NI weds FPGA, system-level design

David Lammers - August 23, 2004

Austin, Texas [] Buoyed by the early fruits of its effort to develop reconfigurable test and measurement platforms, National Instruments Corp. has its sights set on extending its system-level design thrust to the wider electronic system design market, with LabView as the locus.

Co-founder and CEO James Truchard said last week that NI is "embarking on a very long-term effort in system-level design" that involves "grappling with the challenge of developing LabView as a design tool."

The company has several of the threads needed to become a major player in system-level design, Truchard said at NI Week, an annual conference that draws several thousand LabView programmers to NI's Austin base each summer.

In May 2003, after a decade of effort, National Instruments began selling LabView FPGA, a version of its flagship graphical development language that lets engineers program NI's line of FPGA-enhanced virtual instruments.

Last week, NI announced Compact RIO (reconfigurable I/O), a chassis with up to eight slots for 1U (3.5-inch-high) board-based modules. The Compact RIO platform has a 1 million-gate Xilinx FPGA in the backplane to handle the I/O functions of the virtual instruments, using a parallel-processing, reconfigurable computing engine controlled by LabView-generated code. A version based on a 3 million-gate FPGA will roll in the near future, the company said.

Because FPGAs can run multiple functions in parallel, they are more flexible than the von Neumann architectures used in nearly all microprocessors, said NI co-founder Jeff Kodosky, who wrote LabView in the mid-1980s. FPGAs are suited to the kinds of data-driven, reconfigurable computing platforms that may become the dominant computing model in years to come. And LabView's drag-and-drop approach makes it relatively simple to program the new computing engines, he said.

NI chose to work with Xilinx Inc. on the initial FPGA support in its hardware and software because of Xilinx's early research work in reconfigurable computing.

Asked whether NI will try to push LabView as a front end for an industry-standard system design language, Kodosky said, "We have so much to learn about system-level design that it may be too early to standardize. If we standardize on sequential languages, that is probably the wrong
approach, and we will fall short of our goals. The C language can be extended to parallel constructions, but it is not as simple as in the data flow approach."

Truchard asserted that NI's customers are doing system-level design now with its tools. NI's RIO platforms and instruments, along with LabView FPGA, let companies develop test and measurement system-level designs in a matter of months, without high nonrecurring engineering costs, Truchard said. Rather than spend hundreds of thousands to develop an ASIC for a customized test system, customers are opting to spend perhaps $15,000 on reconfigurable hardware that later can be upgraded in the field, extending the life of the hardware.

**Targeting MCU, DSP design**

Step by step, National Instruments also is moving toward becoming a player in creating control software for DSPs and microcontrollers. Late last year, it bought Hyperception, a small Dallas company with a graphical design methodology for generating embedded code for the Sharc and Blackfin DSP families from Analog Devices Inc. and for DSPs from Texas Instruments Inc. as well.

Tim Dehne, senior vice president in charge of research and development, said NI is incorporating the Hyperception technology into LabView to support an automated form of DSP code generation. The company also has done early work to enable LabView code to control ARM processors and will extend that work to other brands of control silicon, from Freescale Semiconductor Inc. and others, he said.

"Our code eventually has to get to silicon,"Dehne said. Because relatively few engineers are versed in the VHDL skills needed to program FPGAs or DSPs, NI is working to create graphical, drag-and-drop approaches for creating embedded control applications within LabView.

Truchard said NI is taking the long view toward its system and silicon design initiatives, preferring to grow its abilities incrementally rather than via acquisitions. Part of the effort is to seed universities around the world with LabView tools and support reconfigurable-computing research.

Many system design engineers are veteran users of C++, Truchard said, and NI's "toughest sales are to engineers that are experienced C++ programmers. So we start in academia, teaching students how to do embedded development using LabView. They may start out thinking LabView is a test integration tool and then start using LabView for design."

But NI has its work cut out for it, said Sunderraju Ramachandran, a Frost & Sullivan analyst who follows test and instrumentation. Asked about NI's chances for becoming a player in the nascent electronics system design market, Ramachandran said, "LabView is not really built to do that now, so it is going to be difficult. It is great for simpler products, but NI will have to work hard to expand its capabilities to handle more complex engineering tasks."

Moreover, he said, "the experienced engineers all work in C++, and they are not going to change overnight."

But Truchard said he doesn't expect overnight changes. Noting that most programming languages
have roughly a 50-year life span, he said LabView has been evolving since 1986 and still has "three decades to go."

With version 7.1, LabView supports deterministic, multirate timed loops, Truchard noted. "Was that easy to do? No, but we accomplished that. I believe there is a shift coming toward the data flow approach, and we will build the tools on our platform to make that possible."

With annual sales of $500 million, National Instruments is large enough to attract support from other large companies. Last year, TI and NI announced an effort to tie TI's DSP software generation tools with NI's test generation software in LabView.

At NI Week, Analog Devices said it is working with NI on a test integration tool kit for the Blackfin 16-bit fixed-point DSP. ADI and NI intend to develop a coherent development, proto-typing and test environment that will make it easier to program the Blackfin.

"We anticipate taking our work to the product stage by the first quarter," said Derek Leadbetter, an ADI engineer. "We believe the line is blurring about what is a DSP and what is an embedded processor, and we want to make it easier for engineers to use Blackfin within the graphical paradigm of the LabView programming environment."

Jeff Jussel, vice president of marketing at Celoxica Ltd., a system design tool house that is working with NI, said the combination of system-level design tools and NI's reconfigurable hardware is is a powerful one. Vision increasingly is being built in to robotics and inspection tools on the factory floor. One NI customer, for example, wanted to develop a robot with machine vision capabilities to align bags of potato chips in boxes. Working with Celoxica, the customer was able to program its RIO card with custom algorithms that could be dropped onto the FPGA on the card, using LabView.

"FPGAs are moving up in density at the same time that NREs are moving up for traditional ASICs, and the customer couldn't do this machine vision application on a traditional microcontroller [] they are too slow," Jussel said. "An FPGA is just random gates that can be partitioned to handle this I/O in parallel much faster."