

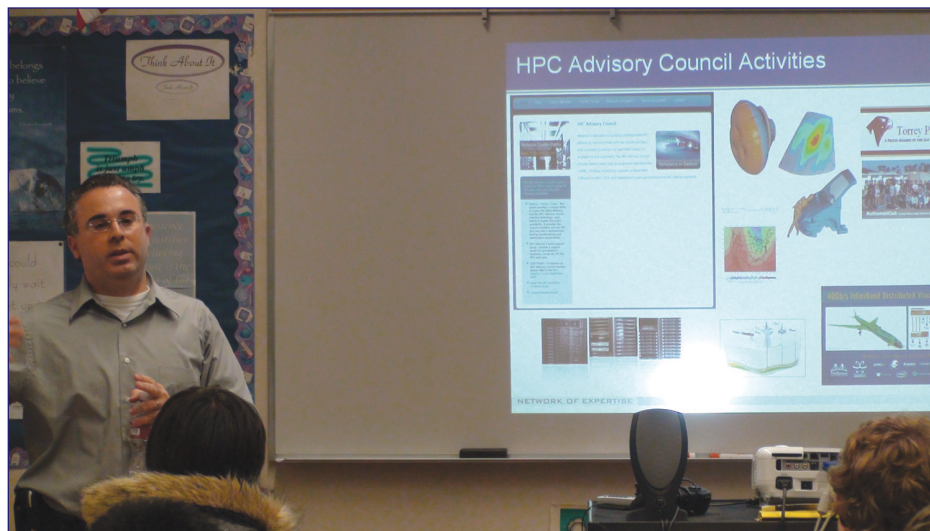
HPC Advisory Council Brings Cluster Computing to Torrey Pines High School

One of the key challenges for America's economic future is to provide advanced educational opportunities for the next generation of leaders. Throughout the country, high schools offer advanced mathematics classes, and students are eager to learn how to apply the latest computer and software technology to real-world problems in engineering, math, life sciences, and economics. Now, the HPC Advisory Council has contributed to these efforts by providing hardware, software, and guidance on the use of an advanced cluster computing system to Torrey Pines High School in San Diego, California.

Single-Processor Hardware Limits Math Software

Among the 2500 students at Torrey Pines High School, many are very interested in math, science, and technology topics in preparation for careers in engineering, medicine, software development, and other disciplines. For students who have already completed other advanced courses such as Advanced Placement Calculus, teacher Abby Brown offers a course called Advanced Topics in Math.

The class was formed a few years ago in partnership with Wolfram Research to give students an opportunity to explore their own projects with Wolfram's *Mathematica* program, which is one of the standard math tools used in industry. Using *Mathematica*, students have learned about areas of math outside of the traditional school curriculum and have applied math in fields such as physics and economics. Unfortu-



nately, the complexity of student math problems meant that individual problems took up to several minutes to execute, with a typical problem taking more than a minute. Given the limited class time, this bottleneck meant that only a handful of students could explore their own projects during any given session.

Searching for a way to upgrade the computing hardware, Brown reached out to her contacts at Wolfram Research. "Through the partnership with Wolfram, we got in touch with the High Performance Computing (HPC) Advisory Council," says Brown.

Formed in May 2008, the HPC Advisory Council is a computing ecosystem comprised of more than 60 members, including best-in-class original equipment manufacturers (OEMs), strategic technology suppliers, independent software vendors (ISVs) and selected end-users across the entire range of HPC market segments. The Council's main mission is to educate students and industry

about the beneficial capabilities of HPC for research, education, innovation and product manufacturing, and to help users gain the expertise needed to operate HPC systems. The Council also provides application designers with the tools needed to enable parallel computing, and strengthens the qualification and integration of HPC system products.

"The Council was interested in donating a cluster computing system in a high school setting," says Brown, "and my classroom was chosen to be the recipient. It was a great opportunity to give the students access to cutting-edge computing technology, and to learn about an area of computing that they would not normally see."

Parallel Processing Performance

On December 15th, 2008, students in the Advanced Topics in Math class arrived to find several boxes containing an HPC system provided by the HPC Advisory Council. Consisting of four compute nodes

provided by Colfax International and powered by quad-core AMD processors, the computers are connected with network switches and adapters based on Mellanox high-speed InfiniBand technology. The system included Microsoft Windows HPC Server 2008 and Wolfram Research *gridMathematica*, which allows math problems to be distributed across all four servers for faster processing of complex mathematical simulations.

With this donation, the class now had a cluster based on the same architecture used by many of the world's fastest supercomputers, including the fastest supercomputer in the world, which is located in Los Alamos National Laboratory. Even though it was a powerful system, however, it was easy to set up and use by students in the class.

"We hooked it up in about twenty minutes the day it arrived, and the students worked with it all day," says Brown. "Everything was color-coded. We just set up the servers and switches, plugged the monitor and keyboard, and connected the servers with the InfiniBand switch so they could exchange data while working on problems. It was much easier than the students or I had expected."

Once it was up and running, the cluster immediately began delivering outstanding performance. In one example, a *Mathematica* problem that took a minute or more to run on the old single-processor system now runs in five seconds on the cluster under *gridMathematica*.

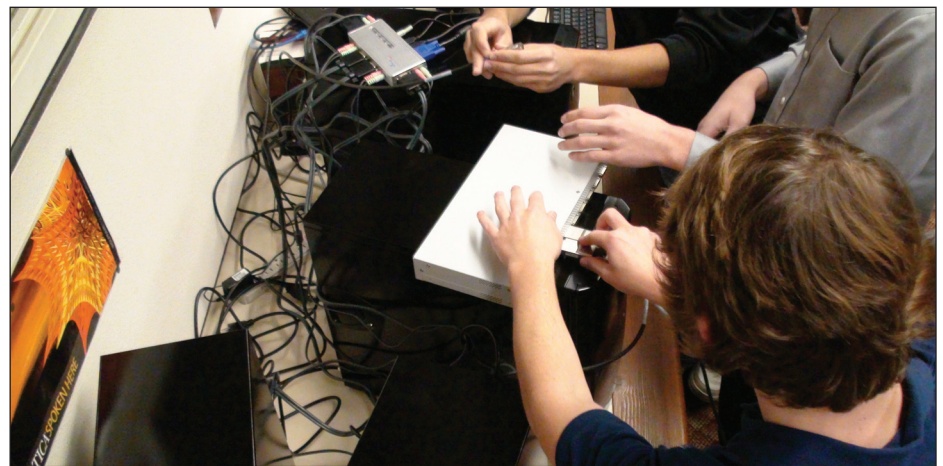
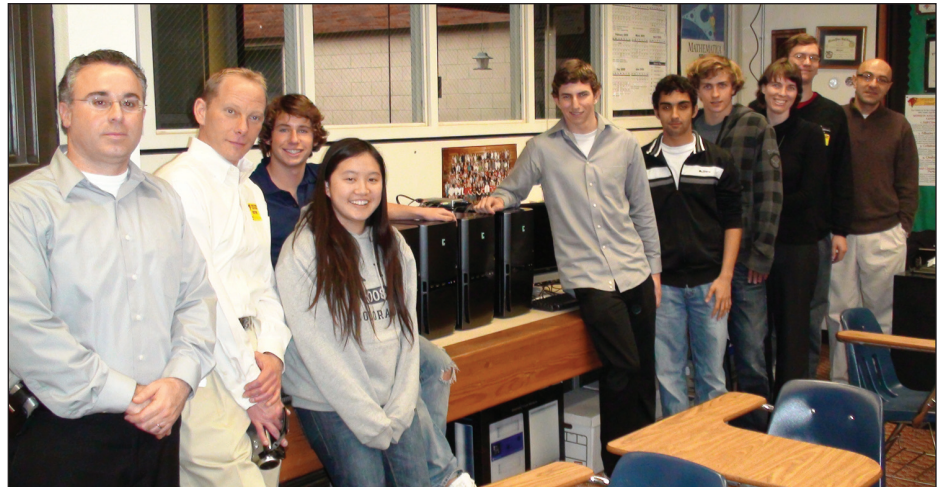
"This has made a big difference," says Brown. "We had been hoping to expand the types of *Mathematica* projects we could do since we were

time-limited by our old single-processor system. With this new cluster, we can tackle broader projects that more people in the class can work on, and maybe get farther into some real-life applications."

Under the terms of the donation, the HPC Council Advisory will provide support for the Torrey Pines High School system throughout the cluster's lifetime, and will also offer educational support on parallel computing usage models. As it is, however, the students have taken to the system so quickly that they may not need much support. "The students seem to be moving ahead with the

new system without any direction at all," says Brown. "It's really great to see them so excited about this new capability and to see them putting it to use immediately."

With the power of advanced cluster-based computing at its disposal, the Advanced Topics in Math class at Torrey Pines High School has significantly expanded its field of exploration. Now, students can apply their skills and interests in the process of learning about high performance cluster computing technology, gaining important skills that will help advance their careers – and America's technical prowess – in the future.



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