UF leads world in reconfigurable supercomputing

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University of Florida researchers say their supercomputer, named Novo-G, is the world's fastest reconfigurable supercomputer and is able to perform some important science applications faster than the Chinese supercomputer touted as the world's most powerful.

In November, the TOP500 list of the world's most powerful supercomputers, for the first time ever, named the Chinese Tianhe-1A system at the National Computer Center in Tainjin, China as No. 1.

In his state of the union speech, President Barack Obama noted, "Just recently, China became home of the world's largest solar research facility, and the world's fastest computer."

But that list does not include reconfigurable supercomputers such as Novo-G, built and developed at the University of Florida, said Alan George, professor of electrical and computer engineering, and director of the National Science Foundation's Center for High-Performance Reconfigurable Computing, known as CHREC.

"Novo-G is believed to be the most powerful reconfigurable machine on the planet and, for some applications, it is the most powerful computer of any kind on the planet," George said.

"It is very difficult to accurately rank supercomputers because it depends upon what you want them to do," George said, adding that the TOP500 list ranks supercomputers by their performance on a few basic routines

in linear algebra using 64-bit, floating-point arithmetic.

However, a significant number of the most important applications in the world do not adhere to that standard, including a growing list of vital applications in health and life sciences, signal and image processing, financial science, and more under study with Novo-G at Florida.

Most of the world's computers, from smart-phones to laptops to Tianhe-1A, feature microprocessors with fixed-logic hardware structures. All software applications for these systems must conform to these fixed structures, which can lead to a significant loss in speed and increase in energy consumption.

By contrast, with reconfigurable machines, a relatively new and highly innovative form of computing, the architecture can adapt to match the unique needs of each application, which can lead to much faster speed and less wasted energy due to adaptive hardware customization.

Novo-G uses 192 reconfigurable processors and "can rival the speed of the world's largest supercomputers at a tiny fraction of their cost, size, power, and cooling," the researchers noted in a new article on Novo-G published in the January-February edition of the IEEE Computing in Science and Engineering magazine.

Conventional supercomputers, some the size of a large building, can consume up to millions of watts of electrical power, generating massive amounts of heat, whereas Novo-G is about the size of two home refrigerators and consumes less than 8,000 watts.

Later this year, researchers will double the reconfigurable capacity of Novo-G, an upgrade only requiring a modest increase in size, power, and cooling, unlike upgrades with conventional supercomputers.

In their article, the researchers discuss Novo-G and its obvious advantages for use in certain applications such as genome research, cancer diagnosis, plant science, and the ability to analyze large data sets.

Herman Lam, an electrical and computer engineering professor and co-investigator on Novo-G, said some vital science applications that can take months or years to run on a personal computer can run in minutes or hours on the Novo-G, such as applications for DNA sequence alignment at UF's Interdisciplinary Center for Biotechnology Research.

Provided by University of Florida