plugins.info/eclipse/index.jsp](http://www.eclipse-plugins.info/eclipse/index.jsp)  
[www.eclipseplugincentral.com](http://www.eclipseplugincentral.com)

*\* Note that in many cases, users will need to validate the utility and compatibility of available plug-ins with Wind River Workbench.*

### **CDT Compatibility**

Workbench is now compatible with the Eclipse C/C++ Development Tooling (CDT), so users can have both CDT projects and Workbench projects in the same Eclipse shell. This allows Workbench to coexist with other vendors’ Eclipse-based products that require the CDT.

### **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. By design, Workbench enables users to manage multiple projects simultaneously.

### **Build System**

The Workbench Build System specifies the tools, options, and parameters to use when building device software projects, enabling you 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-grain control at the level of an individual file, and everything in between. The Build System supports a flexible user-defined build capability,

facilitating customization of the build process. Enhancements include:

- UDBs can select build specs (default and active)
- Users can define project-only-level and per-folder-level build targets
- The name of build targets that appears in the Project Navigator view can be different and more descriptive than the name used for makefiles
- Ability for build-target-specific, build-command-independent rules/commands to get rid of current wrapper makefiles
- Allow build targets project refresh to be optional
- Allow compilation of single files

### **Editor**

The Workbench Editor provides state-of-the-art editing capabilities, including code completion, parameter hinting, and syntax highlighting of source files. These Editor features speed the development process and make the edit-compile-debug cycle less frustrating and less prone to error.

### **Patch Manager**

Workbench contains patch support, so users can easily import and manage patches. The Workbench Editor highlights patched code and displays when errors have been detected.

### **Source Code Analyzer**

The ability to quickly and completely understand code written by someone else—or to assess the impact of a change under consideration—is vital to development productivity. Wind River Workbench source-code analysis capabilities enable this function. Integration of these capabilities into the editing and debugging functions of Workbench speed both code creation and debugging.

### **Debugger**

The Workbench Debugger provides more capability than GDB or other basic source-level debuggers. Our debugger was designed to provide simultaneous, side-by-side debugging of device software running in multiple contexts that may be different tasks, different real-time pro-

cesses, and different processors. These capabilities can be extended further with Wind River’s on-chip debugging solutions. Together, these tools provide the necessary functionality for hardware bring-up, device driver/BSP debugging, kernel debugging, and application software debugging. Users also have the ability to detect signals on targets and set breakpoints using them. This helps users debug failures that generate signals, such as hardware exceptions and software applications, using the “kill” command (This feature is similar to GDB’s “handle signal” command.)

### **QEMU Debugger Support**

QEMU is an open-source processor emulator supported by Workbench. Previously, users could only roughly simulate Linux targets by running the target software natively on a Linux host. Using QEMU allows users to more accurately simulate code on specific target processor architectures.

### **Target Debug Agents for Linux**

Wind River Linux platforms with Wind River Workbench provide extensive debugging capabilities for the kernel, kernel modules, and user-mode applications. User-mode applications are supported using an advanced agent based on the ptrace API. Advanced multithreading in the Linux 2.6 kernel enables developers to debug individual threads reliably inside processes without stopping the entire process. Because ptrace is applicable only with the debugging of applications in user mode, another method is required for debugging the kernel.

Kernel debugging for Linux 2.6 kernels, including device drivers, kernel modules, and interrupt handlers, is achieved by using the open-source KGDB-2 agent, or the kernel-debugging version of GDB. With standard debugging tools, this would be a problem, because connecting to KGDB is not typically performed using the same debugger as the one used for user-mode applications. Workbench’s multiple-context technology allows

multiple simultaneous target connections, enabling a simultaneous connection to KGDB-2 and the target agent through the same interface. Workbench provides the synchronization necessary to debug a multiple agent connection in a synchronized manner, even if multiple target debugger agents are in use.

### **User-Mode Agent Support for Virtual I/O**

Workbench allows users to view a target's standard input/output from Workbench. This enables easier remote access to a device's display.

### **Linux Kernel Configuration Tool**

The new kernel configuration tool facilitates Linux kernel configuration with an improved GUI, compared to the traditional `xconfig` and `menuconfig` configuration tools. The GUI shows two tabs in the Kernel Configuration view. One tab provides read-only summary information about the current configuration, including the configure command arguments used to create it. The other tab provides the ability to include or exclude kernel items, and also allows users to view and modify `kconfig` files, get help, and view dependencies. A search capability is available, and it is possible to show disabled items and filter the view.

### **Linux User Space Configuration Tool**

The new user space configuration tool provides a GUI for RPM package configuration in the target root file system. It also offers an easy way to add or remove packages from the existing configuration, and enables users to view package dependencies and get help.

### **Linux Host Shell**

The Linux Host Shell provides a command line interface (CLI) that lets you download, invoke, and debug user processes. The Linux Host Shell executes on the development host, not the target, but it enables you to spawn processes, read from or write to target devices, and exert full control over the target. The Linux Host Shell receives your commands, executes them locally on the host, and dispatches requests to the debugger framework for any action involving the symbol table or target-resident programs or data.

### **Wind River System Viewer**

Wind River System Viewer, formerly known as WIND@VIEW, is a run-time analysis tool for device software developers who need to inspect the dynamic behavior of device software systems in order to detect run-time problems and improve system performance. System Viewer captures the dynamic interactions of the operating system, device software applications, and target hardware. The tool supports events created by the user and now uses the open-source Linux Trace Toolkit Next Generation (LTTng) tracer for custom events.

System Viewer provides detailed analysis and graphical visualization of system events, revealing the complex interactions of processes, threads, interrupts, and system objects of applications executing on a target. Context changes are clearly shown, as well as such system events as semaphores, message queues, signals, tasks, timers, and user events. This tool is best suited for use when developers need to diagnose and solve one or more of the following problems:

- Process and thread scheduling problems, such as deadlocks, starvation, and race conditions
- Performance problems, such as priority setting, resource contention, and mutual exclusion
- Timing problems arising from the interaction of interrupts and threads

System Viewer allows device software developers to detect anomalous behavior quickly, as well as decipher the cause and effect by reviewing the complete history of events leading up to the problem. The tool uses LTTng instrumentation and provides enhanced GUI features, such as the System Viewer radar and the event table, which offer several display modes for visualizing areas of activity within an event log. Developers can use the radar to show all events, peak activity, and event intensity; quickly zoom into areas of particular interest in the log; or use the event table tree to filter events based on process or thread context.

### **Wind River ScopeTools**

ScopeTools are powerful and dynamic visualization tools for device software applications. They provide developers

with visibility into the entire platform: application code, third-party libraries, and the operating system. You can monitor variables, optimize performance, and find memory problems—all while the system is still running.

- **Wind River ProfileScope:** Profiling is critical for real-time systems. Once you understand performance bottlenecks, it becomes easier to optimize application code. ProfileScope is a dynamic execution profiler that provides detailed function-by-function performance analysis, specifying individual routines within the program that are consuming the CPU cycles. ProfileScope pinpoints inefficiencies and shows how performance changes over time.
- **Wind River MemScope:** Ensuring optimal use of memory is a critical activity in device software design. In many applications, memory usage is not fully understood, and a large portion of available memory is wasted. Systems can run for days before failing due to non-characterized memory leaks. MemScope is an instant memory analyzer that provides greater visibility into memory usage. Without any special compilation or instrumentation, you can monitor available memory, detect leaks that occur due to system calls or third-party libraries, and even watch leaks as they happen.
- **Wind River StethoScope:** This real-time graphical monitoring tool is used to examine variables, data structures, or memory locations in your system. You can watch any set of variables, see peak values and out-of-range settings you would otherwise miss, trigger collection on specific events, change variables while your program runs, and save collected data to disk. StethoScope presents this live analysis of your program without stopping or slowing your code.
- **Wind River CoverageScope:** Analyze your code to determine which code segments are executed during testing. Visibility into the execution of individual statements, decisions, and conditions enables you to create more thorough test scenarios ensuring higher-quality devices. It also becomes easy to identify code that is never executed, allowing you to remove the code to prevent future problems and reduce your overall memory footprint.

## ARM Vector Floating Point (VFP) Support

VFP, a special coprocessor available on some ARM microprocessors, is now supported by Workbench. It increases computation speed for parallelizable data, such as images, audio, and sensing devices. This greatly increases performance for some applications in the consumer, automotive, and industrial device industries.

## Java Support

Java language programming is now supported in Workbench. The Java Development Toolkit (JDT) is now included in the development suite to facilitate Java development. For device developers, this allows Java development on targets, as well as support for Java use in multi-language applications.

## Optional Add-Ons

### Wind River Real-Time Core

Real-Time Core and Wind River Linux provide device manufacturers with a mature, proven technology for developing complex, next-generation, Linux-based applications that require guaranteed real-time with microsecond-level interrupt and scheduling latency. Wind River Real-Time Core employs a simple real-time executive that runs the non-real-time Linux kernel as its lowest priority task and routes interrupts to the Linux kernel scheduler through a virtual interrupt layer. All interrupts are initially handled by Real-Time Core and are passed to the standard Linux kernel only when there are no real-time tasks to run. Real-time applications are implemented as standard POSIX threads and receive interrupts immediately, resulting in near hardware-threshold speeds for interrupt processing. Real-Time Core and user-space tasks communicate through lock-free queues and shared memory. From the application programmer's point of view, real-time queues look very much like standard Linux character devices, accessed via POSIX read/write/open/ioctl system calls. Shared memory is currently accessed via the POSIX mmap calls.

Benefits of Wind River Real-Time Core include:

- Guaranteed real-time response times, regardless of system load
- Real-Time Core applications are implemented as standard POSIX threads
- Linux kernel remains largely untouched, maintaining standard interfaces that don't interfere with kernel, silicon vendor, community, or user-developed patches

### IPL Cantata++ for Wind River Workbench (formerly Wind River Unit Tester)

IPL Cantata++ for Wind River Workbench, now available for Wind River Linux, is a set of tools that allows developers greater efficiency in completing unit testing, integration testing, and code coverage analysis on the tests. The integration of Cantata++ with Workbench places these capabilities within easy reach. Cantata++ increases software quality, decreases time-to-market, and reduces support costs through better, faster, more automated testing during the development life cycle.

### Wind River Workbench On-Chip Debugging

In the early stages of hardware and software development, a robust connection to the microprocessor through its run-control port is essential. Wind River Workbench provides connectivity between the host development environment and the target device via the JTAG or on-chip debugging interface of the microprocessor that resides on the device.

The on-chip debugging interface of most microprocessors enables full control of the microprocessor itself, access to core and peripheral registers, and access to on-chip switch fabrics and memory controllers, along with access to external buses and many devices attached directly to the bus. In addition, some microprocessors support either internal or external trace buffers, allowing developers to capture information regarding the exact code that ran on the target and when.

On-chip debugging provides developers with complete system-level control of their environment at all times, enabling more efficient and effective hardware bring-up, firmware development, device driver, and BSP generation. On-chip

debugging can also be a useful alternative to agent-based debugging in applications where serial, Ethernet, or USB interfaces are not available, or in environments where agent instrumentation of the operating system is not desired.

The Workbench Debugger provided with Wind River platforms can be enabled for on-chip debugging. This capability, along with Wind River ICE, Wind River Trace, or Wind River Probe hardware, provides access to significant additional capability within Workbench.

Additional Workbench capabilities offered with Wind River's on-chip debugging connection include:

- On-chip debugging Target Connection Manager
- On-chip debugging Command Shell
- On-chip debugging console
- Flash programming
- Hardware and memory diagnostics
- CF options
- JTAG editor
- Extensions to Register view, including:
  - Bit-level register details
  - Additional peripheral register support for most processors
- Combined Register view with Agent views and perspectives
- On-chip debugging user perspective within Workbench
- Wind River Trace (may require additional hardware to be purchased separately)
- Firmware update
- Cache Memory view
- Statistical Performance Analyzer (PFA)
- On-chip debugging reset and download/launch
- Linux OS awareness via JTAG

*\* For more information, please refer to the Wind River Workbench product note and the Wind River Workbench, On-Chip Debugging Edition, product note.*

### Wind River Device Management

Wind River Device Management consists of two interoperable products that create a powerful, enterprise-wide infrastructure to enable development, test, and field engineering teams to collect and aggregate data about—as well as diagnose and repair faults in—running software across the entire device life cycle. Benefits include faster time-to-market for higher-quality products and the ability to rapidly and remotely diagnose and repair

software defects in deployed devices. This leads to lower support costs, increased system uptime, and improved customer satisfaction. Both products are available for Wind River Linux 1.4 and 1.5.

New in Lab and Field Diagnostics 2.1:

- Persistent Sensorpoints after reboot
- Programmatic Sensorpoint API with scripting capability
- Enhanced security between site manager and devices
- Upgradeable agent to enable update of deployed devices
- Support for Emerson MicroTCA
- Power PC and Intel Architecture support

### **Wind River Lab Diagnostics**

Lab Diagnostics is a root-cause analysis system that enables development and test teams to dynamically instrument, isolate, diagnose, and correct defects in running software in a highly collaborative environment. Lab Diagnostics is a secure, enterprise-class server application for data aggregation and storage. It allows companies to greatly enhance productivity by streamlining test and QA, spreading the test load across distributed teams, enabling fact-based diagnostics of multiple devices, and eliminating unnecessary instrumentation-build-test cycles. Lab Diagnostics also enables manufacturers to “design in” supportability, which eases and speeds issue resolution in deployed devices. This standalone product is interoperable with Wind River Workbench and is sold as an add-on to Wind River platforms. For more information, see the Wind River Lab Diagnostics product note.

### **Wind River Field Diagnostics**

Wind River Field Diagnostics is a scalable, remote diagnostics system that enables support engineers to securely collect and manage deployed device data to diagnose and correct faults in running software. Field Diagnostics is an enterprise-wide infrastructure that includes a site-installed application for device data collection and diagnostics, as well as an enterprise application to manage data aggregation, analysis, and archiving from worldwide deployments. It links device manufacturers with device users through a secure data exchange infrastructure. With Field Diagnostics,

device manufacturers can improve uptime, streamline service operation, reduce support costs, and increase service revenue. This standalone product is interoperable with Wind River Workbench and is sold as an add-on to Wind River platforms. For more information, see the Wind River Field Diagnostics product note.

### **Wind River Network Management**

Wind River Network Management includes advanced SNMP, CLI, and Web-based management interface development tools. These products are designed and implemented cross-platform and validated both on VxWorks and Linux. This makes it easy for developers to implement management interfaces for both VxWorks- and Linux-based devices, or to migrate from VxWorks to Wind River Linux.

### **Wind River Network Management SDK**

Wind River Network Management SDK is an integrated network management development kit. It includes a standards-based implementation of SNMP consisting of SNMP v1/v2c, v3, and AgentX support, as well as a scalable, unified, small-footprint management framework to create Web-based, CLI-based, or custom management interfaces to manage networked elements. The scalable framework consists of a management backplane that acts as a conduit for data handling between management interfaces (Consumers) and manageable elements (Producers); it can have any type of Consumer and any type of Producer.

Wind River Management Backplane interfaces with a CLI agent, Wind River CLI; an embedded Web server, Wind River Web Server; and an SNMP implementation, Wind River SNMP. This framework comes with a full-featured, Windows-based developer tool (GUI): Wind River Management Integration Tool (WMIT). This tool eases the development of management interfaces by bringing all the framework components together. In addition to WMIT, this SDK also includes a simplified Eclipse plug-in, Management Configuration Editor (MCE), to help with development of CLI and Web-based management interfaces. MCE is integrated with Workbench and can be run on

any host that Wind River Workbench supports. Developers may choose WMIT, MCE, or a combination of the two to develop a desired management interface.

Wind River Network Management SDK 3.0 includes:

- Wind River SNMP 10.2
- Wind River CLI 4.6, Wind River Web Server 4.6, and Wind River MIBway 4.6
  - Web and CLI-based network management interfaces
  - Standalone web server: HTTP and HTTPS
  - Integrated with SNMP via MIBway
- Wind River Management Integration Tool (Windows host support only)
- Management Configuration Editor

### **Wind River SNMP**

The Simple Network Management Protocol (SNMP) is designed to facilitate management and configuration of networked devices. Wind River SNMP is a highly portable, memory-efficient, and standards-compliant implementation of SNMP specifically designed for original equipment manufacturers (OEMs) and system integrators who require full compliance with SNMP standards in a fast, small SNMP agent. This complete solution for integrated SNMP design and implementation includes a full MIB development platform. It comprises SNMP v1/v2c/v3 and AgentX.

Features of Wind River SNMP 10.2 include:

- Bilingual SNMP agent supports SNMPv1/v2c protocols
- Asynchronous support
- SNMPv3 security features
- SNMP notifications
- “Target” and “notify” MIBs
- SNMP proxy
- SNMP v1/v2/v3 coexistence
- AgentX module
- MIB compiler
- Compact, interoperable, standards-based configuration
- Integrated and validated with Wind River Networking Technologies (Interpeak-based)

## Wind River Web Server

Wind River Web Server is a scalable, secure, small-footprint commercial embedded Web server. In addition to the functionality of a standard Web server, it provides all the functionality needed to quickly create a browser-based management interface. Specifically designed for embedded systems, Wind River Web Server is HTTP 1.0- and 1.1-compliant and supplies SSL hooks to provide secure transaction mechanism. The Wind River Management Integration Tool accelerates the process of creating and configuring a custom Web-based management interface or a standalone Web server by generating more than 70 percent of the required embedded code for such an application. The Web-based management interfaces with a scalable backplane that interacts with SNMP through Wind River MIBway or with any custom manageable data.

Features of Wind River Web Server 4.6 include:

- HTTP 1.0/1.1-compliant Web server
- Bidirectional CGI layer
- LiveUpgrade
- Visual integration tool
- GZIP/PKZIP compression
- Support for HTML, DHTML, CSS, JavaScript, and XML
- Drop-in support for SNMP objects
- Bundled SMTP email alerts
- User time-out sessions
- HTML/query string processing
- Bidirectional gateway for tying management objects to HTML pages, email alerts, and JavaScript libraries
- File-based uploads (RFC-1867)
- Server Side Includes (SSI)
- Secure authentication (basic base64 encoding and digest authentication)
- SSL hooks verified with OpenSSL
- Wind River SNMP inheritance through MIBway
- In-depth tutorial and sample code that steps through API usage, development tools, and best practices

## Wind River CLI

Wind River Command Line Interface (CLI) includes a full-featured command shell and a set of development tools that enable users to build either the standard "Craft" style interface or a custom inter-

face to manage a networked device. CLI commands can be executed on a device through either an RS-232 or a Telnet connection. The Wind River Management Integration Tool is a GUI tool that accelerates the process of creating and configuring a custom Web-based management interface or a standalone Web server by generating more than 70 percent of the final embedded CLI code for such an application. CLI interfaces with a scalable backplane, which interacts with SNMP through MIBway or directly with any custom manageable data.

Features of Wind River CLI 4.6 include:

- Complete CLI management solution
- High-speed generation of command tree, handler functions, and individual commands
- Drop-in, prebuilt commands
- Telnet server
- Secure communication over SSH
- With MIBway, instant reflection of SNMP MIBs in the command line
- Same architecture as Wind River Web Server
- Command completion
- Context-sensitive help
- Command history
- Intermediate mode handling
- Parameter handling, verification, and grouping
- Negate commands (e.g., to restore defaults)
- Support for simultaneous Telnet sessions and serial ports
- Common command libraries
- Security parameters defined by object, command or session
- Fully reentrant ANSI C code
- In-depth tutorial and sample code that steps through API usage, developed tools, and best practices

## Wind River MIBway

Wind River MIBway enables developers to leverage all Simple Network Management Protocol (SNMP) objects for reuse in command line and Web-based management interfaces, with no additional engineering effort required. Wind River MIBway provides an SNMP inheritance library to access data objects already instrumented for the Wind River SNMP agent. This makes it possible to leverage the thousands of developer hours already invested in writing MIB

variables and code in a schema that is both flexible and scalable for future device management requirements.

Features of Wind River MIBway 4.6 include:

- Instantly leverages all existing SNMP code
- Reduces months of coding and testing down to days
- Enables creation of powerful, feature-rich Web and command line interfaces
- Separates application logic from interface design
- Embedded code handles SNMP-specific queries from Wind River Management Backplane
- Single-click integration with Wind River SNMP
- In-depth tutorial and sample code that steps through API usage, development tools and best practices

## Wind River Management Integration Tool

The Wind River Management Integration Tool (WMIT) is a Windows-based GUI that enables users to build Web-based or CLI-based management applications by incorporating features to set project options, configuration options, build options, resource constraints settings, and automate code generation. It includes an MIB compiler to facilitate Wind River SNMP users, as well as a simple HTML editor as a miscellaneous tool.

## Management Configuration Editor

Management Configuration Editor (MCE) is an Eclipse plug-in integrated with Wind River Workbench to help develop management interfaces. This tool is provided in addition to WMIT, so developers may use MCE on any host that supports Wind River Workbench (whereas WMIT is supported only on Windows). MCE functionality in this version of Platform for Network Equipment is limited when compared to that of WMIT. WMIT and MCE will coexist until all necessary functionality is available in MCE, and customers have completed migration to MCE.

## Wind River Advanced Networking Technologies

All Wind River networking add-on products are delivered in ANSI-compliant C source code, with ready-to-run examples on Wind River Linux. The optional Wind River Advanced Networking Technologies portfolio addresses networking, security, and mobility requirements in markets such as wireless infrastructure, network infrastructure, and consumer devices. In particular, IPv6, routing, wireless, and mobility technologies enable device and equipment manufacturers to deliver products to market quickly while offering the latest networking and security capabilities on Wind River Linux.

Key advantages of Wind River Advanced Networking Technologies include:

- Smaller, more scalable footprint
  - 25–40 percent smaller than Linux native stack
  - Can be configured as IPv6-only or UDP-only stack
- Includes advanced networking, security, wireless, and mobility protocols on Linux that are not currently available in open-source, including:
  - Virtual routing (multi-instance) support
  - Virtual Router Redundancy Protocol (VRRP)
  - MPLS data plane support
  - Proxy ARP network routes
  - IKE v2
- Extreme scalability
  - Routing table entries (1,000,000+ efficiently supported)
  - Interfaces (100,000+ efficiently supported)

### Wind River Network Stack

The Wind River Network Stack is a full-featured TCP/IP stack specifically designed for use in modern device software. The stack contains a comprehensive suite of protocols that enables devices to take full advantage of the Internet, with support for all standard protocols, such as IP, UDP, TCP, ICMP, and IGMP. It also contains extensive routing support, with a built-in Virtual Routing module that enables a single stack to assume the responsibility of multiple TCP/IP stacks. This facilitates more efficient use of existing hardware and software capabilities. In addition, the Network Stack also implements IPv6,

which extends IPv4 in a number of key ways. Wind River Network Stack is a true dual-mode stack, with support for simultaneous use of IPv4 and IPv6; and it supports Quality of Service (QoS) through a comprehensive implementation of Diffserv, which provides differentiated classes of service for Internet traffic.

### Wind River IPsec

Wind River IPsec is a scalable implementation of IPsec, as specified by the IETF. It provides authentication, data integrity, and encryption of any network traffic on the IP layer. It is implemented as a tightly integrated software module for the Wind River Network Stack for both IPv4 and IPv6 operations. Wind River IPsec is interoperable with other IPsec implementations and conforms to the IPsec RFCs, as specified by the IETF.

### Wind River IKE

Wind River IKE is a scalable implementation of IKE versions 1 and 2, as specified by the IETF, and it provides for secure key exchange for IPsec. Key features include:

- Supports IKE v1 and IKE v2
- Allows NAT traversal of ESP packets over UDP
- Interoperable with native Linux stack
- Authentication based on X509 certificates and preshared secrets (passwords)
- Passive and active establishment of IPsec connections
- Secure, interoperable communication with other IPsec end-points
- Plug-and-play integration with IPsec
- Flexible and powerful policy-based configuration
- Establishes both tunnel and transport IPsec connections
- Delivered in ANSI-compliant C source code
- Complete, ready-to-run integration with examples, makefiles, etc.

### 802.1x

The Wind River implementation of 802.1x is part of Interpeak Wireless Supplicant (IPWPA). This module, which handles all 802.1x messages and interfaces with the Wind River Network Stack and a wireless driver, runs in Linux user space. It is integrated with WPA and WPA2 and works with several EAP methods, as mandated by the Wi-Fi Alliance.

### Wind River Firewall

Wind River Firewall protects the protocol stack from hacker attacks and security breaches. It can be configured to discard unwanted packets that may be sent from a malicious host, so your applications can continue to run smoothly. The firewall can also log packets for later investigation to determine if they were part of a hacker attack, or if they originated from a misconfigured host that sends out unintended packets. Wind River Firewall is designed for IPv4 and IPv6 operation and optimized for deployment with Wind River Linux.

### Mobility Protocols

The Wind River Mobile IPv4 solution includes support for full mobile node, home agent, and foreign agent functionality. Since the IPv6 versions of the Mobile IP protocols have been completely redesigned to leverage IPv6 functionality, a separate IPv6 Mobile Node product is available.

### Testing and Validation

Wind River is committed to providing quality products for both proprietary and open-source-based technologies. Our quality policies include formal code inspections, peer reviews, project reviews, program audits, and traceable requirements change management. Platform for Network Equipment was created following a methodical process to thoroughly test key features on every supported reference configuration (defined by development host, kernel and package configurations, and supported board).

Wind River has developed a robust, scalable, and automated build and test infrastructure with more than 5,000 unique tests. This infrastructure supports many processor architectures and uses a combination of commercial, open-source, and proprietary tests, including LTP Core, LTP Network, LSB, TAHI, and Open POSIX. Wind River uses coverage tools, such as gcov and lcov, to optimize test development and close gaps in existing test suites.

Automated testing packages for Wind River Linux 1.5 include:

Test Suite	Description
Automated Boot Login Test	This tests the booting process of any target architecture for a given kernel and rootfs. The process is completely automated for a set of targets, which helps in determining the boot sanity of target.
BSP Validation Suite	This suite, which validates BSP-specific features, is shipped with the product.
CD Sanity Test	This automation suite covers CD installation on a new release, followed by building the rootfs for various target combinations using prebuilt rpms. It boots the target with the prebuilt kernel and rootfs and executes KGDB and user-mode tests on the target, then reports the results to the database.
Linux Test Project	This test suite validates the reliability, robustness, and stability of Linux kernel and its network components.
Open HPI	This is the Open Hardware Platform Interface (Open HPI) conformance test.
Open POSIX	This test suite is for POSIX 2001 APIs not tied to specific implementations. It provides conformance, functional, and stress testing, with an initial focus on threads, clocks and timers, signals, message queues, and semaphores.
Perl_test	This tests the Perl package.
RT Feature Testing: LMBENCH Realfeel	Real-time feature testing was taken up to test performance. LMBENCH was used to benchmark the product against the vanilla kernel.
Safest	This tests the Open HPI package.
TAHI IPv6 Conformance	This test suite validates IPv6 protocol conformance to various RFCs.
TAHI Tests	These test IPv6 router configuration, IPsec, and the Mobile IPv6 router.

In addition to automated testing, we completed significant manual testing—including feature testing, Workbench testing, and complete system testing—for Wind River Linux 1.5:

Test Suite	Description
1.5 Bug Fix Testing	The bugs fixed during various release cycles were tested for the fixes, then closed.
1.5 New Feature Testing	New features were tested for support on Wind River Linux 1.5. The conditions of satisfaction for each of these features were met, as mentioned in the ClearQuest.
Board-Specific Testing	Along with new BSPs added for release, there are board-specific tests mentioned in the board readme. These tests were executed as part of regression testing on Wind River Linux 1.5.
Documentation Testing	Documentation for Wind River Linux 1.5 was tested to make sure all steps are properly recorded.
Host OS Testing	Installation testing on various host OSes supported for Wind River Linux 1.5. Also completed sample application build and debugging from Workbench.
HRT Regression Testing	HRT features for previous releases were tested for regression on the supported platforms.
Install Bundle Testing	Installation testing for various product structure bundles.
Nessus Report	Nessus report for Intel Tigpr2u (glibc_cgl, cgl).
Pre-PRT Testing	Some user scenarios for Workbench, ScopeTools, and Build System were tested on supported hosts and platforms, as done by the PRT.
Regression Testing Async BSPs	Tested the Async BSPs (IMX31) for regression (Workbench and other platform testing).
Regression Testing Sync BSPs	Tested the regular BSPs for regression (Workbench and other platform testing).
RT Regression Testing	Regression testing features for previous releases were tested for regression on the supported platforms.
SNMP Testing	SNMP tests were performed.
Stress Testing	Stress tests were performed.
Usability Testing	Wind River Linux 1.5 and Workbench 2.5 usability testing is based on the usability testing document.
Use Case Testing	The use cases for Workbench, ScopeTools, and Build System were tested on supported hosts and platforms.
Workbench Integration Testing	Tested the Workbench feature integration with Wind River; the new features added to Workbench were also tested, along with regression testing on features from previous releases. The testing included Wind Manage testing, Wind System Viewer testing, and Wind River ScopeTools testing.

## Hardware Reference Designs and Board Support Packages

Wind River Linux board support packages (BSPs) are based on a common Wind River platform-specific configuration template and a common kernel code base, which is generated from pristine kernel.org kernel versions and individual Wind River platform-specific kernel patches. A typical BSP includes board-specific configuration files that overwrite or add configuration options defined by the common platform templates. Additional kernel patches included in the BSP can add new device drivers or apply necessary changes to existing Linux code.

Wind River has validated proper operation of the Linux run-time for each supported reference board. The supported features are board-specific and depend on availability and maturity of the code in the open-source community. Please contact your Wind River sales representative for details on supported features for your chosen board.

Wind River continues to add boards according to customer demand and hardware availability. Additional BSPs will be made available via Wind River's Online Support website to customers under an active platform subscription. If you plan to build custom hardware, have special requirements, or use boards that are not currently supported, Wind River can enable our platforms for your hardware through a BSP engagement with our Professional Services team.

### Supported Target Processors\*

- AMCC PowerPC: 405, 440
- ARM: ARM9
- Broadcom: BCM 47xx, 12xx, and 14xx
- Freescale: 82xx, 83xx, and 85xx
- Intel: Pentium 4 and EM64T
- MTI MIPS: 24kxx, 4kxx, 5kx

### Supported Target Reference Boards \*

Our list of available reference boards is constantly growing. Please contact your Wind River sales representative for information on the latest BSPs for a particular board.

## Partner Ecosystem

Wind River's world-class partner ecosystem assures tight integration between our core technologies and those of the premier hardware and software companies we've chosen to build out our solutions. Our partners help extend the capabilities of Platform for Network Equipment by offering out-of-the-box integration and support for key technologies in a number of fast-moving markets. Our team is trained to troubleshoot partner technologies in use with Wind River products, making ours the best-supported ecosystem in the DSO industry.

The following list includes a sample of partners for Wind River Linux platforms. The Wind River Partner Ecosystem is constantly expanding—please contact us for more details.

Our hardware partners include:

AMCC	Intel
AMD	Kontron
ARM	Marvel
Broadcom	Mercury Computer
Cavium	MIPS Technologies
Emerson Network Power	Motorola
Freescale	RadiSys
IBM	Texas Instruments
	Xilinx

Our software partners include:

Data Connection Ltd. (DCL)	NextHop Technologies
Datalight	OpenClovis
DigiOn	Skelmir
Esmertec	Solid Information Technology
Flextronics	Tilcon
GoAhead Software	Trolltech
IBM Rational	Virtutech
IP Infusion	Visuality Systems
LVL7	

## Alignment with the Open-Source Community

Wind River has a long history of working with, and contributing to, the open-source community. We were one of the early adopters of the GNU compiler and debugging technologies for use with our VxWorks real-time operating system and Tornado cross-development environment, and we contributed several bug fixes and improvements to these projects.

We continue our commitment to enabling our customers to successfully leverage open source in their development of next-generation devices through our active involvement in a number of organizations:

### Carrier Grade Linux (CGL)

[www.linux-foundation.org/en/Carrier\\_Grade\\_Linux](http://www.linux-foundation.org/en/Carrier_Grade_Linux)

The Linux Foundation CGL working group is developing the Carrier Grade Linux specification and driving the adoption of Linux in the network infrastructure industry.

### Service Availability Forum (SAF)

[www.saforum.org](http://www.saforum.org)

The SAF is an organization developing APIs and specifications for high availability of hardware and software applications. Their specifications include the Hardware Platform Interface (HPI) specification and the Application Interface Specification (AIS).

### Mobile Linux Initiative (MLI)

[www.linux-foundation.org/en/Mobile\\_Linux](http://www.linux-foundation.org/en/Mobile_Linux)

The Linux Foundation Mobile Linux working group is focused on accelerating the adoption of Linux in the rapidly growing mobile device market.

### Eclipse Forum

[www.eclipse.org](http://www.eclipse.org)

The Eclipse Forum works to improve and enhance the core Eclipse framework, and also enables Wind River Workbench to be integrated with a wide range of complementary Eclipse plug-ins for software development.

## SCOPE Alliance

[www.scope-alliance.org](http://www.scope-alliance.org)

SCOPE is an industry alliance committed to accelerating the deployment of carrier grade base platforms for service provider applications.

## Consumer Electronics Linux Forum (CELF)

[www.celinuxforum.org](http://www.celinuxforum.org)

CELF drives adoption of Linux in the consumer electronics industry.

## TIPC Project

<http://sourceforge.net/projects/tipc>

The TIPC Project provides an open solution for communication and messaging.

## 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 design. As part of our comprehensive solutions, Wind River offers a Linux Services Practice, 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 your company's success. Backed by our commercial-grade project methodology, Wind River Professional Services include device design, Linux BSP and driver optimization, software system and middleware integration, and legacy application and infrastructure migration.

### Installation and Orientation Service

Proper installation and orientation of Platform for Network Equipment means you won't waste time on easily avoidable problems before you can begin your next project. Wind River offers an Installation and Orientation Service to ensure your project starts on time and without hassle by delivering:

- **On-site 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 also 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, improved efficiency in the processes they employ, and faster adoption of the tech-

nology you have purchased. Personalized Learning Programs deliver improved business performance—customers have reported a return on investment ranging from 18 to 80 percent over a traditional training approach.

Please consult your local Wind River sales representative for more information on Personalized Learning Programs.

### 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:

- 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

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

### On-Site Education

If you have a large project team or a number of new users, you may benefit from custom on-site 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.

Advantages of on-site education:

- Your entire team gains a common knowledge base
- On-site education 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

Please consult your local Wind River sales representative for further information about on-site education.

## Support Services

Wind River Customer Support, a certified Support Center Practices (SCP) organization, provides support for Wind River Linux platforms. Your subscription to Platform for Network Equipment includes full maintenance and support, delivered through Wind River's Online Support website and our worldwide support team. Wind River Support includes the development suite and cross-toolchain, Linux kernel, and the reference root file system, as validated on supported boards and development host operating systems. While under subscription, customers receive both maintenance updates and major upgrades.

### Technical Support

Wind River works with every customer to help you solve technical support problems. We may not be able to support every configuration of hardware and software that a customer may have selected, but we will do everything we can to provide support. Linux Technical Support on modified or unsupported configurations is best effort-based. Wind River Customer Support will try to reproduce the problem on a supported configuration. If the problem can be validated, we will provide a fix that will be tested on a supported configuration. Wind River Professional Services can provide support for boards or host operating system versions that are not supported by the standard product, as well as for customized versions of the source code or additional nonstandard packages.

Customer Support will provide bug fixes following the process outlined in Wind

River's Customer Support User's Guide, available at [www.windriver.com/support/resources/csug.pdf](http://www.windriver.com/support/resources/csug.pdf).

If appropriate, Wind River will submit changes in open-source code to the open-source project maintainer for inclusion in a future release of the open-source package. Wind River will maintain changes until a new version from the open-source project is available and can be released for Platform for Network Equipment.

Customers with a valid support or subscription agreement are eligible for all respective updates 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.

Visit Wind River Online Support (OLS) for fast access to product manuals, downloadable software, and other problem-solving resources. OLS offers 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. OLS also provides new BSPs, updates to existing packages, patches, manuals, the latest errata, and other announcements about Platform for Network Equipment. Wind River will also provide new contributed Linux packages through our support website. These packages have been contributed by the open-source community and are prebuilt and tested with Platform for Network Equipment.

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.

If you cannot find the information you need through OLS, please contact our global support team for access to the industry's most knowledgeable and experienced support staff:

### *North America, South America, and Asia/Pacific*

support@windriver.com  
Toll-free tel.: 800-872-4977 (800-USA-4WRS)  
Tel.: 510-748-4100  
Fax: 510-749-2164  
Hours: 6:00 a.m.–5:00 p.m. (Pacific time)

### *Japan*

support-jp@windriver.com  
Tel.: +(00)81-3-5778-6001  
Fax: +(00)81-3-5778-6003  
Hours: 10:00 a.m.–5:00 p.m. (local time)

### *Europe, the Middle East, and Africa*

support-ec@windriver.com  
Toll-free tel.: +(00)(800) 4977-4977  
France tel.: +33(0) 1 64 86 66 66  
France fax: +33(0) 1 64 86 66 10  
Germany tel.: +49(0) 899 624 45 444  
Germany fax: +49(0) 899 624 45 999  
Israel tel.: +972(0) 9741 9561  
Israel fax: +972(0) 9746 0867  
UK tel.: +44(0) 1793 831 393  
UK fax: +44(0) 1793 831 808  
Hours: 9:00 a.m.–6:00 p.m. (local time)

## Appendix A: Target Run-Time Packages

Name	Summary	Version
atk	Accessibility Toolkit (GNOME Accessibility Project)	1.11.4
binutils	A GNU collection of binary utilities	2.16
boa	The boa web server	0.94.13
busybox	A GNU archiving program	1.1.2
bzip2	A file compression utility	1.0.2
cairo	An embedded systems 2D graphics library	1.2.0
directfb	An embedded systems graphics library	0.9.25.1
directfb-examples	A set of example directfb graphics applications	0.9.25
expat	A library for parsing XML	1.95.8
fbset	A system utility to show or change the settings of the frame buffer device	2.1
filesystem	The basic directory layout for a Linux system	2.1.6_5
flex	A tool for creating scanners (text pattern recognizers)	2.5.33
fontconfig	A library for font customization and configuration	2.3.2
freetype	FreeType 2 is a software font engine.	2.1.10
gdb	The GNU Debugger	6.5
glib2	A library of handy utility functions	2.12.0-1.1
glibc	The GNU libc libraries	2.3.6
grub	Grand Unified Boot Loader	0.95
gtk	GTK+ is a multi-platform toolkit for creating GUIs	2.10.0
hfsutils	Tools for reading and writing Macintosh HFS volumes	3.2.6
hotplug	A helper application that loads modules for USB devices	2004_09_23
ipsec-tools	Tools for configuring and using IPsec	0.6.3
libgcc	GCC version 3.0 shared support library	3.4.4
libjpeg	A library for JPEG image compression	6b
libpng	The official PNG library	1.2.12
libtiff	A library of functions for manipulating TIFF format image files	3.7.1
libusb	A library that allows user-space access to USB devices	0.1.10a
linux	The core of the Linux operating system	2.6.14
lttc	Linux Trace Toolkit tracedaemon	0.12-21062006
mac-fdisk	fdisk for linux-m68k on Macintosh	0.1
makedev	A program used for creating the device files in /dev	2.3.1
microperl	The Pathologically Eclectic Rubbish Lister	5.8.7
ncurses	A CRT screen-handling and optimization package	5.4
net-snmp	A collection of SNMP protocol tools and libraries	5.3.0.1
openssh	The OpenSSH implementation of SSH protocol versions 1 and 2	4.3p2
openssl	The OpenSSL toolkit	0.9.7h
pango	A library for laying out and rendering text	1.13.1
sdl	Layer for graphics and input device access via library	1.2.11
setup	A set of system configuration and setup files	2.5.49-1
strace	Tracks and displays system calls associated with a running process	4.5.14
sysklogd	System-logging and kernel-message-trapping daemons	1.4.1
unionfs	Union file system	1.1.5
usbutils	Linux USB utilities	0.71
wrproxy	Wind River proxy	1.1
wrsnmp	SNMP agent	10.2
yaboot	Linux bootloader for Power Macintosh "New World" computers	1.3.13

Name	Summary	Version
zlib	The zlib compression and decompression library	1.2.3
acl	Access control list utilities	2.2.34
acpid	The ACPI daemon	1.0.4
aide	Advanced Intrusion Detection Environment	0.1
apache-ssl	A secure Web server	1.3.34
at	Job spooling tools	3.1.8-11
atftp	The client for the Trivial File Transfer Protocol (TFTP)	0.7
attr	Utilities for managing file system extended attributes	2.4.28
bash	GNU Bourne Again Shell, version 3.1	3.1-6.2
beecrypt	An open-source cryptography library	4.1.2
bind	The Berkeley Internet Name Domain (BIND) DNS (Domain Name System) server	9.3.2-4.1
bootpc	Bootp client	0.64
checkpolicy	checkpolicy from NSA	1.28
chkconfig	A system tool for maintaining the /etc/rc*.d hierarchy	1.3.29-1
coreutils	The GNU core utilities: a set of commonly used utility applications	5.2.1
cpio	A GNU archiving program	2.5
cracklib	A password-checking library	2.8.6-1.2.1
cracklib_dict	cracklib-words data files	2.8.6-1.2.1
crontabs	Root crontab files used to schedule the execution of programs	1.1
db4	The Berkeley DB database library (version 4) for C	4.3.29-2
device-mapper	device mapper library	1.02.02
dhcp	A DHCP (Dynamic Host Configuration Protocol) server and relay agent	3.0.2rc3
diffutils	A GNU collection of diff utilities	2.8.1
dmapi	DMAPI library	2.2.3
e2fsprogs	Utilities for managing the second extended (ext2) file system	1.38
ed	The GNU line editor	0.2
elfutils	A collection of utilities and DSOs to handle compiled objects	0.108-1
ethtool	Ethernet settings tool for PCI Ethernet cards	3
expect	A tcl extension for simplifying program-script interaction	5.43.0
fam	File Alteration Monitor	2.7.0
file	A utility for determining file types	4.1
findutils	The GNU versions of find utilities (find and xargs)	4.1.20
gawk	The GNU version of the awk text processing utility	3.1.3
gdbm	A GNU set of database routines that use extensible hashing	1.8.3
gmp	Multiprecision arithmetic library	4.1.4
grep	The GNU versions of grep pattern matching utilities	2.5
gzip	The GNU data compression program	1.2.4a
inetutils	Basic UNIX network utilities	1.4.2
initscripts	The inittab file and the /etc/init.d scripts	8.31.1-1
iproute	Advanced IP routing and network device configuration tools	2.6.14-051107
iptables	Tools for managing Linux kernel packet filtering capabilities	1.3.4
iputils	Network monitoring tools, including ping	20020927
ixp-access-libs	Intel hardware access libraries	2.3
kbd	Tools for configuring the console (keyboard, virtual terminals, etc.)	1.12
kexec-tools	The kexec/kdump user-space component	1.101-51.fc6
keynote	Keynote tool and library	2.3
krb5	Kerberos 5 security from MIT	1.4

Name	Summary	Version
less	File viewer that is better than "more"	382
libcap2	Support for POSIX.1e capabilities	0.cvs.20010529
libevent	An asynchronous event notification library	1.0b
libpcap	A system-independent interface for user-level packet capture	0.9.4
libselinux	libselinux from NSA	1.29.6
libsemanage	libsemanage from NSA	1.5.20
libsepol	libsepol from NSA	1.11.12
libsetrans	libsetrans from NSA	0.1.18
libstdcxx	The GNU Standard Cxx Library v3	3.4.4
libtermcap	A basic system library for accessing the termcap database	2.0.8-39
libtool	The GNU libtool, which simplifies the use of shared libraries	1.5.8
libxml2	Library providing XML and HTML support	2.6.26-2.1.1
ksctp-tools	User-space access to Linux kernel SCTP	1.0.6
logrotate	Rotates, compresses, removes, and mails system log files	3.7
lsdf	Lists information about files that are open on the system	4.74
lvm2	LVM2 tools	2.00.32
mdadm	mdadm controls Linux md devices (software RAID arrays)	2.2
mhash	Library of hashing algorithms	0.9.1
mingetty	A compact getty program for virtual consoles only	1.06
minicom	A text-based modem control and terminal emulation program	2.1
mip6	Mobile IPv6 user-side code	2
mktemp	A small utility for safely making /tmp files	1.5
mm	A shared memory library	1.4.0-1_WR
module-init-tools	Kernel module management utilities	3.2.2
mysql	Multiuser, multithreaded SQL database	5.0.21
neon	An HTTP and WebDAV client library	0.25.2
net-tools	Basic networking tools	1.6
newt	A development library for text-mode user interfaces	0.51.6
nfs-utils	NFS utilities and supporting daemons for the kernel NFS server	1.0.8.rc2-4.FC5.2
ntp	Synchronizes system time using the Network Time Protocol (NTP)	4.2.0
pam	A security tool that provides authentication for applications	0.99.4.0-5
parted	The GNU disk partition manipulation program	1.6.20
pciutils	PCI bus-related utilities	2.2.1
pcre	Perl-compatible regular expression library	5
perl	The Pathologically Eclectic Rubbish Lister	5.8.7
policycoreutils	policycoreutils from NSA	1.29.18
popt	A C library for parsing command line parameters	1.7
portmap	A program that manages RPC connections	5
powerpc-utils	Various utilities for Linux/PowerPC	1.1.3
ppp	The PPP (Point-to-Point Protocol) daemon	2.4.3
procps	System and process monitoring utilities	3.2.6-3.2
psmisc	Utilities for managing processes on your system	21.5
pyca	Certification Authority written in python	20031118
python	An interactive high-level object-oriented language	2.4.2
rdist	Maintains identical copies of files on multiple machines	6.1.5
readline	A library for editing typed command lines	5
reiserfsprogs	User-level tools for ReiserFS file systems	3.6.19

Name	Summary	Version
rng-tools	rng tools	2
rpm	The RPM package management system	4.4.2
rsh	Clients for remote access (rsh, rlogin, rcp)	0.17
rsync	A program for synchronizing files over a network	2.6.8-3.1
scsidev	Provides easy access to your SCSI devices	2.3
sed	A GNU stream text editor	4.1.1
setserial	A utility for configuring serial ports	2.17
shadow-utils	Utilities for managing accounts and shadow password files	4.0.14-1.2
slang	The shared library for the S-Lang extension language	1.4.9
sudo	Allows restricted root access for specified users	1.6.8p9
sysstat	The sysstat package contains the sar, mpstat, iostat sadf, and sa system performance tools for Linux	5.1.5
sysvinit	Programs that control basic system processes	2.85
tar	A GNU file archiving program	1.15.1
tcl	Tcl scripting language development environment	8.4.12rc4
tcp_wrappers	A security tool that acts as a wrapper for TCP daemons	7.6-40.2
tcpdump	A network traffic monitoring tool	3.9.4
telnet	The client program for the telnet remote login protocol	0.17
timezone	This package is for time zone information	2006l
tnftp	Enhanced NetBSD FTP client	20050625
traceroute	Traces the route taken by packets over a TCP/IP network	1.4a12
udev	A user-space implementation of devfs	79
util-linux	A collection of basic system utilities	2.12
vim	The VIM editor	6.3
vixie-cron	The Vixie cron daemon for executing specified programs at set times	3.0pl1
vlan	i802.1q vlan implementation for Linux	1.9
vsftpd	Very Secure FTP Daemon	2.0.4-1.2
watchdog	Software watchdog	5.2.5-1.rf
wget	A utility for retrieving files using the HTTP or FTP protocols	1.9.1
which	Displays where a particular program in your path is located	2.16
xerces	Xerces-C is a validating XML parser written in a portable subset of C++	2.6.0
xfsdump	Administrative utilities for the XFS file system	2.2.33
xfspgrog	A set of commands to use the XFS file system, including mkfs.xfs	2.7.11
xinetd	A secure replacement for inetd	2.3.14-3.1
zebra	GNU Zebra routing suite	0.94
ipmiutil	A package that includes various IPMI server management utilities	1.8.1-1
libnet	A C library for portable packet creation and injection	1.1.2.1
openais	OPENAIS Project	0.7
openhpi	Library that provides SA Forum's HPI	2.2.1
openipmi	IPMI abstraction layer	1.4.26
schedutils	Linux utilities for manipulating scheduler attributes	1.5.0
tipc	Transparent Interprocess Communication protocol for Linux	1.5.12
tipc-kernel	Transparent Interprocess Communication protocol for Linux	1.5.12
usagi-tool	The USAGI IPv6 networking extension	s20051205
evlog	Event logging	1.6.1
freeradius	High-performance and highly configurable free RADIUS server	1.1.2-1.1
fuse	File System in User Space (FUSE) utilities	2.5.3-1.fc5

Name	Summary	Version
heartbeat	The heartbeat subsystem for high-availability Linux	2.0.2
ifenslave	Configure network interfaces for parallel routing	1.1.0
ipmitool	Utility for interfacing with IPMI devices	1.8.2

## Appendix B: Host Packages

Name	Summary	Version
SDL	Simple DirectMedia Layer for graphics and input device access via library	1.2.11
agent-proxy	Proxy for UDP/TCP connection	1.6
autoconf	A GNU tool for automatically configuring source code	2.6
automake	A GNU tool for creating makefiles	1.9.6
beecrypt	An open source cryptography library	4.1.2
byacc	A public domain Yacc parser generator	1.9.1
bzip2	A file compression utility	1.0.2
ccache		2.4
cramfs		1.1
elfutils	A collection of utilities and DSOs for handling compiled objects	0.108-1
expat	A library for parsing XML	1.95.8
fakechroot		2.5
fakepasswd		1
fakeroot		1.2.2
flex_old	A tool for creating scanners (text pattern recognizers)	2.5.4a
fontconfig-tools	A library for font customization and configuration	2.3.2
freetype-headers	FreeType 2 is a software font engine	2.1.10
gdb	The GNU Debugger	6.5
genext2fs		20050714
glib2		2.12.0
gtk-tools	GTK+ is a multi-platform toolkit for creating GUIs	2.10.0
libpng	The official PNG library	1.2.12
libraryopt		1.0.1
libtool	The GNU Portable Library Tool	1.5.22
linux-live		5.5.0
Indir		
mkimage		
mtdd	Utilities to manage jffs2 images	20051219
ncurses	A CRT screen handling and optimization package.	5.4
neon	An HTTP and WebDAV client library	0.25.2
nfs-server	User Mode NFS server	2.2beta47
patch	Apply a diff file to an original	2.5.9
prelink	An ELF prelinking utility	0.3.9
python	An interactive high-level object-oriented language	2.4.2
qemu	Full system emulator, including a processor and various peripherals	11607
quilt		0.45
rpm	The RPM package management system	4.4.2
rpmpython	A separate release of rpm-python to build against different versions of rpm and python	4.4.2.4

Name	Summary	Version
smartpm	Package management tool for fulfilling dependencies when upgrading and installing packages	0.4
squashfs		3.1-r2
uml-tools	User-mode Linux management tools	20060323
unionfs	Union file system	1.1.5
vde2	Virtual Distributed Ethernet for binding simulators and host networks	2.1.2
wget	A utility for retrieving files using the HTTP or FTP protocols	1.9.1
yaffs2		1/30/2006
zlib	The zlib compression and decompression library	1.2.3