



Spotlight on Cloud-First Innovators

Case studies of Rescale customers who empower engineers, scientists and researchers through digital transformation with cloud HPC

Spotlight on Cloud-First Innovators

Table of Contents


- 3 Cloud-First: Why It Matters, and What It Enables**
A Built-for-the-cloud Approach to Computational Engineering Enables Faster Time to Market and Improved Collaboration
- 4 NOV**
NOV Goes All-In on Cloud HPC With Rescale to Unlock Engineering Productivity & Manage Growth
- 5 Vertical Aerospace**
Vertical Aerospace Pioneers Urban Air Mobility with Cloud-First Strategy on Rescale
- 6 Arrival**
Arrival Drives Modern Sustainable Product Development On Rescale
- 7 Nissan**
Nissan and Rescale: Innovation that Excites
- 8 Liberty University**
Liberty University Engineering Invests In Cloud-Native HPC to Enable New R&D Capabilities
- 9 Solution Overview**
Rescale Provides a Comprehensive Solution for Agile, Cloud-first HPC to Empower Engineers, Scientists, and Researchers
- 10 About Rescale**
High Performance Computing Built for the Cloud, Details on Security & Compliance

Rescale Customers at a Glance



7 of Top 10
Global Automakers

Read the case study about Nissan Motor Co.



7 of Top 10
Global Aerospace Companies

Watch webinar on Aerospace Multidisciplinary Design Optimization



6 of Top 10
Global Automotive OEMs

Read the case study about DENSO Co.



3 of Top 6
Life Science Companies

Watch Bionano Genomics discuss the use of cloud in modern genomics



3 of Top 5
Global Beverage Companies

Read more about HPC in Food and Beverage



6 of Top 20
New Space Companies

Read the case study about Firefly Aerospace.

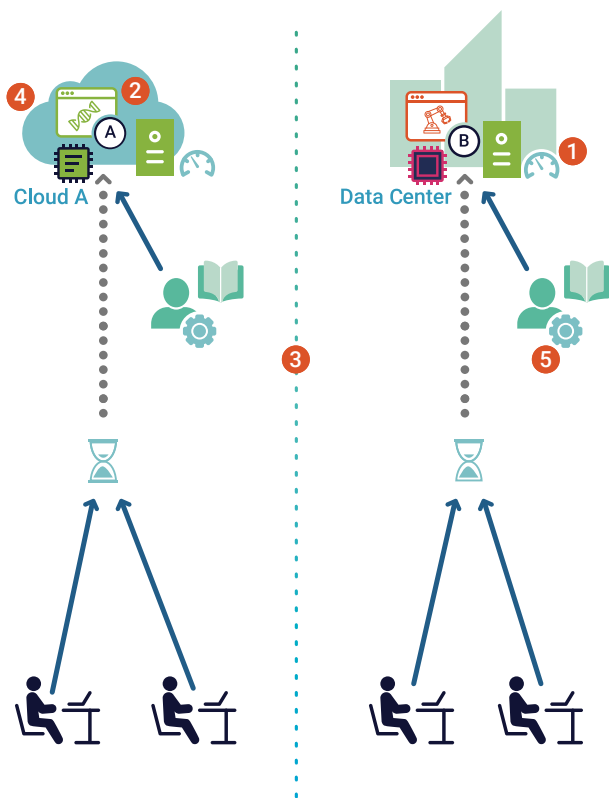
Cloud-First: Why it Matters, and What it Enables

High Performance Computing (HPC) is the engine that powers computational engineering. Traditional HPC approaches (whether in datacenter or cloud), focus on infrastructure and utilization, as opposed to engineering velocity or R&D collaboration.

A cloud-first approach takes full advantage of what the cloud makes possible: near-unlimited scale, broad variety of

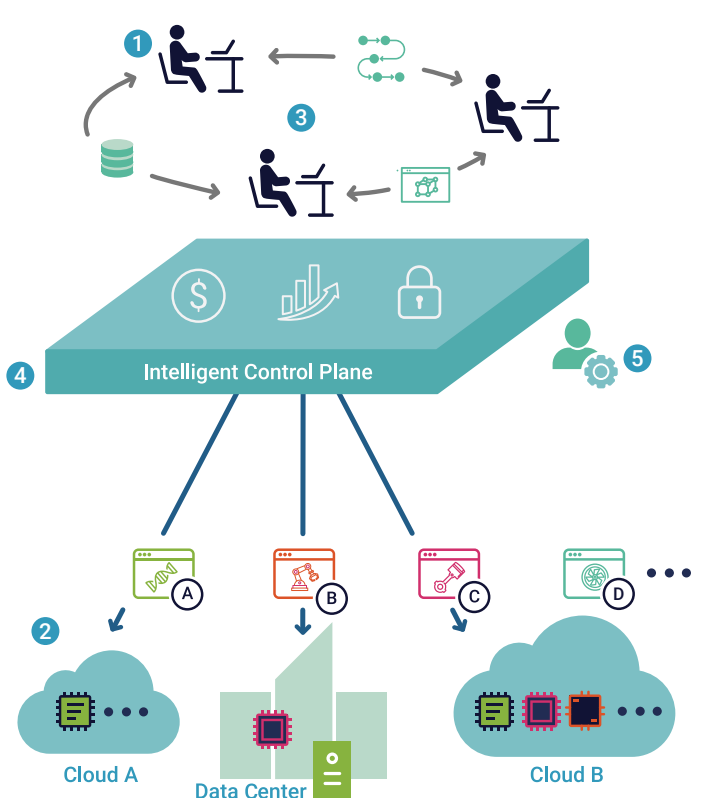
architectures, and connectedness. A built-for-the-cloud HPC approach is user-centric, unlimited, connected, intelligent, and automated. Learn more in the [High Performance Computing Built for the Cloud](#) ebook.

Traditional HPC (On-prem or Cloud)



- 1 **Hardware-centric** - Focused on HW utilization
- 2 **Inflexible** - Predefined HW, SW and fixed capacity
- 3 **Siloed** - Isolated islands of analysis
- 4 **Static** - One-time tuning with stagnant configs
- 5 **Manual** - Script-based, complex operations

HPC Built for the Cloud



- 1 **User-centric** - Intuitive with SaaS-like simplicity
- 2 **Unlimited** - Any scale, any architecture, any application
- 3 **Connected** - Seamless, secure, global collaboration
- 4 **Intelligent** - Continuous performance optimization
- 5 **Automated** - Policy-driven control & end-to-end workflows



NOV Goes All-In on Cloud HPC With Rescale to Unlock Engineering Productivity & Manage Growth



95% reduction

reduction in cloud HPC deployment time

80%+ decrease

in upfront HPC costs and reduced overall operational costs

Challenge & Solution

NOV faced increasing engineering delays from HPC resource queuing and backlogs of IT support caused by business growth and new R&D initiatives. Engineering and IT teams decided to pursue a global cloud HPC strategy managed on Rescale that alleviated resource constraints and unlocked new capabilities in oil and gas and renewables R&D to bring new products to market faster.

Outcomes Achieved

- » 100% software license utilization and optimized licensing costs
- » 95% reduction in cloud HPC deployment time
- » 80%+ decrease in upfront HPC costs and reduced overall operational costs

Leading the Future of Energy by Reimagining Computing

Global leader in oil and gas and renewable energy, NOV uses advanced computer-aided engineering (CAE) simulation to design and test new technologies pumps, regulators, and drill heads. NOV operates in 600+ locations across six continents, operating across multiple business units that serve a range of equipment manufacturing and services from oil and gas to renewable energy. NOV relies on high performance computing (HPC) resources to get accurate predictions on safety, durability, and economic viability of new products before they reach production operations. As the company expanded, so did the demands on their fixed on-premises infrastructure. This led NOV to evaluate cloud as a flexible solution to their growing and varying workload needs and maintain their competitive advantage in R&D.

Betting on Cloud to Optimize and Accelerate Engineering

NOV's computational needs quickly outpaced the capacity of their rapidly aging on-prem clusters, at times leading to a simulation job backlog of 300+ days. The cost of purchasing physical hardware to handle their design optimization workloads would have taken months to implement. Beyond growing capacity and performance requirements, NOV's expanding portfolio of R&D software led to increased complexity and cost.

NOV's engineering systems team in charge of enabling R&D engineers with hardware and software explored Rescale as a potential cloud HPC solution. During their evaluation, the NOV engineering and IT leaders discovered that Rescale could help them increase their overall computing capabilities and productivity. Prompted by urgent project needs and a growing backlog, NOV decided to deploy some test workloads on Rescale. Within 7 days, NOV's scientists and engineers had access to HPC resources on-demand, and ensured each team had the optimal hardware across multiple cloud providers for the best cost-performance.

For example, their computational fluid dynamics workloads (STAR-CCM+) performed well on Azure hardware with high interconnect while finite element analysis (Abaqus) performed well hardware with high memory. By optimizing their software workloads, NOV can simulate products faster and to a higher fidelity resulting in increased safety and reliability. As they brought on more engineers, projects, and software, Rescale's application management capabilities improved existing licenses utilization and ensured all applications were installed and up-to-date automatically.

From Unblocking Bottlenecks to Unlocking Business Growth

NOV's cloud migration of their HPC operations transformed their simulation and analysis practice from a bottleneck of engineering productivity to an accelerator of R&D projects across the company. With Rescale, they were able to quickly process their backlog and move onto new initiatives like artificial intelligence for predictive maintenance and digital twin. On top of new innovation, As sources and best-practices for energy production continue to evolve, organizations like NOV that have computational flexibility and agility will stay one step ahead.

"Deploying cloud HPC across multiple software and cloud providers would have taken us 9 months, but with Rescale we were up and running in a matter of days. We also have assurance that Rescale optimizes our engineering efficiency and helps remove IT obstacles to get back to solving big problems."

— Matthew Robinson, NOV Engineering Systems Administrator

Software Deployed on Rescale:





VERTICAL

Vertical Aerospace Pioneers Urban Air Mobility with Cloud-First Strategy on Rescale



4300% increase

in performance for computational fluid dynamic simulations

75% reduction

in the cost per job for engineering simulation workloads

Leading a New Frontier in the Cloud

In a race to be first to market for urban electric vertical takeoff and landing (eVTOL) taxis, Vertical Aerospace invests heavily in engineering talent and digital capabilities that give them a competitive edge. Adapting cutting-edge digital R&D techniques from automotive and aerospace sectors, the team takes advantage of simulation and high performance computing (HPC) to improve their vehicles' aerodynamics, battery performance, and rotor drivetrain efficiency.

Vertical Aerospace CIO, Madhu Bhabuta explains: "We need new tools to produce a new kind of vehicle - old tools like on-prem computing systems just aren't sufficient and can be cost-inefficient." The company decided early on to adopt a cloud-first strategy and pursued a platform to automate and optimised their HPC operations. "Cloud is fundamental for our Business. Access to the cloud HPC technologies means that we have access to the world's expertise for solving the toughest aerospace challenges," added Bhabuta.

Gaining Engineering Efficiency and Speed for Takeoff

Vertical Aerospace evaluated the Rescale to see how it could handle a variety of compute-intensive workloads by testing a variety of R&D simulation applications. Bhabuta shares: "Anything we can do to maximize the outcomes from our R&D spend and help our engineers to be more productive will ultimately enable us to achieve our goals faster. We recognized that our simulations were not running as quickly as they could, and we looked for ways to dramatically accelerate delivery of results. Additional on-premises HPC infrastructure would require significant capital, and would not suit our changing and varying computing needs. We needed a way to manage scale, volume, and workload effectively, and deliver a cost-efficient solution for our R&D workloads."

Kurt Clement, Team Lead for aerodynamics, aero-acoustics, and thermodynamics at Vertical Aerospace comments that "In early testing of Rescale, we realized that we could not only move our HPC operations into the cloud quickly without incurring large CapExr costs, but it was also more than capable of handling a wide variety of our workloads." With access to the latest Azure HPC hardware on Rescale, Vertical was able to monitor and adjust the cost-performance efficiency of each workload by

finding the optimal architectural configurations and maximising utilisation of software licenses. This helped the company understand where to invest and optimize its R&D resources to deliver product improvements. Bhabuta adds: "Rescale Insights are a real game-changer, giving us the ability to dive deep into the cost of running HPC workloads—including our various software licensing arrangements— while also strengthening system governance with robust access controls."

Charting a Flight Plan to Commercial Success

Vertical Aerospace's improvements in time and cost efficiency have made them a global leader in eVTOLs and the company plans to go public in 2021. They also have an early lead in commercial offerings with pre-orders from major airlines like American Airlines and Virgin Atlantic. Bhabuta, concludes "By choosing Rescale as our strategic cloud partner for digital R&D, Vertical Aerospace has dramatically increased engineering efficiency and accelerated new product commercialization without compromising quality or safety. These improvements help us drive innovative design and deliver personal, on-demand, and carbon-free air travel."

"The improvements delivered by Rescale were truly impressive: We were able to run Ansys Fluent and CFX fluid dynamics simulations four times more quickly, enabling engineers to gain access to vital data more quickly to accelerate R&D. We saw similar improvements, up to 3.3x faster, with CHARM rotor dynamics simulations on Rescale. Work that previously extended over a five-day design period can now be completed in just one day, reducing the typical cost per job by 75%."

— Kurt Clement, Vertical Aerospace Lead Aerodynamics Engineer

Software Deployed on Rescale:



Arrival Drives Modern Sustainable Product Development On Rescale

400% increase

in compute throughput with only 30% increase in cost

Challenge & Solution

Arrival product designers and engineers needed a scalable and flexible HPC solution that met their evolving business environment requirements. Rescale provided a platform for multiple teams to intelligently run various high fidelity models on the most cost-effective and performant hardware for the job.

Outcomes Achieved

- » **Performance & Efficiency:** The latest, best-fit hardware and continuous costperformance optimisation
- » **Control at Scale:** Complete IT/HPC controls simplify operations and manage cost & security risks
- » **Empowered R&D:** Turnkey R&D compute tools accelerate productivity

Rethinking an Entire Industry From the Ground Up

Arrival set out to shift the automotive industry to more sustainable products and services, but doing so from the ground up required a unique approach. The company formed a team of specialised engineers within Rapid Engineering Design called RED-CAT to apply a broad set of simulation techniques to find new ways to build more robust vehicles and optimise the overall engineering process. To meet their complex computational needs, RED-CAT utilised the Rescale platform to optimise and accelerate their engineering simulation workflows.

A Solution for Modern, Data-Driven Product Development

Completely overhauling how vehicles are developed requires validating numerous combinations of materials, designs, and processes. Critical product simulations related to safety, durability, and aero-thermal require enormous data sets and compute capacity. Arrival looked to cloud for operational agility, increased collaboration, and financial flexibility but standing up advanced workflows and navigating infrastructure in the cloud posed new challenges.

To accelerate bringing a best-in-class vehicle to market, Arrival chose Rescale to achieve speed, efficiency, and reliability in

their high performance computing (HPC) operations. RED-CAT needed an HPC simulation process that could be easily learned and quickly implemented by new engineers. Rescale platform intelligence gave the team the data to select the most cost performant hardware across multiple leading cloud service providers for each specific simulation application like LS-Dyna, STAR-CCM+, and OptiStruct. For some workloads, Arrival was able to achieve a 400% increase in compute throughput with only a 30% increase in cost. Additionally, they utilized Rescale's flexible options for on-demand licensing and integrating their existing cloud storage. Nathan Baker, the Vice President of RED-CAT, said "The Rescale platform has enabled Arrival to meet its rapidly growing computational needs, run higher fidelity models faster, and improve collaboration across the company."

Unifying R&D Innovation Across the Entire Enterprise

Fast-growing companies like Arrival are using Rescale to deploy highly scalable, manageable, and reliable HPC across multiple teams and projects. RED-CAT now uses Rescale to optimise and automate engineering workflows across several products including Bus, Van, and Car. As user adoption grows within the organisation, the need for collaboration and secure data sharing demonstrates the value of one unified for enterprise HPC management. Each of their 40+ end users has the flexibility they need to access the latest hardware and software, while managers can easily gain traceability of each project's spend, user-access, progress, and efficiency. As Arrival prepares to launch new products and microfactories, anyone from engineers and designers to business and technology leaders have a shared system of record to enable limitless R&D exploration and innovation.

"Arrival works with Rescale to manage a broad software portfolio and ensure engineers have access to the right applications, the latest versions, and the most performant hardware across each simulation project."

— Nathan Baker, RED-CAT
Vice President

Software Deployed on Rescale:



18% Cost Optimization

of Applications and Productivity

50% Cost Reduction

for HPC Expenses

- » An 18% cost optimization of applications and productivity due to better matching the hardware to specific workflows. Nissan expects a further cost optimization of 15% with next generation hardware, bringing the combined cost and productivity improvement to more than 30%
- » 50% cost reduction on HPC operating expenses

Background and Challenge

Nissan is a global full-line vehicle manufacturer that sells more than 60 models under the Nissan, INFINITI and Datsun brands. In fiscal year 2018, the company sold 5.52 million vehicles globally, generating revenue of 11.6 trillion yen. Nissan's global headquarters in Yokohama, Japan, manages operations in six regions: Asia & Oceania; Africa, the Middle East & India; China; Europe; Latin America; and North America.

Like many enterprises, Nissan realized they were limited by fundamental aspects of on-premise computing, such as: limited electric power, high total cost, and data center utilization challenges (Nissan averaged 40% - 80% utilization). Nissan recognized that these inherent on-premise problems threatened its innovation, market leadership, agility, and time-to-market.

Their on-premise HPC systems also faced the following challenges:

- » They were constrained by the initial hardware and software specifications. Nissan's computing investments were fixed over a 4 year cycle, until a 9 month hardware refresh.
- » They were complex to operate. Nissan's HPC systems required many specialized employees, facilities, application maintenance, and security measures.
- » They struggled to handle high-demand (peak) loads. Nissan's fixed HPC resources caused their engineers difficulty in allocating priority workloads to computing resources, and added risk of missing design improvement opportunities.

The Rescale Solution

Rescale's managed HPC platform converted Nissan's complex stack of software, hardware, and infrastructure into a single, unified solution that remains agile in the fast-moving technology environment. Nissan's engineers are able to access the latest technology selection through a single, unified solution and at virtually unlimited scale.

- » Completely eliminated all queuing time, which was previously an average of 2 - 3 days

Results and Benefits

Nissan recognized that its ability to remain agile and innovate faster was their key competitive differentiator in the automotive markets. They saw it was a strategic imperative to deliver their global engineering team with platform HPC resources to increase overall operational efficiency. Nissan chose the Rescale solution, which successfully delivered improved ROI across these business drivers:

- » An 18% cost optimization of applications and productivity, achieved by using optimized resources for each application and the agility to instantly scale resources to match computing demands.
- » One unifying platform solution for long-term sustainable product quality and innovation enabling rapid new technology adoption.
- » Faster product development, achieved through improved infrastructure agility and turnkey global deployment and administration, together provide zero queue time during peak engineering demand.

"We selected Rescale's solution because it enables a smooth transition into a cloud environment, resulting in Nissan being able to run hundreds of simulations with on-demand agility and flexibility, without exhausting capacity, to accelerate innovation."

**– Seiji Kawachiya, Nissan Motor Corporation
General Manager of Engineering and Quality
System Department**

Software Deployed on Rescale:



Liberty University Engineering Invests In Cloud-Native HPC to Enable New R&D Capabilities

2,500+ HPC R&D Experiments

Comprising 6+ million core-hours across a wide variety of engineering research projects

Building a Legacy of Engineering Impact

Liberty University is on a mission to educate values-driven students in an environment that encourages innovation that drives impact for tomorrow's society. In order to empower student and faculty researchers and continue to attract future leaders, the Liberty School of Engineering invests in curriculum and tools that enable cutting-edge research projects. Adapting to the demands of a quickly evolving industry landscape, the university has woven the practice of simulation-based design throughout its various disciplines. By applying simulation and other computational engineering approaches to its classes, competitions, and clubs, the school hopes to continue growing its reputation for producing high-quality research and top graduates.

Solving the Obstacles to Next-Gen R&D

As the fastest growing school within Liberty, the engineering program quickly grew its need for computation-intensive R&D and faced challenges providing adequate specialized high performance computing (HPC) resources. Across a wide range of engineering programs including civil, electrical, industrial, mechanical and computer engineering, the HPC software and hardware required varies greatly. This variation in addition to the ongoing need for support posed a challenge for the IT team leading to a search for a solution that could quickly scale to the needs of the school. Brian the cool IT guy said: "When we received the request for a robust HPC system, we had concerns around cost and our ability to deliver it quickly. When we explored their specific requirements we knew we were short personnel to implement and maintain a solution on-premises, so we explored options for cloud-HPC."

Evaluating the Best Path to Cloud-HPC

Liberty's IT and Engineering teams searched for a solution that could easily scale and support any number of students and an array of compute needs like batch HPC workloads and cloud desktops for visualization and pre/post processing. Once deciding that cloud was their preferred strategy, they began to assess the work required to build their own cloud services on top of a public cloud service provider. In this process, the team was working to enable a specialized HPC software who's vendor had experience working with Rescale and recommended it as a comprehensive and easy-to-deploy HPC solution for that software. It was determined that Rescale could also support all of Liberty's other HPC applications while providing pre-built IT management tooling that would save the team significant time to implementation.

From Resource Constrained to Compute-Empowered

Rescale helped the Liberty team overcome "limitations around cost, IT bandwidth, and expertise", explains IT Systems Operations Manager Dan Harmony, "Rescale provided an all-in-one HPC platform that was easy to implement, use, and control. IT allows us to manage the hardware and costs down to a project level which is a huge benefit." Giving Liberty researchers an easy-to-learn user experience and flexible on-demand access to the latest cloud-HPC tools through Rescale has opened up new possibilities. The Dean of the Engineering School, Dr. Mark Horstemeyer, explains that "Being able to efficiently leverage cloud-HPC helps us use our staff and financial resources more efficiently and reach our goal of educating our students to go out and impact society by revamping the industrial world."

Today, the Engineering school empowers students to explore complex questions through geological, weather, finite element, fluid-dynamic, thermodynamic, electromagnetic, and other computation-intensive simulation types. Students enrolled in engineering programs are free to utilize custom HPC software codes such as 'Terra', developed by Liberty professor and researcher Dr. John Baumgartner and widely used engineering applications like Simulia Abaqus.

"Rescale is part of our unique model of 'Creationengineering' which brings together state-of-the-art technology and processes to drive new innovation. This approach has enabled us to attract and educate students who will serve others and transform society."

**— Dr. Mark Horstemeyer, Liberty University
Dean of Engineering**

Software Deployed on Rescale:

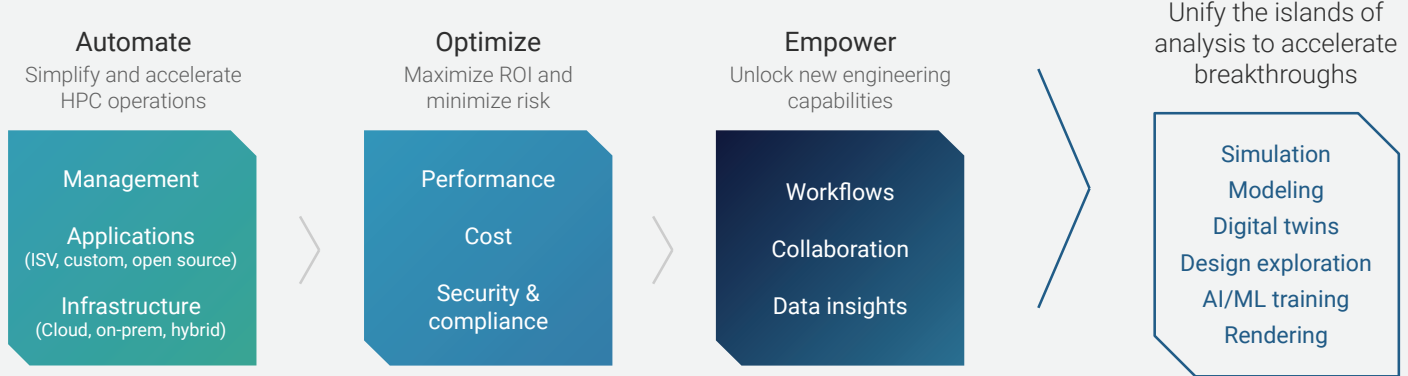
 **SIMULIA
ABAQUS**

Rescale Powers Cloud-first Strategies Unlock New Breakthroughs Across Industries

Digital transformation from legacy HPC systems to modernized, cloud-first strategies delivers unprecedented agility for new product R&D and optimization, enabling engineers, researchers, and scientists to be more productive and efficient.



Supporting Organizations in Their Digital Transformation Journey



Rescale Gives You Turnkey Access to the Latest Technologies, On-demand...



About Rescale

Rescale is high performance computing built for the cloud to empower engineers while giving IT security and control. From supersonic jets to personalized medicine, industry leaders are bringing new product innovations to market with unprecedented speed and efficiency with Rescale, a cloud platform delivering intelligent full-stack automation and performance optimization. IT leaders use Rescale to deliver HPC-as-a-Service with a secure control plane to deliver any application, on any architecture, at any scale on their cloud of choice.

Rescale's mission is to empower anyone to accelerate innovation to deliver engineering and scientific breakthroughs that enrich humanity.

Rescale's Meets Leading Security and Compliance Standards



High Performance Computing
Built for the Cloud

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