Racing to find the next marginal gain

Mercedes-AMG PETRONAS Formula One Team accelerates access to performance data to empower engineering expertise

To create the optimum conditions for identifying the next racing advantage, Mercedes-AMG PETRONAS Formula One Team is building the most performant network possible at its Brackley campus. The result supports a relentless quest for innovation, powered by machine learning, high performance computing, and the best engineering expertise.

AMG PETRONAS FORMULA ONE TEAM

Industry: Sports and entertainment
Country: United Kingdom

Finding marginal gains in the ultimate test of engineering innovation

Formula One (F1) is the ultimate test of engineering innovation and driver skill. The 24-race competition season spans nine months of each year, on tracks all around the world, from Melbourne to Las Vegas. Each team must work within tightly governed technical limits. Each season sees a new set of regulations. The 10 teams are in a race to find a new competitive advantage, gains are measured in fractions of a second.

Mercedes-AMG PETRONAS Formula One Team is one of the sport's leading teams. It won a record eight consecutive Constructors' Championships from 2014 to 2021. The team is geared around a relentless search for performance improvements.

"The car is a prototype that evolves from race to race, effectively becoming a new product every two weeks," says Michael Taylor, IT Director at Mercedes-AMG PETRONAS Formula One Team.

The team has two cars and two drivers in all 24 race weekends. There is an engineering team on-site at each race, but numbers are strictly limited. It is the same with testing events; not all engineers can be trackside.

Like other teams, Mercedes-AMG PETRONAS Formula One Team makes use of its wider, off-site engineering expertise by sending live race data to its Race Support Room at its headquarters in Brackley, UK.

"Formula One is the fastest laboratory in the world," says Toto Wolff, CEO at Mercedes-AMG PETRONAS Formula One Team. "The speed in which we are able to download the data from the car and filter the noise from what is really relevant is essential."

For individual races, it's all about car setup—finding the optimal balance between speed, downforce, and all the components involved in how the car behaves. These adjustments are informed by billions of data points. Each car is full of data-sensing devices with 18,000 channels per race. Close to 100 virtualized and bare-metal servers run data-intensive workloads to help ensure the cars' reliability and performance.

"At the track, those demands go to the next level. With volatile conditions and the need to provide engineers with rapid decision-making capabilities in an environment where every second counts, we need to be ahead of the competition," David Cadywould, Head of Core Technology at Mercedes-AMG PETRONAS Formula One Team, explains.

A mobile data center built on HPE ProLiant servers and HPE Edgeline provides the enterprise-grade processing power at the edge, where the data is being created and consumed.

All of this is underpinned by the need to connect everything together—getting data from the car processed, put in front of the right people, and then transferred back to the factory in Brackley to empower more engineers and decision-making.

Vision

Strengthen race performance through culture of relentless engineering, technical, and competitive improvement

Strategy

Enable wider engineering team to deploy machine learning, simulations, and high performance computing to discover marginal gains

Outcomes

— Facilitates faster access to race strategy and lap times to boost performance

— Reduces pre-event simulation times by 67%

— Secures sensitive workflows to protect operational continuity

"It's rarely one single idea or improvement that makes a big difference, but rather the sum of many smaller ones," says Cadywould. "This idea of continuous improvement and marginal gains is fundamental to everything we do."

Using high performance computing and global expertise to find an on track advantage

To create the optimum conditions in which to find the next racing advantage, Mercedes-AMG PETRONAS Formula One Team is building the most performant network possible at its Brackley campus. The goal is to transform the way performance data is stored, moved, accessed, and exploited.

"Getting data transferred back to Brackley as quickly and securely as possible enables the wider engineering and simulation teams to contribute directly to car performance for that race," Cadywould explains.

As soon as data is received from the car, it is processed and sent to engineers in Brackley. Real-time communications mean the expertise of off-site engineers, mechanics, and strategists—using simulation and high performance computing—can be shared with the pit wall crew at the track. It gives the team a better chance of making rapid decisions and performing race-winning moves.

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"We do huge amounts of simulation, either through computational techniques or driver-in-the-loop simulators to add the human touch, all being performed and evolved in time for qualifying and race day," says Cadywould.

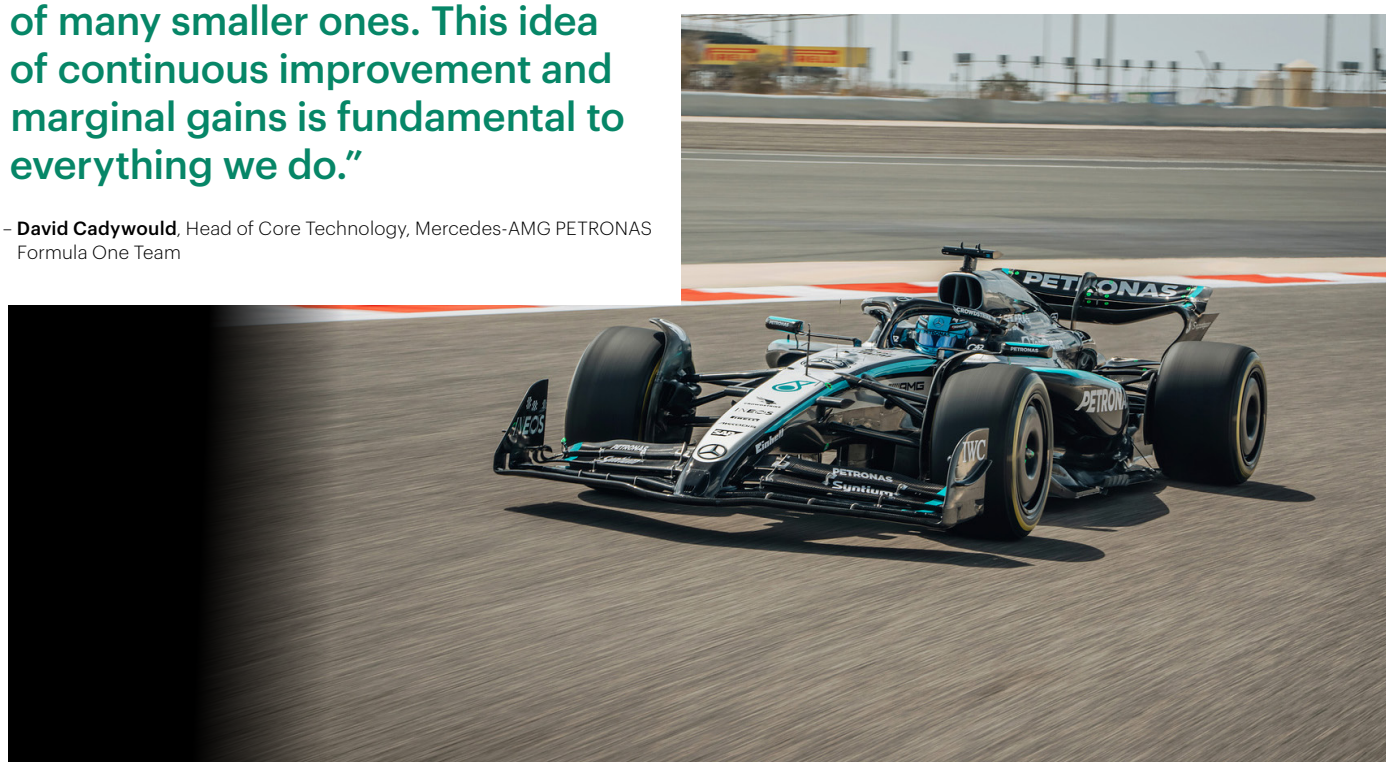
The network capability, he adds, is focused on performance, but it must also deliver against security, resilience, and cost. F1 teams have to work within tight budget constraints, including IT spend, and network uptime is critical to keeping systems online.

"Of course, we need to keep all this secure and avoid third parties or any other teams hearing our plans," Cadywould points out. "And in a sport where timing is everything, we can't afford a disconnection."

Accelerating the performance of latency-sensitive and data-intensive applications

The Mercedes-AMG PETRONAS Formula One Team technology advantage is supported by Hewlett Packard Enterprise. The partnership includes HPE Aruba Networking throughout the campus and data centers, blanketing the Brackley site in Wi-Fi 7 access points, enterprise platforms based on HPE Synergy, and high performance computing workloads on HPE Apollo clusters.

At the heart of all these technologies, HPE Aruba Networking connects everything together. The network helps ensure data gets to the right places quickly, efficiently, and securely. The latest generation Wi-Fi empowers users wherever they are on campus or trackside.



"HPE Aruba Networking Wi-Fi 7 access points offer higher capacity, increased throughput, and reduced latency, all of which are crucial for managing our campus network that consists of many high-demand devices," says Ben Reynolds, Principal Network Engineer at Mercedes-AMG PETRONAS Formula One Team. "It provides us with the opportunity to take a Wi-Fi-first approach and future capability with things like inventory tracking using location-based services. It also presents some cost-saving opportunities in the future when it comes to switching and infrastructure cabling."

The Brackley campus and data center network comprises HPE Aruba Networking CX 9300, CX 8325, CX 8360, and CX 6300M SR10 Switch Series, orchestrated through HPE Aruba Networking Central and secured with HPE Aruba Networking ClearPass Policy Manager. The business secures and optimizes its wide-area network using HPE Aruba Networking EdgeConnect SD-WAN and HPE Aruba Networking SSE, delivering a unified secure access service edge (SASE) architecture.

"HPE Aruba Networking EdgeConnect SD-WAN accelerates these connections and gets critical performance data where it needs to be, as quickly and as efficiently as possible," says David Cadywould. "It also gives us resilience by combining multiple links into one seamless connection."

The use of HPE Aruba Networking EdgeConnect WAN Optimization accelerates the performance of latency-sensitive and data-intensive applications. It leverages the latest networking techniques such as per-packet path conditioning and forward error correction to help ensure data arrives efficiently and, more importantly, correctly the first time, every time.

"With HPE, we've accelerated pre-event simulations from three days to one. That's a huge opportunity to evolve the car," says Michael Taylor.

Using machine learning to conduct large-image-analysis of tires has removed the need for manual processing, delivered greater accuracy, and massive time savings. Similarly, HPE Apollo, which runs high-performance compute (HPC) workloads, like computational fluid dynamics (CFD) and race strategy simulations, has on multiple occasions, reduced work time from multiple days to just a handful of hours.

"In our world, this is the difference between not having those results available for that race weekend at all and making them available right now—ahead of qualifying and race day—can make a meaningful difference to race results," Ben Reynolds explains.

The HPE engagement also addresses the challenge of managing huge amounts of fresh and historic data.

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"To enhance data management across specialized, high-bandwidth workloads, we adopted HPE Solutions with the WEKA storage platform," explains Cadywould. "This delivers very low latency, fast metadata, high IOPS, and high throughput."

The HPE approach is designed with resilience and security in mind. "We work closely together to get the balance of resilience and simplicity, keeping everything always on through things like seamless automation to move workloads on HPE Synergy and storage that can keep up with rapid simulation," Ben Reynolds adds.

The Mercedes-AMG PETRONAS Formula One Team has adopted a zero trust approach to security, with remote access to cloud services managed using the full suite of tools available in HPE Aruba Networking SSE. Data in transit is protected using encrypted tunnels through HPE Aruba Networking EdgeConnect.

"Software-defined networking enables deeper understanding of how our network is used," says Ben Reynolds. "We expect the use of AI to only get stronger and deliver automated remediations, decipher complex issues, and present greater insight."

In addition, HPE engineers work closely with the team to help Mercedes-AMG PETRONAS Formula One Team stay up to date on technology without losing focus on strategy and faster lap times.

"We see HPE expertise as an extension of our team," David Cadywould adds. "As a lean IT team, it can be difficult to stay ahead of the ever-evolving world of technology, but HPE partners with us to deliver solutions that satisfy the unique demands of F1. The more context they have, the more efficiently this expertise can be delivered."

In a world where innovation at the core and marginal gains become significant advantages, this is where HPE technologies make a difference, he adds:

"We have to convert technology into performance, enabling everyone to contribute their tenth of a second in their own ways — whether through reliability, capability, or performance—which ultimately ends up as improvements in car performance."

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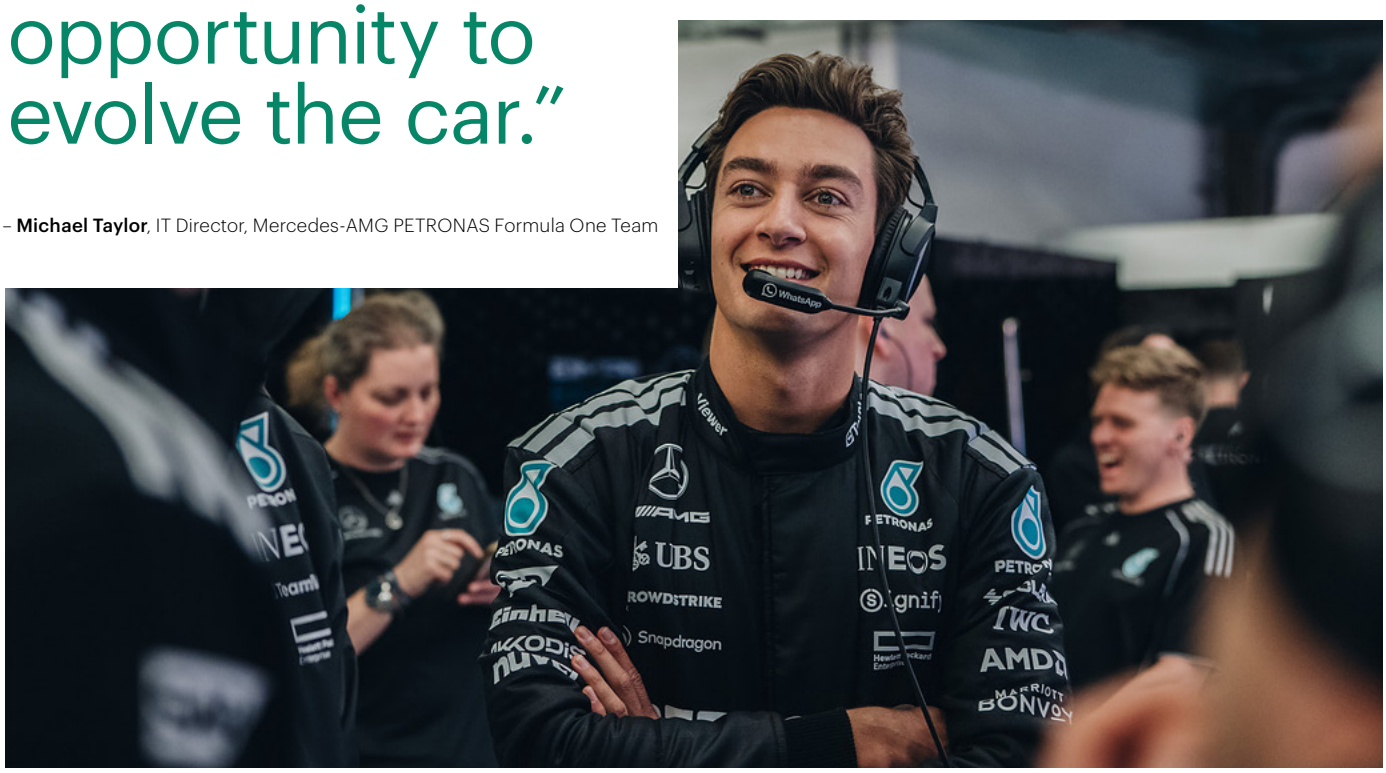

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