

University of Colorado Boulder Improves Cluster Performance and Support with Bright Cluster Manager®

CASE STUDY

When the University of Colorado at Boulder needed to upgrade and add to the high performance compute cluster used for mechanical engineering research, they wanted to take the opportunity to solve some of the problems they'd been experiencing. After they replaced their original cluster management platform with Bright Computing's Bright Cluster Manager, they were able to boost cluster performance by more than 10 percent for some users, while eliminating a laundry list of annoying issues that had a negative effect on the important research being conducted. In addition, both administrators and users have especially taken to Bright's hands-on technical support team approach, which includes detailed user manuals, videos, and remote sharing that teaches the administrators how to fix issues themselves.

Management issues confound University of Colorado cluster administrators

The Department of Mechanical Engineering, University of Colorado at Boulder, first deployed its high performance compute (HPC) cluster in 2010. Dubbed Prospero, the cluster was composed of 32 nodes, and used a Linux distribution designed for high-performance computing clusters.

Over the next few years, several mechanical engineering labs used the cluster extensively. Examples of their cutting edge research projects include improved decision support tools through inverse modeling and sensitivity analysis; constraining ammonia distributions through remote sensing, modeling and surface observations; accounting for costs of air quality and climate impacts on the future US electricity mix; and looking at sources of nitrate in Antarctica, among many others.

While pleased with the cluster resources, users and administrators experienced numerous challenges with the management platform on which the cluster was running. Dr. D. K. Henze, Assistant Professor of Mechanical Engineering, expressed concern about some of these issues. At the top of his list were losing Intelligent Platform Management Interface (IPMI) access to one node and being unable to reinstate it; skipped node numbers after hardware upgrades; issues with creating and moderating user accounts; dropped support for the Terascale Open-source Resource and QUEue Manager (TORQUE) + Maui Cluster Scheduler job queuing system; and queue manager issues that led to jobs not being run. On some occasions, new users did not have access to compute nodes and the account had to be deleted and re-created.

"We had no good way of monitoring the health of the nodes," said Dr. Henze. "A few times, the air conditioning units in the room stopped working and all of the nodes got very warm. The software automatically scaled down the processes to protect the hardware, but it didn't give us any kind of notification."

But perhaps the biggest issue was the lack of customer support. "If a new problem arose, it was not very intuitive to solve. Issues had to be resolved by searching online forums and mailing lists," says Dr. Henze. "In one instance, I spent many hours searching online just to find the name of the specific setting that I wanted to change. We would run into troubles and struggle to fix them ourselves."

This lack of support, combined with an unintuitive user interface and difficulty with node health monitoring, spelled trouble for Prospero's users.

Adding resources and transitioning to a new management system

In 2014, the Department sought to expand its resources by adding 8 nodes to the cluster and relicensing its management system. Ace Computers, their hardware reseller, helped them go through several hardware options over the next couple months as Intel came out with the next generation Haswell E5 CPUs that took DDR4 memory. At the same time Ace suggested that Henze begin managing Prospero with Bright Cluster Manager to solve support issues and boost cluster performance.

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To get the ball running, Bright Computing provided a one-week free trial to the University of Colorado at Boulder's Prospero team. The team did their own Bright test installation (one head and two virtual compute nodes) and was impressed by the cluster manager's smooth installation. The virtual environment created by the trial deployment also allowed the Prospero team to experience Bright's intuitive, user-friendly graphic user interface (GUI).

The Prospero team found that the configuration was very easy on the virtual environment (no IPMI or InfiniBand network). Adding new nodes was also fairly easy. They also learned that, due to the new tool chain, they would be able to install newer versions of key software like the Python programming language and R and RStudio, the free software programming language and software environment for statistical computing and graphics.

Ace Computers then took the existing 32 node cluster running the original distribution, added 8 nodes running current technology, and converted the entire cluster to Bright Cluster Manager.

The transition was made even smoother by the detailed user resources available. "From the very start, we have been impressed by the customer-centered, intuitive nature of every aspect of Bright Cluster Manager," said Henze. "Bright offers useful, updated manuals, detail-oriented videos on their YouTube channel about various configuration subjects, and a convenient GUI for configuration and management."

"Our cluster management experience has vastly improved since deploying Bright Cluster Manager."

— Dr. Henze,
University of Colorado
Boulder

When minor issues arose in the full-scale deployment, the Bright team was able to remotely access Dr. Henze's console, sharing his screen to resolve the issues seamlessly while teaching him how to do so himself the next time around. "Bright offers great customer support, with a rapid response to our emails and phone calls, and remote access to our GUI if necessary," Dr. Henze added. "We've found that to be one of the most useful aspects of their product, especially after struggling to resolve the issues with our distribution for so long."

Besides addressing the prior troubles, administrators had encountered in running and maintaining Prospero, the 8-node expansion and distribution update effectively uses the Intel Haswell E Series Processor. Prospero users have reported a performance boost of greater than 10 percent, most probably due to newer kernel and new device drivers.

Users also reported satisfaction with how modules now avoid having issues with conflicting libraries. Dr. Shannon Capps, a postdoctoral research associate working on the impact of energy production methods on regional air quality, commented that it was now easy to load libraries for Community Multi-scale Air Quality Model (CMAQ). In addition, providing sample scripts has made it very easy to spin up the adjoint work. She added, "The opportunity to visualize output directly from Prospero will speed analysis in the future. And having the data directories preserved was very nice."

The University also received an extremely competitive pricing deal for Bright Cluster Manager from Ace Computers, always appreciated by educational institutions with an eye on their computing budgets.

"For the same cost as upgrading our old, problematic platform, we got all of the benefits of the Bright solution: our cluster is running smoothly, we feel that we have a great handle on issues as they arise, and the performance is excellent," said Dr. Henze. "Our cluster management experience has vastly improved since deploying Bright Cluster Manager."