

## Course Description

This course focuses on the fundamentals of the PCI Express® protocol specification. The typical PCIe architecture, including data space, data movement, and the most used Transaction Layer Packets (TLPs) are covered. Interrupts and error handling are also discussed.

Implementation issues are covered in the two-day *Designing a LogiCORE PCI Express System* course.

**Level** – Connectivity 2

**Course Duration** – 1 day live instructor led training (in person or online)

**Price** – \$800 or 8 Xilinx Training Credits

**Course Part Number** – PCIE18000-13-ILT

**Who Should Attend?** – FPGA designers, logic designers, and anyone who needs an in-depth knowledge of the PCIe protocol

#### Prerequisites

- None

#### Software Tools

- None required
- VCD viewer optional

#### Hardware

- Architecture: N/A\*
- Demo board: None\*

\* This course does not focus on any particular architecture.

\*\* Check with [Morgan Advanced Programmable Systems, Inc.](http://www.morgan-aps.com) for the specifics of the in-class lab board or other customizations.

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

- Interpret various transactions occurring on the link
- Describe the layered architecture and the tasks and packet types each is responsible for
- Properly estimate maximum performance of a link
- Illustrate how errors can be communicated within the system
- Explain the relationship between Virtual Channels (VCs) and Traffic Class (TC) and the interaction with flow control credits

## Course Outline

- Introduction
- Introduction to the PCIe Architecture
- Review of the PCIe Protocol
- Packet Formatting Details
- **Lab 1:** Packet Decoding
- Packet Routing
- Interrupts and Error Management
- Summary

## Lab Descriptions

- **Lab 1:** Packet Decoding – This lab explores what *really* happens on the link between a root complex and the endpoint. Various packets, including the Physical Layer, Data Link Layer, and Transaction Layer packets are explored. Insight as to what is transpiring on the lanes becomes a powerful tool for understanding the protocol as well as debugging various link issues.

## 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 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 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.