



Customer Profile

WIND RIVER

Customer:

Wind River, Inc
Alameda, California

Industry:

Device Software Optimization

Products:

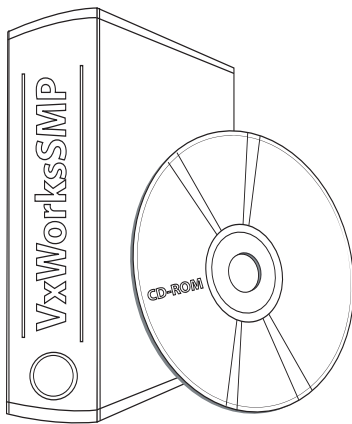
Simics Developer
Simics Hindsight
Freescale 8641D model

Users:

VxWorks-SMP development team

Benefits:

Pre-silicon software development
Improved debugging productivity
Reduce time to market



Case Study: Wind River

Developing a Multi-core Operating System Using Simics

About Wind River

Wind River is the global leader in device software optimization (DSO) enabling companies to develop and run device software better, faster, at lower cost, and more reliably. Wind River technology is currently deployed in more than 300 million devices worldwide by industry leaders like Apple, Hewlett Packard, Boeing, Motorola, NASA, and Mitsubishi. Wind River Professional Services enable leading electronics vendors like Philips, Siemens, Nortel, and Samsung to design, develop, and deploy innovative products on or ahead of schedule, at or below budget.

DSO is a holistic, enterprise-wide solution to the challenges generated by increasing complexity in developing and running device software. Key tenets of the DSO solution include standardization of technologies and processes across projects, teams, and sites, and the embrace of open standards to provide companies with the broadest possible choice of tools, technologies, and architectures. Wind River's DSO solution is built on a choice of operating systems, an ecosystem of validated and integrated partner technologies, and expert services and support available around the world, around the clock.

Problem

Multi-core chips for embedded applications had been announced by a number of semiconductor companies, so Wind River knew that it would need to provide multi-core versions of its operating systems which supported

task of creating a multi-core version, which eventually would become VxWorks-SMP, was a major undertaking, involving over 25 engineers for more than a year. Waiting until silicon was available in late 2006 would

“Simulation is really the only way to develop multi-core software”

--Tomas Evensen, Chief Technical Officer, Wind River

symmetric multi-processing. One of the first chips targeting this market was the Freescale MPC8641D dual-core high-performance processor for embedded networking, telecom, military, storage and pervasive computing applications. However, silicon was not available in December 2005 when the development needed to start, and was only tentatively scheduled to be available in fall 2006.

VxWorks had historically supported only single-core processors and so the

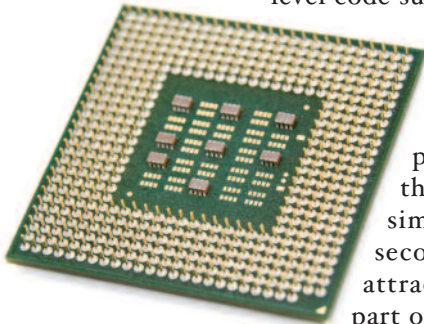
neither meet the internal needs of Freescale themselves, nor of the early end-users needing to run VxWorks on 8641D-based systems.

When first prototype silicon was finally available in November 2006 it still contained errors. For example, there were major difficulties in getting the system to run in symmetrical multi-processing mode which meant that it was unusable for testing the most challenging parts of the code.

“ We have used it extensively to debug race conditions or problems while making the kernel SMP safe that would have required an ICE. The difference was that Simics was quicker ”

Solutions

Virtutech had developed a model of the Freescale MPC8641D which was available in early 2006. The model was accurate enough that it could run production code unchanged, even low-level code such as the internals of the VxWorks kernel and the device drivers in boars support packages (BSPs). The model had a performance measured in the hundreds of millions of simulated instructions per second meaning that it was attractive to use the model as part of the edit-compile-debug loop of the software engineers developing the multi-core version of VxWorks.



Simics Developer is completely deterministic, meaning that even subtle bugs caused by timing issues between the two cores can easily be reproduced, which is not the case with physical hardware. In addition, Simics Hindsight allows deep bugs to be discovered by simply waiting for the system to crash or hang and then running the system in reverse to determine the root cause. Simics exposes all of the internals of the multi-core processors in a way that JTAG-based debugging cannot, and it does this in a completely non-intrusive way.

To further stress synchronization protocols between the two cores it is possible to run the cores with different clock frequencies. Virtutech even has a four-core version of the chip (the 8641Q?) to future-proof software by running it on configurations that are today merely points on a future roadmap.

Benefits

By using Virtutech Simics and the Virtutech model of a Freescale MPC8641D-based system meant that Wind River's VxWorks-SMP development team could start work close to a year ahead of silicon availability, which meant that the final product would be available a lot earlier than it would be if development was based on waiting for the availability of prototype silicon.

In addition, debugging multi-core systems using physical hardware is known to be a hard problem since they are not deterministic and it is not possible to freeze and single-step the system. Virtualized software development avoids both these problems: the system is completely deterministic and time is carefully managed so that the system can be stopped and restarted at will, and even reversed to discover why the system had ended up in an unexpected state. "Using a model of the hardware is really the only practical way to debug a multi-core system," said Tomas Evensen, CTO of Wind River.

When prototype silicon was finally available, even members of the development team who were initially skeptical about virtualized software development had become converts, wanting to continue to do development in the virtual environment and use the now-available silicon just for final testing of the product. "I identified many performance improvements using the Simics branch profiler," said one of the engineers.

VxWorks-SMP is currently in early release with beta customers, and will be generally available in the fall 2007 release of Wind River's products.



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