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Think like a fish!

... that's the key to success in the electronics industry, says Joe Costello.

Special Report: Automotive Electronics

Plus: • Shape shifting processors? • Finding faults in complex systems • Probing the intricacies of electronic designs • Overcoming interference in high speed interconnects • Broadening the spectrum for optoelectronics • Enhancing fpga prototype visibility

Complex systems, such as those in aerospace and defence, are driving demand for advanced diagnostics tools. By **Paul Parkinson**.

Finding **fault**

Moore's Law has been exploited in the microprocessors used in desktops and servers, which have seen tremendous growth in their respective markets. Away from the desktop, electronic devices – from pdas to automotive infotainment systems to full blown command and control systems – have seen similar growth as emerging applications have sought to exploit these new hardware capabilities.

Increasing complexity requires ever greater levels of investment, even while time to market windows continue to shrink. This has placed further pressure on device manufacturers to reduce development timescales and to maintain a balance between the financial risks of product development and the financial return from success in the marketplace.

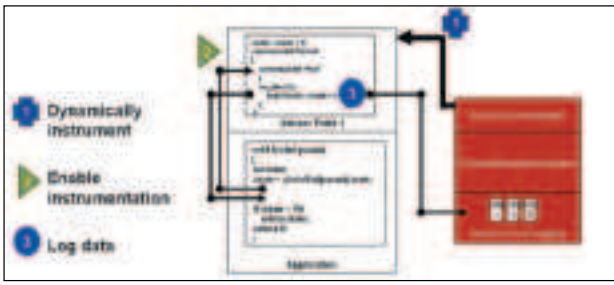
If product development time exceeds scheduled time to market, the success of the product may be greatly diminished. In addition, if the product encounters quality or reliability issues after deployment, the manufacturer's reputation can suffer and product sales will fall rapidly.

In the aerospace and defence industry, the challenges may appear to be very different at first glance. However, there are parallels at the technical level, with programmes striving to achieve technological advantages against a potential foe, and at the commercial level, where programme developments may be undertaken on a fixed price contract basis, and late deployment could even result in financial penalties being imposed.

A handle on the problems

The recently launched Wind River Management Suite provides advanced technologies to address the problems related to the business issues of development time and product quality, which applies across multiple market segments.

Many engineering development organisations are seeking to use new processor technologies and other semiconductors in their device designs, which



can mean that hardware teams need to 'bring up' these new designs and to prove their operation. Sometimes, the scarce availability of new silicon means there is a lack of hardware for the software teams to undertake development on the target hardware early in the development phase.

This parallel development of hardware and software can result in a short and intense integration phase later in the development life cycle, presenting a significant risk to the project development. The later in the development cycle a software fault is detected, the more expensive it is to rectify.

In aerospace and defence, avionics systems and naval command, control, communications and intelligence systems are becoming enormously complex – often comprising many subsystems and millions of source lines of code.

To reduce the risk that a fault detected during testing will require protracted debugging, advanced development diagnostic tools are required to enable software developers and testers to rapidly pinpoint the cause and to test patches to rectify the problem.

"It is unlikely that all potential hardware and software faults will be detected before the product leaves the factory."

Paul Parkinson, **Wind River**

Whilst it is possible for engineering development teams to create these diagnostic tools in house, this can be a distraction from the main product development and can tie up valuable engineering resources. In addition, it is likely that the diagnostics tools will be designed for the specific project under development, and may not provide the scalability or portability required for use on other projects within the engineering organisation.

However, by selecting a suitable COTS based solution, it should be possible to integrate these diagnostics tools into an open framework based on industry standards, providing portability and scalability for use on a range of projects.

To help software developers and testers to pinpoint the cause rapidly and to test patches to rectify the problem, Wind River Workbench Diagnostics uses two runtime technologies – 'core images' and 'sensor points'.

Core images provide a snapshot of the system memory and the state of the processor when a fault occurs. When a fault occurs, the core image can be generated by VxWorks 6.2 (or a later version) and analysed in the Workbench Diagnostics environment, where software developers can isolate the root cause of the problem. This information enables the developer to determine the cause of the fault quickly and then fix the fault using sensor points.

Sensor points provide the ability to patch a running system with new code dynamically. This enables developers to prototype and test possible fixes on a system production build without having to rebuild the software or create a specific debug build which may alter the runtime characteristics of the application.

The sensor points can be enabled and disabled dynamically to confirm the absence and presence of the fault respectively. Once proven, the sensor point can be integrated into the source code at a convenient point in the product test schedule, rather than having to wait to trial the fix in the next production build.

There are two steps involved in sensor points. In step 1, the developer installs the sensor point binary, the Workbench Diagnostic tool downloads the sensor point binary to the running target, where it is received by the Device Management Agent, which places the binary in a reserved area of memory.

In step 2, when the developer enables instrumentation in Workbench, the Sensor Point Manager patches the desired instrumentation point into the original function with the branch instruction to the start point of the sensor point binary. The sensor point will then execute whenever the patched function is executed.

As an example, the sensor point may be written to log variable values with the log() call. This sensor point logs a variable defined in the original function and a variable defined within the sensor point itself. The logging mechanism has minimal impact to the performance of the application.

Service delivery

Even with rigorous testing regimes, hardware and software simulation and integration testing strategies, it is unlikely that all potential hardware and software faults will be detected before the product leaves the factory. As a result, manufacturers are increasingly looking for ways to manage the software in their electronic devices post deployment in order to address software problems which occur in the field, and to provide software patches.

Wind River has recently developed Field Diagnostics technologies, which complement Workbench Diagnostics by providing the ability to run and manage software deployed on devices in the field.

The technology provides a scalable remote diagnostics system that allows support engineers to collect and manage operational information from deployed devices. This provides accurate fault information, which can lead to faster diagnosis and resolution of the fault.

Author profile:

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