

### Course Description

This course provides software developers with an overview of the capabilities and support for the Zynq® UltraScale+™ MPSoC family from a software development perspective.

The emphasis is on:

- Reviewing the catalog of OS implementation options, including hypervisors and various Linux implementations
- Booting and configuring a system
- Applying various power management techniques for the Zynq UltraScale+ MPSoC family

#### What's New for 2020.1

- All labs have been updated to the latest software versions

**Level** – Embedded Software 3

#### Course Details

- 2 days ILT or 24 hours OnDemand
  - 52 lectures
  - 14 labs
  - 8 ILT demos / 5 OnDemand demos

**Price** –

**Course Part Number** – EMBD-ZUPSW

**Who Should Attend?** – Software developers interested in understanding the OS and other capabilities of the Zynq UltraScale+ MPSoC device.

#### Prerequisites

- General understanding of embedded and real-time operating systems
- Familiarity with issues related to implementing a complex embedded system

#### Software Tools

- Vivado® Design Suite 2020.1
- Vitis™ unified software platform 2020.1
- Hardware emulation environment:
  - VirtualBox
  - QEMU
  - Ubuntu desktop
  - PetaLinux

#### Hardware

- Zynq UltraScale+ MPSoC ZCU104 board\*

\* This course focuses on the Zynq UltraScale+ MPSoC architecture. Check with your local Authorized Training Provider for the specifics of the in-class lab environment or other customizations.

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

- Distinguish between asymmetric multiprocessing (AMP) and symmetric multiprocessing (SMP) environments
- Identify situations when the Arm® TrustZone technology and/or a hypervisor should be used
- Effectively use power management strategies and leverage the capabilities of the platform management unit (PMU)
- Define the boot sequences appropriate to the needs of the system
- Define the underlying implementation of the application processing unit (APU) and real-time processing unit (RPU) to make best use of their capabilities

### Course Outline

#### Day 1

- **Application Processing Unit**  
Introduction to the members of the APU, specifically the Cortex™-A53 processor and how the cluster is configured and managed. {Lecture, Lab}
- **Real-Time Processing Unit**  
Focuses on the real-time processing module (RPU) in the PS, which is comprised of a pair of Cortex processors and supporting elements. {Lectures, Demo, Lab}
- **Arm TrustZone Technology**  
Illustrates the use of the Arm® TrustZone technology. {Lecture}
- **QEMU**  
Introduction to the Quick Emulator, which is the tool used to run software for the Zynq UltraScale+ MPSoC device when hardware is not available. {Lecture, Demo, Lab}
- **HW-SW Virtualization**  
Covers the hardware and software elements of virtualization. The lab demonstrates how hypervisors can be used. {Lecture, Demo, Lab}
- **Multiprocessor Software Architecture**  
Focuses on how multiple processors can communicate with each other using both software and hardware techniques. {Lecture}
- **Xen Hypervisor**  
Description of generic hypervisors and discussion of some of the details of implementing a hypervisor using Xen. {Lecture, Demo, Lab} (Pairs with OpenAMP, but not SMP)
- **OpenAMP**  
Discusses how the OpenAMP framework can be used to construct systems containing both Linux and Standalone applications within the APU. {Lecture, Lab} (Pairs with the Xen Hypervisor, but not SMP)
- **Linux**  
Describes how to configure Linux to manage multiple processors. {Lecture, Demo}

#### Day 2

- **Yocto**  
Compares and contrasts the kernel building methods between a "pure" Yocto build and the PetaLinux build (which uses Yocto "under-the-hood"). {Lecture, Demo, Lab}
- **Open Source Library (Linux)**  
Introduction to open-source Linux and the effort and risk-reducing PetaLinux tools. {Lecture, Demo, Lab}
- **FreeRTOS**  
Overview of FreeRTOS with examples of how it can be used. {Lecture, Demo, Lab}
- **Software Stack**  
Introduction to what a software stack is and a number of stacks used with the Zynq UltraScale+ MPSoC. {Lecture, Demo}
- **PMU**  
Introduction to the concepts of power requirements in embedded systems and the Zynq UltraScale+ MPSoC. {Lecture, Lab}
- **Power Management**  
Overview of the PMU and the power-saving features of the device. {Lecture, Lab}

- **Booting**  
How to implement the embedded system, including the boot process and boot image creation. Also how to detect a failed boot. {Lectures, Lab}
- **First Stage Boot Loader**  
Demonstrates the process of developing, customizing, and debugging this mandatory piece of code. {Lecture, Demo}

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