LabVIEW FPGA

Overview

The LabVIEW FPGA course prepares you to design, debug, and implement efficient, optimized applications using the LabVIEW FPGA Module and reconfigurable I/O (RIO) hardware. You learn how to compile and deploy your VIs to different types of NI targets, such as NI R Series multifunction RIO, CompactRIO, NI FlexRIO, and NI RIO instruments. You develop applications where you learn to acquire digital and analog I/O, control loop timing, and pass data between your host VI and your FPGA target.

Duration

Classroom: Two (2) Days
Online: Four (4) Days

Audience

- LabVIEW FPGA Module users and users preparing to develop applications using LabVIEW FPGA and RIO hardware
- Users and technical managers evaluating LabVIEW FPGA in purchasing decisions
- LabVIEW or LabVIEW Real-Time Users who need the performance and flexibility of an FPGA hardware target

Prerequisites

- LabVIEW Core 1 course or equivalent experience

Other recommended courses

- LabVIEW Core 2 course
- LabVIEW Real-Time Applications course

NI Products Used During the Course

- LabVIEW Professional Development System
- LabVIEW Real-Time Module
- LabVIEW FPGA Module
- PXI-7831R Reconfigurable I/O (simulated)
- CompactRIO 9074 Real-Time Controller

Note: The LabVIEW FPGA course covers use the LabVIEW Real-Time Module in conjunction with the LabVIEW FPGA Module for basic communication between a Real-Time host and an FPGA target. Refer to the LabVIEW Real-Time Applications course for further instruction on creating a well-architected Real-Time application.

Registration

Register online at ni.com/training or
call (800)433-3488 fax: (512)683-9300
email info@ni.com

Outside North America, contact your local NI Office.
Worldwide Contact Info: ni.com/global

Part Number

910661-xx
-01 NI Corporate or Branch
-11Regional
-21 Onsite (at your facility)
-69 Online

After attending this course, you will be able to:

- Understand system architectures for LabVIEW FPGA and NI RIO hardware
- Select hardware for your FPGA system
- Configure NI RIO hardware
- Create & compile your LabVIEW FPGA VI and download to NI RIO hardware
- Acquire and output analog and digital measurements
- Understand and control timing of operations on FPGA target
- Design and implement applications using the LabVIEW FPGA module

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LabVIEW FPGA Course Outline

Introduction to LabVIEW FPGA

This lesson introduces FPGA and LabVIEW FPGA. You learn the components of a LabVIEW FPGA system and the types of applications that are well-suited for LabVIEW FPGA. You also explore a comparison between a LabVIEW FPGA system and a traditional measurement system. Topics include:

- Introduction to FPGA Technology
- LabVIEW FPGA System
- Comparison with DAQmx
- LabVIEW FPGA Applications

LabVIEW FPGA Basics

In this lesson, you learn about the two major RIO architectures: FPGA on Windows and FPGA for Real-Time. You also learn about R Series devices and CompactRIO, two of the different RIO platforms. You then learn to configure your RIO hardware in Measurement and Automation Explorer (MAX) and create a LabVIEW FPGA project. Topics include:

- Evaluating system requirements
- Reconfigurable I/O architectures
- FPGA Platforms
- System Configuration
- Creating a LabVIEW FPGA project

FPGA Programming Basics

In this lesson, you learn how to reconfigure an FPGA target using the LabVIEW FPGA Module. You gain a high-level understanding of how logic is implemented on the FPGA and how LabVIEW code is translated and compiled into FPGA hardware. After you develop an FPGA VI, you test, debug, compile and then execute on an FPGA target. You examine different reports generated during compilation and learn techniques to optimize your code for size. Topics include:

- Defining FPGA Logic with LabVIEW
- Developing the FPGA VI
- Interactive Front Panel Communication
- Selecting an Execution Mode
- Compiling the FPGA VI
- Basic Optimizations

FPGA I/O

In this lesson, you learn how to add FPGA I/O to your LabVIEW project and use it on the block diagram. You also learn about the differences between performing I/O on an R Series device and on a CompactRIO chassis, and you learn the differences between integer and fixed-point data. Using I/O Nodes, you learn how to access both analog and digital data. Topics include:

- Configuring FPGA I/O
- I/O Types
- Integer Math
- Fixed-Point Math
- CompactRIO
- Error Handling

Timing an FPGA VI

In this lesson, you learn to use the Loop Timer to set your FPGA loop rates, the Wait to add delays between events, and the Tick Count to benchmark your FPGA code. Topics include:

- Timing Express VIs
- Implementing Loop Execution Rates
- Creating Delays between Events
- Measuring Time between Events
- Benchmarking Loop Periods

Data Sharing on FPGA

In this lesson, you learn how to transfer data between multiple loops on your FPGA VI. You examine three data sharing methods: variables, FPGA memory, and FPGA FIFOs. You learn the benefits of each technique and when each should be used. Topics include:

- Parallel Loops
- Shared Resources
- Variables
- Memory Nodes
- Race Conditions
- FPGA FIFOs
- Comparison of Data Sharing Methods

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LabVIEW FPGA Course Outline

Single-Cycle Timed Loop Execution

In this lesson you learn to improve performance of your FPGA VI by using the Single-Cycle Timed Loop (SCTL) which executes at the rate of selectable FPGA clocks. Topics include:

- Data Flow in FPGA
- Single-Cycle Timed Loop
- Single-cycle Timed Loop Errors
- Optimizing Code within a While Loop

Basic Host Integration

In this lesson, you learn how to interface with your FPGA VI from your host PC or real-time controller. You create host VIs to control and pass data between your FPGA and host system. Topics include:

- Windows Host Integration
- Developing a Windows Host VI
- Introduction to Real-Time
- Developing a RT Host VI
- Developing a Windows VI
- Prepare RT Host for Final Application

DMA Data Transfers

In this lesson, you expand your knowledge of transferring data between your host system and FPGA by using DMA FIFOs . With DMA FIFOs you can ensure that no data is lost when streaming data to your host system. Topics include:

- LabVIEW FPGA and Host Communication
- DMA FIFOs
- Lossless DMA Transfer
- Interleaving

Modular Programming and Code Reuse

In this lesson, you learn how to most efficiently use subVIs in your FPGA application. You learn when to set your VIs as re-entrant or non-reentrant, depending on your FPGA needs. You also learn about FPGA Controls so that you can reference FIFOS, memory, and I/O nodes in subVIs. Topics include:

- Review of SubVIs
- Using SubVIs on the FPGA
- Reentrancy and Non-reentrancy in FPGA
- Control Types for Passing to SubVIs
- Testing FPGA SubVIs
- LabVIEW FPGA IPNet

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