

# VxWORKS 5.x



WIND RIVER

REAL-TIME OPERATING SYSTEM

## The embedded industry's most popular real-time operating system

**VxWORKS**, the runtime component of the **TORNADO II** embedded development platform, is the most widely adopted real-time operating system (RTOS) in the embedded industry. With a reputation for performance, flexibility, compatibility, and scalability, **VxWORKS** provides an extremely reliable runtime platform for embedded application development. **TORNADO II** also includes a comprehensive suite of cross-development tools and utilities, and a full range of communications options from the host connection to the target.

**VxWORKS** is flexible, with more than 1800 powerful application program interfaces (APIs); scalable, from the simplest to the most

complex product designs; reliable, used in mission-critical applications ranging from anti-lock braking systems to interplanetary exploration; compatible, works with numerous industry standards; and available, can run on all popular CPU platforms.

The **VxWORKS RTOS** comprises the core capabilities of the **WIND Microkernel** along with advanced networking support, powerful file system and I/O management, and support for C++ and other runtime standards. These core capabilities can be combined with add-on operating system runtime extensions available from Wind River and its wide range of Partner Program partners.

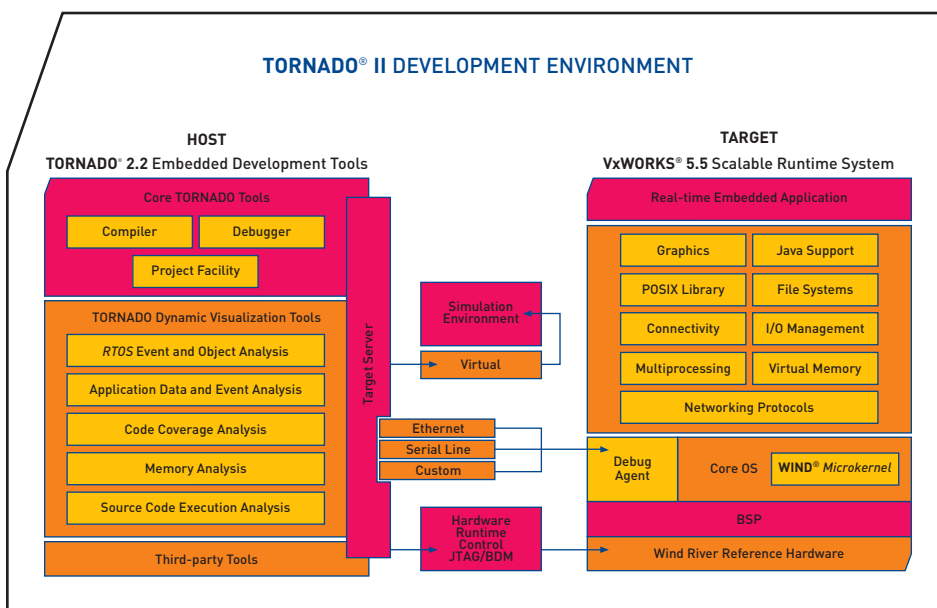
### High-performance microkernel design

At the heart of the **VxWORKS** runtime system is the highly efficient **WIND Microkernel**. This microkernel supports a full range of real-time features, including fast multitasking, interrupt support, and both preemptive and round-robin scheduling. The microkernel design minimizes system overhead and enables fast, deterministic response to external events.

**VxWORKS**' efficient intertask communications mechanisms permit independent tasks to coordinate their actions within a real-time system. The developer may design applications using shared memory (for simple sharing of data), message queues, semaphores, events and pipes (for intertask communications within a CPU), sockets and remote procedure calls (for network-transparent communication), and signals (for exception handling). For controlling critical system resources, several types of semaphores are provided — binary, counting, and mutual exclusion with priority inheritance.

### Scalable runtime software

**VxWORKS** is designed for scalability, enabling developers to allocate scarce memory resources to their application, rather than to the operating system. From deeply embedded designs requiring a few kilobytes of memory, to complex high-end real-time systems (where more operating system functions are needed), the developer may choose from over 100 different options, to create



highly customize configurations. Individual modules may be used in development and omitted in production systems.

Furthermore, these individual subsystems are themselves scalable, allowing the developer to optimally configure **VxWORKS**' runtime software for the widest range of applications. For example, individual functions may be removed from the ANSI C runtime library, or specific kernel synchronization objects may be omitted if they are not required by the application.

Also, TCP, UDP, sockets, and standard Berkeley network services can all be scaled in or out of the networking stack as necessary.

These configuration options can be easily selected by means of the **TORNADO II** project facility's graphical interface. Developers can also use **TORNADO II**'s auto-scaling feature, which automatically analyzes application code and incorporates the appropriate options.

### Comprehensive networking facilities

**VxWORKS** was the first real-time operating system to integrate industry-standard TCP/IP networking facilities optimized for real-time applications. This tradition of innovation continues with standard support for the latest Berkeley networking features, including:

- BSD 4.4 TCP/IP networking
- IP, IGMP, CIDR, TCP, UDP, ARP
- RIP v1/v2
- Standard Berkeley sockets, zbufs (a.k.a., zero-copy sockets)
- SLIP, CSLIP
- BOOTP, DNS, DHCP, TFTP
- NFS, SUN RPC
- FTP, rlogin, rsh, telnet
- SNTIP

Wind River also supports optional **WIND<sup>®</sup>NET** and **WIND<sup>®</sup>MANAGE** products, and augments these core technologies with the industry's most extensive networking development environment, available through the Wind River Partner Program.

### POSIX compliance

**VxWORKS** supports the POSIX 1003.1b and POSIX 1003.1c specifications and basic system calls in the 1003.1 specification, including process primitives, files and directories, I/O primitives, language services, and directory handling. In addition, **VxWORKS** adheres to the final approved standard for POSIX 1003.1b Real-Time Extensions, including POSIX-compliant asynchronous I/O, counting semaphores, message queues, signals, memory management (page locking), and scheduling control. The pThreads implementation of POSIX 1003.1c comes standard in **VxWORKS**.

### Broad silicon support

Wind River supports a wide range of the latest RISC and CISC architectures so users can select the right silicon for their designs.

**VxWORKS**' open design is highly portable and complete across all supported processors, allowing application migration between architectures with minimal effort.

### Easy porting to custom hardware

Architecture support is strengthened by the availability of the industry's broadest selection of validated Board Support Packages (BSPs). BSPs provide users with a turnkey software package that enables **VxWORKS** to run out of the box on Wind River's extensive set of evaluation boards, as well as many third-party evaluation boards, reference boards, and popular COTS boards.

The BSP Developer's Kit enables developers to easily use **VxWORKS** with custom hardware; for developers using commercial hardware, over 200 BSPs are available. When developing a BSP for a custom board, developers can choose from a vast array of standard device drivers provided for all target architectures.

### Hardware reference designs and tools

In addition to offering Wind River's hardware reference designs with **VxWORKS**-ready

BSP's, Wind River offers specification details for chip evaluation and early hardware and software development.

**VxWORKS** also supports a full line of optional hardware-assisted tools to aid in the entire development cycle, from board bring-up to real-time trace and data acquisition. The hardware-assisted tools are integrated within the **TORNADO II** tools to allow developers to access and debug their application from a familiar development environment. These tools extend the power of Tornado development to designs that do not have Ethernet ports or to debugging Ethernet drivers.

### Operating system accessories

Accessory products give developers access to an unprecedented range of features and help to extend the **VxWORKS** platform. These products include the BSP Developer's Kit (included as standard), support for flash file systems with TrueFFS for Tornado, support for graphics applications, Java, virtual memory management with **VxVMI**<sup>™</sup>, multiprocessing with **VxMP**<sup>™</sup> and **VxFusion**<sup>™</sup>, and connectivity through the Common Object Model (COM, included as standard) and the USB Developer's Kit.

# Features

## WIND® Microkernel

- Efficient task management
- Multitasking, unlimited number of tasks
- Preemptive and round-robin scheduling
- Fast, deterministic context switching
- 256 priority levels
- Fast, flexible intertask communications
- Binary, counting, and mutual exclusion semaphores with priority inheritance
- VxWORKS® events
- Local and distributed message queues
- POSIX pipes, counting semaphores, message queues, signals, and scheduling
- Control sockets
- Shared memory
- Highly flexible design allows for wide range of applications
- High scalability footprint
- Incremental linking and loading of components
- Fast, efficient interrupt and exception handling
- Optimized floating-point support
- Dynamic memory management
- System clock and timing facilities

## Networking support included as standard

Fast, flexible I/O and local file system

- POSIX asynchronous I/O and directory handling
- SCSI support
- MS-DOS compatible file system
- Raw disk file system
- TrueFFS flash file system - optional
- ISO 9660 CD-ROM file system
- PCMCIA support

## Target development features

- Full ANSI C compliance and enhanced C++ features for exception handling and template support
- Extensive POSIX 1003.1, .1b, .1c compatibility (including pThreads)
- Interactive C interpreter target shell
- Symbolic debugging and disassembly
- Powerful performance monitoring
- Extensive kernel, task, and system information utilities
- Dynamic linking loader
- Libraries of over 1800 APIs
- Auto-scale feature
- Flexible booting from ROM, flash, local disk, or over the network
- Highly scalable design allows for wide range of applications
- System-level debugging via Ethernet, serial line, JTAG, BDM or custom
- Hardware bring-up via JTAG or BDM (optional)

## Supported VxWORKS® 5.x targets\*

- Motorola / IBM PowerPC®
- Motorola ColdFire
- Motorola 68K/CPU32
- Intel® Architecture family (Pentium)
- Intel StrongArm and XScale™ Microarchitectures
- MIPS™
- ARM
- Hitachi SuperH™

\* For latest target availability information, please contact your local Wind River sales representative.



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