Wind River Workbench, On-Chip Debugging Edition

The introduction of 32-bit and 64-bit processor technologies has created new challenges that require an innovative approach to JTAG debug and analysis. Wind River offers the industry's first Eclipse-based development environment for on-chip debugging that takes you through early hardware bring-up to test and manufacturing. The advanced hardware diagnostics and patent-pending multicore debugging capabilities of Workbench help you unlock the power of today's advanced microprocessor technology.

Eclipse-Based JTAG Debugging Solution

Wind River Workbench On-Chip Debugging software is based on the industry-standard Eclipse framework, providing the first integrated JTAG debugging environment that can be easily extended through in-house, third-party, open-source, or commercially available Eclipse plug-ins. For example, you can integrate software version control and change management solutions like CVS and ClearCase. You can also integrate UML-based software visualization and code generation tools, enhanced static analysis solutions, and simulation/virtualization software.

Wind River on-chip debugging solutions enable you to take advantage of the growing Eclipse ecosystem to improve the collaboration between hardware, firmware, and software developers, ensuring a smooth handoff in the debug process.
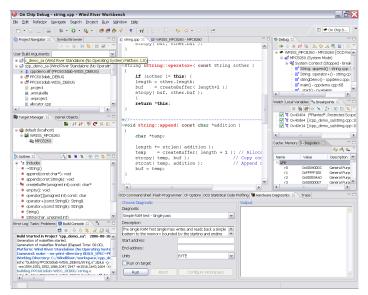

Figure 1: Wind River Workbench, On-Chip Debugging Edition

Key Features

- *Eclipse-based JTAG debugging solution reduces development costs*
- *Centralized project-oriented environment simplifies end-to-end debugging*
- *Advanced editing capabilities reduce the complexity of the edit-compile-debug cycle*
- *Connection and configuration management streamlines connections to multiple targets*
- *Industry-leading features support debug of an entire system from a single console*
- *Flexible flash programming*
- *Internally and externally buffered trace enables debugging of complex and intermittent code defects*
- *Patent-pending multicore technology debugs even the most complex 32-bit and 64-bit multicore processors*
- *Wide range of processor and operating system support*

Centralized, Project-Oriented Environment

Workbench On-Chip Debugging provides a centralized, standards-based development environment that automates the debugging and analysis process. Its project-oriented methodology simplifies the handoff between the different phases of development, from initial hardware bring-up to firmware design, OS implementations, and platform and application development.

The Workbench development environment efficiently manages hardware and software development projects. Its flexible, configurable project interface enables you to customize project data based on type of project and development activity. Wizards and utilities walk you through the creation of new projects to get you up and running quickly.

From a single console, you can see information about multiple project files, multiple targets, and the software running on those targets. Because different stages of development require different debug views and capabilities, you can specify a particular developer perspective that provides only the information relevant to a specified task.

The On-Chip Debugging perspective delivers the starting point for JTAG debugging, including the views required for connection to Wind River ICE and Wind River Probe, as well as the specific tasks associated with JTAG debugging.

Perspective in Eclipse

"Perspective" is a specific term in the Eclipse platform that refers to the visible actions and views within a window. It includes an input attribute, which defines the resources in a workspace; and a type attribute, which defines the actions and views in the user interface.
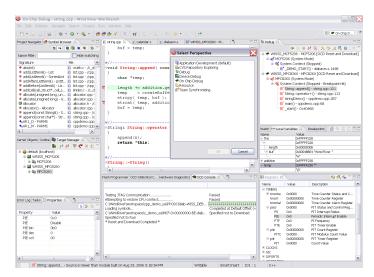

Figure 2: Workbench On-Chip Debugging perspectives

Project Navigation Capabilities
Advanced project navigation capabilities reduce the complexity of managing multiple projects. You can organize and manage all the software components in a device software development project, as well as create and share projects among other development team members, reducing setup and configuration time and improving collaboration. When combining software

debugging with on-chip debugging, you can tighten the project handoff between hardware and software developers.

Integration with CVS enables you to identify when other developers are editing the same code, in order to prevent editing conflicts. The Workbench File Navigator feature also allows you to quickly search and find symbols and functions within all files loaded in the project workspace, shortening development time.
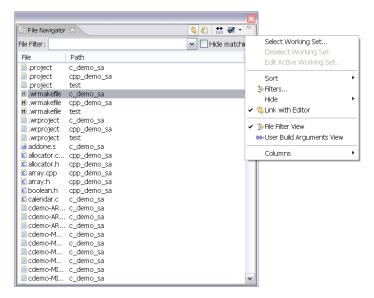

Figure 3: Workbench File Navigator enables quick searches for symbols and functions

Comprehensive Build System
The Workbench On-Chip Debugging Build System provides the tools, options, and parameters for device software build management, enabling you to define everything from global build parameters to fine-grain control of an individual file. By using a single build environment, you can reduce the time associated with managing multiple environments. With build capabilities built directly into the software, you have a centralized solution for the entire edit, compile, and debug process.

Advanced Editing Capabilities
The Editor provides state-of-the art editing, including vi emulation. Performance-enhancing features, such as code completion, parameter hinting, and syntax highlighting of source files, improve edit-compile-debug cycle time and reduce errors. The Editor is tightly integrated with the Project System, Build System, Source Code Analyzer, and Debugger in Workbench, enabling you to move back and forth easily between various source-code debugging tasks.

JTAG Editor
In addition to software editing capabilities, Workbench On-Chip Debugging offers a JTAG Editor to create and modify board files. The Editor allows you to connect Wind River ICE or Wind River Probe to a board with multiple devices on its scan chain. The

Editor then provides a graphical view of the layout of devices on the scan chain, expediting the update of board configuration files.

When you only have one or two devices in a scan chain, it is easy to set up the connections and configurations. As devices are added, complexity increases—and so does the chance for error. A graphical view enables you to understand what devices are in the chain, so you know how to configure the emulator to support the correct number of devices. The JTAG emulator will also need to know how to address the various devices on the scan chain, so it can access specific devices for a debug task while the rest of the devices are set in bypass mode. The Editor saves this information and downloads it to the target.

Connection and Configuration Management

Workbench On-Chip Debugging centralizes all target configuration and connection management in a single graphical view, eliminating the need to toggle between multiple GUIs or manually configure connections via CLI. These connections can be cores, processors, processes, or simulators. You can even manage multiple connections simultaneously.

On-Chip Debugging Command Shell

If you prefer using CLI, the on-chip debugging command shell provides CLI access to the target via Wind River ICE or Wind River Probe. The command shell and associated logging capabilities allow you to make target and emulator configuration adjustments. You can also write low-level scripts for target initialization and download sequences to automate commonly occurring tasks.

The command shell is used to load target register files into Wind River ICE or Wind River Probe, then execute low-level commands through the emulators. Sessions in the on-chip debugging command shell can be recorded and replayed as scripts. There are two command log options: input logging and full logging. Input logging only records input commands, while the full logging option records input commands and their associated results. These files can be saved and played back later.

Console for Target Status Reporting

Workbench On-Chip Debugging also includes a console specifically for JTAG connections, providing data on target connection status and the events executing on the target, verifying that a given task executed as instructed.

Graphical Display of all CF Options

To expedite the configuration process, Workbench On-Chip Debugging provides a target register configuration file for the majority of supported processors. You can customize these configuration files using the Workbench On-Chip Debugging CF Options view.

With the graphical display, you can visualize all the CF options associated with the Wind River emulator for a specified target, including command name, current setting, parameters, and description data.

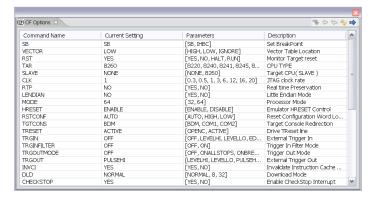| Command Name	Current Setting	Parameters	Description
SB	SB	[SB, IHBC]	Set BreakPoint
VECTOR	LOW	[HIGH, LOW, IGNORE]	Vector Table Location
RST	YES	[YES, NO, HALT, RUN]	Monitor Target reset
TAR	8260	[8220, 8240, 8241, 8245, 8...	CPU TYPE
SLAVE	NONE	[NONE, 8260]	Target CPU(SLAVE)
CLK	1	[0.3, 0.5, 1, 3, 6, 12, 16, 20]	JTAG clock rate
RTP	NO	[YES, NO]	Real time Preservation
LENDIAN	NO	[YES, NO]	Little Endian Mode
MODE	64	[32, 64]	Processor Mode
HRESET	ENABLE	[ENABLE, DISABLE]	Emulator HRESET Control
RSTCONF	AUTO	[AUTO, HIGH, LOW]	Reset Configuration Word Lo...
TGTCONS	BDM	[BDM, COM1, COM2]	Target Console Redirection
TRESET	ACTIVE	[OPENC, ACTIVE]	Drive TReset line
TRGIN	OFF	[OFF, LEVELHI, LEVELLO, ED...	External Trigger In
TRGINFILTER	OFF	[OFF, ON]	Trigger In Filter Mode
TRGOUTMODE	OFF	[OFF, ONALLSTOPS, ONBRE...	Trigger Out Mode
TRGOUT	PULSEHI	[LEVELHI, LEVELLO, PULSEH...	External Trigger Out
INVCI	YES	[YES, NO]	Invalidate Instruction Cache ...
DLD	NORMAL	[NORMAL, 8, 32]	Download Mode
CHECKSTOP	YES	[YES, NO]	Enable CheckStop Interrupt

Figure 4: Workbench On-Chip Debugging provides a graphical display that allows visualization of all CF options associated with the Wind River emulator for a specified target

Expanded Register View Capability

Get your target up and running quickly with the built-in information on the bit-level registers. With one click, you can access a wide range of information on peripheral registration configuration options. This eliminates the time-consuming task of sorting through processor documentation.

In addition, you can create a graphical representation of custom peripheral register groups to more effectively manage custom configurations. Specific capabilities include:

- Target registration configuration file utility to modify the target initialization file
- Custom register files to manage additional peripherals
- Bit-level details on a specific processor's peripheral register configuration options

Analysis and Diagnostics

Advanced Hardware Diagnostics

Workbench On-Chip Debugging provides comprehensive hardware diagnostic capabilities that eliminate the need for certain standalone hardware diagnostics tools, reducing capital and training costs. By integrating preconfigured test routines and scope loop tests into a single interface, you do not have to spend valuable development time writing your own test tools for data and address bus diagnostics.

Wind River provides robust and integrated software that quickly isolates and resolves hardware layout and bus issues. You are guided by a set of wizards to configure and run the various diagnostic utilities, including:

- Address and data bus tests to verify address and data bus performance and quickly identify and resolve issues
- Cyclic redundancy check (CRC) calculations for a defined section of memory
- Range of RAM tests from simple RAM to full RAM: The simple test writes a consecutive pattern of three values into a defined area of memory, then reads it back for errors; the full test executes in a single pass or continuous test pattern, walking a "1" bit through memory and then "0" bit, reading the values back as they are written
- Scope loop tests put a known pattern on the address and/or data bus for monitoring by an external data scope; scope loop

patterns include writing a rotating value to a sector of memory, write and compliment to a sector of memory and a write then read to/from a sector of memory, and write to location.

Source Code Analyzer

The Source Code Analyzer simplifies the process of documenting the code structure of a file system to support effective integration of large project file systems. This is especially valuable when multiple developers are writing code, code is reused among projects, or newly developed code must be integrated with a legacy code base. You can quickly and completely understand the code written by someone else and integrate it effectively into the existing project. In addition, you can instantaneously see the impact of a proposed change in the existing code, improving overall development productivity and reducing errors.

Statistical Code Profiling

Built-in performance analysis and code coverage profile software performance and identify system bottlenecks to optimize software execution on a target processor. Unlike a typical profiling solution, no configuration or instrumentation is required. It is easy to select a function from the statistical code profiler, then see where the function resides in the Source Editor view.

Profiling is as simple as identifying a section of code. The Workbench On-Chip Debugging software does the rest, displaying the results in a chart, table, or histogram that includes:

- Function name
- Full path to the function
- Start and end addresses for the function
- Percentage of time within the function for all functions to be executed on the target

Cache Memory Analysis

Tracking cache coherency issues with main memory can be a challenge for a single-core device application. The complexity of multicore implementations makes it almost impossible without sophisticated cache memory analysis. The cache analysis capabilities in Workbench On-Chip Debugging monitor execution on one or more targets and identify differences between data stored in memory versus data stored in cache. You can quickly identify the source code and function for each instruction in cache, and easily toggle to its location in the Editor/Source Code view or symbol browser.

Comprehensive JTAG Debugging Engine

Debugging is the most time-consuming and costly phase of any development cycle. Wind River provides a single console for debugging multiple projects across multiple targets. With these debug collaboration capabilities, different developers can easily share information, dramatically improving debug cycle time.

The advanced debug engine supports multiple debug connection types, including JTAG tools, agents, and simulators, providing maximum flexibility in debugging both hardware and software from the early hardware diagnostic stages to application development. You can debug from any host OS to any target OS.

Multicore debugging is easier, since you can set cross-correlated breakpoints and track information across multiple targets.
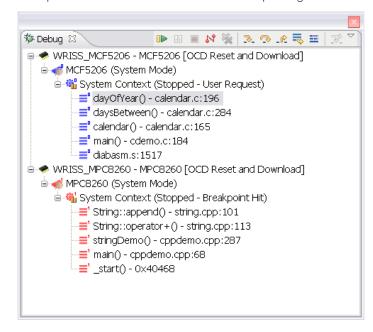

Figure 5: Debug view monitors, controls, and manipulates active tasks

Debug visualization shows at a glance the processors being debugged and the active debug tasks through color-coded and numbered debug sessions. It provides the following information:

- Standard run-control capabilities: Start/Resume, Stop/Suspend, Terminate, Step-In, Step-Over, Step-Return, Source Mode, Function Mode, and Assembly Mode debugging
- Data on the target or process attached to the target: stack frame, threads, processes, and tasks
- System information: Memory views, Register views, Watch view, local and global variables
- Multicore Debug view of the stack frame: every process or target running under debugger control displayed in the Debug view, color-coded, and numbered

Common Scripting Framework

Workbench On-Chip Debugging comes with a host shell-scripting framework to control all debugger activities. It supports standard scripting languages, such as GDB command syntax for low-level debug commands and TCL for high-level flow control. The host shell is supported on Linux, Solaris, and Windows hosts and also provides a C interpreter.

Breakpoint Options

Breakpoints are a valuable tool used to stop the target or process running on the system when a specific user-defined event occurs. Workbench On-Chip Debugging supports hardware and software breakpoints configured as either data or expression breakpoints. A graphical view of all breakpoints on a target provides more effective management of multiple breakpoints. You can set breakpoints from the Breakpoint, Source/Edit, Register, and Memory views.
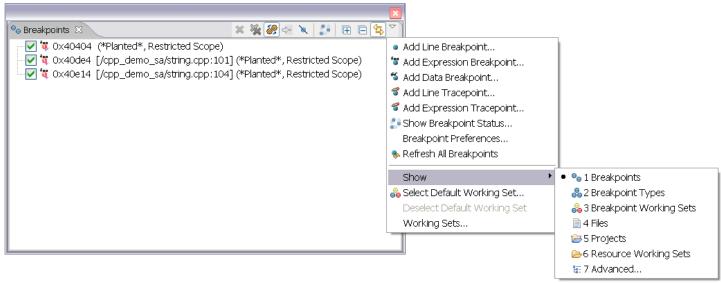
Figure 6: A graphical view of all breakpoints on a target provides more effective management of multiple breakpoints

Specific breakpoint features include:

- Hardware breakpoints
- Software breakpoints
- Expression, line, or data breakpoints
- Enablement and disablement of any event in the system
- Save to a file and redeploy among multiple projects
- Multi-context awareness, allowing breakpoints to stop the specific core or processor in context with an event
- Ability to stop the entire system when the event the breakpoint is associated with occurs
- Range of icons to manage breakpoint configuration and settings

Flash Programming

Workbench On-Chip Debugging simplifies the configuration of flash memory, enabling you to flash images into flash chips on the target board faster than the traditional manual CLI process allows. The flash programming utility supplies common algorithms and diagnostics to pinpoint flash programming issues. It enables you to:

- Configure the flash address and RAM workspace, supporting flexible memory configuration and user-defined allocation of flash programming algorithms into RAM
- Choose files for download, enabling you to select and manage the files to be flashed onto the target from a single console
- Execute erase and program operations by selecting one or more sectors
- Verify the resulting data residing in flash with the file to be flashed

Trace Support

Workbench On-Chip Debugging provides support for the internal and external buffered trace features of leading SoC vendors. You can quickly spot challenging intermittent defects that take a long time to analyze with traditional debug methods. Hardware trace capabilities use the Wind River ICE emulator and Wind River Trace and provide support for ColdFire, AMCC 40x, and AMCC 44xx processors. Workbench On-Chip Debugging

also supports the Freescale MPC85xx internal trace capabilities with Wind River ICE and Wind River Probe.

You can view the events that occurred in the execution of the trace, such as the start of the trace and end of the trace, along with a description of the event. You can then select an event from the trace event field to locate the specific event occurrence in the trace buffer. Specific trace fields include:

- Event occurrences (unlabeled): type of trace event
- Address: address or line number of trace event
- Absolute time: the elapsed time since the beginning of the trace
- Delta time: change in absolute time since the last trace entry
- Instruction (unlabeled): executed instructions that can be configured to display code at the function, source, or disassembly stage

The flexible trace configuration options enable you to configure and set up the display of trace data, clear the trace buffer, reset the Trace view, save the trace to file, set trace rules, and configure trace filtering.

Multicore Technology

Multicore refers either to a single chip containing multiple logical devices capable of executing code, or multiple processors on a single target board. In addition, in system-level design, you may have multiple processors across multiple boards. The emergence of these multicore processors is creating new debug challenges, requiring innovative technology that leverages the open environment of the Eclipse framework.

Multicore Debugging Challenges

Multicore offers more functionality and higher performance, but it also poses new debug challenges for hardware and software developers:

- How to effectively visualize and manage the edit-compile-debug cycle across multiple cores
- How to optimize the JTAG interface (since many SoCs leverage a single JTAG interface to save on costs)

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- How to manage real-time performance requirements for multicore debugging
- How to support multiple processors from different vendors
- How to support the debug of multiple operating systems across different cores

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Value of Eclipse in Multicore Debugging

A common debug framework with a strong ecosystem is the foundation of a multicore debug strategy. While some take a proprietary approach in integrated development environments, Wind River leverages the Eclipse framework to reduce the complexity of the edit-compile-debug process.

The Workbench On-Chip Debugging solution offers a single project-oriented framework for debugging the most complex multicore scenarios. It allows you to view all your multicore projects from a single interface, whether the cores are on a single board or on multiple boards in an integrated system.

Target Connection Manager

An easy-to-use target connection manager simplifies the attachment to multiple cores and supports multiple connection methods: ICE, Probe, TMD, agent, or simulator. The Wind River solution connects to up to 128 cores in a system and debugs up to eight of those cores simultaneously through a Wind River ICE JTAG connection, solving the problem of managing multiple cores through a single JTAG interface. In addition, the Wind River Connect extension module for Wind River ICE connects up to four different scan chains simultaneously to provide the scalability required in system-level multicore development.
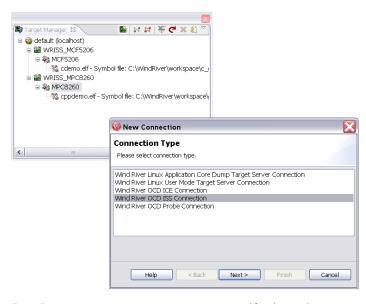

Figure 7: An easy-to-use target connection manager simplifies the attachment to multiple cores and supports multiple connection methods

Advanced Debugging Features

When you're debugging multiple cores, managing and tracking hardware and software breakpoints becomes even more critical. Workbench On-Chip Debugging synchronizes the run-control of a system to start and stop the entire system. You can set cross-correlated breakpoints and track sessions with multiple targets. The debug sessions are color-coded and numbered, so you can quickly spot an issue on an impacted core.

With advanced multicore diagnostics, you can inject errors, such as taking down a specific core, and analyze the impacts on other cores in the system to quickly spot software and hardware dependencies across multiple cores.

Cache memory management tracks cache coherency issues with main memory across multiple cores, including the ability to monitor instruction execution and identify the difference between data stored in memory versus cache. By tying the Cache view back to the editor, you can identify the source code and function for each instruction in the Cache view, improving the troubleshooting of cache coherency problems across multiple cores.

High-Performance JTAG Server

Traditional JTAG servers have limitations in multicore debugging environments, such as low performance and a limited range of semiconductor processor debug support. Wind River brings you all the advantages of a JTAG server: the ability to leverage the debug capabilities of the processor and manage multiple cores with a single JTAG connection, without any of the problems associated with older single-core JTAG server technology.

Wind River has patent-pending technology that optimizes the performance of the JTAG server, providing the speed and reliability required for real-time application debugging. The scope of processor support ensures deep debug and analysis capabilities on the leading SoCs.

OS and Processor Support

Workbench On-Chip Debugging supports many operating systems, including Wind River's VxWorks, Wind River Linux, Linux 2.4 and 2.6 kernels, and Express Logic's ThreadX. Professional services ports are available for OSE and Nucleus.

The third-party operating system (TOS) API allows professional services to add support for an in-house proprietary operating system or a third-party commercial operating system. Kernel object data structure is captured using XML, enabling debug support for all defined kernel objects and their task context associated views. The API comes with documentation, an XML file template, and a VxWorks 6 reference file.

Wind River Hardware

Figure 8: Wind River Probe

Wind River Probe

Wind River Probe is the most comprehensive tool on the market for board bring-up, flash programming, and production/test. It uses embedded on-chip debugging services in a microprocessor and Wind River JTAG accelerator technology to deliver high-performance debugging over a USB connection, offering fast download speeds (in excess of 1.5Mbps on some processors), high debug throughput, and unprecedented debug efficiency. Wind River Probe can also support the internal trace buffer provided on Freescale's MPC85xx processor family.

Figure 9: Wind River ICE

Wind River ICE

This advanced network-based emulator was designed for today's complex processor environments, including 32-bit and 64-bit single and multicore implementations. Simple enough to support the most basic debugging needs, but robust enough to debug up to eight JTAG devices simultaneously in a single scan chain of up to 128 individual EJTAG/JTAG devices, Wind River ICE excels at complex system debugging and multi-site development. In addition, the same emulator used in the development process can be deployed in test and manufacturing to ensure end-to-end integration.

Through its JTAG server capability, Wind River ICE supports multiple JTAG/EJTAG devices on a single scan chain, as well as multiple debugger connections to these devices. It also offers the ability to support the internal trace buffer provided on Freescale's MPC85xx processor family.

In addition, Wind River ICE can support externally trace-buffered SoCs, such as AMCC's PPC405 and 440 families and Freescale's MCF5xxx family, when connected to Wind River Trace.

Figure 10: Wind River Trace

Wind River Trace

This external trace hardware connects to Wind River ICE or Probe and provides visibility into hardware/software interaction in the trace buffer. Its high-performance capture and buffering capability, over 900,000 lines of trace data from the target, makes Wind River Trace ideal for debugging difficult intermittent system problems.

Technical Specifications

Host OS Support
- Red Hat Enterprise Linux 3, update 5
- Red Hat Enterprise Linux 4, update 1
- Solaris 8
- Solaris 9
- SUSE Desktop Linux 9.3
- SUSE Desktop Linux 10
- Windows 2000 Professional with Service Pack 1
- Windows XP Professional with Service Pack 2

Target OS Support
- VxWorks 6.0, 6.1, 6.2, and 6.3
- VxWorks 5.5
- VxWorks 653
- Linux: Wind River Linux platforms
- Linux: Linux 2.4 and 2.6 kernels (Workbench On-Chip Debugging only)
- Native Linux development on Red Hat Enterprise Linux (3 and 4)
- ThreadX 4.0 (Workbench On-Chip Debugging only)
- Customizable target OS awareness capability for Workbench On-Chip Debugging enables support for other target operating systems to be added

VxWorks 6.x
- List of kernel tasks, and object/stack summary for each
- List of RTPs, and object summary for each
- List of RTP tasks, and object/stack summary for each
- List of semaphores, and object summary for each
- List of message queues, and object summary for each
- List of I/O devices, and object summary for each
- List of I/O drivers, and object summary for each
- List of I/O file descriptors, and object summary for each
- List of ISRs, and object summary for each
- List of memory partitions, and object summary for each
- List of triggers, and object summary for each
- List of watchdogs, and object summary for each
- List of sockets, and object summary for each
- List of shared libraries, and object summary for each

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VxWorks 5.5
- Task/process

Linux
- Process
- Thread

ThreadX
- Thread list
- Mutex list
- Semaphores
- Block pools
- Byte pools
- Event flags (type of message queue, not as robust)
- Timers (similar to watchdog timers)

OSE
- Block: Memory Pools
- Processes/Threads

Processor Support

Code Key	Merge
Y	Included in the latest release
E	Early access available from current release
N/A	Not applicable

Vendor	Architecture	Processor Family	Core Type	Device/Part Number	Workbench On-Chip Debugging
AMCC					
AMCC	PowerPC	PPC40x	PPC405	PPC403GCx	Y
AMCC	PowerPC		PPC405	PPC405CR	Y
AMCC	PowerPC		PPC405	PPC405EP	Y
AMCC	PowerPC		PPC405	PPC405GP	Y
AMCC	PowerPC		PPC405	PPC405GPr	Y
AMCC	PowerPC		PPC405	NPE405L	Y
AMCC	PowerPC		PPC405	NPE405H	Y
AMCC	PowerPC		PPC405	PPC405PM	Y
AMCC	PowerPC		PPC405	PPC405STB25xx	Y
AMCC	PowerPC		PPC405	PPC405STB3	Y
AMCC	PowerPC		PPC405	PPC405STB4	Y
AMCC	PowerPC	PPC44x	PPC440	44x (Generic)	Y
AMCC	PowerPC		PPC440	PPC440EP	Y
AMCC	PowerPC		PPC440	PPC440GP	Y
AMCC	PowerPC		PPC440	PPC440GR	Y
AMCC	PowerPC		PPC440	PPC440GX	Y
AMCC	PowerPC		PPC440	PPC440SP	Y
AMCC	PowerPC		PPC440	PPC440SPe	Y
AMD					
AMD	MIPS	Au1xxx		12xx	E
ARM					
ARM	ARM	ARM11		Thumb IS (generic)	Y
ARM	ARM			ARM1136J(F)-S	Y
ARM	ARM			ARM1176JZ(F)-S	E
ARM	ARM			ARM11 MP	E

Vendor	Architecture	Processor Family	Core Type	Device/Part Number	Workbench On-Chip Debugging
ARM	ARM	ARM9		Thumb IS	Y
ARM	ARM			ARM9TDMI	Y
ARM	ARM			ARM920T	Y
ARM	ARM			ARM922T	Y
ARM	ARM			ARM940T	Y
ARM	ARM			ARM926EJ-S	Y
ARM	ARM			ARM946E-S	Y
ATMEL					
ATMEL	ARM	ARM9		AT91RM9200	Y
Broadcom					
Broadcom	MIPS	BCM11xx		BCM1100	Y
Broadcom	MIPS			BCM1101	Y
Broadcom	MIPS			BCM1103	E
Broadcom	MIPS			BCM1104	E
Broadcom	MIPS			BCM1190	E
Broadcom	MIPS	BCM14xx		BCM1480	E
Broadcom	MIPS	BCM33xx		BCM3349	Y
Broadcom	MIPS			BCM3350	Y
Broadcom	MIPS			BCM3351	Y
Broadcom	MIPS			BCM3352	Y
Broadcom	MIPS			BCM3360	Y
Broadcom	MIPS	BCM35xx	MIPS32 4k	BCM3560	Y
Broadcom	MIPS	BCM47xx		BCM4704	Y
Broadcom	MIPS			BCM4710	Y
Broadcom	MIPS	BCM53xx		BCM5365	Y
Broadcom	MIPS	BCM58xx		BCM5836	Y
Broadcom	MIPS	BCM63xx		BCM6348	Y
Broadcom	MIPS			BCM6349	Y
Broadcom	MIPS	BCM65xx		BCM6550A (4704 Core)	Y
Broadcom	MIPS	BCM70xx	MIPS64 R5kf	BCM7038	Y
Broadcom	MIPS	BCM71xx		BCM7100	Y
Broadcom	MIPS			BCM7115	Y
Broadcom	MIPS	BCM73xx		BCM7312	Y
Broadcom	MIPS			BCM7318	Y
Broadcom	MIPS			BCM7320	Y
Broadcom	MIPS	BCM74xx		BCM7401	Y
Freescale					
Freescale	ARM	ARM11		i.MX31	Y
Freescale	ARM	ARM9		i.MX21	E
Freescale	ColdFire	MCF5xxx		MCF5202	Y
Freescale	ColdFire			MCF5204	Y
Freescale	ColdFire			MCF5205E	Y
Freescale	ColdFire			MCF5206	Y

Vendor	Architecture	Processor Family	Core Type	Device/Part Number	Workbench On-Chip Debugging
Freescale	ColdFire	*(MCF5xxx continued)*		MCF5207	Y
Freescale	ColdFire			MCF5208	Y
Freescale	ColdFire			MCF5211	Y
Freescale	ColdFire			MCF5212	Y
Freescale	ColdFire			MCF5213	Y
Freescale	ColdFire			MCF5214	Y
Freescale	ColdFire			MCF5216	Y
Freescale	ColdFire			MCF5221	E
Freescale	ColdFire			MCF5222	E
Freescale	ColdFire			MCF5223	E
Freescale	ColdFire			MCF5249	Y
Freescale	ColdFire			MCF5249L	Y
Freescale	ColdFire			MCF5250	Y
Freescale	ColdFire			MCF5251	Y
Freescale	ColdFire			MCF5270	Y
Freescale	ColdFire			MCF5271	Y
Freescale	ColdFire			MCF5272	Y
Freescale	ColdFire			MCF5274	Y
Freescale	ColdFire			MCF5274L	Y
Freescale	ColdFire			MCF5275	Y
Freescale	ColdFire			MCF5275L	Y
Freescale	ColdFire			MCF5280	Y
Freescale	ColdFire			MCF5281	Y
Freescale	ColdFire			MCF5282	Y
Freescale	ColdFire			MCF5232	Y
Freescale	ColdFire			MCF5233	Y
Freescale	ColdFire			MCF5234	Y
Freescale	ColdFire			MCF5235	Y
Freescale	ColdFire			MCF5307	Y
Freescale	ColdFire			MCF5307a	Y
Freescale	ColdFire			MCF5327	Y
Freescale	ColdFire			MCF5328	Y
Freescale	ColdFire			MCF5329	Y
Freescale	ColdFire			MCF5407	Y
Freescale	ColdFire			MCF5470	Y
Freescale	ColdFire			MCF5471	Y
Freescale	ColdFire			MCF5472	Y
Freescale	ColdFire			MCF5473	Y
Freescale	ColdFire			MCF5474	Y
Freescale	ColdFire			MCF5475	Y
Freescale	ColdFire			MCF5480	Y
Freescale	ColdFire			MCF5481	Y
Freescale	ColdFire			MCF5482	Y
Freescale	ColdFire			MCF5483	Y
Freescale	ColdFire			MCF5484	Y
Freescale	ColdFire			MCF5485	Y

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Vendor	Architecture	Processor Family	Core Type	Device/Part Number	Workbench On-Chip Debugging
Freescale	PowerPC	MPC52xx	MPC603e	MPC5200	Y
Freescale	PowerPC		MPC603e	MPC5200B	Y
Freescale	PowerPC	MPC55xx	MPC603e	MPC5553	E
Freescale	PowerPC		MPC603e	MPC5554	E
Freescale	PowerPC	MPC5xx	MPC500	5xx (Generic)	Y
Freescale	PowerPC		MPC500	MPC505	Y
Freescale	PowerPC		MPC500	MPC509	Y
Freescale	PowerPC			MPC553	Y
Freescale	PowerPC		MPC500	MPC555	Y
Freescale	PowerPC		MPC500	MPC560	Y
Freescale	PowerPC		MPC500	MPC561	Y
Freescale	PowerPC		MPC500	MPC563	Y
Freescale	PowerPC		MPC500	MPC565	Y
Freescale	PowerPC	MPC6xx		6xx (generic)	Y
Freescale	PowerPC			MPCEC603E	Y
Freescale	PowerPC	MPC74xx		MPC7400	Y
Freescale	PowerPC			MPC7410	Y
Freescale	PowerPC			MPC7440	Y
Freescale	PowerPC			MPC7441	Y
Freescale	PowerPC			MPC7445	Y
Freescale	PowerPC			MPC7447	Y
Freescale	PowerPC			MPC7447a	Y
Freescale	PowerPC			MPC7448	Y
Freescale	PowerPC			MPC7450	Y
Freescale	PowerPC			MPC7451	Y
Freescale	PowerPC			MPC7455	Y
Freescale	PowerPC			MPC7457	Y
Freescale	PowerPC	MPC82xx		MPC8220	Y
Freescale	PowerPC			MPC8240	Y
Freescale	PowerPC			MPC8241	Y
Freescale	PowerPC			MPC8245	Y
Freescale	PowerPC			MPC8247	Y
Freescale	PowerPC			MPC8248	Y
Freescale	PowerPC			MPC8250	Y
Freescale	PowerPC			MPC8255	Y
Freescale	PowerPC			MPC8260	Y
Freescale	PowerPC			MPC8264	Y
Freescale	PowerPC			MPC8265	Y
Freescale	PowerPC			MPC8266	Y
Freescale	PowerPC			MPC8270	Y
Freescale	PowerPC			MPC8271	Y
Freescale	PowerPC			MPC8272	Y
Freescale	PowerPC			MPC8275	Y
Freescale	PowerPC			MPC8280	Y

Vendor	Architecture	Processor Family	Core Type	Device/Part Number	Workbench On-Chip Debugging
Freescale	PowerPC	MPC83xx		MPC8321/E	E
Freescale	PowerPC			MPC8323/E	E
Freescale	PowerPC			MPC8343/E	Y
Freescale	PowerPC			MPC8347/E	Y
Freescale	PowerPC			MPC8349/E	Y
Freescale	PowerPC			MPC8358/E + QE Register Support	Y
Freescale	PowerPC			MPC8360/E + QE Register Support	Y
Freescale	PowerPC	MPC85xx		MPC8540	Y
Freescale	PowerPC			MPC8541	Y
Freescale	PowerPC			MPC8543	Y
Freescale	PowerPC			MPC8545	Y
Freescale	PowerPC			MPC8547	Y
Freescale	PowerPC			MPC8548	Y
Freescale	PowerPC			MPC8555	Y
Freescale	PowerPC			MPC8560	Y
Freescale	PowerPC	MPC86xx		MPC8641D	E
Freescale	PowerPC	MPC8xx		MPC801	Y
Freescale	PowerPC			MPC821	Y
Freescale	PowerPC			MPC823	Y
Freescale	PowerPC			MPC823E	Y
Freescale	PowerPC			MPC850	Y
Freescale	PowerPC			MPC850DC	Y
Freescale	PowerPC			MPC850DE	Y
Freescale	PowerPC			MPC850DH	Y
Freescale	PowerPC			MPC850DSL	Y
Freescale	PowerPC			MPC850SAR	Y
Freescale	PowerPC			MPC850SE	Y
Freescale	PowerPC			MPC852T	Y
Freescale	PowerPC			MPC855T	Y
Freescale	PowerPC			MPC857DSL	Y
Freescale	PowerPC			MPC857T	Y
Freescale	PowerPC			MPC859DSL	Y
Freescale	PowerPC			MPC859T	Y
Freescale	PowerPC			MPC860	Y
Freescale	PowerPC			MPC860DC	Y
Freescale	PowerPC			MPC860DE	Y
Freescale	PowerPC			MPC860DH	Y
Freescale	PowerPC			MPC860DP	Y
Freescale	PowerPC			MPC860DT	Y
Freescale	PowerPC			MPC860EN	Y
Freescale	PowerPC			MPC860MH	Y
Freescale	PowerPC			MPC860P	Y
Freescale	PowerPC			MPC860SAR	Y
Freescale	PowerPC			MPC860T	Y
Freescale	PowerPC			MPC862DP	Y
Freescale	PowerPC			MPC862DT	Y
Freescale	PowerPC			MPC862P	Y

Vendor	Architecture	Processor Family	Core Type	Device/Part Number	Workbench On-Chip Debugging
Freescale	PowerPC	(MPC8xx continued)		MPC862SR	Y
Freescale	PowerPC			MPC862T	Y
Freescale	PowerPC			MPC866	Y
Freescale	PowerPC			MPC870	Y
Freescale	PowerPC			MPC875	Y
Freescale	PowerPC			MPC880	Y
Freescale	PowerPC			MPC885	Y
Freescale	PowerPC	PPC6xx		MPC603	Y
Freescale	PowerPC			MPC603E	Y
Freescale	PowerPC			MPC603P	Y
Freescale	PowerPC			MPC603R	Y
Freescale	PowerPC	PPC7xx		MPC740	Y
Freescale	PowerPC			MPC745	Y
Freescale	PowerPC			MPC750	Y
Freescale	PowerPC			MPC755	Y
IBM					
IBM	PowerPC	MPC6xx		PPCEM603E	Y
IBM	PowerPC	PPC6xx		PPC603	Y
IBM	PowerPC			PPC603E	Y
IBM	PowerPC			PPC603P	Y
IBM	PowerPC			PPC603R	Y
IBM	PowerPC	PPC7xx		PPC740	Y
IBM	PowerPC			PPC745	Y
IBM	PowerPC			PPC750	Y
IBM	PowerPC			PPC755	Y
IBM	PowerPC			PPC750CX	Y
IBM	PowerPC			PPC750CXe	Y
IBM	PowerPC			PPC750CXr	Y
IBM	PowerPC			PPC750L	Y
IBM	PowerPC			PPC750FX	Y
IBM	PowerPC			PPC750GX	Y
IBM	PowerPC	PPC9xx		PPC970	E
Intel					
Intel	XScale	IOP3xx		IOP310	Y
Intel	XScale			IOP321	Y
Intel	XScale			IOP331	Y
Intel	XScale			IOP333	Y
Intel	XScale			IOP348	E
Intel	XScale	IXP2xxx		IXP2325	Y
Intel	XScale			IXP2350	Y
Intel	XScale			IXP2351	Y
Intel	XScale		EOL silicon	IXP2400	Y
Intel	XScale			IXP2800	Y
Intel	XScale			IXP2800	Y

Vendor	Architecture	Processor Family	Core Type	Device/Part Number	Workbench On-Chip Debugging
Intel	XScale	IXP4xx		IXP421	Y
Intel	XScale			IXP422	Y
Intel	XScale			IXP425	Y
Intel	XScale			IXP450	Y
Intel	XScale			IXP451	Y
Intel	XScale			IXP452	Y
Intel	XScale			IXP455	Y
Intel	XScale			IXP460	Y
Intel	XScale			IXP465	Y
Intel	XScale	PXA2xx		PXA210	Y
Intel	XScale			PXA250	Y
Intel	XScale			PXA255	Y
Intel	XScale			PXA260	Y
Intel	XScale			PXA270	Y
Marvell					
Marvell	ARM	ARM9		MV88F5181	Y
Marvell	ARM			MV88F5281	E
MIPS					
MIPS	MIPS	20K	20Kc	20Kc	Y
MIPS	MIPS	24K	24Kc	24Kc	Y
MIPS	MIPS		24Kf	24Kf	Y
MIPS	MIPS	25K	25Kf	25Kf	Y
MIPS	MIPS	4K	4Kc	4Kc	Y
MIPS	MIPS		4Km	4Km	Y
MIPS	MIPS		4Kp	4Kp	Y
MIPS	MIPS		4KEc	4KEc	Y
MIPS	MIPS		4KEm	4KEm	Y
MIPS	MIPS	5K	5Kc	5Kc	Y
MIPS	MIPS		5Kf	5Kf	Y
NEC					
NEC	MIPS	VR41xx		VR4131	Y
NEC	MIPS			VR4133	Y
NEC	MIPS			VR4181A	Y
NEC	MIPS	VR54xx		VR5432	Y
NEC	MIPS	VR55xx		VR5500	Y
NEC	MIPS			VR5500A	Y
NEC	MIPS	VR77xx		VR7701	Y
Philips					
Philips	MIPS	PNX30xx		PNX3001	Y
Philips	MIPS	PNX73xx		PNX7300	Y
Philips	MIPS	PNX83xx		PNX8320	Y
Philips	MIPS	PNX85xx		PNX8525	Y
Philips	MIPS			PNX8526	Y
Philips	MIPS			PNX8535	E
Philips	MIPS			PNX8550	Y
Philips	MIPS	PR19xx		PR1910	Y
Philips	MIPS	PR39xx		PR3940	Y
Philips	MIPS	PR44xx		PR4450	Y

Vendor	Architecture	Processor Family	Core Type	Device/Part Number	Workbench On-Chip Debugging
PMC-Sierra					
PMC-Sierra	MIPS	RM79xx		RM7900	Y
PMC-Sierra	MIPS	RM9xxx		RM9000X2	Y
PMC-Sierra	MIPS			RM9150	Y
TI					
TI	ARM	ARM11		OMAP2430	E
Toshiba					
Toshiba	MIPS	TC49xx		TX4925	Y
Toshiba	MIPS			TX4927	Y
Toshiba	MIPS			TX4955	Y
Xilinx					
Xilinx	PowerPC	X2VP		X2VP-4	Y
Xilinx	PowerPC			X2VP-7	Y
Xilinx	PowerPC			X2VP-20	Y
Xilinx	PowerPC			X2VP-30	Y
Xilinx	PowerPC			X2VP-40	Y
Xilinx	PowerPC			X2VP-50	Y
Xilinx	PowerPC			X2VP-60	Y
Xilinx	PowerPC			X2VP-70	Y
Xilinx	PowerPC			X2VP-100	Y
Xilinx	PowerPC			X2VP-140	Y
Xilinx	PowerPC			2VPX20	Y
Xilinx	PowerPC			2VPX70	Y
Xilinx	PowerPC	XC4V		XC4VFX12	Y
Xilinx	PowerPC			XC4VFX20	Y
Xilinx	PowerPC			XC4VFX40	Y
Xilinx	PowerPC			XC4VFX60	Y
Xilinx	PowerPC			XC4VFX100	Y
Xilinx	PowerPC			XC4VFX140	Y

Note: Workbench provides the ability to communicate with an agent running on the target via the Wind River ICE JTAG Connection for VxWorks, where VxWorks support is available. Wind River Professional Services can also create support for Linux, ThreadX, and other operating systems.

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, BSP and driver optimization, software system and middleware integration, and legacy application and infrastructure migration.

Workbench Services

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 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 Workbench'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 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 technology you have purchased. Personalized Learning Programs deliver improved business performance—customers have reported a return on investment ranging from 18% to 30% 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 with 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

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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 include:

- The entire team gains a common knowledge base
- On-site 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

Please consult your local Wind River sales representative for further information.

Support Services

Wind River provides full technical support for Wind River Workbench. Our global support organization is staffed with engineers who have extensive experience with Wind River products and device software development. At major support centers worldwide, our local experts can help diagnose problems, provide guidance, or answer "How do I…?" questions. Support is also available 24 hours a day at our Online Support website (www.windriver.com/support) or by email at support@windriver.com.

Visit Wind River Online Support (OLS) for fast access to product manuals, downloadable software, and other problem-solving resources for Wind River Workbench. Additional features, including 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 Online Support, please contact our global support team for access to the DSO 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. to 5:00 p.m. (Pacific time)

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UK tel.: +44(0) 1793 831 393
UK fax: +44(0) 1793 831 808
Hours: 9:00 a.m. to 6:00 p.m. (local time)

How to Purchase Wind River Solutions

Please visit www.windriver.com/company/contact-us/index.html to find your local Wind River sales contact. To have a sales representative contact you, please call 800-545-9463 or write to inquiries@windriver.com.

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