EE Times Connecting the Global Electronics Community

designlines AUTOMOTIVE

News & Analysis

Berkeley discusses progress in parallel programming

Rick Merritt

2/12/2010 01:00 AM EST

BERKELEY, Calif. — Researchers gave an update Thursday (Feb. 11) on their work to find new programming models for tomorrow's many-core processors at an annual event at the University of California at Berkeley. In addition, Berkeley announced two new research centers—one focused on low-power circuits and another on cloud computing.

Separately, researchers here called for a new class of power engineers to deal with emerging energy challenges. The field needs cross-trained experts to bring the lessons of the Internet to tomorrow's smart electric grid, they said in a panel discussion at the event.

Kurt Keutzer, a professor working at Berkeley's Parallel Computing Lab, described more than half a dozen applications researchers have written using a new parallel methodology called Pallas. In addition, work has begun on a more general framework for parallelism called Copperhead that could be used by a wider group of programmers, he said.

The Parallel Lab and a similar lab at the University of Illinois was launched in December 2008 with a $20 million grant from Intel and Microsoft to find programming models to harness CPUs packing dozens of cores. "We know we can build such chips, the question is can we program them," Keutzer said.

Keutzer reported results on seven high-performance applications using the Pallas methodology. In the approach, graduate students implement complex algorithms from domain experts. They begin by creating software architectures specific to the algorithms that maximize their use of computational and structural patterns, then map those architectures on to parallel processors.

Using this approach, one team created a program that reduced the time needed to create an MRI image from one hour to one minute. The code is already being used at a local children's hospital.

In another example, the approach reduced the time to handle object recognition from 222 seconds on an Intel Nehalem processor to 1.8 seconds on a massively parallel Nvidia GTX 280 chip. Other efforts in areas including speech recognition, option trading and machine learning showed results ranging from 11 to 100-fold performance gains.

"But we can't produce at Berkeley enough of these [expert] parallel programmers to create all of tomorrow's applications, so they will also work on creating programming frameworks" less expert programmers can use, Keutzer said.

The Copperhead framework being co-developed with Nvidia is focused on generating fast executable code for data-parallel applications. It will work both with Nvidia's Cuda and the OpenCL environments.

So far, that work is still in an early stage. "Certainly, a year from now I'll have something to show that hopefully convinces you this is a promising approach," Keutzer said.

Separately Berkeley, MIT and at least four other universities are creating the Center for Energy Efficient Science. It will conduct research in moving toward semiconductor circuits that can operate on a millivolt of power.

"We could be using a million times less energy to process information," said Eli Yablonovitch, a Berkeley professor who will work with the center.

In a panel discussion Yablonovitch and others called for a new generation of power engineers who can apply the techniques of the Internet to craft a smart electric grid.

"We need new thinkers to have an impact on this area," said Randy Katz, a Berkeley professor who helped launch a low-power research effort at the event in 2009.

"This is an opportunity to think about what is the right background—it's not the old Handbook of Power Engineering," Katz said. "It's an opportunity to train a new generation of people who understand both IT systems and how power moves around," he added.

David Culler, a Berkeley professor working on an initiative for energy-efficient buildings, said engineers need to understand a variety of mechanical, civil and electrical disciplines in this sector. "I really worry we are not training people for the wide range of issues coming up," Culler said.

He called for a smart grid that uses Internet-like techniques such as distributed services and separately-defined implementation layers that can evolve independently. "Just like we have virtual networks as overlays on the Net, there's no reason we can't have virtual private grids--that's how you evolve the infrastructure," Culler said.

Katz agreed, adding that new regulations including a carbon tax are needed to motivate utilities and power users. "In order to have the innovation take place the true cost of energy has to be reflected, it's the only way to get people to invest," he said.

Finally, Berkeley professor Michael Franklin formally announced the AMP Lab, a new research center seeking to drive cloud computing to the next level. The center aims to address what Franklin called the scalability problem involving algorithms, machine learning and people.

Machine learning algorithms and data analytics don't scale to increasingly large and complex data sets. Meanwhile cloud services lack crowd-sourcing tools to harness large groups of people over the Internet to tackle shared problems.

The lab is a spin-out of a Berkeley center developing software that will help individuals use cloud computing to launch new Web services. The new lab wants to enable many people to collaborate to collect, generate, clean and make sense of large data sets, he said.