Insight

National Instruments' NIWeek Conference 2014: From Test and Measurement to Intelligent Embedded Systems for the Industrial Internet

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IDC OPINION

National Instruments (NI) held its annual user conference in Austin, Texas, on August 4–7, 2014. With over 7,000 attendees, the conference focused on test and measurement and embedded systems design across a broad spectrum of industries ranging from automotive, telecommunications, and energy to industrial automation. NI, known for its strength in test and measurement through its modular test hardware and LabVIEW system design software, also showcased its increasing focus on embedded systems design automation. This IDC Insight reviews:

- How NI is positioning its modular approach for the industrial Internet.
- Examples of implementations of the company's products and software solutions in the industrial Internet.

IN THIS INSIGHT

This IDC Insight provides an overview of the major announcements that are applicable to the industrial Internet from NI's NIWeek conference held in Austin, Texas, in August 2014. It also examines some examples of how NI's solutions facilitate growth in intelligent systems in the industrial Internet.

SITUATION OVERVIEW

NI is a leading test and measurement company with over $1.1 billion in revenue for 2013. In the quarter ending June 30, 2014, NI grew its revenue to $312.7 million, up from $296.1 million in the year ago quarter, an increase of 5.6%. NI's modular hardware platforms are used in academia as well as a wide range of industries in the test and measurement space. In addition, the company is growing the use of its products in intelligent embedded systems as they simplify and speedup design and implementation.

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National Instruments has three major modular hardware platforms: PXI, CompactRIO, and CompactDAQ. Its software environment is LabVIEW. Key to its embedded systems effort are the CompactRIO platform and the ability to acquire, analyze, and visualize data with LabVIEW:

- CompactRIO is a reconfigurable embedded control and acquisition system powered by a processor and field programmable gate array (FPGA) semiconductor. Processors used in its systems range from Intel microprocessors (MPU) to ARM MPUs depending on the application and platform. The software-designed controller runs Linux Real-Time OS (RTOS), which is supported by LabVIEW.
- LabVIEW enables integration and development on NI's hardware platforms, enabling acquisition and analysis of sensor data, instrument control, FPGA prototyping for embedded control, and test and measurement. Existing libraries of software enable users to quickly prototype and develop on NI's platforms. The LabVIEW platform is differentiated by its higher-level system design environment. For FPGA development, LabVIEW removes the need for designers to know specialized languages such as VHDL or Verilog and allows customization without the need for design experts or consulting services.

As further demonstration of its intent to further penetrate the embedded market, NI announced a system-on-module product, the NI SOM (sbRIO-9651), which combines a Xilinx Zynq system on a chip (SoC), supporting components, and a middleware solution and Linux RTOS. While the CompactRIO system is too large to be utilized in some embedded systems, the NI SOM is a smaller card size module. Developers can utilize the larger module-based CompactRIO to prototype an embedded system and then deploy on the smaller NI SOM.

Although NI has traditionally been categorized as a test and measurement company, IDC notes that the company stands to benefit from three market drivers, namely software-designed systems, intelligent/cyber-physical systems, and big "analog" data systems, which could transform the company into an enterprise-level embedded systems company.

Software-Designed Instruments/Systems

Although virtual instruments (software defined with modular I/O) have existed for a while, a new class of software-designed instrumentation uses user-programmable FPGAs and is in the process of redefining test and measurement systems and moving the industry further away from vendor-defined instruments. Using its programmable FPGA platform approach across its CompactRIO and PXI platforms combined with the LabVIEW system interface that eliminates the need for low-level hardware-defined languages, programmers can create customized test instruments or even customized simulation, monitoring, and control systems. RF test instrumentation engineers have been early adopters of software-designed instrumentation given that the RF test requirements are being redefined with each new evolution of wireless communication.

The elimination of the need for low-level hardware-defined languages is also applicable to a wide range of industrial and energy industries, reducing the need for customized embedded systems and speeding time to prototype development and time to market. National Grid UK demonstrated how this works for the company in the energy space where the CompactRIO platform was utilized directly in performance monitoring in over 100 energy substations across National Grid UK. The platform-based approach with software-designed systems allows for flexibility to adjust to the evolving energy grid as

different energy sources, from microgeneration to renewable energy generation to traditional power generation and decommissioning, occur across its transmission and distribution network.

Cyber-Physical Systems (Intelligent Systems)

Cyber-physical systems are computational systems that are integrated with physical processes. These systems would fall under the intelligent systems nomenclature at IDC. These systems could include medical devices, consumer electronics, traffic control, aircraft control, and a myriad of other industrial systems. Although each of these devices has traditionally been classified as an embedded system, a cyber-physical system could be thought of as a distributed network of these devices interacting with each other. Combining the ability of these devices to interact with a physical process such as an assembly line for manufacturing would result in a cyber-physical system.

Airbus demonstrated how it utilized NI's embedded platform to prototype using CompactRIO then deploy onto NI SOM intelligent shop floor tools as it moves toward its "factory of the future" vision. The manufacturing and assembly of aircraft involves tens of thousands of individual steps that must be followed precisely. Airbus utilized NI's platform to design and build tools and wearable devices with embedded intelligence. The ability of these devices to communicate with one another and with a central control infrastructure eliminates manual data logs and procedures. Airbus envisions a full suite of smart tools that automatically measure and adjust tools to the correct settings as well as monitor and log the results of the operator action. Airbus demonstrated a smart measuring tool that identifies the bolts' locations in the fuselage, measures corresponding sizes and distances, and logs the data for records.

Big "Analog" Data Systems

Big Data can be classified into digital and analog data. Digital data can be structured (such as data from enterprise applications) or unstructured (such as data generated by social media such as Twitter or Facebook). Analog data on the other hand is engineering (generated by industrial systems) and environmental data (such as RF, light, and temperature data and data that has existed since the beginning of the universe) that has to be measured by a sensor and digitized using analog-digital converters for further mining and analysis. NI products (CompactDAQ, PXI, CompactRIO, and WSN) are able to work as analog IoT/M2M gateways, acquiring, aggregating, and digitizing analog data. In addition, NI announced the InsightCM Enterprise suite, which offers data management and transfer, data analytics, and systems management software at the infrastructure/cloud layer for Big Data analysis and mining. Together, these products form a powerful platform for the building of big "analog" data systems for the industrial Internet.

Duke Energy demonstrated its use of NI's InsightCM in its grid. Ultimately, it will be monitoring over 10,000 pieces of equipment at over 60 power plants. It is currently utilizing 1,200 CompactRIO devices and running pilot software at 20 plants. Duke was able to identify a bearing defect at a remote power plant, which allowed for planned repair.

FUTURE OUTLOOK

As intelligent systems in the industrial Internet move toward the edge, the ability to easily program, prototype, and develop systems will enable successful, cost-effective implementations. NI embedded system platforms utilize processors and FPGAs along with NI Real-Time Linux and LabVIEW to enable customers to utilize standardized libraries, analysis tools, and control modules to solve their machine control or monitoring challenges. This platform approach is an attractive alternative to individual systems development for specialized applications and helps speed time to market.

We view the coming years to be a transformative time for NI as it diversifies from a test and measurement company to more of an enterprise-class systems company driven by opportunities in software-designed, cyber-physical or intelligent, and big "analog" data systems. NI is also participating in alliances, consortiums, and standards to enable the industrial Internet and is also a member of the Industrial Internet Consortium (IIC), which we believe will become one of the key consortiums to bring the vision of the industrial Internet to reality.

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