




# Altair PBS Works™ HPC Workload Management Suite

HPC User Forum  
April 1-3, 2019



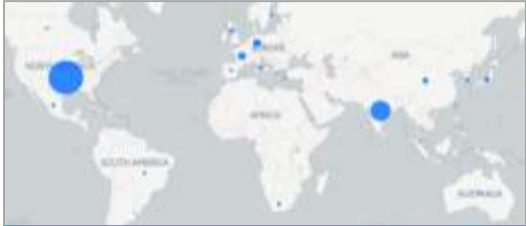
## OUR VISION



**Altair transforms design and decision making  
by applying simulation, machine learning and optimization  
throughout product lifecycles.**



# ALTAIR AT A GLANCE



Founded **1985**  
Headquartered in Troy, MI US

**71 offices**  
in 24 countries

**\$333M**  
2017 Revenue

**100+**  
Software products under our unique,  
patented licensing model



**2,000+**  
Engineers, scientists and creative thinkers

**5,000+**  
Customer installations globally

**60,000+**  
Users



# ALTAIR PBS WORKS™



**Easily manage HPC cluster, cloud, and supercomputing environments**

For IT administrators and HPC users

Direct sales and support

Also sold by computer hardware companies

Workload Management

Cloud Computing

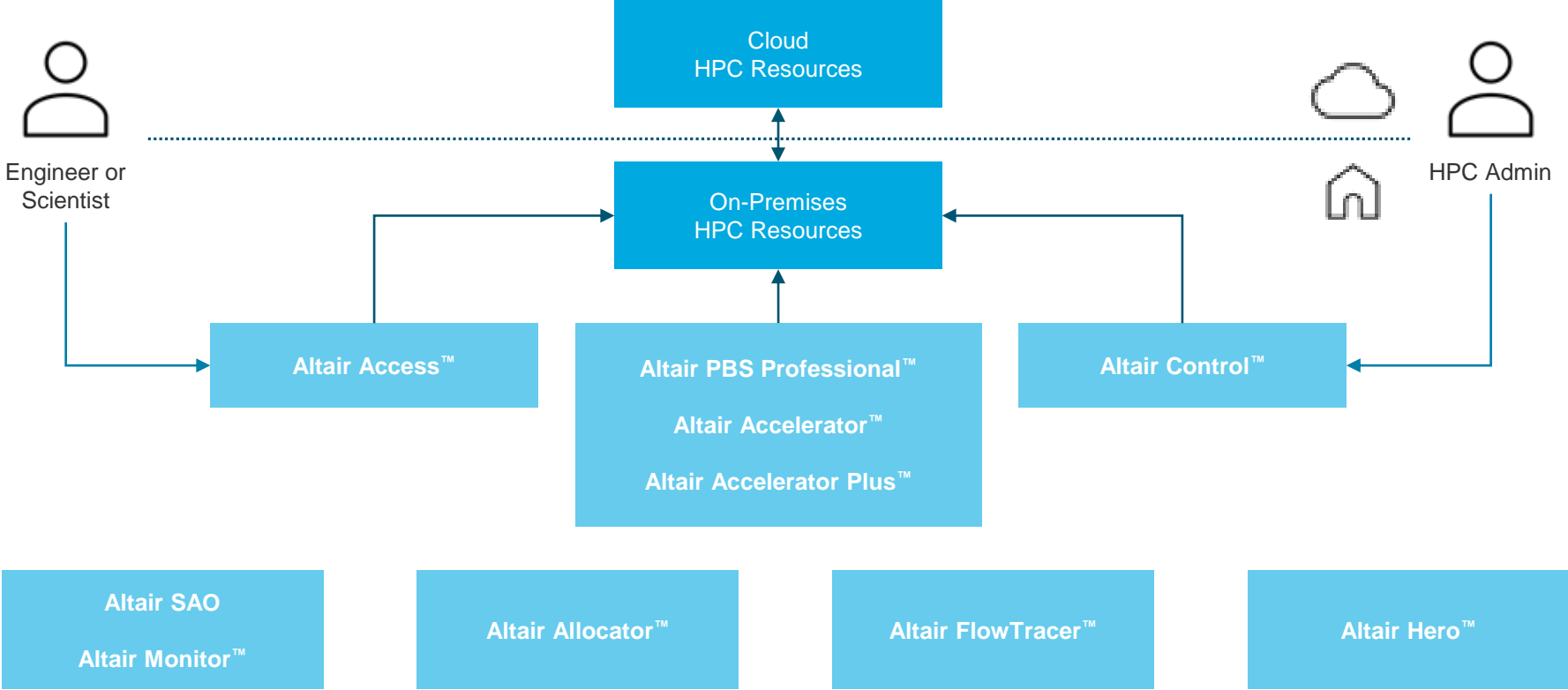
Remote Visualization

IT Analytics

Cross-domain Security



# ALTAIR PBS WORKS™



# ALTAIR PBS WORKS™ PRODUCT SUITE

## Workload Management

Altair **PBS Professional™**

Altair **Accelerator™**

Altair **Accelerator™**  
**Plus**

## Advanced HPC Usability

Altair **Access™**

Altair **Control™**

## License Monitoring and Management

Altair **Monitor™**

Altair **Allocator™**

Altair **SAO™**

## Resource and Dependency Management

Altair **FlowTracer™**

Altair **Hero™**



# INDUSTRY-LEADING WORKLOAD MANAGEMENT

- Smart scheduling across broadly distributed resources
- Hierarchical scheduling (10x improvement)
- High throughput and optimized resource utilization
- Million-core scalability
- Market-leading security
- Green provisioning
- Cloud bursting
- GPU and co-processor scheduling



Altair PBS Professional™

Altair Accelerator™

Altair Accelerator™ Plus



# ALTAIR PBS PROFESSIONAL™

Altair's industry-leading workload manager and job scheduler for  
high-performance computing (HPC) environments





# ALTAIR PBS PROFESSIONAL™ FEATURES

Altair PBS Professional automates job scheduling, management, monitoring, and reporting. It's the trusted solution — not just for complex systems, but also for smaller clusters.

## Highlights

- **Ubiquitous:** open-source and commercial licensing
- **Performant:** million-core scalability, fast throughput
- **Secure:** EAL3+ security certification and MLS (SELinux) support
- **Intelligent:** policy-driven and topology-aware scheduling
- **Scalable:** proven to run millions of jobs per day
- **Green Provisioning™:** power management and control
- **Robust:** known in the industry for stability and support
- **Open Architecture:** implement virtually any new policy
- **Modern:** containers, cloud bursting, parallel scheduling



NASA's workload manager of choice  
for all NAS HPC resources

250k+ cores scheduled by one Altair PBS Professional™



# ALTAIR PBS PROFESSIONAL™ CAPABILITIES

Altair PBS Professional is a fast, powerful workload manager designed to improve productivity, optimize utilization and efficiency, and simplify administration for HPC clusters, clouds, and supercomputers.



## Policy

Meet enterprise-wide scheduling and use policies with resource-based scheduling to ensure the right jobs run at the right times on the right resources



## Utilization

Maximize ROI and minimize waste, ensuring the best use of hardware, software licenses, energy, and cloud resources



## Performance

Fast and scalable execution to meet the needs of even the most demanding enterprises with thousands of users and millions of cores



## Resilience

Secure and hardened to minimize downtime; health checks and automatic failover ensures jobs get done despite faults and failures



## Open

Extensible plugin framework to meet each site's unique needs

Dual-licensed: commercial and open source

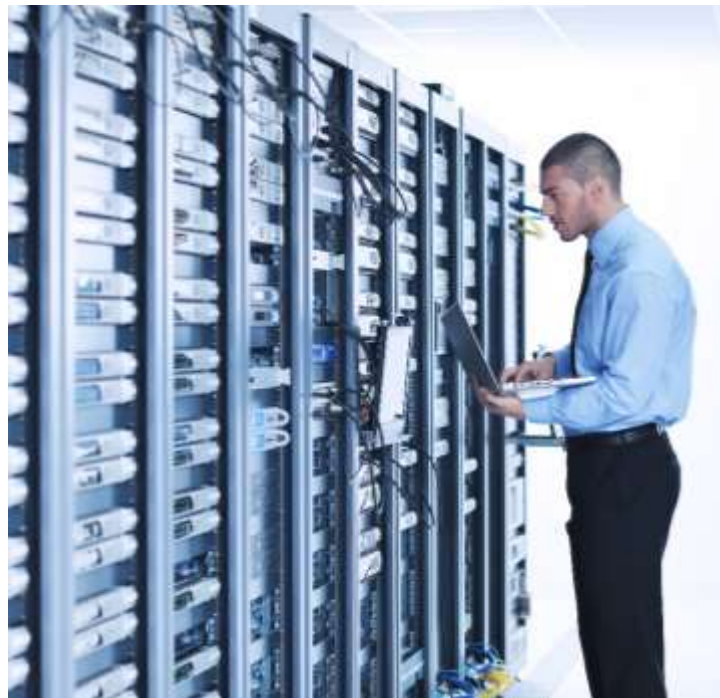


# ALTAIR PBS PROFESSIONAL™

Altair PBS Professional is the industry-leading workload manager and job scheduler for high-performance computing (HPC) environments.

## New Features

- **Docker:** automatically run jobs in per-job specified containers, with added security that mitigates the Docker “as-root issue”
- **MultiSched:** multiple schedulers each handle separate partitions, with per-partition scheduling policies, speeding scheduling while retaining a single global view of the whole cluster
- **Cgroups:** provide kernel-level resource isolation, usage limits, and reporting, so jobs sharing nodes run as fast as possible without interfering with each other
- **Job equivalence:** job class optimization improves scheduling speed by an order of magnitude for workloads with many thousands of small jobs
- **Soft walltime resource:** improve backfill calculations and increase utilization
- **Jobs can shrink:** release no-longer-used nodes (e.g., during post-processing or stage-out), effectively increasing utilization
- **New platform support:** ARM64



# ALTAIR CONTROL™

HPC administrator control center for managing,  
optimizing, and forecasting HPC resources



# ALTAIR CONTROL™ FEATURES

Altair Control is an easy-to-use web application for monitoring and managing jobs and nodes on a high-performance computing (HPC) cluster, with advanced analytics to support data-driven planning and decision-making.

## Highlights

- **Single pane of glass:** configure, deploy, monitor, burst, manage, troubleshoot, simulate, analyze, and tune
- **Real-time monitoring:** simplify troubleshooting and maintenance
- **Reporting and analytics:** powered by Altair SmartSight™
- **Workload simulator:** simulate and optimize infrastructure sizing
- **Multi-cloud bursting:** burst to any cloud for peak loads
- **Modern UX:** drag-and-drop simplicity



# ALTAIR CONTROL™ CAPABILITIES

A platform to easily manage, monitor, analyze, and simulate HPC clusters



## Design

**Design** an HPC model so that an HPC cluster can use cloud bursting to public and private clouds, adding capacity exactly when needed.



## Manage

Deploy an HPC model in the cloud. **Manage** cloud bursting by updating HPC details.



## Monitor

**Monitor** and manage an HPC cluster's nodes and jobs. Monitoring is divided into sub-tabs for easy viewing.



## Configure

**Configure** default WLM server and security settings and manage queues, resource defaults, and limits.



## Analyze

Easy-to-use job accounting and reporting solution with advanced **analytics** to support data-driven planning and decision-making.



## Simulate

Run a **simulation** to perform what-if analysis and determine the most productive way to scale HPC resources.



# ALTAIR ACCESS™

Portal for engineers and researchers



# ALTAIR ACCESS™ FEATURES

Altair Access gives engineers and researchers a simple, powerful, and consistent interface for submitting and monitoring jobs on remote clusters, clouds, and other resources.

## Highlights

- **Novice to expert:** simple and powerful
- **Same UX:** desktop and web
- **Secure:** protected access to HPC resources
- **End-to-end:** submit, monitor progress, steer, fix, and rerun jobs
- **Collaborate:** shared 3D analysis
- **3D remote visualization**
- **Save time:** Simplify job submission and management thanks to a powerful GUI with smart, simplified interfaces
- **Be more productive:** Spend more time focused on work and not IT tasks
- **Increase ROI:** Consolidate access to applications and optimize license availability
- **Reduce errors and improve consistency:** Embed your company's best-practice know-how directly into application definitions used for job submission





# ALTAIR ACCESS™ CAPABILITIES

Engineers, scientists, and researchers can easily access portals that provide access to HPC — no IT expertise needed — to run solvers, view progress, manage data, and use 3D remote visualization via web and desktop.



## Files

Simplify job **file** submission and management thanks to a powerful GUI with smart, simplified interfaces.



## Jobs

Easily define and configure applications for **job** submission via PBS Application Services (PAS).



## Sessions

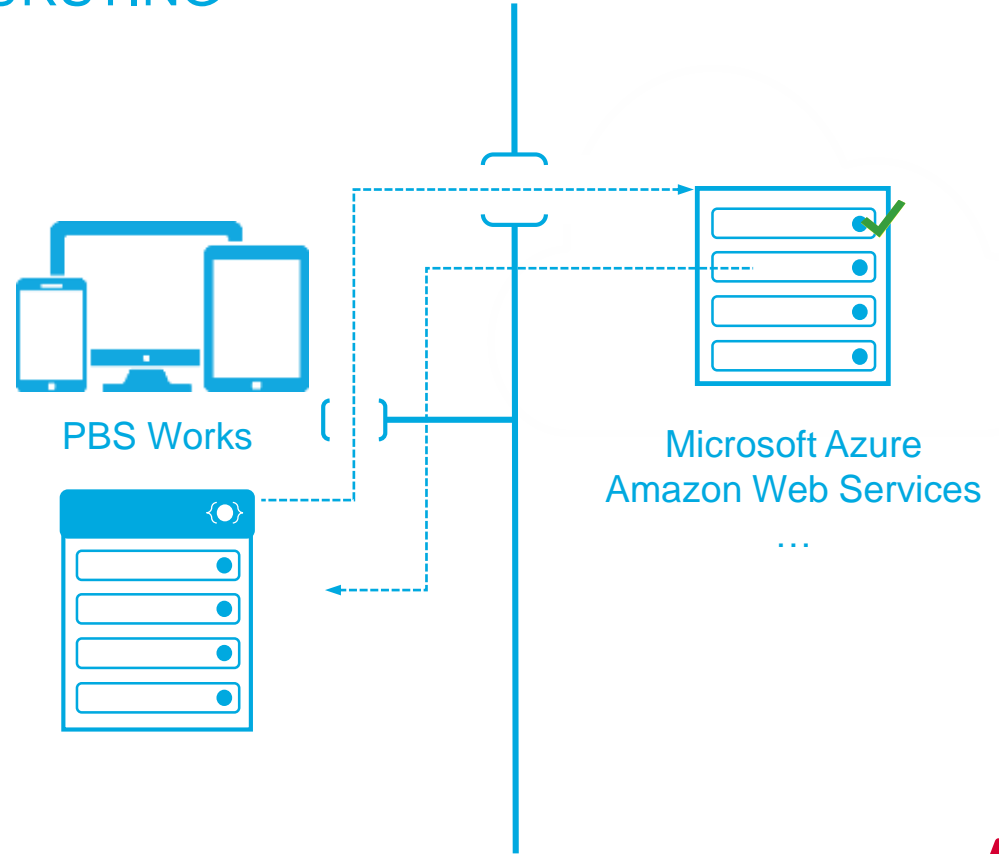
Manage 3D remote visualization **sessions** and data directly from the secure web portal.



# ALTAIR CONTROL™: CLOUD BURSTING

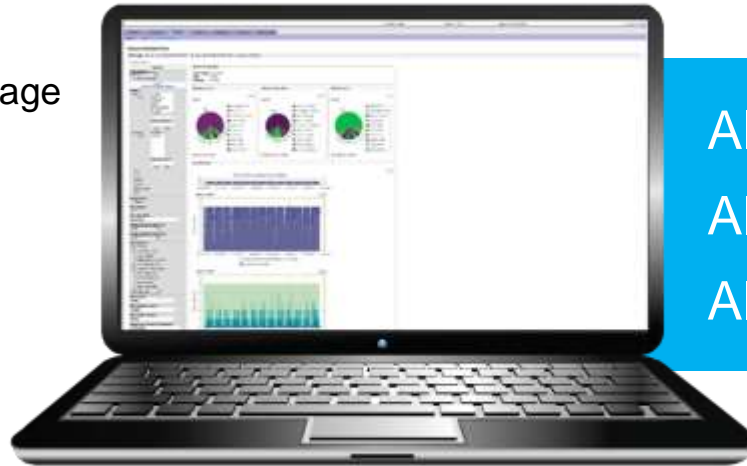
## On-demand use of cloud resources to maximize efficiency

- Improve responsiveness, adding capacity exactly when needed
- Automatic governance and cost controls via site-defined policies and quotas
- Understands on-premises utilization, ensuring bursting only when cost-efficient
- Vendor-agnostic: no lock-in
- Fast: +1,000 nodes in minutes



# ASSET MONITORING FOR OPERATIONAL IMPACT

- Software license monitoring and management
- Optimizes license mix
- Reduces license cost
- Multi-site license allocator
- Real-time license adjustments
- Visibility into license allocation and usage
- What-if simulator



Altair Monitor™  
Altair Allocator™  
Altair SAO



# ALTAIR HYPERWORKS UNLIMITED

Product innovation & simulation platform



# ALTAIR HYPERWORKS UNLIMITED

Altair HyperWorks Unlimited is a state-of-the art private cloud appliance available in both physical and virtual formats, with unlimited use of Altair software.

Cloud-based HyperWorks Unlimited appliances provide users with a secure cloud-based platform — either on-premises or off-premises — to run, monitor and manage simulations.

## Highlights

- Physical or virtual cloud appliance
- Fully managed, turnkey solution
- Tailored design
- Altair HyperWorks™ simulation platform
- Altair PBS Works™ workload management suite
- Third-party software with BYOL
- 3-year lease and trade-in for a new system (physical appliance)
- Complementary solutions grow with you



# ALTAIR HYPERWORKS UNLIMITED

Engineers want to get engineering done. HyperWorks Unlimited lets them focus on their work instead of dealing with the headaches of system and license administration.

## Free your engineers from the burdens of:

- Linux system administration
- Writing shell scripts
- Worrying about whether they have enough licenses

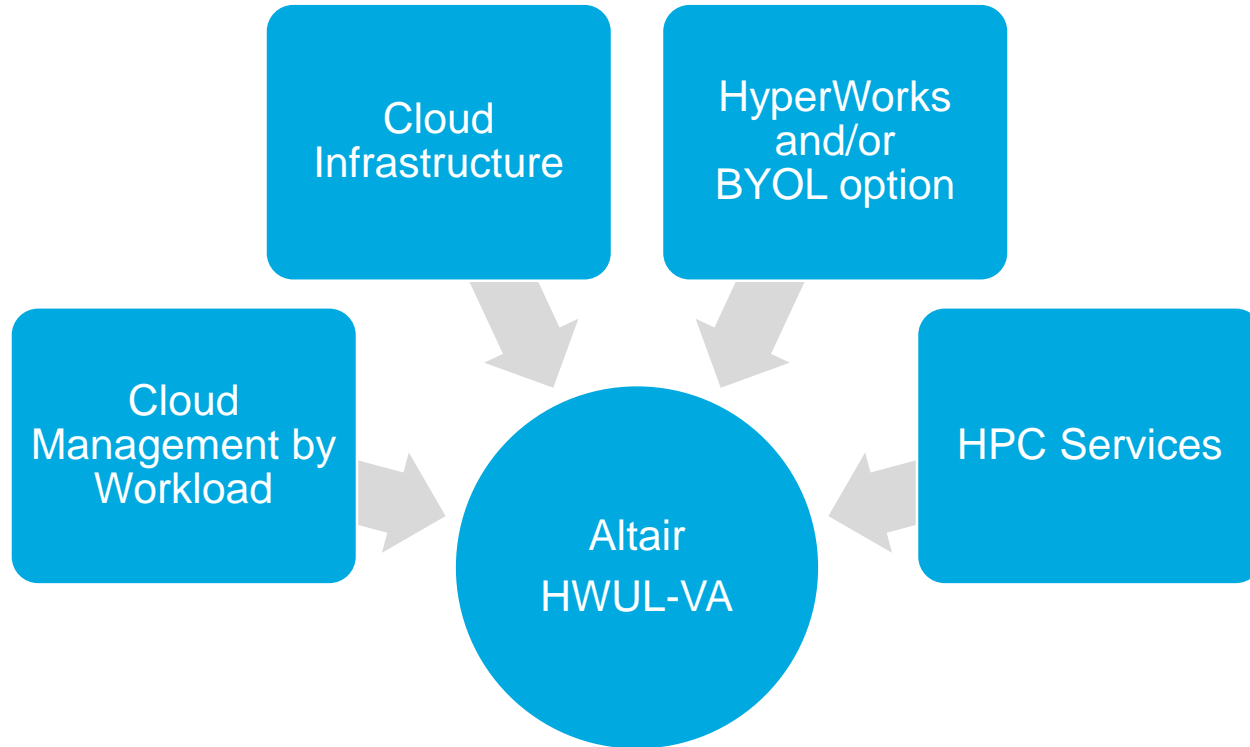
## Give them the tools to succeed:

- Ability to optimally explore the design space and determine the best possible design
- One phone call to make for support — Altair will take care of you

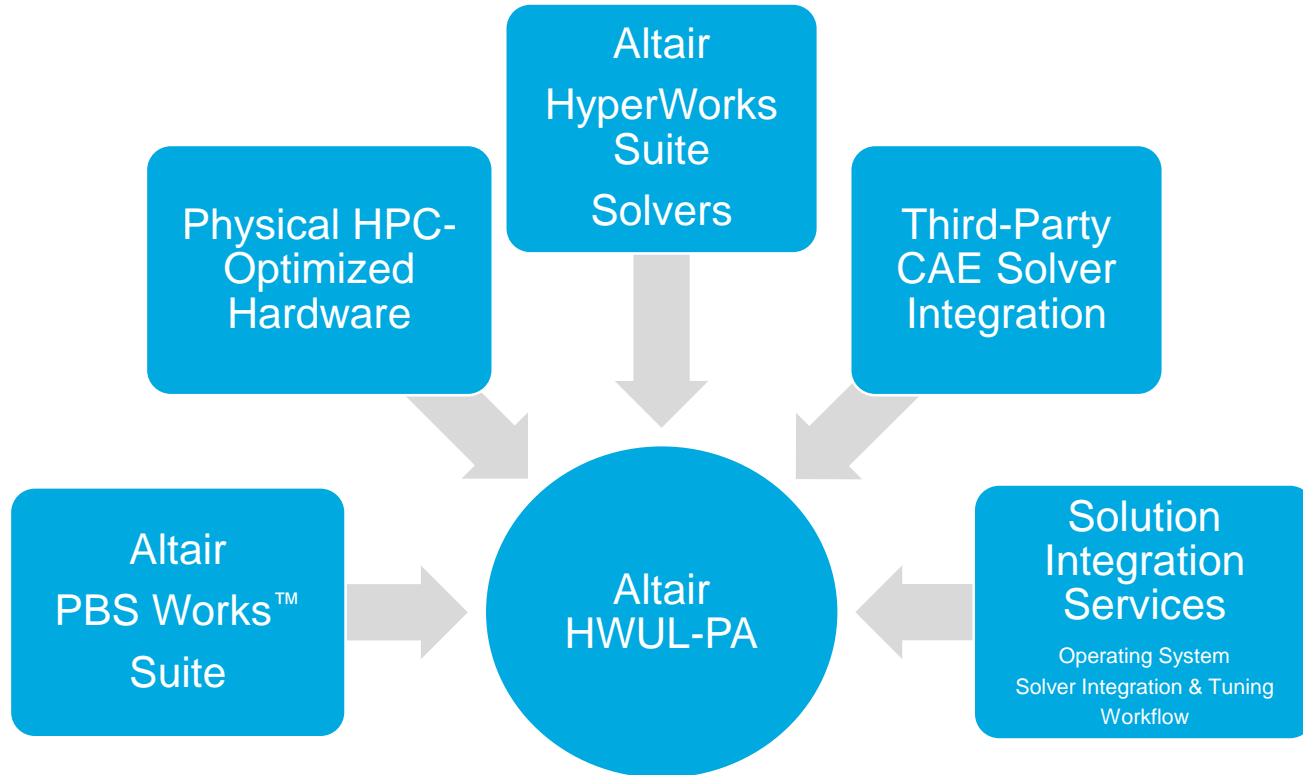
Altair HyperWorks Unlimited appliances are engineered for simplicity and performance.



# HYPERWORKS UNLIMITED VIRTUAL APPLIANCE (HWUL-VA)



# HYPERWORKS UNLIMITED PHYSICAL APPLIANCE (HWUL-PA)







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