



WIND RIVER HELIX VIRTUALIZATION PLATFORM ESSENTIALS FOR INDUSTRIAL

COURSE DESCRIPTION

The Wind River® Helix™ Virtualization Platform Essentials for Industrial course provides engineers with a fast, cost-effective way to acquire the skills necessary to develop safety-critical applications with Helix Platform.

After this course, participants will be able to perform the following:

- Plan systems consisting of multiple virtual machines running on a single hardware target
- Configure and build all parts of the system, including the hypervisor kernel, virtual machines, guest operating systems, and virtual networks, with Helix Platform
- Develop, test, and debug safety-critical applications with the Helix Platform real-time operating system (RTOS)
- Use Helix Platform-specific Wind River Workbench facilities such as VIRTIO, VNIC, shared memory, and direct interrupts to configure Helix Platform applications
- Build applications within partitions and use VIRTIO devices from partitions
- Use core tools such as debuggers and Wind River System Viewer efficiently

PRODUCTS SUPPORTED

- Helix Platform (version SR-0610)

COURSE FORMAT

- This four-day, expert-led course consists of lectures and lab sessions.
- Attendees use Helix Platform to gain experience with the topics presented.
- Participants examine and exercise simulated network topologies in hands-on labs.
- Participants receive individual guidance from an expert engineer who has extensive experience with Wind River technologies.

Course title:	Wind River Helix Virtualization Platform Essentials for Industrial
Duration:	Four days
Format:	Instructor-led lectures and hands-on lab sessions; instructor-led Live Remote delivery available
Format:	Day 1: Introduction to Virtualization; Helix Platform Hypervisor and Root OS in the Standard Configuration; Helix Platform Planning and Building; Helix Platform Runtime Configuration Day 2: Helix Platform VIRTIO Console Feature; Helix Platform VNIC Feature; VxWorks Kernel Shell; Real-Time Multitasking; VxWorks Events Day 3: Semaphores; Intertask Communication; Real-Time Processes; VxWorks Memory; Exceptions, Interrupts, and Timers Day 4: Helix Platform Shared Memory Feature; Helix Platform Direct Interrupt Feature; Helix Platform Performance in Standard Configurations; Debugging a Virtualized System; Debugging in Workbench; System Viewer; Optional Appendices

AUDIENCE

- Application developers creating standards-based safety-critical applications
- Developers who primarily use C and need to develop partition-based applications using the features of the Helix Platform and VxWorks 7 partition operating systems

PREREQUISITE SKILLS

- One year of C or C++ programming experience

PREREQUISITE COURSES

- None

RELATED COURSES

- Wind River Helix Virtualization Platform Essentials for Airborne

SYLLABUS

Day 1

INTRODUCTION TO VIRTUALIZATION

- What is virtualization?
- Benefits of virtualization
- Multi-core software configurations
- Hypervisor requirements for embedded devices

HELIX PLATFORM HYPERVISOR AND ROOT OS IN THE STANDARD CONFIGURATION

- Architectural design
- The root OS
- Memory translations
- Virtual machines and devices
- Booting Helix Platform
- **LAB: Getting Started with Helix Platform on a Simics Target**
- **LAB: Creating a Guest**

HELIX PLATFORM PLANNING AND BUILDING

- System planning considerations
- The build flow
- Configuring the VxWorks VSB
- Configuring the root OS VIP
- Configuring Wind River-supplied guests
- Deploying the root OS and guests
- **LAB: Building and Deploying the Root OS**
- **LAB: Building and Deploying a Guest**

HELIX PLATFORM RUNTIME CONFIGURATION

- VMM and guest configurations
- System configurator
- Configuring virtual machines and devices
- System and user-defined templates
- **LAB: Configuring Helix Platform**
- **LAB: Configuring a Wind River Linux Guest**

Day 2

HELIX PLATFORM VIRTIO CONSOLE FEATURE

- Why VIRTIO consoles?
- Technical details
- System configuration
- **LAB: Inspecting a VIRTIO Setup**

HELIX PLATFORM VNIC FEATURE

- Why VNIC?
- Technical details
- System configuration
- **LAB: Working with VNICs**

VXWORKS KERNEL SHELL

- Introduction to the kernel shell
- Kernel shell configuration
- Kernel shell commands and help
- Kernel shell usage
- Command line history and editing
- Object module loader
- **LAB: Using the VxWorks Kernel Shell**

REAL-TIME MULTITASKING

- Introduction to real-time requirements
- Task states in VxWorks
- Context switching
- Spawning new tasks
- Task control routines
- Task information
- Alternative POSIX® support
- System tasks
- **LAB: Working with VxWorks Tasks**

VXWORKS EVENTS

- VxWorks events overview
- Task event register

- Event handling in VxWorks
- Receiving events
- Sending events
- Other eventLib routines
- Usage caveats
- **LAB: Working with VxWorks Events**

Day 3

SEMAPHORES

- Overview of semaphore types
- Synchronization issues
- Binary and counting semaphores
- VxWorks events and semaphores
- Mutual exclusion issues
- Mutex semaphores
- Deletion and inversion safe mutex semaphores
- Other preemption locks for tasks and ISRs
- **LAB: Using Semaphores**

INTERTASK COMMUNICATION

- Overview of communication methods
- Shared memory and data structures
- Message queues
- Creating, sending, and receiving messages
- Message queue events
- Pipes in VxWorks
- **LAB: Communicating Between VxWorks Tasks**

REAL-TIME PROCESSES

- Overview of the RTP model
- Use of MMU
- Memory allocation and tasks
- VxWorks component support for RTPs
- RTP execution and termination
- Debugging RTPs
- Shared library usage
- Shared data usage
- Public and private objects
- Design considerations
- **LAB: Working with Real-Time Processes**

VXWORKS MEMORY

- Introduction
- Physical memory layout
- Virtual memory layout
- Heap memory allocation
- Virtual memory allocation
- Examining memory
- **LAB: Managing VxWorks Memory**

EXCEPTIONS, INTERRUPTS, AND TIMERS

- Exception handling and signals
- Installing signals to handle exceptions
- Interrupt service routine basics
- Interrupt handling example
- ISR guidelines
- Timing and the system clock
- Watchdog timers
- Polling
- The auxiliary clock
- **LAB: Using VxWorks Exceptions, Interrupts, and Timers**

Day 4

HELIX PLATFORM SHARED MEMORY FEATURE

- Shared memory features
- Technical details
- System configuration

HELIX PLATFORM DIRECT INTERRUPT FEATURE

- Direct interrupt features
- Technical details
- System configuration

HELIX PLATFORM PERFORMANCE IN STANDARD CONFIGURATIONS

- Context scheduling
- Performance factors
- The virtualized real-time OS
- The root OS

DEBUGGING A VIRTUALIZED SYSTEM

- What to debug
- Built-in inspection tools

- Debugging the VMM configuration
- Debugging guests
- VxWorks guest analysis
- **LAB: Inspecting the System Using the Hypervisor Debug and HVCONFIG Shells**

DEBUGGING IN WORKBENCH

- Debugger overview
- Application mode and stop mode debugger
- Setting breakpoints
- Downloading code
- Attaching to running tasks
- Attaching to a system
- **LAB: Debugging with Workbench**

SYSTEM VIEWER

- System Viewer overview
- Configuring System Viewer
- Collecting and displaying event data
- User-defined events
- Additional analysis views
- **LAB: Using System Viewer**

OPTIONAL APPENDICES

- Helix Platform certification
- Miscellaneous certification elements

GLOBAL REACH OF WIND RIVER EDUCATION SERVICES

With more than 30 years of experience delivering software for the intelligent edge, Wind River provides education services in every region of the world. Our private classes can be tailored to your needs by adding or removing topics from multiple courses. If you have more specific project challenges, Wind River Mentoring provides coaching by experienced engineers to help you integrate Wind River solutions into your environment. And when you're too busy to attend a whole class, our On-Demand Learning options provide around-the-clock access to advanced and specialized topics. All of our education services are led by expert engineers who are closely connected to the Wind River technical community for access to specific expertise.

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