CRAY GIVES HAAS F1 TEAM A CRITICAL PERFORMANCE BOOST

Formula One racing is the most technologically advanced motorsport in the world. To compete, teams must develop state-of-the-art race cars. But to stay competitive, they must make continuous updates to them.

For an F1 team like Haas F1 Team it means running a complete design cycle every two weeks. While the vehicle's core design stays the same, its aerodynamic elements do not. Components such as the wings, diffuser, and sidepod change for every race. To give a two-week design cycle its jaw-dropping context, a commercial automaker runs a design cycle every two years.

Like their competitors in the FIA Formula One World Championships, Haas F1 Team relies on computational fluid dynamics (CFD) simulations for the critical, time-sensitive work of running wind tunnel tests, predicting and reducing drag, and improving aerodynamics. Performing these CFD analysis tasks efficiently depends on the capabilities of the compute infrastructure.

CHALLENGE

As the first American-led F1 team in 30 years, Haas F1 Team has the challenge of not only competing in one of the world's premier racing leagues, but establishing their reputation as a newcomer. Making their task even more difficult, F1 cars must conform to a strict set of FIA rules. Among them, FIA restricts the number of core hours any team can use on CFD testing.

> "We're tasked with building the fastest and most efficient race car in the most technologically advanced racing series in the world…. Our new system will help solve our most demanding CFD and data challenges."
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> —Gary Foote, Chief Information Officer
> Haas F1 Team

These limits made a high-performing and scalable compute and storage infrastructure an imperative for the team. They needed a turnkey, fully integrated system solution to support their CFD group. So they took the same approach as they do to racing — turn to a reliable technology partner.

SOLUTION

After demonstrating a clear performance advantage on benchmarks Cray worked with the team to provide a system that customized to all steps in their workflow. Haas F1 Team chose the Cray® CS500™ cluster supercomputer equipped with a Cray® ClusterStor® L300 storage system and AMD EPYC processors.

Customizable, easy to manage, and based on industry standards, the CS500 system could be readily configured to meet the team's demand for performance and scale-up capability. Combining the CS500 system with fast, scalable, all-HDD ClusterStor L300 high-performance storage gave the team all the elements they needed to run complex, computationally intensive CFD simulations.

To help address the FIA-imposed core-hour restrictions, Cray equipped the CS500 system with AMD EPYC processors. The EPYC processors yield faster time to solution because they get their performance from memory bandwidth — a capability not penalized in the formula FIA uses to allocate time. Along with higher performance, AMD EPYC server processors have advanced security features, including secure root-of-trust technology and secure memory encryption.

A final key component for Haas F1 Team was Cray's best-in-class technical support. Cray had the proven expertise developed over decades in the industry to guide the team through the switch to a new infrastructure along with the workload and utilization consultation they needed. The system went into production two weeks after installation.

Cray's expertise proved valuable in transitioning Haas F1 Team to SLURM and simplifying their workflow's through slurm rules and resources — a change that provided a much simpler technical solution for job scheduling. Additionally, the Cray team put workflows in place to help the aerodynamicists submit jobs without the need for extensive knowledge of how to run the system.

RESULTS

Overall, Haas F1 Team realized a 45% performance improvement over their previous system with the Cray solution. Another way to translate it is Cray delivered a 45% reduction in the number of core hours it takes to solve a given job. It means the team can do twice as much CFD modeling within the FIA-imposed CFD cap.

On the technical support side, Cray got the team up and running fast, moving everything to the new cluster, transitioning the engineers, and working the team through problems in less than a month.

How about their on-track performance? The first of the Cray-produced designs hit the track in May 2019 at the Spanish Grand Prix. There, they finished in points-winning 7th and 10th positions.

CRAY CS500 SUPERCOMPUTER

Scalable configurations for compute- or data-intensive and hybrid workloads

Highly configurable in an HPC-optimized, industry-standard package

Customizable software stack compatible with open-source and commercial applications

Reliable and energy efficient

CRAY CLUSTERSTOR L300

All-HDD Lustre® storage system

Ideal for large, sequential I/O workloads

Maximum performance with smallest possible number of components

Complete rack-scale solution delivers dense performance, accessible data, and actionable insights