How to validate your FPGA design using realworld stimuli

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Agenda

- Typical FPGA Design
- NIs approach to FPGA
 - Brief intro into platform based approach
 - RIO architecture
- Case Studies





Mechanical Engineer







The NI Approach

We call this the LabVIEW Reconfigurable I/O (RIO) architecture.



NI FPGA



Why program with LabVIEW FPGA?

Top 3 Reasons to Use LabVIEW FPGA

- 1. Graphical System Design
- 2. IP Libraries and HDL Code Reuse
- 3. Rapid Algorithm / Development Signal Processing Functions

DMA over PCIe





Programming FPGAs with LabVIEW

Program with LabVIEW FPGA

- Develop, simulate, debug, compile and deploy through LabVIEW
- Familiar LabVIEW programming elements
- Integrate external FPGA IP

High-Performance Features

- High-throughput math functions
- Advanced timing control with Single Cycle Timed-Loops
- Access to optimized DSP Cores

Access to IO and Peripherals

- FlexRIO Adapter Module IO
- High bandwidth streaming over High Speed Serial or DMA
- Random access read/write to DRAM





Programming FPGAs with LabVIEW



Embedded Hardware Options >1 MS/s Analog >10 MHz Digital PXI and PC-based Devices PXI: RF, MI, and FlexRIO For the Highest-Performance Applications

MXI-Express RIC

EtherCAT RIO

Wireless



FlexRIO for PXI System Architecture



FlexRIO Adapter Module

Interchangeable I/O Analog, Digital, RF Custom I/O with MDK FlexRIO FPGA Module

Kintex-7 FPGA Up to 2 GB of DRAM PCIe Gen 2 x 8 **PXI** Platform

Embedded Controllers Synchronization Data streaming Power/cooling



FAM Architectures: Basic Analog Input





Concurrent Design and Test



1. On-FPGA Measurements and Stimulus Generation





Instrument Driver FPGA Extensions





The *compatibility* of industry-standard instrument drivers

The *flexibility* of the LabVIEW RIO architecture



Instrument Driver FPGA Extensions





Developing the World's First Real-Time 3D OCT Medical Imaging System





- To achieve 3D imaging capabilities, the two FPGAs in the system computed more than 700,000 512-point FFTs every second.
- Achieved high channel density, high-throughput data transfer, tight synchronization, and peer-to-peer data streams between FPGA modules

"We leveraged the flexibility and scalability of the PXI platform and NI FlexRIO to develop the world's first realtime 3D OCT imaging system."

> Dr. Kohji Ohbayashi Kitasato University



• http://sine.ni.com/cs/app/doc/p/id/cs-13387/