Embedded Open-Source Linux Development

Embedded Software 4

EMBD22000-11-ILT (v1.0)

Course Specification

Course Description

This intermediate-level, two-day course provides embedded systems developers with experience in creating an embedded open-source Linux operating system on a Xilinx development board. The course offers students hands-on experience from building the environment to booting the system using a basic, single-processor System on Chip (SoC) design with Linux 2.6 from the Xilinx kernel tree.

This course introduces embedded Linux components, use of open-source components, environment configurations, network components, and debugging/profiling options for embedded Linux platforms. The primary focus is on embedded Linux development in conjunction with the Xilinx tool flow.

Level – Embedded Software 4
Price –
Course Duration – 2 days
Course Part Number – EMBD22000-11-ILT
Who Should Attend? – Embedded software developers interested in customizing an open-source Linux kernel for a Xilinx embedded processor system

Prerequisites

- Experience in C or C++ programming
- Basic understanding of VHDL or Verilog design
- Basic microprocessor design experience and understanding of MicroBlaze™ or PowerPC® processor architecture
- Knowledge of operating system architecture
- Experience using a Linux command-line shell for common file operations

Software Tools

- Xilinx ISE® Design Suite: Embedded or System Edition 11.1

Hardware

- Architecture: Virtex®-5 FPGA*
- Demo board: Virtex-4 FPGA ML403 or 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 basic training, you will have the necessary skills to:

- Set up a Linux development environment
- Configure a Xilinx FPGA for a Linux operating system
- Describe the toolchain for developing an embedded Linux operating system
- Determine the scheduling requirements for an embedded Linux operating system and apply them to the FPGA configuration
- Analyze the system requirements for Inter-Process Communication and configure the FPGA
- Analyze the system requirements for memory management and apply them to the system
- Develop and add Linux drivers to the system

Course Outline

Day 1

- Course Agenda and Introduction
- Building the Environment
- **Lab 1:** Building the Environment
- Basic Linux System
- **Lab 2:** Basic Linux System

Day 2

- Booting and Debugging
- **Lab 3:** Boot Loader
- Peripherals and Drivers
- **Lab 4:** Peripherals and Drivers
- Embedded Linux Memory Manager
- Processes, Scheduling, and Timing

Lab Descriptions

- **Lab 1:** Building the Environment – On a virtual machine environment, download and build a Linux development system that integrates Xilinx tools and open-source components. Includes the use of build scripts.
- **Lab 2:** Basic Linux System – Configure the kernel; build the kernel without a root file system; download and start the kernel with xmd; try basic debugging techniques; build a minimal rootfs; rebuild Linux with a minimal rootfs; and boot Linux and login.
- **Lab 3:** Boot Loader – Analyze the starting point of the kernel; analyze the boot messages; add the first-stage boot loader; add U-Boot; boot Linux with U-Boot; and boot Linux with an NFS rootfs.
- **Lab 4:** Peripherals and Drivers – Program a Hello World kernel module; compile external kernel modules; and create a simple gpio driver.

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