HOW TOTALCAE ENABLES MULTI-CLUSTER AND MULTI-CLOUD OPERATIONS WITH TOTALCAE MULTI-HPC

Produced by TCI Media Custom Publishing in conjunction with:

HPCwire

TotalCAE

Today's organizations increasingly maintain computing resources across multiple on-premises high-performance computing (HPC) clusters in various locations. Organizations may also use one or more cloud providers to have access to state-of-the-art hardware capable of processing and storing the massive amount of data created by HPC and artificial intelligence (AI) workloads. Organizations often adopt a hybrid mix of multiple on-premises clusters and cloud solutions to meet processing needs. The use of multi-cluster and multi-cloud operations has advantages but leads to challenges for users to utilize.

Challenges Faced by HPC Users

As the number of HPC systems grows—spanning on-premises, cloud, and global clusters — users face challenges in efficiently utilizing available enterprise resources including:

Model data portability: Users face a challenge with data portability when trying to move data that is local to their systems. In the Computer Aided Engineering (CAE) realm, many applications have include files. The include files have hard coded network paths and those network paths are not accessible in other regions of the country, across the globe or in the cloud. Some applications have parts from different teams, and users may not know where all the include files are located which makes running the model or workload overwhelming.

Even if an organization attempts to have a global file system, there can be consistency problems.

Resource discovery: Identifying and selecting the right HPC resources is a problem with multi-HPC systems. Users may need to know the following information to access the best cluster for data transfer and processing.

- Which cluster has the freest capacity?
- What cluster has my application and version installed, such as Abaqus 2025?
- What is the closest cluster to me for faster data transfer?
- How do I orchestrate data to and from that cluster?

Data transfer bottlenecks: Users face difficulty in transferring and accessing data across systems. Slow data transfer to and from remote systems is time-consuming. The data bottlenecks result in wasted time for users.

Ultimately the user chooses to use their local cluster because it is too difficult to gather all their includes, user subroutines, and cluster information to migrate data to other system compute resources and wait for data uploads and downloads. It is just easier to run work on local clusters which makes inefficient use of the enterprise global resource pool.

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Introducing TotalCAE

TotalCAE's Managed HPC Service offers a subscription-based turnkey platform to manage HPC clusters in clients' data centers or cloud subscriptions, with expert administration and one-hour response time.

"TotalCAE manages the HPC, engineering solvers, AI, and machine learning (ML) models, to optimize engineering workflows utilizing our turnkey solution. Our whole goal is to make high performance computing accessible to everyone and easy to access in just a few clicks," states Rod Mach, TotalCAE CEO.

"We have a simple to use interface that lets organizations run hundreds of different applications, commercial codes, and home-grown codes. We won many awards for our hybrid scenarios on cloud and on-premises over the years and are experts in a wide range of engineering applications. TotalCAE manages the HPC, engineering solvers, AI, and machine learning (ML) models, to optimize engineering workflows utilizing our turnkey solution. Our whole goal is to make high performance computing accessible to everyone and easy to access in just a few clicks. We have many customers that have hybrid multiple clusters and use multiple clouds. That led us to build our tools to solve these Multi-HPC challenges described in this paper," states Rod Mach, TotalCAE CEO.

Turnkey HPC clusters and cloud, setup and managed by TotalCAE in the clients' data center or cloud subscription enables clients to reduce simulation time by up to 80% without being HPC CAE IT experts. Using the TotalCAE Multi-HPC solution eliminates IT headaches by professionally managing the client's HPC environment and all engineering applications.

How TotalCAE Meets These Needs with the TotalCAE Multi-HPC Solution

The TotalCAE Multi-HPC submission tool is part of the TotalCAE platform that is installed and configured by TotalCAE in the customer's cluster environment. The Multi-HPC tool can run on Linux, Windows, and mobile devices. The TotalCAE Portal displays a global view of their jobs across all HPC. TotalCAE includes analytics, data management, billing system, and remote visualization for all environments in the standard base offering.

Use Multi-HPC to Automatically Run the Job

To have the Multi-HPC tool find, submit, and orchestrate data automatically, users enter the following on the command line:

```
tsubmit –profile=<auto> <software> -n <cores> -v <software version>
```

Auto is a special profile which indicates find me the best cluster, with the software and version I need, with free capacity that can run the job, and move the data there, run, and bring it back.

The job will automatically orchestrate to the best choice amongst the multiple HPC on-premises clusters and customer cloud instances.

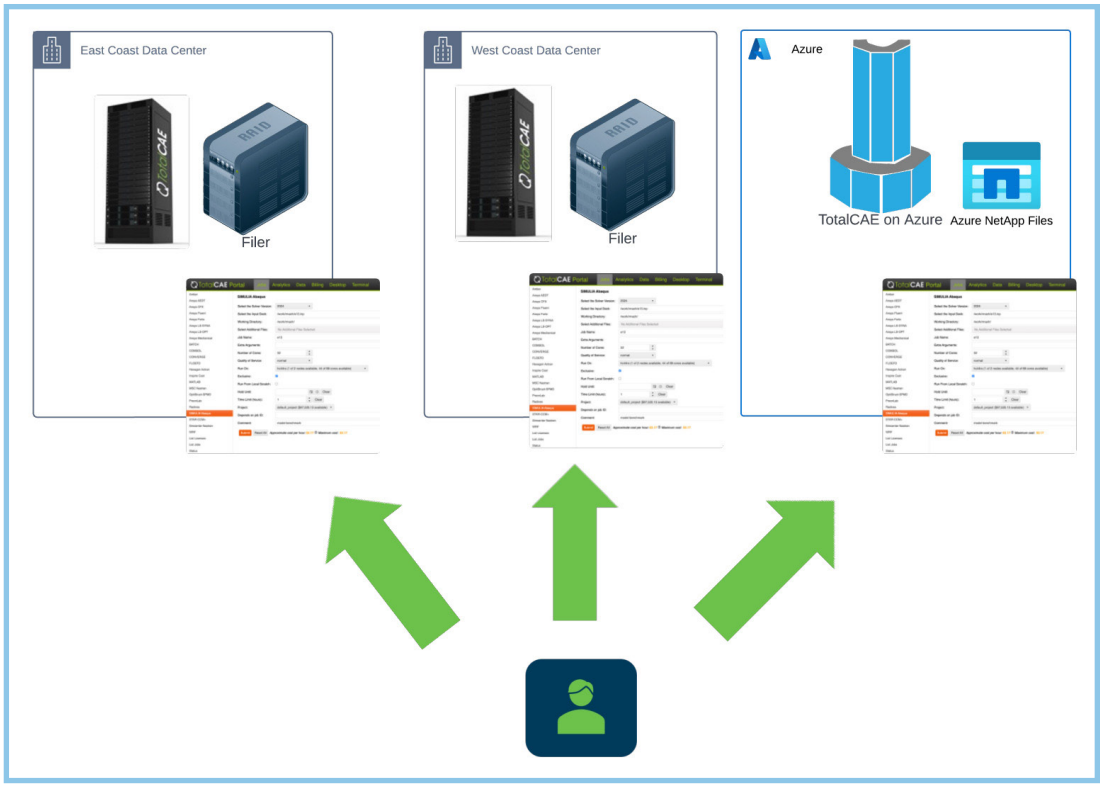
Users do not need to do any manual data orchestration or figure out how to make their data portable.

TotalCAE provides the following data automatic data portability when dealing with application include files:

- Handles LS-DYNA, Nastran, Abaqus, and OptiStruct include options which can easily extend to other applications that make extensive use of includes.
- Handles recursion (includes with includes), and multiple include directives.
- Re-writes files to be portable so they can be moved to another system that does not share any storage.

The end user can disable the automatic orchestration if they choose and target any system directly.

As shown in the following figure, the Multi-HPC tool reviewed clusters located on the west coast data center, east coast data center, and in the Microsoft Azure cloud to locate the best cluster, sends the data to the HPC, automatically runs the job, brings the data back to the users site, and emails the user the completed job is ready to post-process. Post processing can also be automated to run on the HPC.



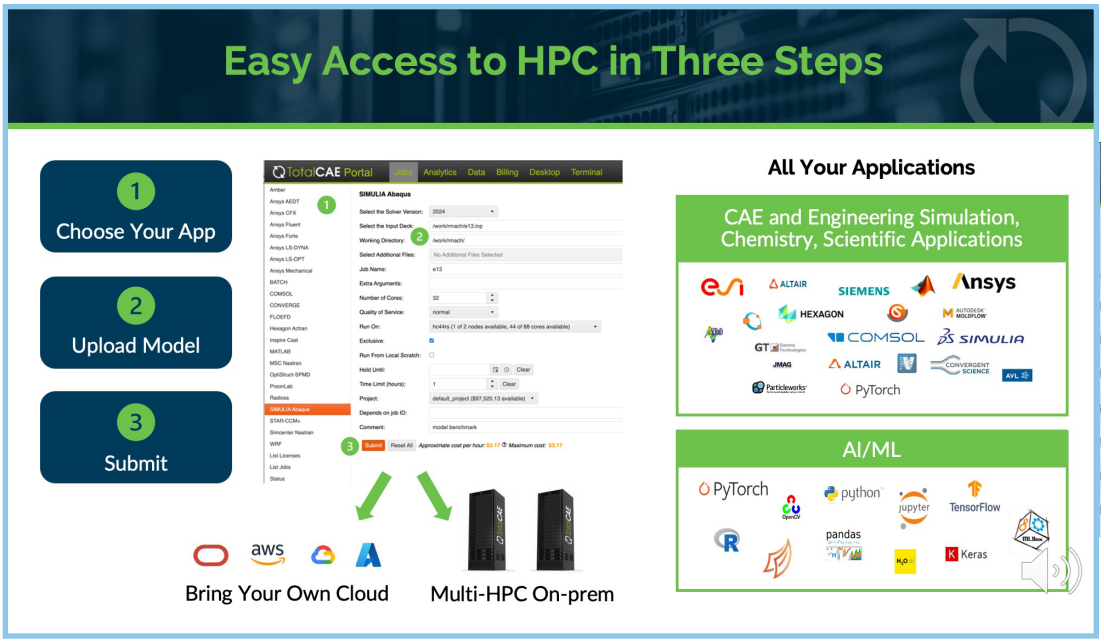
Manually Select a Cluster using the Multi-HPC Tool

Users can also manually select to run a job on a single cluster. To select a specific cluster, users enter the following from the command line version of the portal:

```
tsubmit -profile=<chosencluster> <other options>
```

Alternatively, if the user wants to use the Web Portal, they can go to their chosen cluster and:

1. Choose the desired application from a list of applications and complete information such as version, billing project, and the number of cores needed to run the job.
2. Choose the model.
3. Press the **Submit** button.

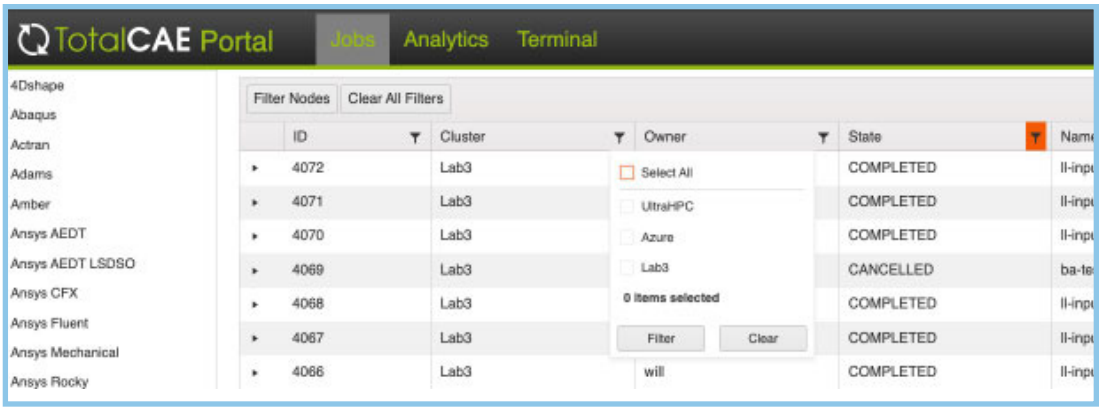


TotalCAE Multi-HPC Tool Ends Data Download and Upload Pain

TotalCAE saves engineers time waiting for files to upload and download. The TotalCAE Multi-HPC tool automatically handles downloading and uploading files. Data movement to and from systems is hidden from the user making efficient use of their time.

Data is moved to and from the cluster (if required) for the user. The user has fine grained control of where to put output results. TotalCAE only copies back changed data. Once a job completes, the TotalCAE application notifies the submitter with an email. This feature can be useful for organizations with on-premises clusters located in global data centers. For example, if a data center in the US needs files downloaded from their data center in India, a job could start in India during their work hours and the results be available to the US team when they come to work in the morning.

The TotalCAE tool displays detailed job status information on the Jobs screen. Information includes the ID and name of the cluster, owner name, status, and input file information.



How Lucid Motors Uses the TotalCAE Solution

Lucid Motors makes one of the leading EV vehicles on the market and makes extensive use of HPC to optimize their EVs. Lucid Motors wanted to decrease turn around time on crash simulations for vehicle designs and adopted TotalCAE's Multi-HPC solution to leverage all of their HPC assets on-prem and cloud, which led to faster turnaround times for crash simulations, enabling Lucid Motors to iterate more effectively and meet stringent development timelines.

"The TotalCAE Multi-HPC solution allows customers to make more efficient use of their global resources by enabling them to work across a collective pool of resources, doing more with existing resources."

Summary

Engineering and technical organizations increasingly maintain computing resources across multiple on-premises high-performance computing (HPC) clusters in various data center locations and on one or more cloud platforms. Organizations often adopt a hybrid mix of multiple on-premises clusters and cloud solutions to meet specialized or regional processing needs. While multi-HPC solutions provide a flexible enterprise environment, the situation raises many challenges for data center, engineers, and IT staff.

The TotalCAE Multi-HPC solution allows users to treat HPC clusters as resource pools. It follows a "share nothing" design, meaning each HPC cluster operates independently, allowing for separate management and maintenance without requiring rigid coupling that can reduce robustness. Users can submit jobs to HPC clusters without the hassle of determining available capacity, application versions, or managing data transfers.

Hybrid workflows can be enabled quickly with minimal effort. Users can access their data when and where they need it, without wasting time monitoring and managing data transfers.

"The TotalCAE Multi-HPC solution allows customers to make more efficient use of their global resources by enabling them to work across a collective pool of resources, doing more with existing resources," states Mach.

For more information visit https://www.totalcae.com/multi-hpc-solution.