Experiences with Compiler Support for Processors with Exposed Pipelines

Field programmable gate arrays, FPGAs, have become an attractive implementation technology for a broad range of computing systems. We recently proposed a processor architecture, Tinuso, which achieves high performance by moving complexity from hardware to the compiler tool chain. This means that the compiler tool chain must handle the increased complexity. However, it is not clear if current production compilers can successfully meet the strict constraints on instruction order and generate efficient object code. In this paper, we present our experiences developing a compiler backend using the GNU Compiler Collection, GCC. For a set of C benchmarks, we show that a Tinuso implementation with our GCC backend reaches a relative speedup of up to 1.73 over a similar Xilinx Micro Blaze configuration while using 30% fewer hardware resources. While our experiences are generally positive, we expose some limitations in GCC that need to be addressed to achieve the full performance potential of Tinuso.
Testing Infrastructure for Operating System Kernel Development

Testing is an important part of system development, and to test effectively we require knowledge of the internal state of the system under test. Testing an operating system kernel is a challenge as it is the operating system that typically provides access to this internal state information. Multi-core kernels pose an even greater challenge due to concurrency and their shared kernel state. In this paper, we present a testing framework that addresses these challenges by running the operating system in a virtual machine, and using virtual machine introspection to both communicate with the kernel and obtain information about the system. We have also developed an in-kernel testing API that we can use to develop a suite of unit tests in the kernel. We are using our framework for the development of our own multi-core research kernel.

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Unit Testing Framework for Operating System Kernels

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