



Business challenge

To create competitive F1 cars and winning race strategies, Aston Martin Red Bull Racing must maximize the performance of the IT infrastructure running its data-intensive simulation and design solutions.

Transformation

For over a decade, IBM has provided the technologies to help Aston Martin Red Bull Racing get the most out of their computing and storage systems. Optimized data management and compute workflows deliver simulations and models on which designers, engineers, and strategists rely on to be ready on race day.

Business benefits:

30%+ boost
in workflow throughput
for simulations

30% drop
in data access times,
enabling real-time decisions

Aston Martin Red Bull Racing Putting smart to work with IBM, transforming data into competitive advantage

After sixteen seasons in Formula One, Aston Martin Red Bull Racing has already racked up 61 pole positions, 61 race wins and four double world championships. Combining exceptional on-track performance and a radically different approach to racing, the Aston Martin Red Bull Racing team has redefined what the sport means to fans the world over. In its factory in Milton Keynes, UK, the team designs, manufactures, tests and refines practically every component of its highly sophisticated cars, preparing them to compete in 22 Grand Prix Globally. On the racetrack, the team analyzes data from more than a hundred sensors on the car to make real-time decisions about race strategy.

“Working with IBM enables us to make better decisions by unlocking the full potential of our data, ultimately translating into success on the track.”

Zoe Chilton
Head of Technical Partnerships
Aston Martin Red Bull Racing

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Speed is everything

Formula One is the world's most popular and most technically advanced motor racing series, encompassing 22 races each year across five continents. Although the sport's FIA governing body maintains complex regulations that restrict maximum performance—both to ensure driver safety and to keep costs sustainable for smaller teams—F1 cars remain exceptionally powerful, light and fast.

Zoe Chilton, Head of Technical Partnerships at Aston Martin Red Bull Racing, says: “Our objective here at Aston Martin Red Bull Racing is to build and race championship winning cars, but nothing in Formula One is gut feeling anymore. Everything is driven by gathering the right information and analyzing it in an intelligent way.”

To stay among the front-runners in F1, Aston Martin Red Bull Racing maintains deep internal technical expertise and works with innovation partners to design an almost entirely new car each year and then continually develop it throughout the racing season. Since 2014, FIA regulations have required the use of small V6 engines, so teams use a combination of advanced turbochargers, energy recovery units and auxiliary electric motors to boost performance. They also have extremely complex

aerodynamic features that balance downforce and drag to permit high speeds on both corners and straights.

Hannah Schmitz, Senior Strategy Engineer at Aston Martin Red Bull Racing, explains: “Our job is to get the highest score we can, at each event, for the team. We prepare almost three months in advance for some races, running millions of different simulations. The week before a race, we send out a preview document of exactly what we're expecting to happen based on all the latest data.”

Matt Cadieux, CIO at Aston Martin Red Bull Racing, adds: “Our car has about 7,500 unique part numbers on it, and evolves so we actually design about 100,000 parts over the course of a season. The speed of this iterative design process requires us to have very aggressive product development processes.”

Non-stop challenges

Computer-aided design and simulation are hugely important in F1, where regulations strictly limit the amount of real-world wind-tunnel and track testing the teams can undertake. In fact, the FIA even limits the number of teraflops that can be used for virtual testing, so Aston Martin Red Bull Racing must squeeze the greatest possible efficiency



The Race Engineering team at Aston Martin Red Bull Racing rely on The Weather Company to make informed decisions on race day.

and performance out of its IT resources in order to keep evolving its cars throughout the season.

Of course, optimization of the cars does not stop during racing; Aston Martin Red Bull Racing gathers and analyzes huge quantities of data from hundreds of on-board sensors which is analyzed in real time to help the drivers and pit crew make decisions on how to adjust the cars during a race. This data is

also used for the all-important race strategy and tactics, both in simulations at headquarters and to respond to emerging challenges and competitive threats trackside during race weekends.

Zoe Chilton comments: “On the Friday of a race weekend we only get three hours on the track to learn about all the new parts that we've taken out specifically for this race. It's not just about data, it's about leveraging, accessing and utilizing

that data effectively with every single one of our team members here.”

A further major challenge comes from the weather—even the fastest car cannot outrun it, and temperature, air density, wind and rain can all have a dramatic impact on race outcomes. As Aston Martin Red Bull Racing plans for each Grand Prix, it needs to understand the likely conditions so that it can accurately model tire wear and plan aerodynamic settings.

Zoe Chilton continues: “Even a few degrees of track temperature can make a huge difference to our tire wear. We could turn up with the best car in the world, but if it doesn’t have that last-minute optimization based on the best track-side data and the best atmospheric information, it doesn’t matter how good the performance is, because you could lose a huge amount of benefit by making the wrong strategy call or set up decision.”



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Gaining a competitive edge

In a high-pressure sport featuring extremely complex equipment, manufactured to micron tolerances, and with equally complex race strategies based on both deterministic and stochastic modeling, Aston Martin Red Bull Racing naturally requires exceptional IT resources. To make the most of the FIA regulations, the team must keep CAD/CAE and race simulation systems running optimally at all times, ensure the constant availability of world-class analytics solutions, and maintain fast, dependable access to huge amounts of data from all over the world, both current and historical.

For all three requirements, Aston Martin Red Bull Racing has chosen to base its infrastructure on IBM Spectrum solutions: IBM Spectrum LSF® to handle the scheduling and management of jobs on its HPC cluster, IBM Spectrum Symphony for its bespoke race analytics, IBM Spectrum Scale™ as the hub for data storage and retrieval. Data is backed up and managed by IBM Spectrum Protect, which provides the high-performance throughput to meet

tight backup and restore windows as well as the hierarchical data management to lower costs.

Brian Jones, Head of Software Development at Aston Martin Red Bull Racing, comments: “IBM Spectrum software is used to automate our workflows and provision and schedule our supercomputers; without it, we would significantly slow down car development processes. Equally, we use IBM Spectrum Symphony to break down the massive amount of calculations that we run. It’s simple, easy, quick and ultimately, something that my developers don’t really need to think about—they just use it.”

Designed for success

Success for Aston Martin Red Bull Racing naturally starts with designing and constructing a competitive car each year. Virtual simulation of airflow, using Computational Fluid Dynamics (CFD), plays a major role in both the initial design and the constant optimization throughout the course of the racing season.

CFD software enables Aston Martin Red Bull Racing to test virtual models of new components, assemblies or even the entire car to see how the all-important aerodynamics will work. By analyzing

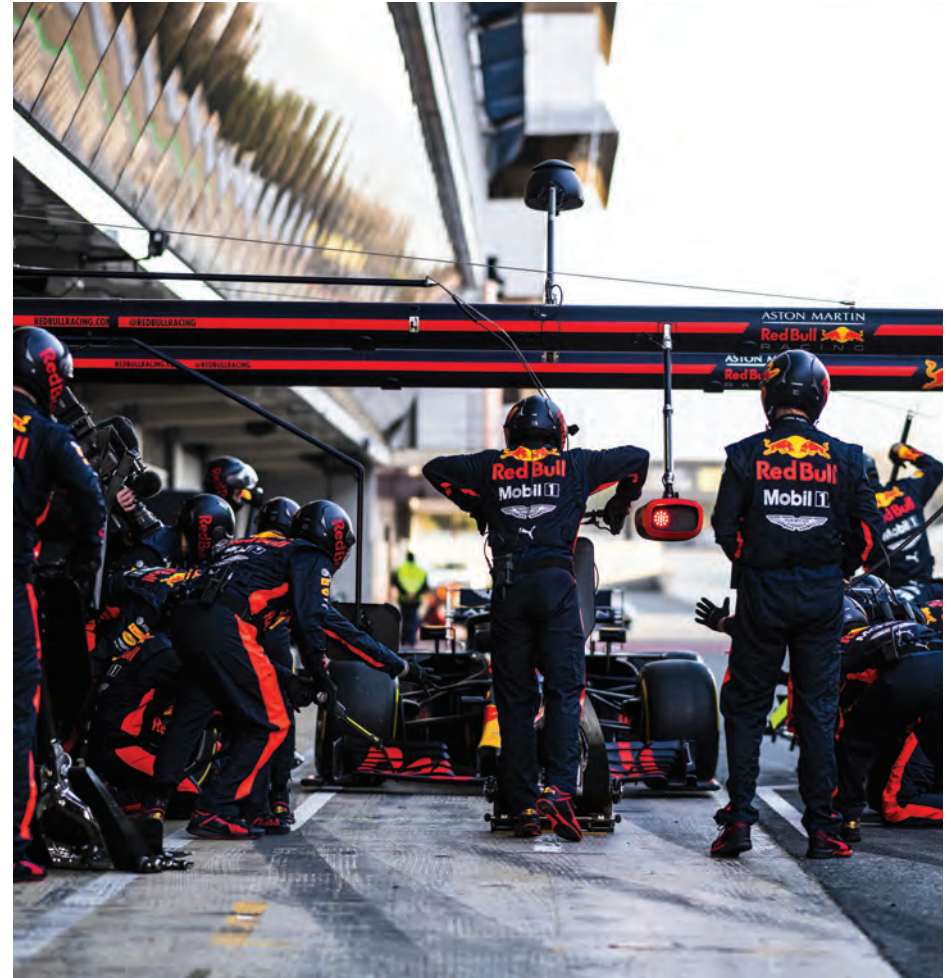
the results of computations executed on its IBM Spectrum LSF managed cluster, Aston Martin Red Bull Racing can refine components much faster and more flexibly than if it were to physically prototype them. In particular, IBM Spectrum LSF makes it easy for Aston Martin Red Bull Racing to use its wide range of simulation tools within a standardized workflow, enabling the team to work rapidly and efficiently to get the best results. Using IBM Spectrum LSF has also enabled Aston Martin Red Bull Racing to create an extremely intuitive working environment for its engineers, allowing the team to onboard new members in a matter of hours versus the six months it previously took.

Wayne Glanfield, HPC Manager at Aston Martin Red Bull Racing, comments: “Each simulation comprises more than 100 million data points, and a typical simulation could generate gigabytes of data - so the faster the storage, the faster we can write that data, and the faster we get to the end of the simulation. High-performance computing is important to Aston Martin Red Bull Racing and F1 because it allows Aston Martin Red Bull Racing to run many more iterations than we could run in the wind tunnel. It’s crucial that the jobs we run operate as efficiently as possible, and IBM Spectrum LSF allows us to do that.”

Zoe Chilton adds: “When we’re designing cars that have to carry a driver at around 200 mph around a racetrack just millimeters from the tarmac, we really have to be confident the designs we’re producing are going to be robust. The value to Aston Martin Red Bull Racing of having IBM as an Innovation Partner is that it allows us to make the very most of the computing power we have here on site. The ability to run more simulations of how the car will behave on track allows us to know more about how the driver will be experiencing the vehicle, and it allow us to be more confident about safety and performance.”

Bringing insight to the track

Another critically important element in race preparation is understanding the weather conditions at each track, from the initial practice and qualifying session right through to the checkered flag. Aston Martin Red Bull Racing has chosen to work with The Weather Company, an IBM Business, to get hyper-local forecasts wherever the racing season takes it in the world. The Weather Company provides the team with detailed forecasts in the run-up to each race weekend, helping Aston Martin Red Bull Racing set its cars up for the conditions and plan the tire strategy.



And when the cars are out on the track, The Weather Company provides minute-by-minute updates to enable real-time adjustments to strategy.

“The Weather Company gives us an edge in understanding how to adapt our race strategy to suit the changing atmospheric conditions.”

Zoe Chilton
Head of Technical Partnerships
Aston Martin Red Bull Racing

Managing valuable data

CFD Simulation, physical testing and racing telemetry together generate enormous quantities of data for processing, analysis and storage by Aston Martin Red Bull Racing. Both for CFD simulation and race analytics applications, the team must have fast, dependable access to these huge volumes of data. And while the value of this data tends to peak at the moment it is produced, the team may also need to refer back to it days, weeks, months or even years later.

With IBM Spectrum Scale acting as the gateway to the storage and archive landscape at Aston Martin Red Bull Racing, the team is able to provide extremely fast retrieval of the most current data while simultaneously reducing the cost of long-term storage for historical data using IBM Spectrum Protect™.

Chris Middleton, Head of IT Infrastructure – Operations at Aston Martin, says: “We have incredibly tight backup windows, with a race weekend finishing typically at 12 am on a Sunday morning, I have until 7, 8 o’clock to back up the entirety of the business’ data. Using IBM Spectrum Protect, I’m able to back it up quickly and effectively without affecting any applications running simultaneously. Our engineers are spending less time worrying about managing data, freeing up more time to make the car go faster.”

He adds: “IBM Spectrum Scale allows us to automatically tier data from the fastest, most expensive disk, to the least expensive disk over time so that we can maximize the value of our investment.”

The combination of IBM Spectrum Scale and IBM Spectrum Protect enables Aston Martin Red Bull Racing to access, store, and recover large volumes of valuable data over time—efficiently, at low cost and with low administration requirements.

Chris Middleton comments: “One of our greatest challenges is capacity management: in our CFD environment, we can produce terabytes per day, in comparison to our mainstream environment where we’re looking at terabytes per year. Using IBM Spectrum Protect allows us to take a backup of the data we need. Shortly after that data has become a little older, we can delete it, safe in the knowledge that it’s backed up, and readily available to be recovered at any point.

Race-winning performance

IBM Spectrum technologies are a cornerstone of the data-driven design and analytics processes at Aston Martin Red Bull Racing, helping the team to gather and access data rapidly and reliably, process and analyze it at high speed, and protect it cost-effectively.



Using IBM Spectrum LSF to manage its compute resources, aligned to data patterns, enables Aston Martin Red Bull Racing to get the maximum useful work done per hour of CPU time, which is critically important given the resource restrictions imposed by the FIA.

Chris Middleton says: “IBM Spectrum solutions have allowed us to understand where the bottlenecks are and use the best hardware for that application. We’ve seen in the past that this has led to over 30 percent improvements in our workflow throughput. Sometimes

we can get runs onto the cluster in half the time. So utilizing much more of the available hardware resource will allow us to get it onto the cluster quicker, and that means we can make decisions faster. Ultimately, this means that we can take better components to the track that help reduce our lap times.”

Supporting both CFD and other simulation requirements, IBM Spectrum Scale has helped to cut data access times by up to 30 percent, enabling faster results and more timely insight into challenges. Chris Middleton comments:

“Implementing IBM Spectrum Scale was the natural choice because it scales, it’s incredibly performant, and it integrates perfectly with Spectrum Protect Suite.”

With real-time, hyper-local weather forecasting from The Weather Company, Aston Martin Red Bull Racing gets the detailed information it needs on air temperature, air density, wind speed and direction, humidity, and precipitation. Armed with this critical insight, the team

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can make better decisions based on data rather than gut-feeling.

“If it’s going to rain in three laps’ time, we need to know,” comments Zoe Chilton. “The Weather Company gives us an edge in understanding how to adapt our race strategy to suit the changing atmospheric conditions.”

In combination with these weather insights, specific IBM Spectrum solutions help Aston Martin Red Bull Racing to take full advantage of its data to drive competitive advantage both in the factory and on the track. Matt Cadieux concludes: “We’re very knowledge-led here. We tend to be early adopters, and we try to engage with the best companies in the world. Working with IBM as an innovation partner enables us to make better decisions by unlocking the potential of our data, and those decisions ultimately translate into success on the track.”

Solution components

- IBM® Spectrum™ LSF
- IBM Spectrum Symphony
- IBM Spectrum Protect™
- IBM Spectrum Scale™
- The Weather Company

Take the next step

To learn more about IBM Spectrum Computing solutions, please contact your IBM representative or Business Partner, or visit: ibm.com/spectrum

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