XILINX

Morgan
Advanced Programmable Systems

Embedded Systems Software Design
Embedded Software 3

EMBD-SW (v1.0)

Course Specification

Course Description

This course introduces the concepts, tools, and techniques required for software design and development for the Zynq® System on a Chip (SoC) and Zynq UltraScale+™ MPSoC using the Vitis™ unified software platform.

The focus is on:

- Reviewing the basics of Vitis tool use
- Customizing board support packages (BSPs) for resource access and management of the Xilinx Standalone library
- Utilizing device drivers effectively
- Developing software applications for the Arm® Cortex™-A9 processors
- Debugging and integrating user applications
- Employing best practices to enable good design decisions

What's New for 2021.2

- All labs have been updated to the latest software versions

Level – Embedded Software 3

Course Details

- 2 days live instructor led training (online or in person)
    - 21 lectures
    - 13 labs
    - 7 ILT demos

Price – $1,600 or 1600 Xilinx Training Credits

Course Part Number – EMBD-SW

Who Should Attend? Software design engineers interested in system design and implementation and software application development and debugging using the Xilinx Standalone library

Prerequisites

- C or C++ programming experience, including general debugging techniques
- Conceptual understanding of embedded processing systems including device drivers, interrupt routines, writing and modifying scripts, user applications, and boot loader operation

Accelerated alternative training:

- Xilinx Rapid Development Embedded Design

Software Tools

- Vitis unified software platform 2021.2
- Vivado® Design Suite 2021.2

Hardware

- Architectures: Zynq-7000 SoC (Cortex-A9 processor) and Zynq UltraScale+ MPSoC (Cortex-A53 and Cortex-R5 processor)
- Demo board: Zynq UltraScale+ MPSoC ZCU104 or Versal® ACAP VCK190 board

* This course focuses on the Zynq-7000 SoC and the Zynq UltraScale+ MPSoC architectures. Check with Morgan Advanced Programmable Systems, Inc. for the specifics of the in-class lab board or other customizations.

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

- Implement an effective software design environment for a Xilinx embedded system using the Xilinx software development tools
- Write a basic user application (under Standalone or Linux) using the Vitis unified software platform and run it on an embedded system

Course Specification

- Use Xilinx debugger tools to troubleshoot user applications
- Apply software techniques to improve operability
- Maintain and update software projects with changing hardware

Course Outline

Day 1

- **Overview of Embedded Software Development**
  Overview of the process for building a user application. {Lecture}
- **Embedded UltraFast Design Methodology**
  Outlines the different elements that comprise the Embedded Design Methodology. {Lecture, Demo}
- **Zynq-7000 SoC Architecture Overview**
  Overview of the Zynq-7000 SoC architecture. {Lecture, Lab, Demo}
- **Zynq UltraScale+ MPSoC Architecture Overview**
  Overview of the Zynq UltraScale+ MPSoC architecture. {Lecture, Demo, Lab}
- **Zynq UltraScale+ MPSoC Software Environments**
  Describes the software development environments for Zynq UltraScale+™ MPSoCs. {Lecture}
- **Driving the Vitis Software Development Tool**
  Introduces the basic behaviors required to drive the Vitis tool to generate a debuggable C/C++ application. {Lecture, Demo, Lab}
- **System Debugger**
  Describes the basics of running a debugger and illustrates the most commonly used debugging commands. {Lecture, Lab}
- **Standalone Software Platform Development and Coding Support**
  Covers the various software components, or layers, supplied by Xilinx that aid in the creation of low-level software and includes a discussion on drivers, domains, operating systems, and libraries. Also covers the basic services (libraries) available when coding in the Standalone environment. {Lecture, Demo, Lab}
- **FAT File System for Standalone**
  Introduces the FAT file system (FFS) from the Standalone/Bare-metal library. The FFS provides drivers and utilities for effectively converting a region of memory into a file system. {Lecture, Lab}
- **Using Linker Scripts**
  Overview of the purpose and typical use of a linker script. {Lecture, Lab}
- **Migrating from SDK to the Vitis Platform**
  Overview of migrating existing Xilinx SDK projects to Vitis software development projects. {Lecture, Demo}
- **Introduction to Interrupts**
  Introduces the concept of interrupts, basic terminology, and generic implementation. {Lecture}
- **Software Interrupts: Writing**
  Describes many of the considerations that a software coder must consider when supporting interrupts. {Lecture, Lab}

Day 2

- **Operating Systems: Introduction and Concepts**
  Introduces the concept of the operating system and provides a simplified view into the generic way that operating systems work. {Lecture}

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- **Linux: A High-Level Introduction**
  Introduces the Linux operating system, a brief history, and how to use it. {Lecture}

- **Linux Software Application Development Overview**
  Highlights important parts of the underlying Linux system as it pertains to applications. {Lecture, Demo, Lab}

- **Driving the PetaLinux Tool**
  Introduces the basic concepts required to build an application using the PetaLinux tool. {Lab}

- **Building a Linux Application in the Vitis IDE**
  Introduces using the Xilinx Vitis IDE tool for Linux software development. {Lecture, Demo}

- **Booting Overview**
  Describes the main points to how booting a processor is handled for Zynq SoC devices and MicroBlaze processors. {Lecture, Lab}

- **Software Profiling Overview**
  Introduces the purpose and techniques for profiling a user application. {Lecture, Lab, Demo}

- **Understanding Device Drivers**
  Explains the concept of a device driver and how it is used by embedded systems. {Lecture, Demo}

- **Custom Device Drivers**
  Describes how to successfully write a custom device driver. {Lecture, Lab}

Register Today

Morgan Advanced Programmable Systems, Inc. (Morgan A.P.S.) delivers public and private courses in locations throughout the central US region; including Iowa, Illinois, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, and Wisconsin.

Visit **morgan-aps.com/training**, for full course schedule and training information.

You must have your tuition payment information available when you enroll. We accept credit cards (Visa, MasterCard, or American Express) as well as purchase orders and Xilinx training credits.

Student Cancellation Policy

- Student cancellations received more than 7 days before the first day of class are entitled to a 100% refund. Refunds will be processed within 14 days.
- Student cancellations received less than 7 days before the first day of class are entitled to a 100% credit toward a future class.
- Student cancellations must be sent here.

Morgan A.P.S. Course Cancellation Policy

- We regret from time-to-time classes will need to be rescheduled or cancelled.
- In the event of cancellation, live on-line training may be offered as a substitute.
- Morgan A.P.S. may cancel a class up to 7 days before the scheduled start date of the class; all students will be entitled to a 100% refund.
- Under no circumstances is Morgan A.P.S. responsible or liable for travel, lodging or other incidental costs. Please be aware of this cancellation policy when making your arrangements.

- For additional information or to schedule a private class contact us here.

Online training with real hardware

During the Covid-19 period, some companies do not allow their staff to participate in live in-person training.

- Consequently, Morgan Advanced Programmable Systems, Inc. has set up a training VPN where engineer participants can take classes online using the same computers and devCards used during in-person training.
- Even better, and upon request, you can use these computers after hours on training days to experiment with labs. This is not possible for in-person training.
- Additionally, just like in-person training, the laptops and devCards, tools, OS, and licensing are set up in advance.
- In some ways, live online-training is better than in-person…for example, you can grant the instructor permission to look at your Vivado, PetaLinux terminal, or Vitis for extended periods of time if your lab is not going exactly has planned to a missed step.
- This is often more comfortable than two engineers crowding around a laptop screen.
- Taking remote training also allows you to learn some tips and tricks for working remote. Whether your devCard is in the lab down the hall, or across the world via VPN, you can control your Xilinx based device quickly and efficiently.