

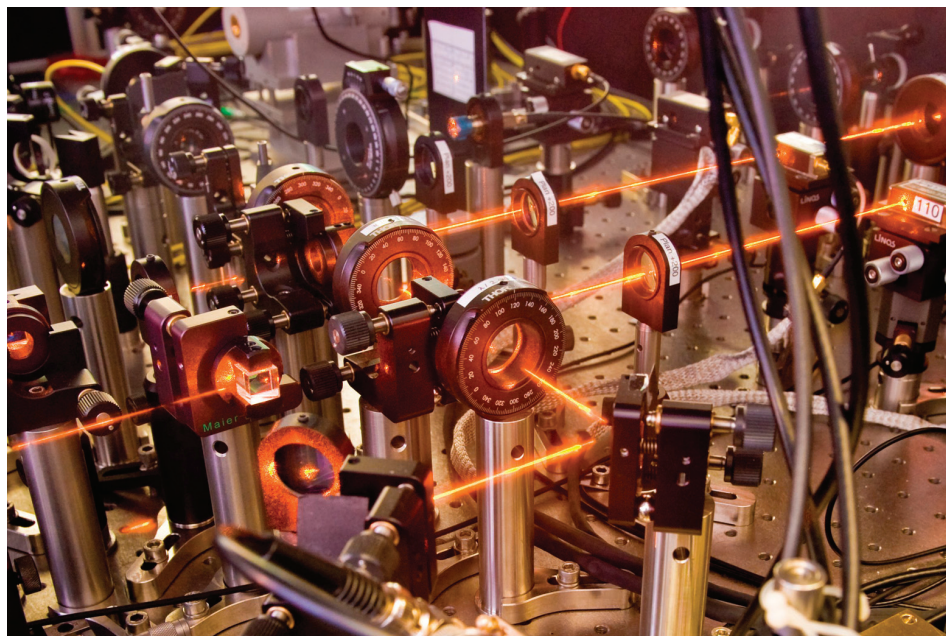


MAKING THE JOB OF THE ENGINEER EASIER

NATIONAL INSTRUMENTS LABVIEW ENVIRONMENT UNLEASHES THE POWER OF FPGAS FOR SOLVING CHALLENGING MEASUREMENT AND CONTROL PROBLEMS



The world expects a lot from engineers. The current generation of researchers and designers is being asked to find better ways to solve difficult problems, including those that comprise the 14 “Grand Challenges” identified by the National Academy of Engineering. National Instruments (NI) was founded to empower engineers around the world to succeed. By better equipping them, NI speeds the processes surrounding innovation and discovery. Today, NI solutions transform the design, prototyping, and deployment of systems for measurement and control applications—empowering the engineering community to design systems that truly make the world a better place.



In 2011, NI and Xilinx jointly presented the first NI LabVIEW FPGA Innovation Awards. From industry, the Max Planck Institute of Quantum Optics won for its instrument that manipulates atoms to study quantum properties of light-matter interaction.

Executive Summary

NATIONAL INSTRUMENTS (NI)

- Measurement and Control
- Austin, Texas USA
- 6,100 Employees

DESIGN CHALLENGES

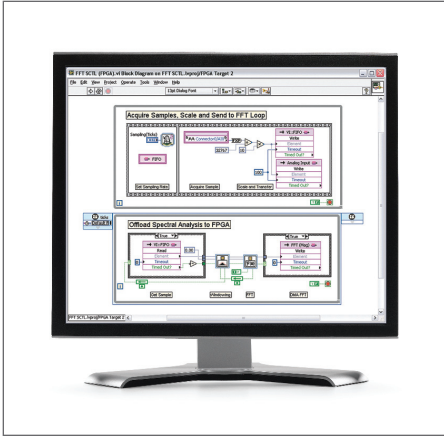
- Help engineers work more productively
- Bring embedded application designs to market faster
- Give non-experts simplified access to the power of programmable logic

SOLUTION

- Extend the LabVIEW language to Xilinx FPGAs
- Offer affordable development and deployment platforms with integrated Xilinx FPGAs

BUSINESS RESULTS

- Intuitive, visual programming that boosts productivity for more than 30,000 companies
- More than 60 NI reconfigurable I/O (RIO) hardware targets powered by Xilinx FPGAs to drive innovation
- Smooth application roadmap, with maximized portability and choice of best target system
- Continual advancements for NI-Xilinx customer bases including the development of extensible processing platforms



The flow of data and steps are programmed visually in LabVIEW, making it easier and faster to design even the most complex flows using shapes and connections that are very similar to block diagrams and flowcharts.

“National Instruments solutions let engineers focus on innovation, rather than implementation. With traditional design approaches, many engineers were reinventing the wheel.”

Rapid Prototyping

Thirty-five years ago, three co-founders began NI by designing a General Purpose Interface Bus (GPIB) that simplified the setup and use of scientific instruments in combination with a microcomputer. The mission today has grown considerably, and the current NI portfolio combines off-the-shelf software and cost-effective hardware to make it easier and faster to turn ideas into real-world solutions.

“National Instruments solutions let engineers focus on innovation, rather than implementation,” said Todd Dobberstein, senior group manager, Embedded Systems, NI. “With traditional design approaches, many engineers were reinventing the wheel.”

One of the flagship NI products, NI LabVIEW system design software, lets engineers visually design and program measurement and control systems.

“Fundamentally, the world would be a better place if there were more engineers to solve the most difficult problems,” said Jamie Smith, director, Embedded Systems, NI. “The next best thing is to raise productivity for existing engineers, which is exactly what LabVIEW does.”

The award-winning LabVIEW platform introduces a level of abstraction for designing control and measurement systems, and eliminates the need to learn more complex programming approaches or hardware design.

Accelerating Product Delivery

LabVIEW gives engineers the ability to program FPGA-based NI RIO hardware platforms for prototyping and deployment of measurement and control systems.

This year, NI announced its highest performance and first multicore NI CompactRIO systems and smallest NI Single-Board RIO devices based on Xilinx Spartan®-6 FPGAs. The architecture also includes powerful floating-point processors and modular I/O. Combined with the flexibility of the Spartan-6 FPGA and the intuitive programming of LabVIEW, the RIO platforms speed the design of custom timing, signal processing, and control of I/O and eliminate the complexities of traditional low-level hardware description languages and board-level design.

The latest NI RIO products come as a result of a collaboration that began more than a decade ago. When NI was first evaluating FPGAs, its selection of a vendor came down to more than a comparison of features and performance.

“Our vision was to significantly reduce the time to market for innovative embedded systems,” said Keith Odom, R&D Fellow at NI. “To fully integrate the power and versatility of an FPGA into these systems, we were looking at a major development investment to extend the level of abstraction in LabVIEW to programmable devices.”



Since introducing its first GPIB product that simplified connecting scientific instruments to microcomputers, NI has evolved a broad portfolio of products used by more than 30,000 companies.

World-Changing Innovations

Over the last ten years, the collaboration between Xilinx and NI has yielded more than 60 flagship NI RIO hardware products including CompactRIO, NI Single-Board RIO, R Series Multifunction RIO and FlexRIO products, all of which have embedded Xilinx FPGAs. LabVIEW software, powerful FPGA logic, and signal processing performance has been a winning combination. The high-level design language of LabVIEW makes powerful parallel-processing hardware fabric more accessible to a broad range of engineers and scientists.

"The Xilinx FPGA is the centerpiece of our RIO hardware architecture, and FPGAs in conjunction with LabVIEW have been a game changer for us in the embedded market," said Dobberstein.

"With FPGAs, we have been able to attract many new customers," added Smith. "Engineers that are new to NI—and new to FPGAs—can solve very challenging and complex control and signal processing problems with the productivity that LabVIEW offers and the performance delivered by the FPGA. This has been the greatest benefit of the Xilinx-NI partnership—we've been able to evolve the embedded market to fully exploit a very compelling technology combination. And LabVIEW lets non-experts and even engineers that are totally unfamiliar with FPGAs gain the benefits of performance, versatility, and determinism."

A decade of design wins has spanned an impressive list of innovations, starting with one of the first NI-Xilinx customers in the field of medicine, OptiMedica. Engineers and scientists at OptiMedica used LabVIEW and FPGA-based hardware from NI to enable a new laser eye surgery technique, eliminating pain and shortening the procedure time for the patient while achieving better results.



Photo Courtesy of OptiMedica.

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Customer Innovations

Visit ni.com/solutions to read more about how companies around the world are using LabVIEW to address the programmable imperative. Some highlights of the major innovations enabled by NI and Xilinx technology include:

- Improving Retinal Disease Treatment with LabVIEW FPGA
- Using Graphical System Design to Rapidly Develop a Low-Cost Device for Helping Premature Infants Learn to Oral Feed
- Implementing FPGA-Based Feedback Control of a Single Atom With LabVIEW and NI FlexRIO
- Developing the World's First Real-Time 3D OCT Medical Imaging System With LabVIEW
- Embedded FedEx Fire Suppression System Using NI LabVIEW and NI Single-Board RIO
- Powering Remote Villages with Revolutionary Airborne Wind Technology Using NI CompactRIO

A Continuum of Performance and Power

The first LabVIEW FPGA solution was based on Xilinx Virtex®-II devices, and led to the associated CompactRIO platform for embedded control. The FPGA was uniquely integrated directly into the backplane of the system, providing a direct connection to I/O and peripherals and giving customers comprehensive, fine-grained control of timing and I/O functions.

The powerful and yet intuitive architecture continued to evolve around Xilinx FPGAs exclusively. After the Virtex-II, NI built in Spartan-3 FPGAs to lower the platform cost and also leveraged the Virtex-5 to give customers more logic and performance for the most challenging applications. After announcing its most recent Spartan-6 products, NI is currently working on products that will leverage the Xilinx 7 series FPGAs.

"The Xilinx roadmap has evolved in terms of both performance and value," said Smith. "The breadth is remarkable, and has contributed to our ability to meet the needs of an incredibly broad range of applications. LabVIEW lets each customer more easily take advantage of the breadth of target platforms. They can develop very portable applications—and choose the best target without changing their implementation."

The close partnership between NI and Xilinx has helped each company anticipate and meet the needs of next-generation application designers. NI provided valuable embedded applications insights to Xilinx during the years of development that led to the recent announcement of the Xilinx Zynq™-7000 Extensible Processing Platform. LabVIEW VI migration to Zynq-based platforms will be seamless for LabVIEW applications. The 28nm single-chip combination of processor, FPGA fabric, and digital signal processing will bring next-generation RIO customers the benefits of more compact packaging, including both size reductions and power savings.

"From the start, our two companies have been extremely well aligned," said Odom. "Our common mindset around innovation has allowed our customers to do extraordinary things."



Siliken Renewable Energy uses NI LabVIEW software and NI RIO hardware to design and test renewable energy products like solar panels, solar panel inverters and hydrogen fuel cells.

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