

Computer science researchers explore virtualization potential for high-end computing

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Dimitrios Nikolopoulos, associate professor of computer science, and Godmar Back, assistant professor of computer science, both at Virginia Tech, have received a National Science Foundation (NSF) – Computer Science Research (CSR) grant of \$300,000 for their Virtualization Technologies for Application-Specific Operating Systems (VT ASOS) project.

"By combining supercomputing, parallel programming, virtualization, and operating systems aspects, this new grant demonstrates the new possibilities for collaboration that were enabled by bringing together different researchers with different areas of specialty under the roof of the Center for High-End Computing," Back said.

Applications running on modern supercomputers need system software modules--such as operating systems, compilers, and runtime libraries--tailored to specific characteristics of the applications and specific properties of the underlying hardware.

Unfortunately, there is no "one size fits all" approach to developing system software for supercomputers, because of the diversity in application characteristics and because of numerous interweaving interactions between software and hardware.

This problem becomes acute with the introduction of multi-core and

many-core processors, i.e. processors with tens or hundreds of execution cores packaged on a single chip. The complexity of the hardware and the hardware/software interfaces is responsible for negative interference between applications and system software and for counterintuitive behavior of the system as a whole.

“This research develops a new framework for customizing the system software environment that hosts the execution of parallel applications, on emerging supercomputers built from multi-core processors. We leverage paravirtualization, a technique which enables us to tailor the system software to applications, tune applications and system software in a synergistic manner to make best use of hardware resources, minimize the intrusiveness of system software, and eventually improve performance and utilization on precious supercomputing resources.” Nikolopoulos said.

“On the technical side, our goal is to develop a new paravirtualization framework that provides applications with significantly more accurate view and accounting of hardware resources than existing paravirtualization systems, such as Xen,” he concluded.

According to the NSF website, the CSR program supports innovative research and education projects that have the potential to lead to significant improvements in existing computer systems by increasing our fundamental understanding of such systems; produce systems software that is qualitatively and quantitatively more reliable and more efficient; and/or, to produce innovative curricula or educational materials that better prepare the next generation of computing professionals.

The CSR program is also interested in projects that expand the capabilities of existing systems by exploiting the potential of new technologies or by developing innovative new ways to use existing technologies. Projects supported will strive to make significant progress

on challenging, high-impact problems—as opposed to incremental progress on familiar problems—and will have a credible plan for demonstrating the utility and potential impact of the proposed work, according to NSF.

Source: Virginia Tech

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