It has been three seasons since we began our journey in Formula 1® - and what a journey it has been. Our collaboration with Formula One Management (FOM) and the Mercedes AMG Petronas Formula One Team has reaped rich rewards. Our partnership with FOM has always been about pushing technology to the limits for the benefit of everyone involved with the race, including viewers and fans.

Tata Communications powers FOM with 10-times faster connectivity at every race location. Our Pit Crew team covers over 4.5 laps of the globe annually, responding instantly to race-day issues and requests, including setting up a trackside data centre at each race location in two days and dismantling it in just three hours after the chequered flag waves, a process that with a traditional structure would take weeks.

Tata Communications has also enabled Formula1.com to reach over 157 million fans over the past three seasons, and we enable the site to share a vast amount of real-time data with up to 7 million simultaneous users during each race weekend.

The increased communications speed and infrastructure Tata Communications offered became even more crucial as the new regulations took effect. Tata Communications has enabled innovation across multiple spheres in the business of Formula One. This includes the first-ever live transmission of 4K ultra-high definition resolution from a Formula One race, the Singapore GP, to London, powering FOM’s Remote Operations Centre at Biggin Hill in the UK with cutting-edge connectivity solutions and also enabling transatlantic video communications in real time for the Mercedes AMG Petronas Formula One team.

Our ongoing pursuit of excellence in innovation led us to join forces with FOM and the Mercedes AMG Petronas F1 team to create the F1 Connectivity Innovation Prize. With the aim of engaging the brainpower of F1 fans globally this crowd-sourcing challenge runs across the race season and assembles a panel of F1 judges of extraordinary calibre to foster and reward innovative and creative thinking in connectivity. To learn more about the 2015 competition and its milestones sign up for updates about the 2015 competition log onto www.tatacommunications.com/f1prize.

All of this, combined with the Championship win of our partner Mercedes, has made our journey in the sport this year a truly enriching experience.
F1 evolves at a pace like no other organisation, with a speed of decision-making and scale of innovation that is unparalleled. Beyond the F1 track, the approach to innovation can inspire global enterprises to imagine the possibilities. For example, the same technology used on the track is being used in hospitals to remotely manage patients.

We meet enterprise leaders every day who are looking at their businesses and trying to find the next leap that pushes them out ahead of the competition. Our service model is geared to today’s global economy where remote operations are essential whether you’re racing cars, servicing cell phone grids, or managing security systems.

As an enabler of technology innovation whether in Formula One racing or in industries such as manufacturing, banking or healthcare, Tata Communications sees it as our mission to bring new thinking to the table, helping to unleash the collective imagination of these organisations and enabling them to view their world, their problem and their potential solution through a radically different lens.

It is our singular aim to help enterprises accelerate operations across the globe, reach global audiences faster, expand into new territories, and drive better collaboration worldwide. The possibilities are endless.

Tata Communications is at the technological helm of FOM’s F1 operations and as a fan and a business leader, I’m thrilled to be a part of the action. Formula One is the most demanding, challenging, and fastest-paced operations I have ever been involved in, but it is also the most rewarding. We are proud to be supporting this amazing sport.

Tata Communications is the Official Connectivity Provider of Formula One enabling the sport to seamlessly reach out to its tens of millions of fans across the globe. Tata Communications is also the Official Managed Connectivity Supplier to the Mercedes AMG Petronas Formula One Team, providing three times faster connectivity to the team.

Tata Communications owns and operates one of the world’s largest fiber network measuring more than 710,000 kilometres of subsea fiber facilitating over 24% of the world’s internet routes across 200 countries and territories, as well as nearly 1 million square feet of data centre and collocation space worldwide.
FORMULA 1 IS A UNIQUE BLEND OF PASSION, STYLE AND TECHNOLOGY.

The style underlines the premium quality of the sport and its participants.

And the technology tells the story of the incredible innovation that takes place within the F1 ecosystem, from breakthrough advances in aerodynamics or hybrid engines to the 4K proof of concept, carried out for broadcasters by Tata Communications at the Singapore Grand Prix 2014.

It is this Innovation that drives the sport and sets it apart and there are many good examples of stunning innovations in the last few years, many of which will find their way into the public arena via the automotive and other industries.

"Data is what drives innovation"

Paddy Lowe, Executive Director (Technical), Mercedes AMG Petronas FORMULA 1 team
THE CHALLENGE: HOW TO INCLUDE MORE ENGINEERS IN THE KEY DIAGNOSTIC AND DECISION-MAKING PROCESS, WHEN THE RULES STATE THAT A TEAM IS RESTRICTED IN THE NUMBER OF TRAVELLING PERSONNEL.

Towards the end of 2014, the MERCEDES AMG PETRONAS Formula One Team trialled a new live HD video system in the garage with its partner Tata Communications, to improve communication with engineers back at the factory in the UK to speed up diagnostics and decision-making.

The rules in F1 state that a team is restricted to 60 people at the track across all roles and departments, so it follows there is a cap on the number of technical experts a team can have trackside.

With cameras in the garage and engineers’ briefing room connected live and in real time, the support engineers in the UK can assist with diagnostics and decision-making. That basic facility has been in place for some time. But up to now it has been at a CCTV kind of level; the facility has been very crude, with a standard definition camera sending low-resolution images with a refresh every few seconds. This is not very Formula 1, but the limitation was the bandwidth available from the pit lane suppliers.

There was demand from the Mercedes race engineers to be able to interact live with their colleagues at the factory in real time and in High Definition, as if the UK-based engineers were there at the racetrack and vice versa. The idea is for the UK based people to see and understand as much of what is going on as if they were there and to be part of the decision making process in real time. This is particularly useful during frantic periods, like qualifying and especially those fraught few minutes between the three qualifying sessions.

Typically the TV feed is 3 seconds behind. To a normal business, that might not make a big difference. But in F1 qualifying, generally the fastest car is the last to start the final flying lap. Sometimes they go past with a second to spare.
By removing responsibility from the trackside staff for keeping their colleagues at the factory informed of what is going on, it also frees them up to focus more on their jobs at the track, the thinking goes.

It takes Tata Communications 0.244 secs to send a signal around the world on their fibre optic ring. In a Proof of Concept trial last season, live HD video images were fed in real time from five cameras in the team garage and briefing room. This required an extra 25Mbps of bandwidth in addition to what was already needed for the operations of the F1 cars. The cars each produce 2.5Mbps of telemetry data and the 60 staff on site use a further 10Mbps for internet traffic and data.

All kinds of possibilities are opened up by this innovation for improving efficiency, speed and thoroughness of response. It also creates the possibility for more key roles to work remotely from base, thus saving money on travel costs.
The hybrid turbo Formula 1 power units used in F1 today are the most thermally efficient engine ever produced, in terms of energy produced per unit of fuel. This is thanks to the hugely powerful and innovative Energy Recovery Systems (ERS) employed in addition to the internal combustion engines.

F1 has long been considered a mobile test laboratory for the automotive industry. Disc brakes, seat belts, deformable crash structures and many other standard components today were incubated in motor sport.

The sport develops innovative technologies, which then find their way onto mass produced road cars. But the initial direction is set by the automotive industry in the first place, creating the demand.

The hybrid turbo power units we have today are a prime example of that. Introduced following demand from manufacturers in the sport including Renault, Mercedes and Honda, the 1.6 litre V6 power units comprise six components: an internal combustion engine; a turbocharger; a Motor Generator unit – Kinetic (MGU-K); a Motor Generator Unit – Heat (MGU-H); an Energy Store (battery) and Control Electronics.

Whereas previously F1 engines were 2.4 litre V8s consuming around 150 kg of fuel for a 300km Grand Prix, the new Power units do the same distance in the same time with just 100kg, or 35% less fuel. They are more powerful, have far more torque and the top speeds on the straights are far higher. The ERS accounts for over 160hp of the total power output and the engineers are innovating constantly to improve the hybrid technologies, which will soon find their way onto road cars.

The MGU-K harvests energy under braking, stores it in a battery and then reintroduces it when the driver accelerates; while the MGU-H harvests energy from the turbo, which is then reintroduced back into the turbo to cut throttle lag. The turbo on an F1 car spins at over 125,000 RPM.
The solution, created in 2010 by engineers at McLaren, was the F Duct, which was a device operated by the driver's upper arm, which opened and closed a vent when the car was on a straight. It gave McLaren a speed boost of around 8-10km/h.

When operated, it channelled an air flow from a intake in the nose, which passed through the chassis and out onto through small holes to the top element of the rear wing, which stalled the rear wing on the straights, cutting the drag and giving a speed boost. When the driver closed the vent, the airflow was cut and the rear wing went back to behaving normally.

It was ingenious because it did not contravene any of the technical regulations, but did something that it had been considered previously, could only be done through a movable aerodynamic device, which would be illegal. As it was operated by the driver's arm movements, it was above board.

The only mystery is why it was called an F Duct. Some say it’s because the duct on the chassis was F shaped, others that it was concealed beneath the ‘F’ of main sponsor Vodafone's branding on the chassis!
THE CONNECTED CAR

THE ROAD CAR OF TODAY IS BECOMING MORE AND MORE ‘CONNECTED’ TO THE WORLD AROUND IT, BUT THAT’S NOTHING COMPARED TO THE F1 CARS RACING AROUND THE GRAND PRIX CIRCUITS OF THE WORLD.
Thanks to innovations in the Electronic Control Unit, by McLaren Electronics in partnership with Microsoft and Freescale, the F1 car knows precisely where it is on track at all times, has messages fed to it, processes and sends data to teams and other recipients and can have all its parameters measured in real time as it circulates round the track.

There are over 120 sensors on an F1 car; recording over 500 parameters that are transmitted live via telemetry to the pits, but also to the teams’ factories in the UK and Europe. Tata Communications helps to provide Mercedes with high speed connectivity for this, meaning better understanding and faster decisions.

The ECU has massive processing power for something so small, but what sets it apart is its robustness as it operates in a very hostile environment, with high temperatures and even higher G forces to contend with.

There are other applications of the ECU outside of F1. A lightly adapted version is being used in a children’s heart hospital in England to measure things like heart rate, oxygen levels and blood pressure in an ill child.

And, inevitably, it is far more capable than the units currently used in hospitals; it can take a heart cardiogram 125 times a minute, instead of once an hour, for example.

This allows doctors to pick up signs of deterioration in a child’s condition much earlier and it detects subtle shifts, which the current system would not register.

This is what F1 has arrived at through the desire to know as much as possible in real time about what is happening on the race car.

Beyond that, what is very interesting is that McLaren Electronic Systems and Freescale which makes the micro-controllers, are using the learnings from F1 telemetry to play a part in a revolution in the automotive world, with the “connected car”; external data coming to the car is going to be used to affect the way the car is driven to make it safer and more efficient, two goals that it shares with F1.

Currently we see the “connected car” concept in technology like dynamic traffic management systems, which link in with Sat Navs to reroute cars away from congestion. But looking further ahead things like anti-collision radar technology and more sophisticated vehicle-to-vehicle communications will make motoring safer and more efficient.
THE CHALLENGE: HOW TO MAXIMISE THE DOWNFORCE AT THE REAR OF THE CAR, IMPROVING STABILITY FOR THE DRIVER AND GRIP IN LOW AND MEDIUM SPEED CORNERS?

EXHAUST BLOWN DIFFUSER
The exhaust blown diffuser was an ingenious technology, which dominated F1 for three years from 2011, with Red Bull Racing and Renault as the greatest innovators in the space. They won four consecutive World Championships for Drivers and Constructors during this time, largely thanks to this innovation, which others struggled to copy and perfect.

A diffuser is an aerodynamic device, which creates a low-pressure area under the rear of the floor, which in turn creates downforce.

What Renault perfected, was the art of blowing exhaust gases into that sensitive area to significantly increase that downforce, using innovations in ignition and engine mapping to create the perfect exhaust flow.

But that’s not the half of it; F1’s governing body, the FIA, modified the rules several times between 2011 and 2013 to make it more difficult to achieve this effect.

They moved the exhausts further away from the sensitive areas, so to get around that, the final iteration of the blown diffuser used what is known as the ‘Coanda’ effect, where the exhaust gases were aerodynamically trained to follow the contours of the bodywork, down towards the sensitive diffuser area.

At the same time, the engineers innovated with the engine mapping, to create a pulsing effect in the exhaust gas flow. They also found clever ways to keep the throttle butterflies open, which maintained gas pressure – and thus downforce - even when the driver lifted off the throttle for a corner!

To achieve this a team needed a very sophisticated CFD (Computational Fluid Dynamics) model, which could take up to 3 days at a time in a Super Computer to render.

It didn’t have direct applications in the automotive industry, but it did advance drive-by-wire technology, CFD sophistication and also deepened understanding of engine mapping technology.
VIRTUAL SAFETY CAR

THE CHALLENGE: HOW TO CONTROL THE SPEED OF THE CARS IN A DANGER ZONE, FOLLOWING AN ACCIDENT WHERE COURSE VEHICLES AND CORNER WORKERS ARE VULNERABLE
French driver Jules Bianchi suffered a terrible accident in the 2014 Japanese Grand Prix, sliding off the track in wet conditions and hitting a mobile crane, suffering severe head injuries. The area had been subject to waved yellow caution flags, but Bianchi's speed had not been regulated through the danger zone.

In response, for 2015 it was decided that F1 needed a new system to regulate the speeds in such situations and the idea of a Virtual Safety car was born. A Safety Car is a course vehicle that is dispatched onto the track to pick up the race leader in the event of a serious problem on track, which requires the race to be neutralized.

A Virtual Safety Car covers only the section of the track where an incident is being cleared up and officials may be in danger, but where the incident doesn’t warrant a full Safety Car. It uses the connectedness of the cars to the Race Control to reduce the speed of the cars through that section of track.

All competing cars must reduce speed and stay above the minimum time set by the FIA Electronic Control Unit at least once in each marshalling sector (a marshalling sector is defined as the section of track between each of the FIA light panels).

The speeds are centrally monitored and the race is effectively neutralized with everyone circulating in a holding pattern with gaps maintained until the VSC signal is lifted and the race restarts.
THINK YOUR IDEA’S WORTH $50,000?

WE’LL BE THE JUDGES OF THAT.

Tata Communications presents the 2015 F1® Connectivity Innovation Prize – a trailblazing contest that will award a grand prize of USD $50,000 to a winning individual or team. To find out more about the competition and how to enter visit tatacommunications.com/f1prize or join the conversation at #tatacommsf1prize

Terms and conditions apply.