EDUCATION SERVICES

MULTI-CORE TECHNOLOGIES AND DESIGNING FOR CONCURRENCY

COURSE DESCRIPTION

The Multi-core Technologies and Designing for Concurrency course provides engineers with a fast, cost-effective way to acquire the skills necessary to design, develop, and tune applications and systems using multi-core processors. Wind River® VxWorks® symmetric multiprocessing (SMP) technology is used for lab purposes, although the principles taught in this course also apply to Linux design.

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

- Describe multi-core processor architectures
- Identify the benefits and choices involved in leveraging multi core processors in a new system design
- Explain the need for a new programming model
- Design and implement parallel and lock-free algorithms

PRODUCTS SUPPORTED

- Wind River VxWorks 6.9
- Wind River Workbench 3.3
- Wind River Simics 4.6

COURSE FORMAT

- This two-day expert-led course consists of nine lectures and eight lab sessions.
- Attendees use VxWorks 6.9, Workbench 3.3, and Simics 4.6 to gain experience with the topics presented.
- Participants receive individual guidance from an expert engineer who has extensive experience with Wind River technologies.

AUDIENCE

- Engineers starting a new real-time design on a multi-core system
- System architects and designers who want to extend their multi-core skills
- Software developers who work on multi-core platforms
- Senior engineers who will evaluate multi-core technology

Course title:	**Multi-core Technologies and Designing for Concurrency**
Duration:	Two days
Format:	Instructor-led lectures and hands-on lab sessions; instructor-led Live Remote delivery available
Content:	**Day 1:** Introduction to Multi-core; Multi-core Architecture; Multi-core Processing; The Sequential Model; Parallelism **Day 2:** Parallel Programming Model; Multi-core Threads; Parallel Algorithms; Migrating to Multi-core

PREREQUISITE SKILLS

- Three years of C programming
- Basic understanding of operating systems and debugging techniques
- Functional knowledge of UNIX/Linux
- Basic understanding of data structures and common computer science algorithms

PREREQUISITE COURSES

- Real-Time Programming for Embedded Systems
- Introduction to Linux

RELATED COURSES

- VxWorks 6.x Symmetric Multiprocessing
- VxWorks 6.x Asymmetric Multiprocessing

SYLLABUS

Day 1

INTRODUCTION TO MULTI-CORE

- Why do we need multi-core?; multi-core use cases
- Who is driving the multi-core market
- Multi-core vendors and architectures

MULTI-CORE ARCHITECTURE

- Overview
- Examples
- Homogeneous and heterogeneous multi-core
- On-chip inter-connect architecture
- Uniform and non-uniform memory access
- Cache and cache coherence
- Multi-core processor benchmarks
- **LAB: Getting started**

MULTI-CORE PROCESSING

- Overview
- Asymmetric multiprocessing (AMP)
- SMP
- Bare metal
- Virtualization
- Multi-core inter-process communication (MIPC)
- Choosing your multi-core configuratio
- **LAB: Hypervisor Hello World 2 cores**

THE SEQUENTIAL MODEL

- Von Neumann computer architecture
- Instruction-level parallelism
- Atomic operations
- Memory barriers

PARALLELISM

- What is parallelism?
- Why do we need parallelism?
- Types of parallelism
- Creating parallelism

Day 2

PARALLEL PROGRAMMING MODEL

- Introduction
- Parallel programming challenges
- Limits of parallel execution
- Shared memory model
- **LAB: Implicit synchronization**

MULTI-CORE THREADS

- Overview
- Concurrency and multi-threading
- Pthreads
- Thread pools
- Threading development cycle

PARALLEL ALGORITHMS

- Introduction
- Quantifying parallelism
- Problems decomposition
- Locking
- Designing parallel algorithms
- Lock-free and wait-free algorithms
- **LAB: Problem decomposition**
- **LAB: Lock granularity**
- **LAB: Lock-free stack**

MIGRATING TO MULTI-CORE

- Introduction
- Migration challenges
- **LAB: Data synchronization**
- **LAB: Core affinity and reservation**

GLOBAL REACH OF WIND RIVER EDUCATION SERVICES

With more than 30 years of device software experience, Wind River provides education services in every region of the wo rld. Our private classes can be tailored to your needs by adding or removing topics from multiple courses. If you have more speci fic 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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