

Wind River ICE 2

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

Wind River ICE 2 is a high-performance JTAG solution that improves debugging efficiency across a broad range of 32-bit and 64-bit JTAG-, EJTAG-, XDP-, and BDM-enabled devices. Built on a high-performance hardware and software platform, Wind River ICE 2 delivers differentiated value through a highly responsive debugging environment, support for a broad range of processors, and integration with Wind River Workbench, an award-winning Eclipse-based development environment. It supports the debug of complex multi-core designs and provides advanced hardware and software diagnostic and analysis capabilities for 32- and 64-bit single and multi-core systems and SoCs.

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 debug port on the industry's leading 32- and 64-bit single core and multi-core 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 debug 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.



Figure 1: Wind River ICE 2

Key Features

- Multi-core leadership
 - Supports a broad range of ARM, ColdFire, Intel, MIPS, and PowerPC-based single core and multi-core processors
 - 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
- Remote access
 - 10/100/1000 Mbps Ethernet network interface
- Leading download performance
 - Up to 100MHz JTAG clock speed
- Simplified usage
 - LCD panel that eases configuration and monitoring
- OS support for VxWorks 6.3 and higher, VxWorks 5.5, VxWorks 653, Wind River Linux, kernel.org Linux kernels, and ThreadX
- Extensible solution
 - Wind River Workbench
 - Wind River On-Chip Debugging API
 - Wind River Trace 2 real-time external trace unit
 - Wind River Connect 2 for select processors)

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Benefits

- Simplifies complex system design with visibility into advanced multi-core SoCs that cannot be provided by external logic or bus analyzers
- Enables developers to isolate and resolve challenging multi-core system-level issues
- Provides cost-effective JTAG solution
 - Allows access to multiple targets
 - Enables remote debug
- Protects investment through firmware upgrades and support for a broad set of processors and operating systems
 - Supports ARM, ColdFire Intel, MIPS, and PowerPC architectures
 - Supports VxWorks, Wind River Linux, and open source Linux kernels
 - Optional Trace 2 real-time external trace unit (for supported processors)

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 multi-core processor SoCs.

Through its support of industry-leading microprocessors, Wind River ICE 2 can connect and manage 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 semiconductor vendor reference design platforms. Developers are able to use these target initialization register files to quickly bring up their hardware 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 supported processors. This data can be accessed and viewed when Wind River ICE 2 is used with Wind River Workbench On-Chip Debugging or accessed 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.

Internal Trace Buffer Support

Wind River ICE 2 supports the internal trace buffer capabilities provided on supported processors. When used with Wind River Workbench On-Chip Debugging, Wind River ICE 2 can extract trace data and provide a visual representation in the Workbench Trace view. This capability provides developers with visibility into what code executes on the target.

Multi-core Debugging

Wind River ICE 2 was designed for complex multi-core debugging. It features Wind River's JTAG server technology that leverages debug capabilities of the processor and manages multiple cores with a single JTAG connection. This 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 core to halt the execution of multiple cores.
- 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 displays an IP address and enables developers to better monitor debug 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 Gigabit Ethernet connection and a JTAG/EJTAG/BDM interface that provides support for up to 100MHz clock rates.

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Remote Debugging

Wind River ICE 2 offers the ability to support remote debugging, when your target system is 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 debug remotely and still have access to serial communication data coming off the target.

Boot Options

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 Remote Systems Explorer view.

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

ICE 2 can be updated with new firmware via the Firmware Update Utility in Wind River Workbench. After the update, the unit defaults the updated firmware to static boot.

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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 or cores 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 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.

Wind River Trace 2

The Wind River Trace 2 external trace module extends the capability of Wind River ICE 2 to include real-time trace capability for supported processors and provide better visibility into hardware/software interaction on the target platform. This enables developers to identify and resolve the most difficult program-flow problems such as when software is randomly crashing the target or when the root cause is not easily found using standard system-level debugging methods via register and memory access. Benefits include the following:

- 1GB trace buffer for storage of instructions and timestamp information
- Ability to capture real-time trace at clock speeds up to 200MHz
- Integration with Wind River Workbench for program-flow monitoring and user-specified trace configuration and event filtering
- Fast hardware-based buffer post-processing to enable efficient viewing, analysis, and navigation of trace information

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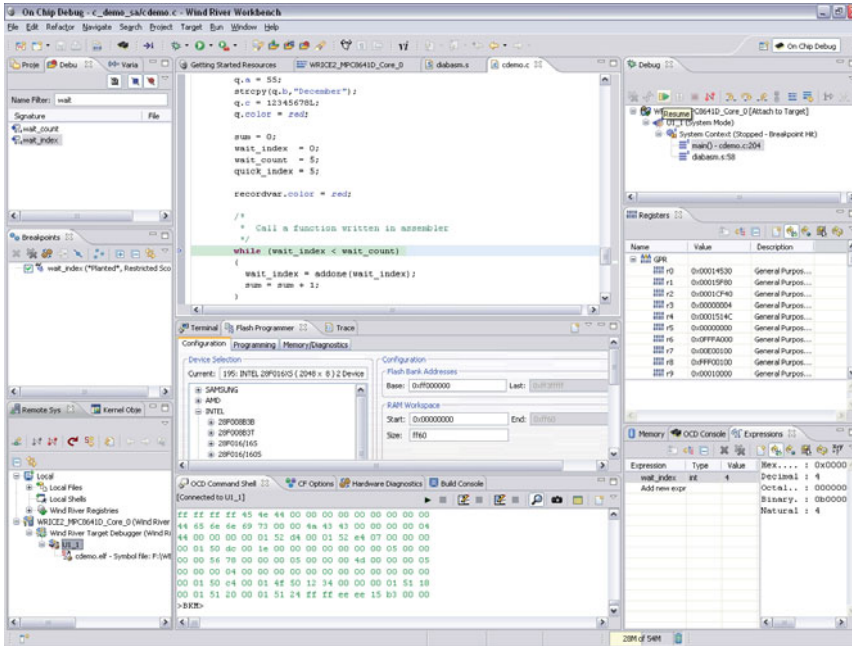


Figure 2: Wind River Workbench GUI

Wind River Connect 2

Wind River Connect enables developers to connect multiple processors, scan chains, and boards by tying the individual scan chains associated with each processor together onto one continuous scan chain. This process requires complex debugging tools, but it allows developers to simultaneously stop and start the processor's program execution, synchronously restarting the processors as well as reading their internal registers and memory contents.

Wind River Connect provides a unit to take uncommon JTAG scan chains and concatenate up to four independent scan chains together onto a common scan chain.

Features include the following:

- Connection of up to four independent scan chains to a single Wind River ICE 2
- Scan chains that can each run at their own voltage levels, from 1.65V to 3.3V
- Integrated with Wind River Workbench On-Chip Debugging 3.2 and higher versions

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.



Figure 3: Wind River Trace 2

Technical Specifications

Host OS Support*

- Fedora Core 13, 32-bit x86 and 64-bit x86-64
- Red Hat Enterprise Linux Workstation 6 (Update 1), 32-bit x86 and 64-bit x86-64
- Red Hat Enterprise Linux Workstation 5.0–5.7, 32-bit x86 and 64-bit x86-64
- Red Hat Enterprise Linux Workstation 4 (Update 9), 32-bit x86
- Ubuntu Desktop 10.04, 32-bit x86-32 and 64-bit x86-64
- SUSE Linux Enterprise Desktop 11.0, 32-bit x86-32 and 64-bit, x86-64
- OpenSUSE 11.2, 32-bit x86-32 and 64-bit x86-64
- Solaris 10, 32-bit SPARC/GTK**
- Windows XP Professional with Service Pack 3, 32-bit x86
- Windows 7 with Service Pack 1, 32-bit x86 and 64-bit x86

*When used with Wind River Workbench On-Chip Debugging 3.3.2 or Wind River On-Chip Debugging API 3.9.6

**Wind River Probe is not supported on Solaris hosts.

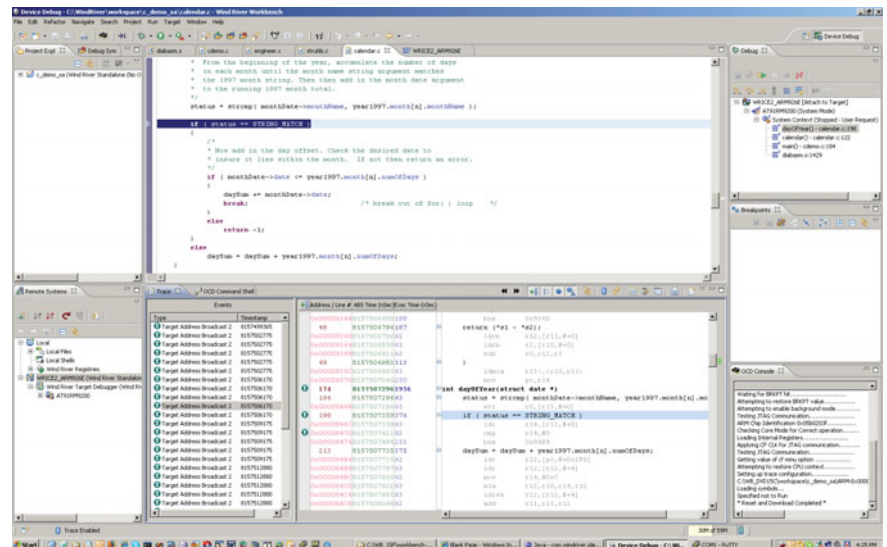


Figure 4: Wind River Trace 2 configuration and debug interface

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Target OS Support

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

- VxWorks 6.3 and higher
- VxWorks 653
- VxWorks MILS
- VxWorks Cert
- VxWorks 5.5
- Wind River Linux
- Open source Linux kernels versions 2.6.x.

- Wind River Hypervisor 1.3.1
- UEFI-compliant BIOS and boot loaders (Intel architecture)

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

Supported Architectures

Support for specific processors varies by Workbench On-Chip Debugging version

and specific JTAG debug unit. For details on currently supported processors, refer to the processor support matrix at www.windriver.com/products/OCD/. Wind River is continually adding new processor support. If you do not see your processor listed, contact your Wind River sales representative.

Wind River ICE 2 Processor Family Support

ARM ARM9 ARM11 ARM Cortex-A8 ARM Cortex-A9* ARM CoreTile Express A9x4 ARM Cortex-M3 ST Micro SPEAr1310 ATMEL AT9x* Cavium Econa* Freescale i.MX* Marvell* TI OMAP* ColdFire MCF52xx MCF53xx MCF54xx MCF544xx Intel Architecture Intel Atom* Intel Core 2* Duo Intel Core i3* Intel Core i5* Intel Core i7* Intel Xeon* MIPS MIPS 4Kc, 4Km, 4Kp, 4KEc MIPS 5Kc, 5Kf MIPS 20Kc MIPS 24kc, 24kf	MIPS (continued) MIPS 25Kf MIPS 74k* Broadlight BL23570R Altera MP32* Broadcom BCM11xx*, BCM12xx*, BCM14xx* Broadcom BCM33xx*, BCM35xx* Broadcom BCM47xx* Broadcom BCM5300x Broadcom BCM53xx*, BCM5621x*, BCM58xx* Broadcom BCM63xx*, BCM65xx* Broadcom BCM70xx*, BCM71xx* Broadcom BCM73xx*, BCM74xx* Cavium OCTEON CN3xxx* Cavium OCTEON Plus CN5xxx* Cavium OCTEON 2 CN6xxx* NEC VR41xx*, VR54xx*, VR55xx*, VR77xx* NetLogic (RMI) AU1x00* (formerly AMD Alchemy) NetLogic (RMI) XLR*, XLS* Philips PR19xx*, PR39xx*, PR44xx* Philips PNX30xx*, PNX73xx*, PNX83xx*, PNX85xx* PMC-Sierra RM79xx*, RM9xxx* Toshiba TX49xx* Wintegra Winpath*	Power Architecture (PowerPC) AMCC PPC403* AMCC PPC405* AMCC PPC440* AMCC PPC460* CPU Tech Acalis CPU872 LSI Axxia ACP3442 LSI Axxia ACP3448 Freescale PPC5xx* Freescale MPC512x* Freescale MPC52xx* Freescale MPC55xx*, MPC56xx* Freescale/IBM PPC6xx* Freescale/IBM PPC7xx* Freescale MPC74xx* Freescale MPC8xx* Freescale MPC82xx* Freescale MPC83xx* Freescale MPC85xx* Freescale MPC86xx* Freescale QorIQ P1xxx* Freescale QorIQ P2xxx* Freescale QorIQ P3xxx* Freescale QorIQ P4080* Freescale QorIQ P5xxx* P.A. Semi PA6T-1682M ST Microelectronics SPC560xxx* Xilinx Virtex-II Pro X2VP* Xilinx Virtex-4 XC4V*
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*Specific processors only; for details on currently supported processors, refer to the processor support matrix at www.windriver.com/products/OCD/. If you do not see your processor listed, contact your Wind River sales representative.

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