Advanced Features and Techniques of Embedded Systems Development

Embedded Hardware 4

EMBD33000-11-ILT (v1.0)

Course Specification

Course Description

Advanced Features and Techniques of Embedded Systems Development provides embedded systems developers the necessary skills to develop complex embedded systems and enables them to improve their designs by using the tools available in the Embedded Development Kit (EDK). This course also helps developers understand and utilize advanced components of embedded systems design for architecting a complex system.

This course builds on the skills gained in the *Embedded Systems Development course*. Labs provide hands-on experience with the development, verification, debugging, and simulation of an embedded system. Some labs use the Virtex®-5 FPGA ML507 demo board in which designs are downloaded and verified.

Level – Embedded Hardware 4
Course Duration – 2 days
Price –
Course Part Number – EMBD33000-11-ILT
Who Should Attend? – FPGA design engineers, system architects, and system engineers who are interested in Xilinx embedded systems development flow

Prerequisites

- *Embedded Systems Development* course or experience with embedded systems design and Xilinx EDK tools
- Some HDL modeling experience
- Basic microprocessor experience and understanding of PowerPC®-processor and MicroBlaze™-processor systems

Software Tools

- Xilinx ISE® Design Suite: Embedded or System Edition 11.1
- Mentor Graphics ModelSim simulator 6.4b or later

Hardware

- Architecture: Virtex-5 FPGA*
- Demo board: Virtex-5 FPGA ML507 board*

* This course focuses on the Virtex-5 architecture. Check with your local Authorized Training Provider for the specifics of the in-class lab board or other customizations.

After completing this comprehensive training, you will have the necessary skills to:

- Assemble an advanced embedded system
- Take advantage of the various Virtex-5 FPGA and PowerPC® 440 processor features, including the crossbar and multi-port memory controller
- Apply advanced debugging techniques, including the use of the ChipScope™ tool for debugging an embedded system and HDL system simulation
- Identify the steps involved in integrating a memory controller into an embedded system using the PowerPC 440 processor
- Integrate an interrupt controller and interrupt handler into your embedded design
- Design a Flash memory-based system and boot load from off-chip Flash memory
- Perform HDL-based system simulation

Course Outline

Day 1

- Embedded Systems Development Review
- **Lab 1:** Building a Complete Embedded System
- PowerPC 440 Processor Crossbar
- Debugging Using the ChipScope Pro Analyzer
- **Lab 2:** Debugging Using the ChipScope Pro Analyzer
- Block RAM Memory Controllers
- Multi-Channel External Memory Controller for Static Memory
- PowerPC 440 Processor DDR2 Memory Controller for the Crossbar MCI
- Multi-Port Memory Controller for Dynamic RAM
- **Lab 3:** Instantiating a DDR2 Memory Controller

Day 2

- Interrupts
- Fast Simplex Links
- Advanced Processor and Peripheral Interface Options
- **Lab 4:** Interfacing an Embedded System to FPGA Fabric
- Advanced Processor Configurations
- Boot Loader
- **Lab 5:** Boot Loading from Flash Memory
- HDL System Simulation in XPS
- **Lab 6:** Simulating an Embedded Processor System

Lab Descriptions

- **Lab 1:** Building a Complete Embedded System – Develop hardware that incorporates IP cores to interface to push buttons, a rotary switch, LEDs, an LCD display, and serial communication. Develop an application that interacts with switches, push buttons, an LCD display, and serial communication.
- **Lab 2:** Debugging Using the ChipScope Pro Analyzer – Perform simultaneous hardware and software debugging with the ChipScope™ Pro Analyzer, SDK Debug perspective, and XMD.
- **Lab 3:** Instantiating a DDR2 Memory Controller – Use XPS to instantiate a DDR2 memory controller. Explore memory device configurations and proper memory controller clocking procedures.
- **Lab 4:** Interfacing an Embedded System to FPGA Fabric – Move data between an embedded system and FPGA fabric via an FSL and a dual-port block RAM. Implement an interrupt controller and an interrupt handler.
- **Lab 5:** Boot Loading from Flash Memory – Develop an application that is stored in flash memory, load it through a boot loader program, and execute the software from external memory.
- **Lab 6:** Simulating an Embedded Processor System – Set up and perform HDL-based simulation on a design that contains an embedded processor system. Explore the tool flow for performing embedded processor simulation as part of a Project Navigator design in the ISE software.

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