



# CLOUD SEEDS SIMULATION FOR SMES

Small and medium-size manufacturers need economical access to simulation during their design cycles to remain competitive. This requires a software stack to make it easier for these companies to expand their use of high-fidelity modeling tools on cloud computing resources.

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Producing higher-quality products. Shortening time to market. Reducing product failure early in the design process. These are well-established needs in the manufacturing sector that can be addressed by making high-performance computing (HPC) simulation part of the early phase of a product life cycle. There are more than 300,000 small and medium-size manufacturing enterprises (SMEs) in the U.S. alone, and many are reliant upon desktop workstations for their routine CAE design and development work. According to the U.S. Council on Competitiveness [1,2], more than

half of these SMEs need more computing power.

Organizations looking to expand simulation capabilities increasingly investigate cloud-based simulation platforms as an attractive alternative to desktop or other in-house hardware solutions. For SMEs, the cloud can support simulation for both routine design needs and the occasional demands for

large model sizes or more extensive design exploration without having to make a large hardware infrastructure purchase. On-premise workstation or server hardware may not be suitable for future simulation demands, and can be costly to maintain and support when not fully used. Cloud-based hardware resources offer the benefit of scaling an organization's simulation usage up or down as needed. For a product designer, more computing power available on demand translates into more product variations analyzed and more parametric studies completed in less time, which increases product quality and accelerates time to market.

### HPC Cloud Experiment

The UberCloud online community and marketplace was created as an initiative to understand and overcome cloud computing roadblocks using a crowd-sourcing approach. The UberCloud HPC Experiment began in 2012, sponsored by ANSYS, Intel, Hewlett-Packard Enterprise and Microsoft Azure. Its purpose is to foster collaboration among engineers, HPC experts, independent software vendors (ISVs) and cloud service providers so that they can address cloud-based simulation challenges at scale, and to promote the wider adoption of digital manufacturing to SMEs. Since its inception, the HPC Experiment has drawn more than 200 engineering teams, each consisting of an industry end-user, a simulation software provider and a cloud provider. For SMEs, cloud computing is a key enabler of upfront simulation, which can reduce time to market, decrease costs and expand product innovation.

To this end, UberCloud developed HPC software containers that package the desired simulation tools along with the utilities needed to easily complete the engineer's analysis on cloud hardware. The containers abstract tasks such as partitioning, security, backup and data visualization into a browser-like experience, very similar to the engineer's workstation. The ANSYS software is pre-installed in the container, and configured and tested to give similar performance whether it is running on dedicated in-house hardware or hardware in a remote data center.

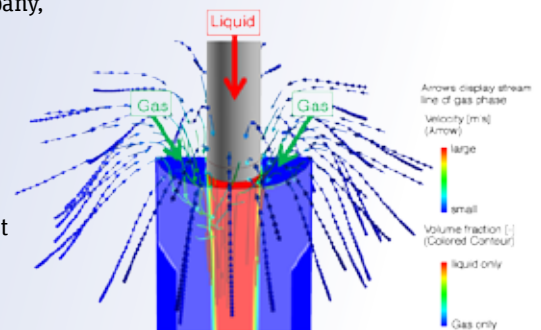
Working on the end-user's application, each team defines the requirements, implements the application using HPC in the cloud, runs and monitors the simulation jobs, views the results remotely, and transfers the simulation data back to the end-user. Each team then summarizes their results, experience and key findings in a case study, including studies of different mesh densities and numbers of CPU cores. Among the 18 case studies highlighted using simulation software from ANSYS [3] were analyses of a medical inhaler and two-phase flow in an energy plant. These and other examples demonstrate a wide range of applied CAE work being carried out in the cloud today by SMEs that can benefit from what Intel calls the "democratization of high-performance computing."<sup>▲</sup>



**ANSYS Cloud Hosting Partners**  
[ansys.com/cloud-partners](https://www.ansys.com/cloud-partners)

### ENERGY PLANT GAS ENTRAPMENT

Chiyoda Corporation, a leading Japanese engineering company, relies on ANSYS Fluent to tackle a variety of engineering challenges for clients in the global energy business. Chiyoda was challenged to complete very large simulations within short time frames to meet customer needs. With an overtaxed IT infrastructure, the company required a flexible approach that would provide extra computing capacity on an ongoing basis. For example, engineers needed to simulate gas entrapment in an energy plant with a two-phase gas-liquid flow application using ANSYS Fluent. Chiyoda partnered with Fujitsu Ltd. and the UberCloud collaboration platform to maximize its ANSYS HPC Pack licenses and leverage additional computing capacity. Today, by using 32 parallel cores via Fujitsu's Technical Computing Cloud, processing speeds are two times faster than if simulations were run in Chiyoda's own IT environment.



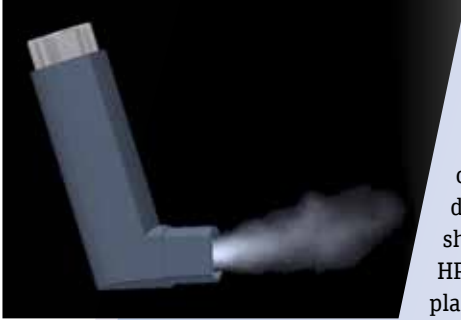
<sup>▲</sup> Flow path and volume fraction of liquid and gas for a gas-entrapment application  
*Image courtesy Chiyoda*



**Cloud Computing Best Practices for Engineering Simulation**  
[ansys.com/cloud-best-practices](https://www.ansys.com/cloud-best-practices)

## INHALER SPRAY MODELING

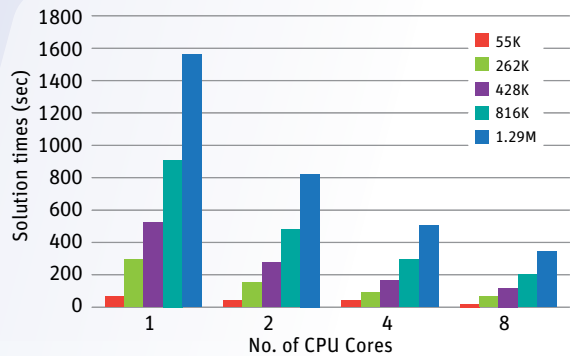
Pressurized meter dosage inhalers (PMDIs) are widely used to deliver aerosolized medications to the lungs, most often to treat symptoms of asthma or other chronic respiratory diseases. In the medical device industry, simulation is increasingly used to predict the flow and deposition of spray particles both inside the respiratory tract and also in the PMDIs and add-on devices. Such simulations require detailed information about the spray as it originates from the PMDI nozzle to ensure the validity of the downstream results.



The objective of UberCloud Team 184's project, led by independent consultant Praveen Bath, was to characterize the fluid particles dispensed by a PMDI, in which the spray typically forms into a cone shape. The team used ANSYS Workbench with ANSYS CFX in an UberCloud HPC Container, which was integrated with the Microsoft Azure cloud platform [4], to evaluate the predictions of spray emitting from the nozzle and through a cylindrical domain of air at standard atmospheric pressure.

By creating five different volume meshes with increasingly finer resolution, the engineers performed a mesh refinement study and then benchmarked the solver's HPC performance on multiple CPU cores.

Although there was a learning curve for using the overall cloud platform and its features, the UberCloud HPC container made the process of model creation using Workbench and CFX much easier by drastically reducing the time for mesh generation, solver processing and post-processing the results for remote viewing. Altogether, the engineers invested about 10 hours to create the models and used the equivalent of about 500 CPU core hours to generate solutions. With the benefit of HPC, the finest mesh (1.2 million cells) was solved in about five minutes on eight CPU cores. The UberCloud container's auto-update email module enabled continuous monitoring of simulation jobs without requiring the engineers to log in to the server to check the status. Such container features helped the team with smoother execution of the project by facilitating user-friendly access to cloud server resources for an application with complex physics.



▲ Solution time comparison for different mesh densities running on different CPU core configurations

## ANSYS CLOUD-PARTNER SOLUTIONS

ANSYS participated in the UberCloud HPC Experiment so that our customers can explore the end-to-end process of partner-enabled cloud solutions for their simulation workload.

This has also helped us to develop cloud-computing best practices as well as to build out our cloud-partner ecosystem, providing customers with a choice of cloud computing solutions that best meet their needs. UberCloud is now one of our cloud-hosting partners.

– Wim Slagter,  
Director, HPC & Cloud Alliances



### References:

- [1] Reveal: Council on Competitiveness and USC-ISI Broad Study of Desktop Technical Computing End Users and HPC. [compete.org/reports/all/420-reveal](http://compete.org/reports/all/420-reveal)
- [2] Reflect: Council on Competitiveness and USC-ISI In-Depth Study of Technical Computing End Users and HPC. [compete.org/reports/all/421-reflect](http://compete.org/reports/all/421-reflect)
- [3] UberCloud and ANSYS. [theubercloud.com/ANSYS](http://theubercloud.com/ANSYS)
- [4] ANSYS 17.2 Fluids and Structures: UberCloud. [azuremarketplace.microsoft.com/en-us/marketplace/apps/ubercloud.ansys-17-2-fluids-structures](http://azuremarketplace.microsoft.com/en-us/marketplace/apps/ubercloud.ansys-17-2-fluids-structures)