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Application: Microkernel Developed Using MIPS Malta EPK

Industry: Academia

Customer Challenge

At the University of Wrocław Institute of Computer Science, several students including Rafal Cielak, a master's candidate, under the auspices of Professor Krystian Bacławski, are developing a micro-kernel for the Malta MIPS platform. The project was to investigate the platform and OS development process, learn about internal kernel mechanisms, and explore challenges that arise when designing a micro-kernel. With no access to actual Malta boards, they needed a convenient, affordable solution for high-level simulation and exploration of the Malta platform running OS. So, the professor provided a full Imperas OVPsim license for use in the Institute lab.

Imperas Solution: OVPsim Beats QEMU

For platform simulation, initially they used QEMU, but were disappointed with its low fidelity, so they switched to OVPsim - and say the difference was huge. Professor Baclawski stated, "OVPsim beats QEMU in fidelity in CPU simulation – its' determinism and speed were pretty impressive. OVPsim configurability is a big advantage as well. We were able to configure low-level CPU features, thanks to comprehensive documentation. I was also enthusiastic about the machine description file. It was easy to connect a missing interrupt signal we needed."

They experienced good progress, and were able to run the Linux kernel. Rafal Cielak commented, "We're having a great time with OVP, and given the momentum our project is gaining, I can see us using OVPsim for our research for a long time."

Benefits

Highlights of what this program appreciated most in Imperas virtual platforms and the high-performance simulator OVPsim:

- Fast performance of high-level simulation, with very strict conformance to platform specs.
- Perfect determinism, a particular feature not offered by other simulators/VMs. Having the kernel run 100% consistently each time is tremendously helpful for debugging, unlike QEMU where interrupts arrive at seemingly random patterns.

For a video demo on the MIPS Malta Platform booting Linux in 4 seconds see www.imperas.com/mips-malta-linux-video-1-installing-ovpsim-simulator-mips-malta-platform-and-booting-linux-boots-in

Design Challenges

- Developing a micro-kernel for the Malta MIPS platform
- Investigating OS development process
- Learning about kernel mechanisms
- Exploring challenges that arise when designing a micro-kernel

Results

- Simulation of the MIPS Malta platform and Linux with OVPsim
- OVPsim simulator superior to QEMU
- Strict conformance to platform specs
- Perfect determinism
- Fast performance for high-level simulation

To learn more about this project

- See their repository at https://github.com/cahirwpz/mimiker.

"" All in all... if one is interested in high-fidelity CPU simulation – OVPsim is a better choice than QEMU."

Professor Krystian Bacławski, Institute of Computer Science at University of Wroclaw