

SOC-OS-HYPER (v1.0)

**Course Specification**

**Course Description**

This course provides software developers options and techniques for selecting and implementing various types of operating systems and hypervisors on AMD Zynq™ UltraScale+™ and Versal™ devices.

The emphasis is on:

- Exploring the capabilities of the application processing unit (APU) and real-time processing unit (RPU) relative to performance improvement and OS implementation
- Reviewing the catalog of OS implementation options, including Arm® TrustZone technology, hypervisors, and various Linux® implementations
- Applying various power management techniques for Zynq UltraScale+ and Versal devices

**What's New for 2024.1**

- All labs have been updated according to the latest tool release.
- The lab on PMU: System Power Management has been added.

**Level** – Embedded Software 3

**Course Details**

- 3 days live instructor led training (online or in person)
  - 39 lectures
  - 9 labs
  - 6 demos

**Price** – \$2,400 or 24 AMD Training Credits

**Course Part Number** – SOC-OS-HYPER

**Who Should Attend?** – Software developers interested in understanding popular OS and hypervisor options and other high-level system design issues.

**Prerequisites**

- General understanding of C coding
- Familiarity with issues related to complex embedded systems

**Software Tools**

- Vivado™ Design Suite 2024.1
- Vitis™ Unified IDE 2024.1
- Hardware emulation environment:
  - VirtualBox (We use faster native installation)
  - QEMU (We use faster hardware)
  - Ubuntu® desktop
  - PetaLinux

**Hardware**

- Zynq UltraScale+ MPSoC ZCU104 board\*
- Versal adaptive SoC VCK190 board

\* This course focuses on the Zynq UltraScale+ and Versal 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:

- Leverage the innate capabilities of the application processing unit (APU) and real-time processing unit (RPU)
- Investigate Arm TrustZone technology
- Explore the concept of hypervisors and implement a Xen hypervisor example
- Implement Linux solutions, including asymmetric multiprocessing (AMP) and symmetric multiprocessing (SMP) configurations

- Deploy FreeRTOS in the RPU
- Effectively use power management strategies

**Course Outline**

**Day 1**

- **Application Processing Unit**  
Introduction to the members of the APU, specifically the Arm® Cortex®-A53 processor and how the cluster is configured and managed. {Lectures, Lab}
- **Real-Time Processing Unit**  
Focuses on the real-time processing module (RPU) in the PS, which is comprised of a pair of Arm Cortex processors and supporting elements. {Lectures, Demo, Lab}
- **Arm TrustZone Technology**  
Illustrates the use of Arm TrustZone technology. {Lectures}
- **QEMU**  
Introduction to the Quick Emulator, which is the tool used to run software for a device when hardware is not available. {Lectures, Demo, Lab}
- **HW-SW Virtualization**  
Covers the hardware and software elements of virtualization. {Lecture}

**Day 2**

- **Multiprocessor Software Architecture**  
Focuses on how multiple processors can communicate with each other using both software and hardware techniques. {Lecture}
- **Xen Hypervisor**  
Discusses generic hypervisors and reviews some of the details of implementing a hypervisor using Xen. {Lectures, Demo, Lab}
- **OpenAMP**  
Discusses how the OpenAMP framework can be used to construct systems containing both Linux and Standalone applications within the APU. {Lectures, Lab}
- **Linux**  
Describes how to configure Linux to manage multiple processors. {Lectures, Demo}
- **Driving the PetaLinux Tool**  
Introduces the basic concepts required to build an application using the PetaLinux tool. {Lecture, Lab}
- **Yocto**  
Compares and contrasts the kernel building methods between a "pure" Yocto build and the PetaLinux build (which uses Yocto "under the hood"). {Lectures, Lab}
- **Open-Source Library (Linux)**  
Introduction to open-source Linux and how the PetaLinux tools reduce effort and risk. {Lectures, Demo}

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**Day 3**

- **FreeRTOS**  
Overview of FreeRTOS with examples of how it can be used. {Lectures, Demo, Lab}
- **Software Stack**  
Introduction to what a software stack is and a number of commonly used stacks. {Lectures, Demo}
- **Power Management**  
Introduction to the concepts of power requirements in embedded systems and the Zynq UltraScale+ MPSoC. {Lectures, Lab}

- 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 as 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.

**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](http://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 or in person training with real hardware**

- 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.