

Course Description

The Xilinx Zynq® All Programmable System on a Chip (SoC) provides a new level of system design capabilities. This course provides system architects with the knowledge to effectively architect a Zynq All Programmable SoC.

This course presents the features and benefits of the Zynq architecture for making decisions on how to best architect a Zynq All Programmable SoC project. It covers the architecture of the ARM® Cortex™-A9 processor-based processing system (PS) and the connections to the programmable logic (PL) at a sufficiently deep level that a system designer can successfully and effectively utilize the Zynq All Programmable SoC.

The course details the individual components that comprise the PS: I/O peripherals, timers, caching, DMA, interrupt, and memory controllers. Emphasis is placed on effective access and usage of the PS DDR controller from PL user logic, efficient PL-to-PS interfacing, and design techniques, tradeoffs, and advantages of implementing functions in the PS or the PL.

Level – Embedded Architect 3

Course Duration – 2 days

Course Part Number – EMBD-ZSA-ILT

Who Should Attend? – System architects who are interested in architecting a system on a chip using the Zynq All Programmable SoC.

Prerequisites

- Digital system architecture design experience
- Basic understanding of microprocessor architecture
- Basic understanding of C programming
- Basic HDL modeling experience

Software Tools

- Vivado® Design or System Edition 2017.3

Hardware

- Architecture: Zynq-7000 All Programmable SoC*
- Demo board: Zynq-7000 All Programmable SoC ZC702 or ZedBoard*

* This course focuses on the Zynq-7000 All Programmable SoC. 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:

- Describe the architecture and components that comprise the Zynq All Programmable SoC processing system (PS)
- Relate a user design goal to the function, benefit, and use of the Zynq All Programmable SoC
- Effectively select and design an interface between the Zynq PS and programmable logic (PL) that meets project goals
- Analyze the tradeoffs and advantages of performing a function in software versus PL

Course Outline

Day 1

- Overview {Demo}
- Application Processor Unit (APU) {Lab}
- Neon Co-Processor
- Input/Output Peripherals {Demo}
- PS Peripherals
 - Low-Speed: Overview {Lab}
 - Low-Speed: UART {Demo}
 - Low-Speed: CAN {Demo}
 - Low-Speed: I2C
 - Low-Speed: SD/SDIO
 - Low-Speed: GPIO

- High-Speed: USB
- High-Speed: Gigabit Ethernet {Lab}
- DMA Controller (DMAC) {Lab}
- DMA
 - Introduction and Features
 - Block Design and Interrupts
 - Read and Write

Day 2

- AXI
 - Introduction
 - Variations
 - Transactions {Demo, Lab}
- PS-PL Interface {Demo, Lab}
- Booting {Lab}
- Memory Resources {Demo}
- Meeting Performance Goals {Lab}
- Hardware Design {Lecture}
- Software Design {Demo, Lab}
- Debugging {Lab}
- Tools and Reference Designs

Topic Descriptions

Day 1

- Overview – Provides a general overview of the Zynq All Programmable SoC.
- Application Processor Unit (APU) – Explores the individual components that comprise the APU.
- Neon Co-Processor – Describes the Neon co-processor that is the companion to each Cortex-A9 processor.
- Input/Output Peripherals – Introduces the components that comprise the IOP block of the Zynq device PS.
- Peripherals
 - Low-Speed: Overview – Introduces the low-speed peripherals in the Zynq All Programmable SoC.
 - Low-Speed: UART – Introduces the UART low-speed peripheral.
 - Low-Speed: CAN – Introduces the CAN low-speed peripheral.
 - Low-Speed: I2C – Introduces the I2C low-speed peripheral.
 - Low-Speed: SD/SDIO – Introduces the SD/SDIO low-speed peripheral.
 - Low-Speed: GPIO – Introduces the GPIO low-speed peripheral.
 - High-Speed: USB – Introduces the USB high-speed peripheral.
 - High-Speed: Gigabit Ethernet – Introduces the Gigabit Ethernet high-speed peripheral.
- DMA Controller (DMAC) – Explores the operation of the DMAC, which is located in the APU.
- DMA
 - Introduction and Features – Introduces the direct memory access controller.
 - Block Design and Interrupts – Introduces the DMA block design and the DMA interrupts.
 - Read and Write – Introduces the concepts behind DMA reading and writing.

Day 2

- AXI
 - Introduction – Introduces the AXI protocol.
 - Variations – Describes the differences and similarities among the three primary AXI variations.
 - Transactions – Describes different types of AXI transactions.
- PS-PL Interface – Describes in detail the PS interconnect and how it affects PL architecture decisions.

- **Booting** – Explains the boot process of the PC and configuration of the PL.
- **Memory Resources** – Explains the operation of the on-chip (OCM) memory and various memory controllers located in the PS.
- **Meeting Performance Goals** – Focuses on Zynq device performance, including DDR access from the PL, DMA considerations, and power control and reduction techniques.
- **Hardware Design** – Discusses the use and configuration of the PS in a hardware design.
- **Software Design** – Explores the software side of the Zynq device.
- **Debugging** – Introduces debug tools and methodology on the Zynq All Programmable SoC.
- **Tools and Reference Designs** – Describes Xilinx-provided reference design platforms, use cases, and third-party operating systems and tools for the Zynq All Programmable SoC.

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