



Debugging demystified?

There is a world of difference between the test and measurement requirements of the shop floor and those of the design lab. Production test is all about rapid, repetitive measurements; test in the lab is all about one off measurements, often to prove a concept.

So it's no surprise that test equipment on the production line differs markedly from the distant cousins used in the design office. In some respects, this doesn't pose a problem; because both areas have their own requirements, the equipment can develop down different paths. But what if engineers on the shop floor could use similar approaches to their design colleagues, whilst still using the equipment with which they are familiar?

Wind River believes this could bring a range of benefits, including boosting production line throughput, more effective validation and verification of finished products, and less scrap and rework. And it also believes that custom test applications could be created more readily.

Its solution is called On Chip Debugging (OCD) for Manufacturing and Test, which is described as a 'standards based offering that provides test and manufacturing engineers with the ability to diagnose hardware problems from the production line'.

According to Wind River, OCD can be valuable in manufacturing test, since it does not require much of the device under test (DUT) to be operational. In addition to being useful for controlling a DUT manually, Wind River's OCD Utility can be used to help structure and test, using higher level tests destined to be implemented with the OCD API and the OCD LabVIEW VIs. Before a test is

A move to link designers with the shop floor is set to ease the debug process. By **Graham Pitcher**.

committed to an automated sequence, the OCD Utility is useful for sequencing through the steps to form a strategy, as well as for determining expected results.

The solution blends Wind River's on chip debug solutions with specific test and manufacturing tooling, along with National Instrument's LabVIEW platform.

The approach takes advantage of the Jtag port available on most microprocessors. Even though the same connector is used, OCD is different than boundary

scan testing. Boundary scan is usually used to test device interconnectivity on the circuit board; OCD debug, meanwhile, is a low level method of accessing the microprocessor's core to execute such primitives as reading to and writing from a register, reading to and writing from a memory location, and starting and stopping the processor executing code.

Specifically, OCD for Manufacturing and Test includes Wind River's ICE and Probe emulator products, the OCD API and Utility JTAG testing solution, and NI's LabVIEW Virtual Instrument Driver. When used collectively, the



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company claims the solution enables manufacturing organisations to:

- streamline the testing process in manufacturing because the DUT does not have to be fully operational
- shorten the manufacturing debug process through target cpu and memory subsystem analysis and debugging
- simplify the creation of elaborate test and automation systems, reducing test/manufacturing costs and improving manufacturing cycle time
- use automated tests that deliver consistent and predictable results.

Sandy Orlando is vice president and general manager of OCD for Wind River. She said: "We recognise that the increasing complexity of embedded device development spans the entire

product development life cycle, including manufacturing and test. Through the use of OCD for Manufacturing and Test, our customers should be able to increase manufacturing throughput by enabling more thorough testing in a shorter amount of time, resulting in the identification and resolution of defects late in the manufacturing process, decreasing scrap inventory, and reducing manufacturing costs. Through our partnership with NI, we enable our joint customers to easily create custom solutions that fit their manufacturing environment needs."

Wind River has made some specific enhancements to its OCD utility in order to support the manufacturing test environment. In particular it has upgraded the memory upload utility and provided support for enhanced Virtual Instruments (VIs).

The Memory Upload Utility allows developers to select a specific area of memory on the target and extract data into a file saved in the host pc file system. This feature allows test and manufacturing engineers to load and run test scripts on their targets, capture the results stored in specific areas of memory and store the results for future reference and analysis.

Meanwhile, the OCD API has been enhanced using National LabVIEW, allowing the creation of higher level VIs. These enable LabVIEW users to create their own custom test applications more easily.

"With the complexity of embedded device manufacturing today," said Greg Crouch, Embedded Systems Business Director at National Instruments, "the value in complementing existing production test management plans with on chip debugging is growing. One such trend is the need for solutions that combine flash programming, on chip software test and verification for device functionality and defect resolution.

"Many manufacturing organisations need additional capabilities beyond traditional boundary scan test. Wind River OCD extends LabVIEW's test management capabilities and reporting mechanisms, thus enabling our joint customers

to deliver products to market quicker and more efficiently."

It's no surprise to find out that LabVIEW is used widely in manufacturing test applications. But Crouch noted that test requirements are changing. "It's gone from functional test to bed of nails to auto inspection, but it's coming back to functional test again because increasing silicon density means you can't use probes. Meanwhile, Jtag has its limitations and boundary scan can be tedious. All of this means on chip debug emulators are being used more and more on the factory floor."

Inside out, outside in

Wind River is also responding to this perceived requirement for better product test and, in Crouch's opinion, the result is 'pretty neat'. "Engineers can test from the inside out and the outside in," he claimed. "Engineers can use LabVIEW and write test scripts, load them into the product and test it more thoroughly. Scripts test from the outside," he added, "and give more power to test engineers. In the past, they often had to depend on the designer. Now, they can execute firmware."

But why a partnership with Wind River? "Our relationship with Wind River touches many areas," he claimed. "National Instruments has been talking for many years about VIs and these have expanded beyond test into control and embedded design."

National Instruments is keen to promote what it describes as 'graphical system design (GSD)' in an attempt to ease the embedded system design process. And Crouch says the Wind River tool is helping to address complexity. "One of the goals of GSD," he continued, "is to help to bring different domains together, for instance allowing a mechanical engineer to be successful in the embedded arena. "Algorithm engineering is often treated differently to programming and design. The LabVIEW library allows you to communicate with the Wind River debugger and that connects the designer's world with the test world. You can test in C, link to production and perform better debug." 