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WIND RIVER

Wind River ICE 2

Developers working with complex 32- and 64-bit multicore systems-on-chip (SoCs) require development tools that leverage the key debug and analysis capabilities built into these devices. These capabilities are critical to development success as they provide the developer with essential visibility into the interworkings of these complex multiprocessing solutions.

Wind River ICE 2 is a high-quality, high-performance, cost-effective JTAG emulator that improves debugging efficiency across a broad range of 32-bit and 64-bit JTAG- and EJTAG-enabled devices. Built on a high-performance hardware and software platform, Wind River ICE 2 provides differentiated value through open and extensible interfaces and capabilities. It supports the debug of complex multicore designs and provides advanced hardware and software diagnostic and analysis capabilities.

Device software developers are under intense competitive pressure to move their projects from system design to production in an environment where schedule slips can be very costly to the project team and the business. In order to complete their projects on time, device software developers require a development tool solution that is dependable and reliable. It should provide visibility into complex hardware and software interactions and enable them to efficiently resolve critical design challenges such as random defects that crash their systems, without having a negative impact on their schedule.

Wind River ICE 2 was designed in concert with today's leading SoC vendors. Through its tight integration with the JTAG or EJTAG control block on the industry's leading 32- and 64-bit single core and multicore SoCs, Wind River ICE 2 provides developers with direct access and control of their target device under development or test. Having this control means that developers will have access to status information for their target at all times, regardless of its operational condition. Since Wind River ICE 2 leverages the JTAG and EJTAG control block of the microprocessor, it is not dependent on an operating system to work and it can provide the developer with target access even when there is no operating system running on the target.

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Figure 1: Wind River ICE 2

Key Features

- Multicore leadership
  - Recognizes up to 128 devices on a scan chain
  - Simultaneously debugs up to 16 devices on a single scan chain or device
- Advanced debugging capabilities
  - Hardware diagnostics
  - Flash programming
  - Run control
  - Hardware/software conditional breakpoints
  - Target system register and memory access
- Remotely accessible
  - 10/100/1000 Mbps Ethernet network interface
- Leading download performance
  - 100Mb JTAG clock speed support
- Simplified usage
  - LCD panel easing configuration and monitoring
- Broad processor support
  - Architectures: ARM, MIPS, PPC
  - OS support: VxWorks 6.0 and higher, VxWorks 653, Wind River Linux, kernel.org Linux kernels, and ThreadX
- Extensible solution
  - Wind River Workbench
  - Wind River On-Chip Debugging API

Benefits

- Enables developers to quickly verify early hardware performance through its ability to take control of the target, without instrumentation, and provides visualized advanced hardware diagnostic capabilities
- Simplifies complex system design with visibility into advanced multicore SoCs that cannot be provided by external logic or bus analyzers
  - Enables developers to isolate and resolve challenging multicore system-level issues through patent-pending multicore run control capabilities
- Provides cost-effective JTAG solution
  - Allows access to multiple targets through one emulator
  - Enables multiple developers to access and utilize the same on-chip debugger unit regardless of location
- Protects your initial investment through modular upgrades and industry-leading target management support
  - Supports ARM, MIPS, PPC processors
  - Supports VxWorks, Wind River Linux, kernel.org Linux kernels, Express Logic's ThreadX operating systems
  - Extends to include external trace support
- Supports cross-team collaboration, enabling development teams from different groups and different locations to access and debug issues on the same target environment
- Uses a single emulator across the entire development team
  - Works in any or all projects, facilitating collaboration across the team and enterprise

The Wind River ICE 2 platform supplies developers with a rich set of features that provide support for a broad range of development capabilities: target connection and control management, download, Flash programming, diagnostics, register and memory access, cache support, and run control, which includes hardware and software breakpoints, data and expression breakpoints, stepping, trace support, and synchronized run control.

The Wind River ICE 2 platform is built on a flexible and extensible framework that allows it to scale and extend capabilities to meet the needs of future complex device software development projects.

Basic Run Control Support

Wind River ICE 2 provides developers with a direct connection to their targets. Wind River ICE 2 supports devices from 32-bit microcontroller devices through complex 64-bit multicore processor SoCs.

Through its support for many industry-leading JTAG- and EJTAG-enabled microprocessors, developers are able to use Wind River ICE 2 to connect and manage their devices. Wind River ICE 2 provides support for the following:

- Target connection management
- Target reset
- Downloading software to the device
- Flash programming
- Starting and stopping the device
- Stepping (step one statement or instruction into function calls and step over or out of a function)
- Hardware and software breakpoint support
- Access to target registers and memory

Advanced Run Control Support

Target Initialization Files

Wind River ICE 2 provides developers with a library of target initialization files for supported SoCs and their associated semiconductor vendor reference designs. Developers are able to use these target initialization register files to quickly bring up their targets and move on to the next stage in the project.

Hardware Diagnostics

Wind River ICE 2 features a suite of hardware diagnostic scripts that provide developers with the ability to run low-level diagnostic routines on their systems for the purpose of validating address and data bus configuration as well as verifying read/write memory. Hardware diagnostics include a comprehensive suite of RAM tests, scope loops, and cyclic redundancy check (CRC) tests.

Cache Support

Wind River ICE 2 provides developers with access to L1 and L2 instruction and data cache for many of the processors it supports. This data can be accessed and viewed graphically when Wind River ICE 2 is used with Wind River Workbench, On-Chip Debugging Edition, or this data can be mined through a rich command set when used with either Workbench's command shell, host shell, or the Wind River On-Chip Debugging API.

MMU Support

Wind River ICE 2 provides memory management unit (MMU) support for translation lookaside buffer (TLB) configuration and management when ICE 2 is used with operating systems that require the MMU to be enabled, such as VxWorks 6.x, VxWorks 653, and Wind River Linux.

Synchronized Run Control

Wind River ICE 2 provides simultaneous connectivity to up to 16 cores. When used in this configuration, Wind River ICE 2 can synchronously start and stop all cores or just some of them and set cross-correlated breakpoints so that when a breakpoint is hit in one core it can stop that core or all cores in the system.

Internally Buffered Trace Support

Wind River ICE 2 supports internally buffered trace capabilities provided on Power- and PowerPC-based SoCs. When used with Wind River Workbench, On-Chip Debugging Edition, Wind River ICE 2 can extract trace data from the internal trace buffer and provide a graphical representation of the data in the Workbench Trace view. This capability provides developers with visibility into what code executes on the target and, in some processors, traffic that traverses across the internal system bus.

Multicore Debugging

Wind River ICE 2 was designed with complex multicore debugging in mind. Wind River ICE 2 features Wind River's JTAG Server technology, which allows developers to do the following:

- Access a single device on the scan chain, or multiple devices simultaneously, to provide synchronous start and stop
- Set breakpoints within a single microprocessor to halt the execution of multiple microprocessors
- Make JTAG debugging connections to many microprocessors, regardless of their architecture
- Establish and remove connections without affecting any microprocessor or device on the scan chain

Simplified Usage

Wind River ICE 2 provides developers with an LCD panel that features information on ICE 2's Ethernet address, debug status, and pertinent configuration options. The LCD panel enables developers to better monitor Wind River ICE 2 and its current status.

High-Performance JTAG

ICE 2's efficient use of the JTAG interface eliminates slow download times and run control when developing with on-chip debugging microprocessors. Hardware logic that caches common JTAG scan chains improves performance. Wind River ICE 2 combines this capability with a high-speed 10/100/1000 Mbps Ethernet connection and a JTAG/EJTAG interface that provides support for up to 100MHz clock rates.

Remote Debugging

Wind River ICE 2 offers the ability to support remote debugging, when your device and/or emulator are not located next to your desktop environment. With Wind River ICE 2, your device can be located anywhere, as long as you can connect to it via a network. With its target console port, Wind River ICE 2 supports remote debugging by allowing developers to backhaul the serial output port of the target device via an Ethernet connection.

Scalability

Wind River ICE 2 is a scalable solution that enables developers to add capabilities, such as trace support, through a simple plug-in module. Wind River ICE 2 also provides a broad range of processor support with easy migration from one processor family to another via an interchangeable adapter located at the end of the emulator's target connection cable.

Target Console Port

Wind River ICE 2 provides a target console port that provides connectivity to the serial port on the target hardware through Wind River ICE 2's Ethernet interface. The target console port backhauls serial traffic over the network to the developers' desktops and transports commands back down to the serial interface. With the target console port, developers are able to remotely locate their on-chip debugging unit in the lab down the hall, next to a target in another building, in another state, or in another country and still have access to serial communication data coming off the target.

Boot Options

Remote Boot

In normal operation, Wind River ICE 2 boots from system files located in the flash file system. The Wind River ICE 2 unit is also capable of booting from firmware via Trivial File Transfer Protocol (TFTP) from a remote host. The only configuration required is the server IP address, making setup simple. With remote boot, a group of developers can manage the Wind River ICE 2 firmware from a single server, with everyone in this group booting remotely. This allows synchronized changes across all Wind River ICE 2 units used in a project. Configuration files can also be loaded remotely, allowing a group to manage all of its files from a central location.

Static Boot

In this mode, a default target driver is loaded automatically when the Wind River ICE 2 unit is booted. Multiple target drivers can also be automatically loaded at boot. The whole process is controlled by a bootapps.1st file, similar to an autoexec.bat file. This file can be generated by the Wind River ICE 2 unit or it can be edited on a host and copied into the flash file system.

Dynamic Boot

Dynamic boot is the default mode for the Wind River ICE 2 unit. Without the bootapps.1st file, no applications are loaded. Target drivers can be loaded manually using the Load command or by using Wind River Workbench, which automatically loads the target driver required by the specified target in the Workbench Configuration view. If a target driver is not found, Wind River ICE 2 searches for it on the default TFTP server then boots remotely.

Additional Custom Registers

The Wind River ICE 2 unit supports 32 custom register groups, with a total of 960 custom registers.

Wind River ICE 2 Firmware Update Emulation

For backward-compatibility, you can send new firmware to the unit using the Firmware Update Utility in Wind River Workbench. After the update, the unit defaults the updated firmware to static boot.

Wind River Technologies

JTAG Server

The majority of CPUs available today make use of the JTAG scan chain to offer access to core components that enable control and configuration of the CPU for debugging. Access through the JTAG scan chain provides visibility and control of internal processor resources (hardware breakpoints and registers) as well as external memory to allow users to download code or program Flash.

Wind River ICE 2, coupled with Wind River's JTAG Server technology, allows developers to control all the devices that exist in the scan chain via a single tool. With a single interface, this system eliminates the need to separate the scan chain and use precious board real estate for additional JTAG access headers. Fewer headers also means reduced routing complexity and increased board yield rate.

Within the scan chain, Wind River's leading-edge tools provide the capability to simultaneously or individually debug code on one or more CPUs of the same or dissimilar architectures, whether they are individual components or embedded within a SoC. Wind River ICE 2 also supports multiple debug sessions running on one or more hosts simultaneously.

Wind River ICE 2 High-Performance JTAG

Wind River's JTAG Accelerator technology enables Wind River ICE 2 to incorporate maximum scheduling efficiency, yielding 100 percent use of the available JTAG scan chain communication bandwidth.

Wind River ICE 2 eliminates slow download times and slow user response to user-run control commands (step in, step out, and single step) when developing with on-chip debugger microprocessors. With our new hardware logic that optimizes JTAG scan chain communications, Wind River ICE 2 dramatically improves performance in development.

Related Products

Wind River Workbench

Wind River ICE 2 is fully compatible with Wind River Workbench, the industry-leading open and extensible development suite. Wind River Workbench, On-Chip Debugging Edition is specifically configured to meet the needs of developers early in the device software development cycle—handling initial board bring-up and validation, developing device drivers, incorporating low-level software capabilities, and developing C/C++ applications. This edition offers a feature-rich development suite optimized for the capabilities of JTAG-based debugging using Wind River ICE 2 and Wind River Probe.

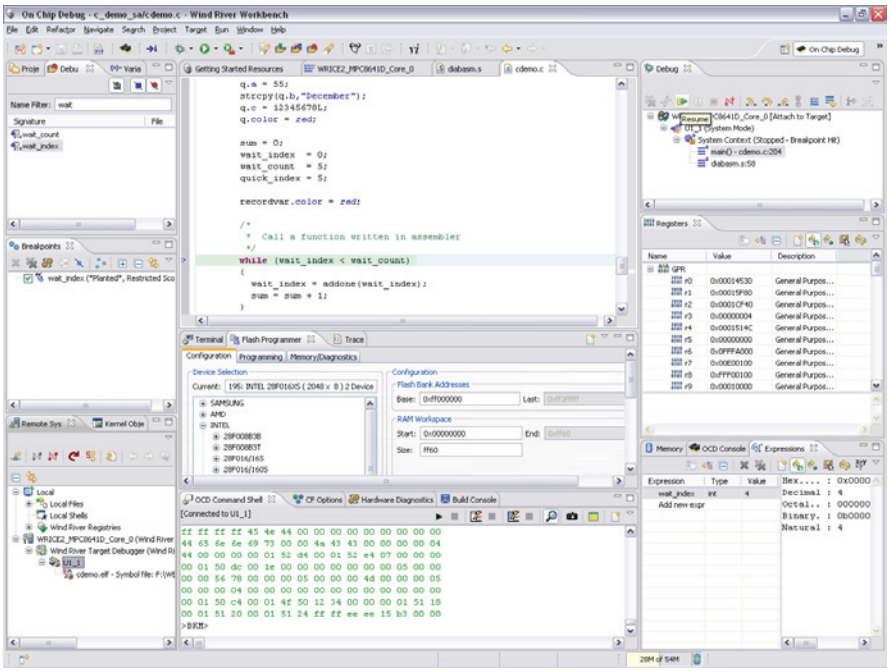


Figure 2: Wind River Workbench GUI

Wind River Trace 2

This optional trace capability provides developers with better visibility into the hardware/software interaction within their devices. It offers a GUI within the development environment, providing trace configuration parameters and displaying trace data. The same GUI supports both internally and externally buffered trace solutions. Wind River ICE 2 is integrated with Wind River Trace 2, which provides support for externally buffered trace solutions.



Figure 3: Wind River Trace 2

Wind River On-Chip Debugging API

Wind River ICE 2 is fully integrated with the Wind River On-Chip Debugging API, allowing fast and flexible integration of ICE 2's powerful capabilities into your own custom environment (e.g., automated test and production application). Wind River On-Chip Debugging API comes with complete and intuitive documentation, so developers can take full advantage of its features and benefits.

Technical Specifications

Host OS Support

- Red Hat Enterprise Linux 4, 32-bit, x86
- Red Hat Enterprise Linux 5, 32-bit, x86
- Red Hat Enterprise Linux Workstation 5, 64-bit, x86-64
- Fedora Core 7, 32-bit, x86
- OpenSUSE Linux 10.2, 32-bit, x86
- SUSE Linux Enterprise Desktop 10, 32-bit, x86
- Solaris 9 and 10, 32-bit, SPARC
- Windows XP Professional with Service Pack 2, 32-bit, x86
- Windows Vista, 32-bit, x86

Host OS Requirements

Specific host operating system requirements depend on the host software connected to Wind River ICE 2. Refer to the product information for Wind River Workbench and Wind River On-Chip Debugging API for details.

Target OS Support

Wind River ICE 2 provides support for the following target operating systems:

- VxWorks 6.3 and higher
- VxWorks 5.5
- Wind River Linux, Wind River Real-Time Core for Linux
- Open source Linux kernels version 2.4.26 and above, and versions 2.6.x.
- Express Logic's ThreadX 4.0, 5.0

Customizable target OS awareness capability for Wind River Workbench, On-Chip Debugging Edition enables support for other target operating systems.

Processor Family Support

ARM
ARM 9
ATMEL AT9x
TI DM64xx
Freescale i.MX1, L, S, 2x
Marvell MV88x
ARM 11
ARM 11 MP
Freescale i.MX31
TI OMAP 24xx, Cortex M3, A8

MIPS
MIPS 32 and MIPS 64
MIPS 16 IS
MIPS 4Kx, 4KEx, 5Kx
MIPS 20Kx, 24Kx, 25Kx
Philips PR19xx, 39xx, 44xx
Philips PNX30xx, 73xx, 83xx, 85xx

MIPS (cont.)
Broadcom BCM11xx, 12xx, 14xx
Broadcom BCM33xx, 35xx, 47xx
Broadcom BCM53xx, 5621x, 58xx
Broadcom BCM63xx
Broadcom BCM70xx, 71xx, 73xx, 74xx
Cavium CN3xxx, CN5xxx
NEC VR41xx, 54xx, 55xx, 77xx
Toshiba TX49xx
PMC-Sierra RM79xx, 9xxx
AMD AU12xx

Power
P.A. Semi PA6T-1682M

PowerPC
AMCC PPC40x (including Xilinx Virtex-II Pro and Virtex-4)
AMCC PPC44x
Freescale PPC52xx, 51xx
Freescale PPC55xx
IBM/Freescale PPC6xx
IBM/Freescale PPC7xx
Freescale PPC74xx
Freescale PPC82xx
Freescale PPC83xx
Freescale PPC85xx
Freescale PPC86xx
Xilinx Virtex-II Pro X2VP
Xilinx Virtex-4 XC4V

Professional Services

Wind River Professional Services helps companies to reduce risk and improve competitiveness. Our team delivers device software expertise within structured engagements that directly address key development challenges and contribute to the success of our clients. Our track record of timely delivery and in-depth understanding of market and technology dynamics makes Wind River a valuable implementation partner for clients worldwide. Based on our commercial-grade project methodology, service offerings include device design, board support package (BSP) and driver optimization, software system and middleware integration, and legacy application and infrastructure migration.

Workbench Services

Whether you select Wind River ICE 2 with Wind River Workbench as a standalone product or as part of our platform solutions, Wind River Professional Services knows how to jump-start your development efforts. Even if you opt for a non–Wind River platform, Linux distribution, host operating system, or target architecture, we can help.

No matter which development environment you use, Wind River Professional Services can extend Workbench to adapt to your needs with the following offerings:

- Extend Workbench processor support
- Extend Workbench target OS support
- Validate Workbench on Linux host environment
- Validate Eclipse plug-ins
- Integrate agents

Installation and Orientation

Proper installation and orientation of Wind River Workbench, On-Chip Debugging Edition means you won't waste time solving easily avoidable problems before you can begin your next development project. Wind River offers an Installation and Orientation Service to ensure that your project starts on time and without hassle and delivers the following:

- **Onsite installation:** Guided installation 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 the development platform's full potential.

Education Services

Education is fundamentally connected to individual performance as well as 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 Programs

Wind River offers a unique solution to minimize the short-term productivity drop associated with adopting new device software technology and optimize the long-term return on investment in a new device software platform. Wind River Personalized Learning Programs deliver the right education required by individual learners to accomplish their jobs. The programs identify work-related skill gaps; generate development plans, materials, and learning events to address these gaps; and quantify 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 technology you have purchased. Personalized Learning Programs deliver improved business performance—customers have reported a return on investment ranging from 18 percent to 30 percent over a traditional training approach.

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 with 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

Courses of interest to Wind River ICE 2 customers may include Workbench for On-Chip Debugging; General Purpose Platform, VxWorks Edition; General Purpose Platform, Linux Edition; and Workbench for Linux. Consult your local Wind River sales representative or visit education.windriver.com for course schedules and fees.

In addition to these Wind River–sponsored courses, we also offer half-day seminars on a regional basis for processor architecture and OS development training. Refer to education.windriver.com or contact your local Wind River sales representative for information on courses in your area.

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.

Advantages of onsite education include the following:

- The entire team gains a common knowledge base.
- Onsite education helps ensure that knowledge and skills will transfer from the classroom to the workplace.
- The location saves employees both travel expenses and time away from the office.

Support Services

Wind River provides full technical support for our development solutions, including Wind River ICE 2, Wind River ICE, Wind River Probe, Wind River Trace 2, Wind River Trace, Wind River Workbench, VxWorks 6.x, and Wind River VxWorks and Wind River Linux platforms. Our products are backed by the most comprehensive customer support network in the Device Software Optimization (DSO) industry.

Wind River's global support organization is staffed with experienced engineers who have extensive knowledge of Wind River products and device software development. With 10 major support centers and 15 additional support hubs worldwide, our local experts can help diagnose problems, provide guidance, and answer basic "How do I…?" questions.

Support is available 24/7 at our Online Support website or by email at support@windriver.com. The site provides patches, manuals, and the latest errata. Online Support also offers tech tips, application notes, and answers to FAQs. Visit Online Support at www.windriver.com/support, or consult our Customer Support User's Guide at www.windriver.com/support/resources/csug.pdf.

Wind River experts are also available for phone support during business hours. If you cannot find the information you need through Online Support, contact our global support team:

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WIND RIVER

Wind River is the global leader in Device Software Optimization (DSO). We enable companies to develop, run, and manage device software better, faster, at lower cost, and more reliably. www.windriver.com

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