



## PBS Professional® for Cray

### Optimized Job Scheduling and Resource Management

PBS Professional gives Cray users a more efficient, reliable solution for HPC workload management. Altair collaborates closely with Cray to ensure tight, seamless integration. As a Cray-integrated product, PBS Professional optimizes job scheduling on Cray systems to achieve the **highest possible utilization levels.**

### Cray Users Gain:

- Superior Job Scheduling:**  
 Proven for over 20 years at thousands of customer sites, PBS Professional efficiently distributes workload across Cray platforms – PBS operates Cray's #1 machines in the UK and Korea.
- Custom-built Cray Performance:**  
 PBS Professional offers support for the full PBS 'vnode' feature set, and the PBS Server/Scheduler is not required on SDB node – freeing up management resources for core SDB functionality. See side 2 for more integration features.
- Architected for Exascale:**  
 The latest version of PBS Professional scales to millions of cores and is tested to 50,000+ nodes.
- Improved Job Placement:**  
 For Cray's XC systems, our integration with Cray's Application-Level Placement Scheduler (ALPS) ensures intelligent job placement and policy enforcement, for increased throughput and quick turnaround of high-priority jobs.
- Ease of Use:** PBS Professional simplifies system use and management, abstracting complex processes from the end user who can focus instead on core research.

*"With Cray and Altair we were able to improve the performance and manageability of our numerical weather prediction environment. Their solution, allowing for local customization, allowed us to implement our own custom toolbox for handling production jobs without the need for invasive resource preemption."*

Danish Meteorological Institute

### Ideal for Users Who Seek To:

- Maximize** value from Cray investments
- Improve** system utilization, end-user productivity and decision making
- Increase** workload security and reliability (PBS Professional is the only workload management solution with EAL3+ security certification and SELinux support (limited availability for CS series))
- Implement** business priorities by ensuring high-priority work runs first and completes on-time
- Reduce** costs by minimizing wasted hardware, software, and electrical power
- Simplify** HPC with an easy-to-use workload management product



## Why PBS on Cray?

- **Industry-leading technology**
  - Proven for over 20 years at thousands of customer sites
  - Scalability to millions of cores
  - Support for GPUs and co-processors (Intel® Xeon® Phi™)
  - Topology-aware scheduling
  - Global support with local experts in 22 countries
- **Tight Cray integration**
  - Integration with Cray ALPS
  - Altair and Cray operate many Top 500 global supercomputers, including Cray's #1 machines in the UK and Korea
  - PBS Professional is the workload manager on Cray's top global weather sites

## Key Features & Benefits (for more details, visit [pbsworks.com](http://pbsworks.com))

- GPU / co-processor scheduling prioritizes use and manages access to all types of accelerators (NVIDIA) as well as the Intel® Xeon Phi™ coprocessor, with full access control and accounting
- Power-aware scheduling provides per job power profiles, power capping, and energy accounting to minimize overall facility power usage and operating costs\*
- DataWarp - storage and data-aware scheduling that influence when and where PBS runs jobs.
- Estimated job start times enable you to plan your workflows and meet deadlines
- Backfill TopN scheduling eliminates wasted cycles without delaying any work
- Submission filtering "hooks" to change/augment capabilities on-site, on-the-fly
- Shrink-to-fit jobs boost utilization, especially before planned system outages; plus, jobs actually run sooner.
- Efficiently distributes workloads for maximum return on investment (ROI)
- User, group, and project limits to implement fine grained policy adjustments
- Job arrays allow for maximum throughput to schedule, execute and manage unlimited jobs
- cgroups minimize resource contention
- Tunable scheduling formula defines any policy, including on-the-fly "exceptions"
- User customizable "runjob hooks" ensures allocation management limits are strictly enforced
- Advance resource reservations guarantee resources for recurring needs
- Unified job & resource ("Vnode") architecture allows you to write job requirements once and automatically optimizes placement
- Job status with history (via "qstat -x"), allowing you to never lose track of jobs
- Python, the portable modern scripting language, is available everywhere allowing one script to be used across all architectures
- Preemption with checkpointing allows you to immediately run high-priority work\*\*
- Preemption with suspend/resume allows you to immediately run high priority work\*

## Engineered for Cray

- Support for full PBS 'vnode' feature set
- Robust advance and standing reservations
- Support for Cray's aprun features, including Core Specialization\*
- Fine-granular Cray mapping to segment/NUMA-node level
- Automatic custom resource creation\*
- PBS Server/Scheduler no longer required on SDB node\*
- Ability to manage other clusters or multiple Cray systems
- Support for PBS scheduling capabilities (e.g., per-named user and group limits)

## Cray and Altair: Leaders in HPC

Building on expertise in building the world's most advanced supercomputers, Cray offers a comprehensive portfolio of HPC systems and storage delivering unrivaled sustained performance on a wide range of challenging applications. Altair has served the HPC market for decades with award-winning workload management, engineering, and cloud computing software. The joint Cray-Altair solution provides a superior solution for HPC users, guaranteeing the availability of resources reserved in advance, optimizing the usage of non-reserved resources, and improving scheduling predictability so users have greater insight into when jobs will run. Together Cray and Altair operate some of the largest supercomputers in existence.

\* for XC systems • \*\* for CS systems



For more information about **PBS Professional**, visit [www.pbsworks.com](http://www.pbsworks.com) to request a quote or view a demo.  
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