

Clemson University Chooses PBS Professional for HPC Workload Management



Key Highlights

Industry
Academia

Challenge
To have a reliable workload manager that can easily scale out to support a growing usage base

Altair Solution
PBS Professional with maximum scalability, reliability and support

- Benefits**
- Comprehensive technical support
 - Improved productivity
 - Reliability with robust performance

Customer Profile

Ranked in the top 25 among national public universities, Clemson University is a major land-grant, science- and engineering-oriented research university that maintains a strong commitment to teaching and student success. Clemson is an inclusive, student-centered community characterized by high academic standards, a culture of collaboration, school spirit, and a competitive drive to excel.

The university's IT department, Clemson Computing and Information Technology (CCIT), provides cyberinfrastructure resources and advanced research computing capabilities. CCIT supports an array of advanced computing infrastructure

made possible through integration of high-performance computing (HPC), high-performance networks, data visualization, storage architectures, and middleware.

The Challenge: Supporting the Cluster for a Rapidly Growing Usage Base

CCIT utilizes the Palmetto cluster as Clemson University's primary HPC resource. This 17,032-core, 262 TFlop HPC system is heavily utilized by the university's faculty, staff, students and 144 external users consisting of researchers and faculty in other universities that partner with Clemson University. Adopting a 'condo model' for their cluster, CCIT offers Palmetto users the option to purchase nodes for their own

Clemson University Success Story



“We were looking to fulfill two requirements that our open source scheduling tool could not handle – reliability/scalability and technical support. After evaluating workload management vendors, Altair’s PBS Professional scheduling software came out on top as *the* solution that met our HPC needs.”

Randall Martin,
Executive Director of Advanced Computing Infrastructure, Clemson University

priority usage. The 'tenants' who purchase nodes receive 24/7 priority job time for the amount of nodes they purchased. General 'non-tenant' jobs use the leftover available cycles and the jobs are eligible for preemption by the priority 'tenant' jobs.

CCIT previously used the open-source Maui scheduler, which was not able to handle the scalability and reliability needs of their growing usage base. They determined the need for a commercial-grade workload management solution to address the significant challenges of supporting their rapidly growing user base. "With Maui, we experienced frequent crashes and some of the advanced features did not function properly, causing unreliability with the scheduler," says Corey Ferrier, Information Systems Architect at Clemson University.

"We knew we needed to convert to a commercial-grade workload manager that would offer the support and reliability we required for our increasing set of users."

The Solution: Altair's PBS Professional for Massive Scalability and Technical Support

When evaluating workload management vendors, CCIT investigated several key factors before selecting Altair’s PBS Professional®. "During the evaluation process, we were looking to fulfill two requirements that our open source scheduling tool could not handle – reliability/scalability and technical support. After evaluating workload management vendors, Altair’s PBS Professional scheduling software came out on top as the solution that met our HPC needs," says Randall Martin, Executive Director of Advanced Computing

Infrastructure at Clemson University.

"Altair's PBS Works technical team was able to help us understand PBS Professional advanced features before we purchased the product and provided additional, hands-on training before we began the installation process."

Cost was also an important factor in the decision process for CCIT. Since they were previously using an open source workload management tool, CCIT needed not only a reliable commercial job scheduler, but also one that fit within their budget. Altair was able to provide Clemson University with an attractive academic pricing offer.

CCIT began using PBS Professional 11.1 in September 2011, supporting 1,623 nodes. Today, the node count has increased to



The Palmetto cluster at the Clemson Computing and Information Technology provides users with broad computing resources, integrating high-performance computing, data visualization, storage architectures, and middleware.



1,804, and PBS Professional can easily scale to support additional nodes for the rapidly growing user base.

The Result: Improved Usability and Productivity

Since migrating over to PBS Professional, productivity for CCIT and the university's users has increased while at the same time support calls have decreased. "After implementing PBS Professional, our HPC administration overhead has been reduced significantly. Also, PBS Professional's hooks plug-in technology allows us to easily provide immediate and automatic feedback to our users which decreases the demand for end-user support," says Corey Ferrier.

With increased functionality found in PBS Professional, users are able to easily submit numerous jobs, even queuing up thousands of jobs with confidence in their execution by the scheduler. "We are very pleased with the usability PBS Professional has provided to us, and we are currently evaluating Altair's remaining PBS Works suite of web-based portals for future implementation," says Randall Martin. PBS Professional is also integrated with Clemson's "Hadoop on demand" job framework, which uses myHadoop with their own customized open source file system, OrangeFS. This implementation yields major efficiency benefits since OrangeFS is not collocated with the compute nodes; PBS jobs can directly access data stored on OrangeFS from any compute node without the need for data staging, and the data persists between jobs.

The Palmetto Cluster

- Benchmarked at 262 TFlops
- Connected to Internet2's 100 GbE (gigabit Ethernet) Advanced Layer 2 Service
- Ranked #8 among academic research clusters in the Top500 list (June '13)
- Over 1,800 compute nodes, 17,000 x86_64 cores, with 280 NVIDIA Tesla GPUs (and still growing)
- 12 to 64 GB RAM per node, with 512 GB and 2 TB shared-memory systems available
- Infiniband & Myrinet network fabrics
- 218 TB OrangeFS "scratch" storage space
- Job queuing system: PBS Professional 12.0
- OS: Scientific Linux 6

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About Altair

Altair empowers client innovation and decision-making through technology that optimizes the analysis, management and visualization of business and engineering information. Privately held with more than 2,000 employees, Altair has offices throughout North America, South America, Europe and Asia/Pacific. With a 27-year-plus track record for high-end software and consulting services for engineering, computing and enterprise analytics, Altair consistently delivers a competitive advantage to customers in a broad range of industries. Altair has more than 3,000 corporate clients representing the automotive, aerospace, government and defense, and consumer products verticals. Altair also has a growing client presence in the electronics, architecture engineering and construction, and energy markets.

About PBS Works

PBS Works™, Altair's suite of on-demand cloud computing technologies, allows enterprises to maximize ROI on existing infrastructure assets. PBS Works is the most widely implemented software environment for managing grid, cloud, and cluster computing resources worldwide. The suite's flagship product, PBS Professional®, allows enterprises to easily share distributed computing resources across geographic boundaries. With additional tools for portal-based submission, analytics, and data management, the PBS Works suite is a comprehensive solution for optimizing HPC environments. Leveraging a revolutionary "pay-for-use" unit-based business model, PBS Works delivers increased value and flexibility over conventional software-licensing models.

www.pbsworks.com



Altair Engineering, Inc., World Headquarters: 1820 E. Big Beaver Rd., Troy, MI 48063-2031 USA
Phone: +1.248.614.2400 • Fax: +1.248.614.2411 • www.altair.com • info@altair.com