



# EMBEDDED SOFTWARE DEVELOPMENT SOLUTIONS

# MULTI® FOR VxWORKS/TORNADO

## MULTI KERNEL AWARE DEBUGGING FOR VxWORKS

The MULTI Software Development Environment from Green Hills Software works seamlessly with the VxWorks embedded real-time kernel from Wind River Systems, Inc., and provides detailed, kernel-aware information to developers.

MULTI for VxWorks includes everything needed for embedded development with the VxWorks real-time kernel:

### OPTIMIZING COMPILERS

- C
- C++
- EC++
- Ada 95
- Run-Time libraries

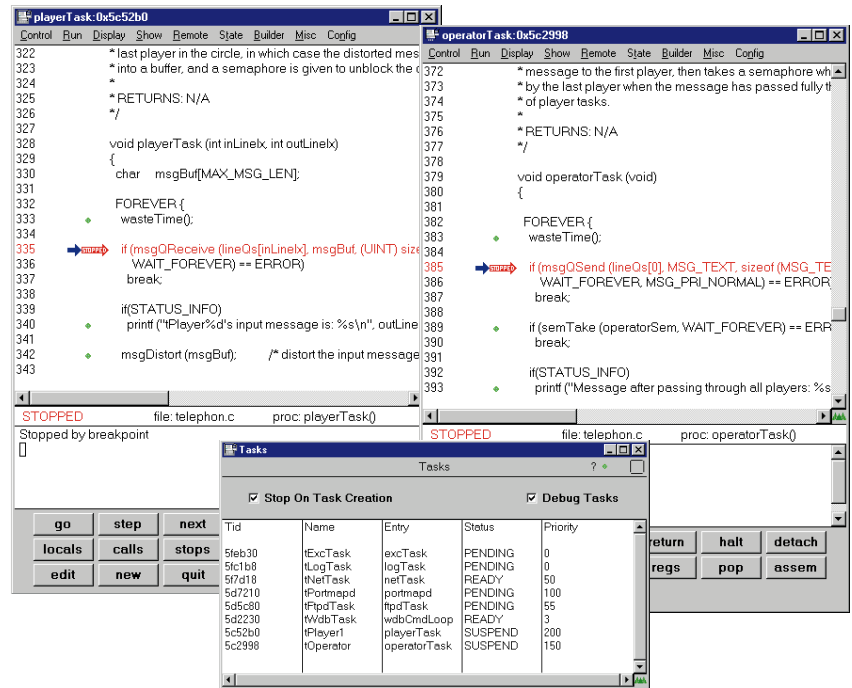
## MULTI INTEGRATED DEVELOPMENT ENVIRONMENT

- Source Level Debugger
- Graphical Project Builder
- Text Editor
- Version Control System
- Graphical Browser
- Performance Profiler
- Run-Time Error Checking
- Remote Target Connection
- Full multi-tasking debugging right out of the box

For general information about each of these product offerings, please refer to our "Software Development Tools for Embedded Applications" brochure.

## PROCESSORS SUPPORTED

- PowerPC
- ARM
- 68K
- MIPS
- CPU32
- VxSim
- SH
- i960
- SPARC
- x86/Pentium



Multiple tasks can be debugged simultaneously, each in its own window.

## VxWORKS INTEGRATION

MULTI, together with the Green Hills family of optimizing C, C++, EC++, and Ada 95 compilers, provide a fully integrated real-time software development environment for Tornado-based applications that encompasses source-level debugging, window-oriented editing, automated program building, execution profiling, and project/version control. Applications developed under MULTI run on the target under the VxWorks operating system, which features real-time multi-tasking with preemptive and round-robin scheduling.

MULTI interacts with VxWorks-based target applications via Tornado's host-based target server. The target server provides services such as dynamic download, task-specific and system-wide breakpoints, and asynchronous event notification. The MULTI/Tornado connection enhances portability and flexibility. It also enables MULTI to be used with a much smaller target image by eliminating the need for a target-

based symbol table, object module loader, shell and networking facilities.

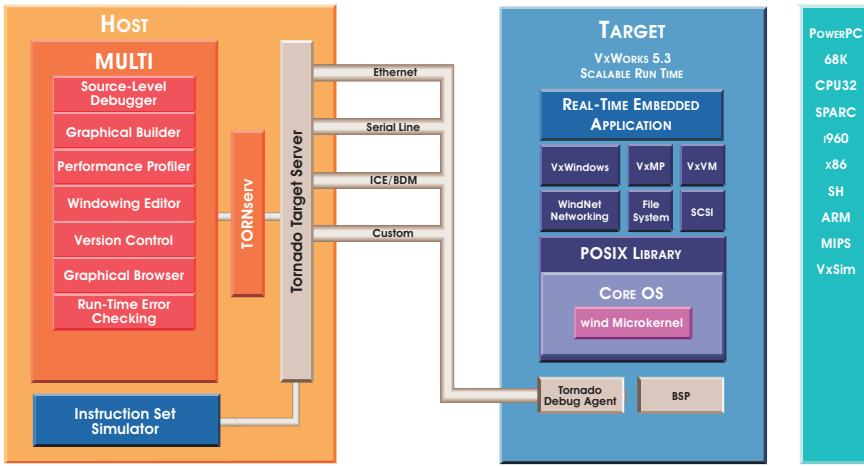
## SYSTEM-LEVEL DEBUGGING

The heart of the MULTI environment is a VxWorks-aware source-level debugger that features process and system-level debug capability. The debugger supports mixed assembly and high-level language formats, includes a language-sensitive expression evaluator, and provides special support for C++ (such as a Class Browser, object display and template debug capability).

The MULTI debugger is fully RTOS aware, which enables designers to debug and tune their applications at the task level. With the MULTI debugger, designers start and stop tasks, set task-specific breakpoints, and monitor OS resources like buff-



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## SYSTEM-LEVEL DEBUGGING CONT'D

ers, queues, and streams. Programmers can also debug new tasks as they are spawned and watch processes as they communicate through pipes, semaphores, etc.

MULTI provides a task window showing a complete list of tasks currently running on the target board. This list will be updated periodically as tasks are created, destroyed, or change their status. Programmers have the option of attaching or debugging a currently running task by single clicking on its entry in the task window.

The MULTI debugger provides a separate window for each task. Within each window, programmers can independently set conditional and temporary breakpoints, single step, and examine local and global variables. Complex expressions and structured elements such as arrays and records can also be displayed. The debugger recognizes pointers and automatically displays the objects that they reference. It also displays a stack trace that simplifies the analysis of hierarchical program structure.



## THREAD-SAFE EXCEPTION HANDLING

The C++ language provides a powerful capability that enables errors to be automatically caught and handled during program execution. Traditionally, multi-tasking applications have not been able to take advantage of this features because the underlying C++ implementation does not support thread-safe, or reentrant, exception handling structures. Green Hills™ Optimizing C++ Compilers and C++ runtime libraries, however, provide the industry's first thread-safe exception handling for the VxWorks real-time operating system. This unique integration enables programmers to unlock the full potential and power of the C++ language.

## EMBEDDED C++ SUPPORT

Green Hills™ Optimizing EC++ Compilers are seamlessly integrated with Wind River Systems' VxWorks/Tornado development environment. EC++ is a subset of ANSI C++ that is designed to meet the needs of embedded systems developers, offer full compatibility with C++, and retain all the major object-oriented advantages of C++. Compared to ANSI C++, EC++ offers reduced code size, increased deterministic behavior, and ease of use -- making it far more appropriate for embedded development.

## SALES AND SUPPORT

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