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Foundation Grant Supports Supercomputing Exhibit

BY EMILY SOPENSKY

On 26 May 2008 the U.S. Department of Energy's Roadrunner supercomputer at the Los Alamos National Laboratory in New Mexico became the fastest computer in the world: It exceeded 1000 trillion calculations per second, breaking the petaflop barrier. A petaflop is a measure of a computer's processing speed and can be expressed as a thousand trillion floating-point operations per second.

Reaching petaflop speeds gave Los Alamos bragging rights. Then the Cray XT5 Jaguar (1.75 petaflops) at the Oak Ridge Laboratory, in Tennessee, snatched the title away. TOP500, the record keeper for supercomputers, reported in its 36th edition in November that the current supercomputing speed star is China's Tianhe-1A (2.57 petaflops).

SAVING THE SUPERS
Supercomputers are used for calculation-intensive tasks such as quantum physics problems, weather forecasting, and simulations of airplanes in wind tunnels.

National security, advanced bioscience, and environmental stewardship drive the Los Alamos lab's need for fast, complex computing power. Its first supercomputer was the Cray-1, which began operations in 1976 with speeds topping 100 megaflops. It became one of the most successful supercomputers in history. The latest addition to the lab's hardware is another Cray computer, nicknamed Cielo. Based on the Cray XT architecture, Cielo is designed to support the National Nuclear Security Administration, a partnership of three national labs: Los Alamos, Sandia, and Lawrence Livermore. The Cielo is No. 10 on the Top 500 list; Roadrunner is No. 7. When completely installed later this year, the Cray computer is expected to operate at a speed of approximately 3.5 petaflops.

To recognize the contributions of the Los Alamos supercomputers, a team from the IEEE Los Alamos Section applied to the IEEE Foundation in 2009 for a grant to upgrade the outdated computing exhibit at the lab's Bradbury Science Museum.

Sitting on the Pajarito Plateau about 1300 meters above sea level in the Jemez Mountains, the town of Los Alamos is framed by tall piñon trees and dotted with booths that control access to the facility. Much of the town is surrounded by fences that secure the lab, which is indeed remote. But don't underestimate the lure of history and science, especially when reinforced by an inviting entrance and warm greetings from museum staff. The museum attracts almost 100 000 visitors annually from around the world.

As with each of the DOE's national labs, the museum supports community outreach and education efforts. The lab traces its history from the World War II Manhattan Project to today's efforts to reduce global threats. The museum has three galleries, which focus on the lab's contributions to defense, research, and history. With funding cuts, the lab can provide only maintenance funding for exhibits, which excludes updating existing exhibits or adding new ones. Thanks to the Foundation grant awarded in 2009, the supercomputing exhibit, slated to be finished this month, has 12 new displays.

The request to the foundation for US $28 585 was approved with little fanfare. Written by David Izraelevitz, past chair of the section, the grant request appealed to the foundation's funding preference for historical and educational projects. The request was attractive because six other organizations agreed to support the project with assistance valued at $74 645. Three of those six organizations are lab-related (the museum, the High Performance Computing Division, and the Communications Arts and Services office).

Support included identifying and removing any residual classified data from associated memory devices, as well as officially declassifying the devices so they could be included in the exhibit. Digital Publications, a company in Los Alamos that develops and implements software quality-assurance processes, provided project oversight.

Interns from New Mexico Highlands University who were preparing for careers in museums and cultural arts multimedia worked on the interactive displays' graphical interface. Section Chair John T. Zoltai manages the project along with the museum's director, Linda Deck.

CLIPPING GRASS

One of the new displays is Comparing Computers Through Time, which highlights the lab's supercomputers side by side.

Brainstorming about how to quickly engage and enlighten museum visitors about supercomputer speeds, the exhibit's project team wanted an easy-to-understand illustration that intuitively captures the nature of the computer's domain: quickly executing tedious, repetitive tasks. Accordingly, the display offers two patches of grass to be "mowed" by the supercomputers. The lawn trimmed with the Cray 1 is slowly clipped by hand, one blade at a time. In comparison, the Roadrunner power mower whips through the lawn in seconds. A victory bell rings loudly, signaling the effortless win for the Roadrunner.

Clearly enjoying the display, Ben, Josh, and Danny Thorp, along with their father, John (part of the installation team for at least three of the lab's supercomputers), try the remaining comparisons among five other historically important lab supercomputers: the 1976 Cray 1, the 1981 IBM PC, the 1986 CM-2 1986, the 2002 Q Mac, and the 2009 Roadrunner.

The other 11 displays trace the history of the lab's computers from the Manhattan Project calculators, the transistor revolution, parallel processing and clusters, computer modeling of earth processes, to the Roadrunner.

NEXT STEPS

Today the strategic plans for many museums reach beyond attracting in-

person visits. Building a strong Internet presence that lures visitors of all ages is just as important. The Bradbury now gets about 1.5 million visits to its website annually.

The next step in the supercomputing exhibit is to introduce virtual displays using mobile apps for the Apple iPhone and Droid-based smartphones. With the help of an intern from NMHU, the applications should be completed this year, Deck says.

For more on supercomputing speeds, see "Better Benchmarking for Supercomputers," *IEEE Spectrum*, January 2011.

Sopensky is an IEEE senior member.

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