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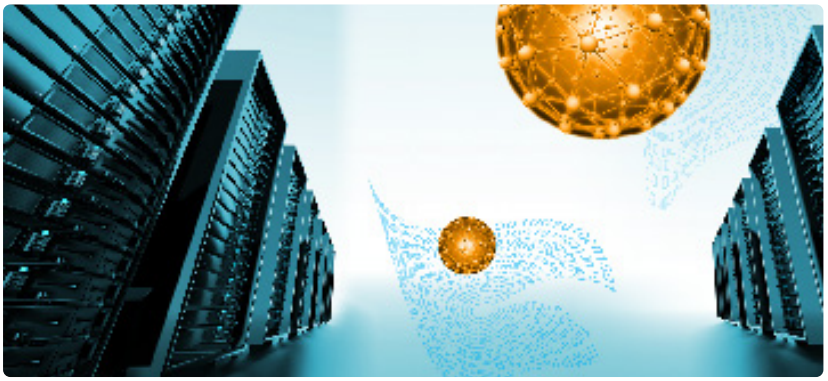


North-German Supercomputing Alliance Uses Moab HPC Suite to Enable Parallel Computing

Adaptive Computing's Big Workflow Solution Connects Multiple HPC Clusters to Advance Scientific Research

A long-time customer of Adaptive Computing, the North-German Supercomputing Alliance (HLRN) first started using Moab to manage its computing workloads in 2008.

HLRN, established in 2001, is a joint project of the seven North-German states: Berlin, Brandenburg, Bremen, Hamburg, Mecklenburg-Vorpommern, Niedersachsen and Schleswig-Holstein. HLRN currently runs Moab HPC Suite: Enterprise Edition on its distributed Cray XC30 supercomputing system, "HLRN III," which is hosted at Zuse Institute Berlin and Leibniz University Hannover. Completed in January 2014, HLRN III is one of the most powerful supercomputers in the world and possesses the computing capacity of approximately 25,000 high-end PCs.

HLRN also benefits from Big Workflow, an industry term coined by Adaptive Computing that denotes the acceleration of insights through more efficient processing intense simulations and big data analysis. Moab HPC Suite is an integral part of Adaptive's Big Workflow solution, which solves HLRN's big data challenges by streamlining the workflow to deliver valuable insights across the alliance's complex, heterogeneous HPC cluster environments.

These HLRN sites leverage Moab to support their advanced scientific research in a wide range of fields, including bio-informatics, chemistry, climate and ocean modeling, engineering, environmental research, fluid dynamics and physics. As a non-profit with funding from state and federal governments in Germany, HLRN's supercomputing system provides an important service to scientists and researchers in Northern Germany at no cost.

The HLRN Scientific Committee approves every research project in consideration and allocates computational resources accordingly, which are distributed between the Berlin and Hannover sites. HLRN's network of consultants provides technical support for each project, addressing key user issues such as optimization, batch job handling, resource allocation and more.

The Challenge

To provide a powerful, efficient petascale computing resource for the northern states of Germany, HLRN needed to jointly operate HLRN III as one combined system. Load balancing two remote locations has special challenges, such as time delays and communication between independent clusters with constantly changing job responsibilities, so HLRN needed to enable parallel computing to manage and optimize the multiple clusters at its Berlin and Hannover sites.

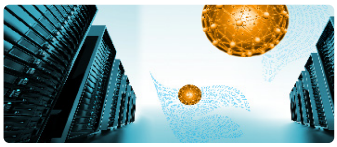
Because its computing resources are available at no cost, HLRN III is in high demand. To handle this large queue of computing jobs, HLRN keeps the Berlin and Hannover sites running 24/7, which creates challenges in resource uptime and job throughput.

At any one time, HLRN is running more than 150 projects with an average job size of 10 GB. The diverse workloads, which cover wide-ranging areas such as environmental, marine and basic sciences, possess different requirements and require researchers to create custom applications.

HLRN's consultants help prepare algorithms for the system to run the intensive computations, which can take up to several days or even weeks. Upon the successful completion of one project, new data sets must be created to prepare for the next incoming project.

The Solution

To fully meet its research objectives and achieve parallel computing, HLRN selected Moab HPC Suite for its new distributed supercomputing system.



The HPC suite is powered by Moab, Adaptive Computing's intelligent workload management software, which optimizes scheduling and management across workloads and resources based on policies. To combine its computing resources across both clusters, HLRN also processes simulations and data analysis with Big Workflow, which unifies all data center resources, optimizes the analysis process and guarantees services.

Big Workflow orchestrates and optimizes the analysis process to increase throughput and productivity, and reduce cost, complexity and errors. Even with its big data challenges, HLRN can still guarantee services that maximize uptime and prove services were delivered and resources were allocated fairly.

Within Moab HPC Suite: Enterprise Edition, HLRN is using a number of Moab modules, including:

Unify

Grid Option – This powerful grid-workload management solution enables HLRN to connect the disparate Berlin and Hannover clusters and share computing resources. This allows HLRN to synchronize management across policies and resources, consolidate reporting and optimize workload-sharing and data management across the clusters. The grid environment enables HLRN to run computing jobs at both sites simultaneously and automate and unify all of the complex workload decisions, resulting in greater load balance.

Optimize

Productivity Acceleration – As conditions and workloads change, Moab's continuous and future scheduling ensure HLRN's priorities are proactively met. With Moab, HLRN's clusters are always used in optimized utilization, even if a group of researchers do not have jobs to run at a certain time. When this occurs, Moab allows jobs with low priority to run even when they would normally run later (also known as backfill). The policy engine automatically ensures that the right workloads are completed at the optimal times (e.g., backfill jobs get low priority or suspended when a new high priority job is expected to run).

Guarantee

Moab Accounting Manager – HLRN integrated MAM with its custom accounting software to schedule resources in line with resource-sharing agreements. This feature administrates accounts for different research groups, which get "fair share usage" of the cluster. Fair share usage can be based on money, compute time or other parameters available in MAM. In addition, MAM aligns HLRN's budget allocations with utilization, ensuring usage limits are not exceeded and budgets are enforced.

The Results

Through coordinated dynamic provisioning and a multi-cluster grid environment, Moab HPC Suite enables HLRN to achieve parallel computing with its distributed supercomputing system. Operating the two clusters as a single ecosystem through Big Workflow, HLRN is able to manage all tasks for its scientific simulations, from workflow scheduling to accounting, in unison.

With Moab, HLRN can better handle workload demand surges and achieve greater management efficiency across multiple heterogeneous systems. Moab's scheduling capabilities also enable HLRN to meet the massive demand for its services and significantly increase job throughput.

In addition to maximizing multi-cluster ROI, Moab enables HLRN to:

- Improve resource utilization and achieve utilization rates as high as 80 percent, a key benefit that enables the alliance to maximize public funds
- Maximize user productivity and schedule more than 10 million nodes worth of computing jobs per quarter
- Virtually eliminate job delays and failures

Ultimately, Moab enables HLRN's researchers to accelerate delivery of invaluable insights that advance humanity's understanding of the world.

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