



CASE STUDY

With Rimac, the **fastest electric hypercars** finally reach the cloud.



Optimizing simulations with **high-performance computing** in the cloud

In early 2021, Rimac and UberCloud forged a partnership, with a need for optimized innovation at its core. Rimac Technology engineers were running more and more simulations with an aging, on-premises high performance computing (HPC) cluster. While compute power continued to fall short, the demand for resources continued to grow exponentially. Engineers were not happy about speed of calculations and resources available.

Tasked with performing an extensive Proof of Concept to evaluate Rimac's existing HPC infrastructure, UberCloud set out to learn whether moving their engineering simulation workloads to the cloud would deliver a net

benefit. This would enable the engineering team to meet a host of ongoing challenges while optimizing processes to achieve maximum productivity.

During the six months that the partners worked together, Rimac and UberCloud implemented several engineering simulations on Microsoft Azure. Designing and configuring the Azure cloud environment specifically for Rimac's needs, this included enabling Ansys and other CAE software. Would Total Cost of Ownership (TCO) of operating in the cloud versus on-premise lead to meaningful savings, and put Rimac in a position to achieve new cost efficiencies? The team had its work cut out for it.

The story of Rimac and UberCloud's partnership

These days, virtual prototyping has become commonplace as part of the product design and development phase in engineering. In order to achieve maximum cost-effectiveness and other important improvements, engineers must simulate a product before they even start to build it, and Rimac Technology was no exception.

UberCloud knows that HPC cloud technology supplies the perfect computing and data resources, on demand and at the right time, for any engineering application. These resources enable dramatically shortened design and development cycles of a new product, avoiding failures early in the design, increasing product quality by performing many simulations simultaneously—and making the design and development process more enjoyable for the Rimac Technology engineers.

Accelerating the Rimac Technology R&D pipeline to design and deliver leading-edge products would make them more competitive, innovative, and cost-efficient. Rimac deploys Computer Aided Engineering (CAE) to design and optimize their mechanical components and assemblies. They actively use Computational Fluid Dynamics with ANSYS Fluent and OpenFOAM, along with simulations based on the Finite Element Method with Dassault Systèmes' Abaqus. All simulations are performed by the team of twenty simulation engineers on their 600+ core on-premises cluster.

With UberCloud, Rimac engineers were enabled with the power to scale up simulations rapidly and easily. The HPC cloud platform allowed the engineering team to leverage the native graphical user interface of simulation software

they were already familiar with, lowering the barrier to entry and flattening the learning curve.

“Using the UberCloud platform and powering our engineering simulations with 3rd Gen AMD EPYC CPUs running on latest Azure HPC cloud infrastructure,” noted a Rimac Technology executive, “our expert simulations engineers strive for the best battery performance and even more powerful and efficient powertrain components.” Achieving the highest levels of optimization started to look more and more realizable.

Rimac engineers significantly hoped to significantly speed up the design processes and increase the number of simulations, in order to meet peak workload demands with flexible and unlimited hardware sizing. By running simulations in the cloud, UberCloud knew that Rimac could make more efficient use of their CAE software licenses. And on-demand access to the latest, fastest hardware could further speed up cloud post-processing and visualization.

Rimac Technology: Tracking the Results

The Rimac engineering team drafted a list of their actual requirements with a roadmap of moving different simulation scenarios to Azure. At the time, Rimac had its own on-premises HPC cluster with 600+ cores and InfiniBand interconnect for its power users. But given the increasing number of projects and the growing engineering team, it was estimated that additional 1000+ cores would be needed for the team to stay on track, facilitating whatever forward-thinking projects they needed to.

Based on Rimac requirements, UberCloud created a flexible global HPC architecture,

which was able to handle different workloads and easily expanded to other sites, providing maximum flexibility and cost efficiency by using on-demand, reserved, and spot instances. UberCloud created custom web interfaces in CycleCloud to provide these on-demand resources to engineers based on Rimac's consumption rules. NetApp Files were used as underlying shared file-storage service for Rimac's HPC environment, because Azure NetApp Files represents one of the fastest performing infrastructure solutions in Azure with up to 4,500 MiB/s. It also features capacity that can be increased or decreased in seconds, on-the-go.

One of the major products of Rimac Technology are high-performance battery packs. To reach peak performances, numerical simulations are used to analyze mechanical integrity, thermal behavior, and electric current distribution. For one particular experiment in the partnership, a steady-state case of conjugated heat transfer for one battery module was studied. The goal of the simulations was to identify uniformity of the cooling, pressure drop, and the outlet temperature. The results were as follows:

- 120 core Azure performs 37% faster than 144 core on-prem
- 120 cores on two HBv2 nodes on Azure are faster than 396 cores on 11 nodes on Rimac cluster
- Reduced license consumption
- Using less HW resources
- Running more jobs in parallel
- MPI optimization for HBv2 nodes
- Using high-throughput storage
- New HBv3 nodes (announced during benchmarks) showed even significantly higher performance.

HPC on Azure with UberCloud allowed Rimac Technology to significantly speed-up design processes and dramatically increase their simulation throughput. "The UberCloud Simulation Platform enables our Rimac engineers to use HPC in a highly efficient way to simulate the thermal and structural behavior of batteries in order to ensure peak performance and durability," the Rimac Engineering team noted.

Post-experiment, the following benefits of Azure and the UberCloud platform were reported:

- Flexible and unlimited hardware sizing to cover peak simulation workloads demand
- Great TCO compared to an on-premise HPC cluster
- Efficient use of expensive CAE licenses. Licenses become available again more quickly for the next simulations to be run
- Azure provides latest and fastest hardware
- The UberCloud Platform enables optimization for the use of hardware for specific applications and jobs
- Cloud post-processing and visualization speed up simulation processes

Extensive testing of HPC resources was performed by the Rimac Technology Simulations Department. Two Ansys Fluent CFD cases were benchmarked on different cloud compute nodes, and the results were compared to the performance of Rimac's internal HPC cluster. The new HB120v3 compute instances (with latest AMD EPYC 7003 "Milan" processors) provided:

- significant better performance and faster time to results,
- higher simulation throughput and optimized ANSYS license usage, and
- great TCO compared to the on-premise HPC cluster.

What UberCloud Can Do for You: Drawing Lessons from Rimac Technology

With Cloud HPC's provision of regularly updated, flexible, and scalable compute resources, we knew we had the right solution for Rimac Technology. When our experts brought award-winning, fully automated, and self-service engineering simulation platform and unique HPC containers to host Rimac simulation workflows, the results were stunning.

UberCloud and Microsoft's work with Rimac and other partners can rapidly and easily be applied to nearly any manufacturing design scenario. From Machine Learning to Design of Experiments (DoE), parameter space evaluation, optimization algorithms, and more, UberCloud's technology is horizontal—it's all about engineering, scientific simulations, and processing data. Together, these resources let organizations move from running tens of simulations per hour on premises, to running hundreds of simulations per hour in the cloud.

UberCloud Engineering Simulation Platform and HPC container technology, running in Microsoft Azure and using 3rd Gen AMD EPYC™ processors, integrates easily into any in-house IT environment, enabled by secure browser-based access to any resource in the cloud. Other than a standard browser, there is no additional software or hardware needed on-premises, nor does the platform require a proprietary portal or cloud appliance that is controlled by a third-party provider. UberCloud's solution is hosted in your own cloud account, with full and sole control by your engineers. There is no third-party control possible. UberCloud's platform and application containers function as an inherent extension of your fully secured on-premises environment.

Challenges of adopting HPC in the cloud for manufacturing

UberCloud knows that for companies involved with complex manufacturing tasks, moving HPC workstations, servers, and applications to Azure requires expertise, people, and time. It may also come with high risk. But when enterprises use their own in-house HPC resources, things can get expensive, given high procurement cost and deployment time. Resources age too quickly, and TCO can be high given the consumption of substantial amounts of electrical power, cooling, and space, as well as the levels of maintenance and support required by such an effort.

Rimac engineers now have on-demand access to additional and more powerful computing resources in the cloud, without having to leave the comfort of their workstations. They gained agility through shorter product design cycles, the direct result of shorter simulation times. They gained a superior level of quality by simulating more sophisticated geometries and physics, and by simply running more simulations. Of course, because it's the cloud, Rimac only pays for what they use, further enabling rapid innovation. All of these benefits and more are now available to any manufacturing company whose work consists of compute-intensive, heavy engineering simulations.



With UberCloud on Azure, engineers can work at the leading edge of the latest high performance cloud computing and software technologies, gaining absolute simulation workflow flexibility while scaling securely whenever projects call for it. These are significant and meaningful benefits that increase a company's innovation and competitiveness—and they are available today, with UberCloud.