The amazing world of F1™ technology
Modern F1 could not exist without computers...

IF EVER A point illustrated the importance of computers to Formula 1, it’s that you can’t even fire up an F1 car without a laptop. The unquestionable fact is that advances in IT have made the cars faster, safer and among the most aerodynamically sophisticated machines on this planet. The influence of technology touches every corner of this beautifully complex sport. Huge supercomputers the size of five fridges perform billions of calculations within hours just so engineers can decide which of a hundred front wing endplates will work best. Mobile servers are lugged to every race to provide a mobile office for over 60 people, 20 times a year. Gigabytes of data travel through virtually bulletproof laptops before being beamed back to a team’s base on the other side of the world, only milliseconds after they’ve been collected. It’s a totally different sport to the one Juan Manual Fangio starred in back in 1950.

But one of the great things about Formula 1 is that it is always relentlessly and unashamedly moving forward. Without some of the truly mind-blowing equipment we celebrate in this supplement, that simply wouldn’t be possible.

Hans Seeberg, Editor, F1 Racing

Do more with Efficient IT
See how Dell and Intel® helped Caterham F1 Team deploy an enterprise-class IT system able to do real-time analysis of data sent from the car, while withstanding the intense heat and vibration of the Formula 1™ trackside environment. Learn more at TeamDellRacing.com.
After getting their entry to Formula 1 approved, the Caterham F1 Team (then operating under the Lotus Racing banner) had just 22 weeks to make the first race of the 2010 season. Needing serious computing help, and fast, they ended up here at Cambridge University...

THE ROOM WHERE IT ALL BEGAN
Formula 1 cars are expensive to design and develop, so the team could never have made it to that first race of the season. The HPC (High-Performance Computing) cluster at Cambridge is an impressive piece of kit – and just what the newly-born team needed. “In 2006, this used to be the biggest academic system in the country and the 20th biggest in the world,” says Paul Calleja, the university’s Head of HPC. “It was even faster than the HPCx National Supercomputer in Edinburgh. It’s normally used for lots of work in biology, chemistry and astronomy – there are astronomers here using the machine to analyze data they get from satellites and people doing jet engine simulations. It’s even being used by a team that link into the work going on at CERN and it’s a very complex system. At the same time, the company was recruiting CFD engineers to help get the cars ready for the first race of the season, so they needed tools to use. That’s why we made use of the HPC facility at Cambridge University.”

It meant that during the winter of 2009, the team were in Cambridge constantly as they worked frantically around the clock to get the car ready. “They were here for about six months in the end,” laughs Paul. “We actually ended up renting them some office space in Cambridge for a while.”

Bill Peters, Caterham F1’s Head of IT, remembers the Cambridge period well. “As soon as we’d sorted out our trackside IT environment, we kicked off work on the supercomputer around the same time as we started getting the factory up and running,” he says. “You have to build a physical environment to house a supercomputer, and it’s a very complex system. At the same time, the company was recruiting CFD engineers to help get the cars ready for the first race of the season, so they needed tools to use. That’s why we made use of the HPC facility at Cambridge University.”

Getting Trulli and Kovalainen on the grid for the first race of 2010 was an incredible feat of organization, tenacity and hard work. But don’t underestimate the importance of the blue room in getting them there. “I’ve had experience with Dell before so I knew their support and reliability was great, but they moved heaven and earth for us.”
This is **Antony Smith**.

He is Caterham’s trackside IT engineer.

And the team can’t go racing without him...
When you turn on your TV on a Sunday to watch an F1 race, an incredible amount of work has been going on behind the scenes to get those 24 cars on the grid – and few jobs in the sport are more vital than that of Antony Smith.

He is Caterham’s Senior IT Support Engineer, or, as we like to call it, ‘The bloke who gets the team’s entire IT infrastructure in the pitlane up and running so that the cars can run’ (although admittedly that would be slightly lengthy for a business card). His job is literally this: set up the entire network and computers for 60–odd people – and very quickly.

‘It is a stressful job,’ says Antony. ‘Everything hinges on me in the early part of the week in the setting up of the equipment, and then I suppose everything hinges on me for the rest of the week in a way as well because we can’t send the cars out if the computers aren’t working properly. One of the reasons there’s so much pressure is because you can never say no! You can’t turn round to someone and say, ‘Sorry, I can’t get the network going’ – it’s always got to work, simple as that.

‘The other thing is the hours – you’re easily working 16–18 hour days quite a few days in a row at a race, and that’s very tiring. But even during the two-week summer break that F1 has there’s stuff to do – there’s no holiday in IT, you know! Plus you’ll walk past someone and they’ll say, ‘Sorry, I can’t get the network going’ – it’s always got to work, simple as that.’

An F1 car can’t even run without being fired up by a laptop, so the role of a Senior IT Support Engineer is vital. This is a diary of Antony’s typical race weekend.

**FRIDAY**

“For a European race our trucks would normally set off from the factory on a Sunday, although what makes the race at Silverstone a bit different is that our three race trucks are all at Kemble Airfield in the south-west of England, due to us doing straightline testing in the days before the race. If it’s a race somewhere like Italy or Germany I’ll usually get to the country early on the Monday afternoon and head to the track – straight from the plane in a lot of cases! The urgent thing I need to do is get to the garage to start laying the cabling to get the power and network in. When I get to a circuit, the first thing I do is start unloading the trucks with the trucks. As well as the three race trucks there are three support trucks, and all the IT equipment is in there somewhere; I can’t access it until everything’s been unloaded.

So before I do anything computer related I’m usually helping to build the garage, sort the paneling and generally helping out. Because we’re not the biggest-budget team on the grid – and all teams are limited on how many people they can take to a race – Caterham F1 has a culture of ‘mucking in’. My job really kicks in once the trucks have been unloaded and I can get on with setting up the IT. I’m the only person who does this. When people ask me what it involves I say, ‘Imagine building an office in a different location about 20 times a year’ – that’s essentially what my job at the race is.

The tricky thing is that all circuits are different, and even if you go back to the same one you went to last year someone will probably have touched what you put in, or you’ll be in a different garage altogether. So I always have to start from scratch.

We have our own electricians who put in the cabling to get the power and network in. When I get to a circuit, the first thing I do is get to the garage, set up the network and get everything running smoothly by then.

It’s quite a lot of pressure, I suppose, and it’s even more intense when there’s a back-to-back race [races on consecutive weekends]. The cars need to be rebuilt between each race because they are set up differently for each circuit, and to do that the engineers and mechanics need build sheets to tell them what specification they’ll be building the cars to. To get these build sheets, they need the network. Everyone relies on communications – in F1 you can’t even turn the car on without a computer.”

By Tuesday lunchtime I’ll usually have all the servers set up and running, which is very useful because ours are condensed into just three machines. Not only is this handy for me but when you have to pay $100 per kilo to transport things, it’s pretty handy for the team’s budget too.

By Wednesday a lot of the team are starting to get to the track and everyone has to be to the circuit by 6am on the Thursday, so the entire IT operation has to be running smoothly by then.

It’s quite a lot of pressure, I suppose, and it’s even more intense when there’s a back-to-back race [races on consecutive weekends]. The cars need to be rebuilt between each race because they are set up differently for each circuit, and to do that the engineers and mechanics need build sheets to tell them what specification they’ll be building the cars to. To get these build sheets, they need the network. Everyone relies on communications – in F1 you can’t even turn the car on without a computer.”

**SUNDAY**

“Imagine building an office in a different location 20 times a year – that’s essentially what my job at the race is”
**SATURDAY**

“The strange thing about my job trackside is that by the time Saturday comes around, the main part of my work has been done because the entire IT infrastructure is up and running. Quite unlike most other people in Caterham, Saturday and Sunday should be my quietest days – in theory at least. I have to say that setting all this up does get easier as we go through the season: for the first few races it can be a bit frantic, but if I haven’t got things working smoothly by the time the Canadian Grand Prix rolls around in June, I’m in big trouble!

One of the main things I have to do throughout the weekend is make sure the data gets back to the team at the factory in England without any problems. We have acceleration software to help with this; data gets back to the team at the factory in around 80 PCs just to run two racing cars, so there’s still a lot to do…”

---

**SUNDAY**

“Usually Saturday passes without too much incident, and Sunday is the same – the vital part of my role has been performed earlier in the week. Unfortunately I can’t just switch off the network as soon as the chequered flag falls, because lots of people in the team still need to use it.

The few hours after the race are still incredibly vital for the engineers, so the IT infrastructure has to work just as flawlessly long after the winning teams have finished celebrating on the podium. Race engineers might not be analyzing live-data at this stage, but they still have to compile reports and send them to various people.

Another task that needs doing is that all parts on the car have to be ‘erased’ – we have to know how many miles each part has done because they all have a certain lifespan, and after a certain mileage they will either have to be reconditioned or discarded.

On top of this, data still has to be sent back to the factory in the UK for further analysis and we also have to wait to receive official track data from the FIA and FOM, who run the sport. All this means that I won’t switch off the network until around four hours after the race – and even then people are still saying, ‘Don’t turn it off’ – I still need it!

One of the other things that delays us packing everything up and getting out of the circuit is that immediately after the race, the cars go to a place called Parc Fermé. This is an official area run by the FIA where the cars are inspected thoroughly to make sure they are the correct weight and dimensions, to ensure that everyone has adhered to the rules. So we don’t even see the cars until at least two-and-a-half hours after the race.

I’ve tried to optimize things so that people can work on the network as long as possible and I’ll give some people a WiFi connection so they can still be online once the network has been switched off. A European race will be finished by about 3pm, and if things go smoothly we’ll get out of the circuit by 5pm.

The thing about my job is that it doesn’t really stop. I mean, the races take up a whole weekend but we fly out to get there quite a bit beforehand – for somewhere like Australia I’ll fly out on the Saturday before you. You’d think that the off-season would be very quiet for someone like me, but it’s the only time we get to do anything to the equipment. While a lot of people might be winding down a couple of weeks before Christmas, we’re making plans to improve all our equipment for the 2012 season because it has to be up and running by the end of January.”

---

**A WEEK IN THE LIFE OF ANTONY SMITH**

The manic working life of a trackside IT guru during a Formula 1 race

**Monday**

“If it’s a flyaway like Australia, we’ve got to set up everything from scratch – cables, tables, chairs, the lot. Then it’s setting the network up and getting the WiFi working so everyone can access their emails without me having to get a load of cabling out!”

**Tuesday**

“Normally this is for cabling the entire garage, including all the connections to the cars. It’s basically sorting out anyone who needs a wired connection.”

**Wednesday**

“Time to get the engineers’ office sorted, because they need a very high performance network. We have this office in a single box to make it easier, so we can just wheel it in and it now the cables in. We’ll also get the marketing team up and running.”

**Thursday**

“I’ll get the pitwall up and tested, and all of our TV feeds too because there are an awful lot of those. We get the feed from the circuit, put it onto our network and then feed it out to whoever needs it.”

**Friday, Saturday and Sunday**

“This is practice qualifying and the race. Obviously I’ve got to be on hand if there are any issues – then it’s just a case of packing it all up and going home...”
The Dell Half-Rack. It looks like a fridge freezer from Darth Vader’s Death Star, and indeed the force is strong within it. But this black box is not from the set of a sci-fi blockbuster; it is the brains behind Caterham’s entire trackside operation.

“IT contains our servers – where all our computer power is – so all the trackside laptops have their network provided by it,” says Bill Peters, Caterham’s Head of IT. And, vitally, the half-rack collates and processes all telemetry to enable the engineers to improve car and driver performance and optimize race strategy.

“Toward the front of the grid,” estimates Bill, “but I think some other teams have seen how compact our rack is and are in the process of reducing their footprint as well. Sending trackside equipment round the world is a huge expense for F1 teams – probably far more significant than people imagine.”

Senior IT Support Engineer Antony Smith agrees. “It has condensed our trackside operation down massively; anything we can do to take up less space, less weight, less heat, it all helps us because we’re really really tight on space during a race weekend. In terms of the weight, I think it costs the team in the region of $100 per kilo to ship equipment round the world for F1. These servers are pretty hefty and the UPSs that power them are even heavier, so you can imagine that having a rack of servers that’s half the size makes a big difference to us.”

“Having a rack of servers that’s half the size makes a big difference to us.”

As for the equipment itself, it makes the complex task of having to serve 60 people and run two racing cars surprisingly straightforward. “The half-rack runs what’s called a ‘virtual environment’, with 20 virtual servers, each doing specific tasks,” says Bill. “Engineers access these from trackside and the factory. Rather than having a physical server for every single application that you need to run, we have some larger servers which run virtual machines, inside which these applications are run.”

Small footprints

Taking about a week to build when the team was first assembled ahead of the 2010 season, one of its benefits is its size and reduced weight. “Our rack is roughly half the size of the ones that some of the other teams take to races, especially at the front of the grid,” estimates Bill, “but I think some other teams have seen how compact our rack is and are in the process of reducing their footprint as well. Sending trackside equipment round the world is a huge expense for F1 teams – probably far more significant than people imagine.”

Senior IT Support Engineer Antony Smith agrees. “It has condensed our trackside operation down massively; anything we can do to take up less space, less weight, less heat, it all helps us because we’re really really tight on space during a race weekend. In terms of the weight, I think it costs the team in the region of $100 per kilo to ship equipment round the world for F1. These servers are pretty hefty and the UPSs that power them are even heavier, so you can imagine that having a rack of servers that’s half the size makes a big difference to us.”

An easy start

Fortunately for such a complicated and impressive piece of equipment, it’s quite easy to set up – and that’s good news for Caterham’s Senior IT Support Engineer Antony Smith, who has to get it working at every race. “It’s very easy to get

HOW THIS BOX REVOLUTIONIZED F1 RACE WEEKENDS

Without this black box, Caterham’s F1 cars wouldn’t even get assembled, let alone race. F1 Racing peers inside the mind-boggling world of Dell’s ‘Half-Rack’
started,” he says, “because at a track we get provided with our WAN (wide area network) connection back to the UK and that’s the same every race – it’s just one cable. It takes longer to unpack the half-rack from the truck than it does to get everything up and running. On a flyaway, I can have the servers up and running by Monday lunchtime if everything goes well – and that’s if I get there on a Monday morning. But by that time we’ll have people coming in wanting to use it, so it’s got to be that quick.”

Given the nature of F1 and its relentless march forwards, nothing stays the same for long – and it’s the same with a team like Caterham’s Dell IT equipment. “We did a lot of tinkering with the half-rack after last season had finished,” admits Antony. “We spent a lot of the off-season expanding what it can do, changing the storage so it has more capacity, increasing the memory to allow us to run more virtual machines – just tweaking it and making it better. It has been working brilliantly for the past two seasons, but all IT equipment needs updating.

“For example, on the half-rack we’ve been doubling up its capacity, going to newer higher-tech parts that will be smaller and generate less heat – basically just tightening everything up and improving things for the people who use it. Increasing the size of the virtual machines, giving them more memory and reallocating more processors to them has been important; if you’re a data engineer at the track you’ll now have more power in your machine to process the data live. This is vital for next year because our cars will be running KERS and this could potentially double our data. At the moment we generate 20GB of data in a race weekend, which all has to go back to the UK from wherever we are. And it’s not only a question of that doubling – there’ll be more complex simulation models on the data, which will put a lot more strain on the virtual environment.”

Sensitive side

Such an important and sensitive piece of kit needs some serious looking after, especially given that it’s constantly being lugged around the globe and pushed in and out of trucks. That’s why it’s got a specially made outside case, built out of aircraft-spec aluminum honeycomb; inside, it has suspended anti-vibration mounts to stop it getting knocked around.

The one thing Bill, Antony or Dell can’t stop? The half-rack getting absolutely filthy. “You’ve got to remember that it’s not kept in a nice server room – it’s out in the real world at a racetrack so it gets caked in dust and sand and all sorts of nasty stuff,” laughs Antony. “That means it needs cleaning – I have to take it apart and get the vacuum cleaner to it. It takes a whole day to do, because everything’s got to come out. The servers have to be removed, the hard drives have to be cleaned and the fans have to be taken apart and cleaned because there’s a lot of air going through them and they pick up a lot of dirt that ultimately stops them from cooling everything.”

Small, money-saving and capable of allowing 60 engineers, managers and strategists to work non-stop, and two F1 cars to race at full tilt, for an entire Grand Prix weekend. Pretty impressive for something that’s just five feet tall.
The power behind the passion

Want to go racing? You’ll need some seriously impressive computing kit...

**AT THE FACTORY**

**THE HPC SUPERCOMPUTER CONSISTS OF:**

- **186 DELL POWEREDGE SERVERS**
- **1,488 INTEL XEON CORES**
- **1,488 INTEL XEON CORES**

**CAPABLE OF:**

- **10,000,000,000 CALCULATIONS IN SEVENTEEN HOURS**

**WHICH RESULTS IN:**

- **200 PICTURES**
- **EIGHT VIDEOS**

**SIXTY**

**Dell Precision high-powered desktops**

**60**

**Dell Optiplex standard desktops**

**100TB STORAGE**

**ENOUGH TO KEEP SIX MONTHS WORTH OF CFD WORK ON IT**

**400X FASTER**

**than your PC at home**

The team generates **20 GIGABYTES** of data over a race weekend

**INSEIDE AN F1 TEAM**

- **250 Caterham F1 Team employees, which includes ten IT staff**
- **1km**

The length of cabling that Caterham lays to connect its IT equipment at races

**1**

**NUMBER OF IT “MAN-HOURS” REQUIRED PER GRAND PRIX**

**AT THE FACTORY**

**OTHER COMPUTING**

- **45 Virtual servers**
- **20 Physical servers**

**65 Dell PowerEdge servers**

**20 Dell PowerConnect switches**

**30 TERABYTES**

Storage using Dell EqualLogic

**TRACKSIDE**

**THE IT SETUP**

- **THE HALF-RACK:**
  - **TWENTY DELL POWEREDGE VIRTUAL SERVERS**
  - **10 Dell PowerConnect switches**
  - **HALF THE SIZE OF OTHER TEAMS’ RACKS**

- **100TB Tracksite storage using Dell EqualLogic**

- **200 HUNDRED DELL LATITUDE LAPTOPS**

**20 TWB**

**Tracksite high-powered desktops**

**20 HUNDRED DELL PRECISION LAPTOPS**

**100TB**

**Storage using Dell EqualLogic**

- **Dell PowerConnect switches**

- **30 TERABYTES**

- **Dell Latitude laptops**

- **60 Dell Optiplex standard desktops**

- **20 Dell PowerConnect switches**

- **10 Dell PowerConnect switches**
Never sleeps, never eats, no tea breaks...

MEET THE HARDEST WORKER IN FORMULA 1

Think you’ve got a lot on your plate? Spare a thought for Caterham’s supercomputer. When analyzing how potential new car parts will perform, it can make an astonishing 163,398 calculations per second, 24 hours a day, seven days a week.
What is Caterham’s supercomputer?
The supercomputer – or HPC (High Performance Computing) to give it its technical name – is comprised of 186 Dell servers, with each server having eight cores – that’s 1,488 Intel CPUs (Central Processing Units).

“The core is effectively your mathematics processor – a calculator, in other words,” says Caterham’s Geoff Dunk, whose job it is to look after the HPC environment. “Each core does a portion of the maths; we join those cores together to be able to calculate larger problems in a shorter space of time.

That is essentially all the machine consists of in terms of its number crunching capabilities, although on top of that there are three large servers that do what they call the ‘visualization work’ in F1. “These servers take the data from the other 186 servers and produce the results in the form of pictures, videos and graphs,” says Geoff. “This helps our engineers see what they’re looking for, because millions and millions of numbers mean nothing to anybody.”

What is it used for?
The HPC cluster’s role as a gigantic number cruncher has only one purpose in F1: to help out with Computational Fluid Dynamics, or CFD as it is known. It’s a technology that creates a completely accurate replica of the car to provide the team with detailed analysis of how potential new parts will perform aerodynamically.

There’s only one way to do this: perform several billion partial differential equations. That’s where the supercomputer comes in.

The team might feed it a hundred slightly different versions of the same part, such as a front wing endplate, with the aim of finding out which one is best. Over the following 17 hours, the HPC cluster will do over ten billion calculations, eventually whittling them down to around 800 million pieces of data. Rather than just present these on a spreadsheet, the final two hours of the process is called ‘Post Pro’, which condenses all the information into around eight videos, 200 pictures and some graphs. The CFD engineers can then see which endplate performed best, and the part can be physically made in order to be tested further.

The main benefit of using the Dell supercomputer is saving time. In the ‘old days’ of F1, before technology like this existed, teams would have to hand-make all the parts to be tested – incredibly time-consuming, much more expensive and nowhere near as comprehensive.

Nowadays a team like Caterham can instantly dismiss ideas that aren’t going to make their car go any faster round the track, all it takes is 17 hours in their Dell HPC cluster.

How was it made?
Supercomputers are entirely bespoke machines made to the individual

Thanks to this technology, Caterham can dismiss any ideas that aren’t going to make their cars go faster
because you’ll be downloading applications and storing bits and pieces on it. But because everything on the HPC is set in stone, it doesn’t get any slower,” explains Geoff.

“The other great thing about our HPC is that when we started talking to Dell about what we needed it to be able to do, we didn’t go for some sort of incredibly cutting edge set-up – this is standard, tried and tested Dell kit that a lot of businesses around the world use. If you start pushing the boundaries with computer equipment it can become unreliable, and that’s not going to work for us when we’ve got so much of our development going through this machine all the time. That decision has really benefited the team and ultimately allowed our cars to be as fast as they can be on track, which is what matters in this game.”

What if it breaks down?

Next to the supercomputer is a slightly odd sight: sixty 24-volt batteries which look identical to the ones you might put in your road car but slightly more robust. The reason for this is simple: if there’s a power cut, the HPC won’t immediately stop working.

“If this happens, these 60 batteries won’t keep the supercomputer going on indefinitely,” explains Geoff. “They only power it for a total of 12 minutes, but that buys us enough time to shut the machine down properly. HPCs don’t like being turned on and off, but if you have to do it, you need to make sure it is done correctly.”

How often is it running?

No piece of equipment in Formula 1 works harder than the supercomputer: it’s on 24 hours a day, 365 days a year. “It usually has a maximum of six 17-hour ‘jobs’ running through it at any one time, meaning every single one of the 186 servers is being used,” explains Geoff. “You tend to find that end of play on a Friday is a very busy time for it, because we’ll load it up to do a variety of jobs over the weekend. Because of the amount of fans the HPC needs to keep it cool, you need earplugs if you spend any length of time in the room – and a coat, because it can get pretty cold.”

The only time of the year the supercomputer isn’t in use is during F1’s enforced two-week shutdown in August, where teams are not allowed to do any work relating to the car in a bid to cut the cost of competing in the sport.

What maintenance does it need?

“Having to physically make the supercomputer isn’t in use is during F1’s enforced two-week shutdown in August, where teams are not allowed to do any work relating to the car in a bid to cut the cost of competing in the sport.”

If this happens, these 60 batteries won’t keep the supercomputer going on indefinitely,” explains Geoff. “They only power it for a total of 12 minutes, but that buys us enough time to shut the machine down properly. HPCs don’t like being turned on and off, but if you have to do it, you need to make sure it is done correctly.”

Getting information about new parts on the same day rather than the following morning could make a massive difference to us, because F1 is all about saving time – both on and off the track.”

F1 is about constant improvement, which is why the supercomputer runs 365 days of the year

In 2011, an F1 team is capable of performing approximately 100x more work on a supercomputer than it would have been able to do ten years ago

The team can analyse virtual parts rather than having to physically make models at their factory

It usually has a maximum of six 17-hour ‘jobs’ running through it at any one time, meaning every single one of the 186 servers is being used
Mr I.T.

As Head of IT for Caterham F1, Bill Peters has to make sure everyone from car designers to aero boffins have the tools for the job. But that’s easy compared to getting the team up and running from scratch in just 22 weeks…
It’s September 2009, and the Lotus Racing team has just had its entry into the 2010 Formula 1 World Championship accepted.

Brilliant. All they are missing is a pair of drivers, two cars and a team of people to make them.

How long after Dell came on board was it that you had what you’d call a proper working IT infrastructure?

In terms of the numbers of people we needed for that first year, with fully functioning trackside, factory and HPC facilities, we were more or less up to strength by about May 2010. Not bad, really.

What are the main challenges of being Head of IT for an F1 team?

It’s probably not dissimilar to being Head of IT for a major corporation or a small manufacturing business. The main thing you need is to have visibility across the business, because IT touches every part of it these days. You need to have a good grasp of the problems and issues each department faces, so you can provide the tools for people to be able to do their jobs.

For me, that means understanding how people like aerodynamicists and designers work. It’s a pretty complicated job but it’s a great one too. I mean, I love racing and I love IT – bringing those two together is a great one too. I mean, I love racing and IT.

So Bill, it’s the end of 2009 and there are under three months to go until the first race of the season. What was the first thing you did to get the team up to speed IT-wise?

Well, normally there would be a process for building an infrastructure in a business like an F1 team: you’d get the factory infrastructure in place first, then the trackside up and running followed by the various other systems layer upon layer.

What we had to do was put that whole process in reverse and get the trackside stuff done first, because we had to be able to perform at testing and at the first race of the season in Bahrain come March; if there were certain things not working at the factory by that time then we thought we could just work around it. So we sorted the trackside systems out and made sure we had the bare essentials at the factory to be able to communicate with the team while they were at a circuit. After that we started focusing on the supercomputer, or HPC, environment.

How would it normally take to set up the IT for an F1 team from start to finish?

So Bill, it’s the end of 2009 and there are under three months to go until the first race of the season. What was the first thing you did to get the team up to speed IT-wise?

Well, normally there would be a process for building an infrastructure in a business like an F1 team: you’d get the factory infrastructure in place first, then the trackside up and running followed by the various other systems layer upon layer.

What we had to do was put that whole process in reverse and get the trackside stuff done first, because we had to be able to perform at testing and at the first race of the season in Bahrain come March; if there were certain things not working at the factory by that time then we thought we could just work around it. So we sorted the trackside systems out and made sure we had the bare essentials at the factory to be able to communicate with the team while they were at a circuit. After that we started focusing on the supercomputer, or HPC, environment.

How long after Dell came on board was it that you had what you’d call a proper working IT infrastructure?

In terms of the numbers of people we needed for that first year, with fully functioning trackside, factory and HPC facilities, we were more or less up to strength by about May 2010. Not bad, really.

So Bill, it’s the end of 2009 and there are under three months to go until the first race of the season. What was the first thing you did to get the team up to speed IT-wise?

Well, normally there would be a process for building an infrastructure in a business like an F1 team: you’d get the factory infrastructure in place first, then the trackside up and running followed by the various other systems layer upon layer.

What we had to do was put that whole process in reverse and get the trackside stuff done first, because we had to be able to perform at testing and at the first race of the season in Bahrain come March; if there were certain things not working at the factory by that time then we thought we could just work around it. So we sorted the trackside systems out and made sure we had the bare essentials at the factory to be able to communicate with the team while they were at a circuit. After that we started focusing on the supercomputer, or HPC, environment.

How long after Dell came on board was it that you had what you’d call a proper working IT infrastructure?

In terms of the numbers of people we needed for that first year, with fully functioning trackside, factory and HPC facilities, we were more or less up to strength by about May 2010. Not bad, really.

What are the main challenges of being Head of IT for an F1 team?

It’s probably not dissimilar to being Head of IT for a major corporation or a small manufacturing business. The main thing you need is to have visibility across the business, because IT touches every part of it these days. You need to have a good grasp of the problems and issues each department faces, so you can provide the tools for people to be able to do their jobs.

For me, that means understanding how people like aerodynamicists and designers work. It’s a pretty complicated job but it’s a great one too. I mean, I love racing and I love IT – bringing those two together is a bit of a dream job really.

So presumably different departments need their computers to do vastly different things?

Yes, but it’s more the applications that different people need to be able to use. The actual hardware, the tin underneath it if you like, most of our staff don’t tend to mind too much about that – they just want the tools to be able to do the job in hand. By far the biggest power users in the whole of Caterham F1 are the CFD guys who use the HPC; they also have incredibly powerful desktops because they’re doing work that requires a lot of graphic capabilities and a lot of pre- and post-processing work. We have to make sure that we’ve got big performance for these people, because the CFD department is working 24/7.

A plan comes together: Peters has established trackside, factory and HPC facilities

At the other end of the spectrum you’ve got something like the marketing department. They need lightweight laptops that don’t require that much power but need to be able to communicate anywhere because marketing are very mobile users. Then you’ve got the race team which is a mixture of the two: mobile users who need a lot of power. They have incredibly powerful laptops. In between all this there’s a whole spectrum of people with a different set of needs; finance users, for example, have pretty standard computing needs.

How does the relationship between Caterham and Dell work on a day-to-day level?

It’s an ongoing relationship, really. While we got everything up and running for that first season and it did the job, there weren’t huge amounts of resilience built in and not a lot of process available. In between then and now we’ve spent a lot of time putting resilience into our systems to make sure we’ve got disaster recovery and things like that. But F1 is a business where things are constantly evolving and being improved, and that includes the IT side of things.

We have to be constantly looking to the future to make sure we can support the latest and greatest applications that our engineering and design guys want to use.

What if something goes wrong with one of the machines or even the supercomputer? That’s not really the sort of thing you can take to PC World to fix, is it?

Not really! Right from the outset we’ve had this thing called Dell ProSupport, which provides us with support 24 hours a day, seven days a week, 365 days a year – so anywhere in the world, whatever time of day, we can get help. We’ve used it too – it could be during a race weekend and it’s on us at our factory in the UK and we can have Dell people available to us. It also includes them bringing hardware replacements to us within four hours, wherever we are in the world. Coupled with that and because of the partnership we have with them, we have a fast-track into the product groups at Dell, because normally the sort of problems we might encounter aren’t the sort of things that their first-line support might be able to help us with.

Finally, how often do you have to replace computers in F1?

We’re still using most of the same stuff the team started with. We’ll replace a lot of it for this coming season because we have to minimize risk and balance the possibility of things going wrong, but I would quite happily run all of our race team kit for another season. That’s quite a testament to how good it is.
Formula 1 is a harsh environment for a delicate piece of equipment like a portable computer – but this innocuous-looking PC can take anything Caterham throw at it.
Knocked about on planes, accidentally bashed around in the garage, inadvertently dropped on the floor – not to mention being expected to work when about 800bhp of F1 car is fired up two meters away from it. These are just some of the things expected of a laptop during a race weekend in the Caterham garage, as well as working perfectly and processing enormous amounts of data in order to help the team make the car go faster. As you can imagine, not just any ordinary laptop will do. Then again, a Dell Precision M4600 isn’t just any old laptop.

Although it looks like the sort of thing a lot of people might use at work or at home, this piece of kit is seriously advanced – as it needs to be to be able to cope with the demands that people like F1 race engineers place on it. One of the first things it’s got to be able to do is work in a variety of different places. In the Middle East – our computing equipment has to be able to function flawlessly in all of them. What allows the Dell Precision to be able to withstand all these and more is the bullet-proof build quality, as Bill explains: “The difference between this laptop and a standard one you might have lying around at home is that the build quality and resilience on these tends to be stronger. They have better power supplies and more robust casings, for example, both of which you definitely need working trackside in F1. They also have Intel Extreme Edition processors for sheer processing power – in fact, everything across the board at Caterham has Intel processors in them. This piece of kit is seriously advanced – as it needs to be to be able to cope with the demands that people like F1 race engineers place on it.

“One of the key things about the M4600 is that it has solid state hard drives. Basically, a typical home-use computer will have spinning discs, so they’re actually mechanical – imagine a whole stack of CDs going round and round. Solid state hard drives have no moving parts in them. There’s lots of reasons for that, but some of the benefits are that it makes the equipment lighter in weight and less likely to be physically damaged.” It’s also helped solve an issue which had F1’s computer boffins scratching their heads a few years ago. “We spent a long time in the F1 garage into account with all the IT equipment all over the world nearly 20 times a year. Generally speaking, the attrition rate on an F1 race team’s IT kit is quite high.” On a race weekend quite a lot gets thrown at it. “The difference between this laptop and any old laptop is the nature of Formula 1 what with hauling all the IT equipment we need over a race weekend, and so far it’s stood up to everything we’ve thrown at it. And believe me, over a race weekend quite a lot gets thrown at it.”

It certainly does, as Antony explains: “An F1 car has a few hundred sensors on it to record every conceivable piece of data you could imagine to feed back to the engineers about how it’s performing. Now, one run of data from a practice session or the race is probably about one-and-a-half gigabytes, which is data that all needs to be loaded into RAM and accessed quickly. There’s a huge demand on the Intel processors and the memory of these systems. Not only that, but they’ve got to have an awesome screen on them; engineers look at all the data graphically, and the more you can fit on screen at once the more chance they’ve got of seeing what they need to be able to see.”

Given that IT as an industry is constantly evolving, even a Dell Precision laptop has a shelf life. “Typically we’d expect to refresh our trackside equipment once every two years,” admits Bill. “This stuff is doing a lot of mileage and getting knocked around a fair bit – that’s just the nature of Formula 1 what with hauling equipment all over the world nearly 20 times a year. Generally speaking, the attrition rate on an F1 race team’s IT kit is quite high.”

“Having said that – and I’m not just saying this – our mobile workstations are still going strong. The team has been using these since that first race of the 2000 season, and we’ve had very few reliability issues with any of the kit, to be honest.” Antony agrees. “We’ve had these laptops since the start and they’re really fast, but we’re getting some new ones for next year which will be able to do even more. They are pretty chunky but they’re incredible – you’re talking a complete workstation PC in a laptop, with incredible amounts of processing power. “They’re as fast as any PC you could have. For us, to get that amount of power in a portable box is brilliant.”

**Conditions it can withstand**

The Dell Precision is designed to withstand extreme temperatures, dust and vibration.

- **Temperatures:**
  - The race in Bahrain can be very windy, blowing in huge amounts of dust and sand around it.
  - Very chilly, while temperatures in places like Malaysia can get very chilly while temperatures in Abu Dhabi can exceed 40°C.
  - Very windy
  - Very chilly

- **Dust:**
  - Extremely dusty places in desert locations
  - Extremely dusty locations in the Middle East
  - Very windy

- **Vibration:**
  - Very high vibration on the car
  - Extremely high vibration on the car

- **Distance:**
  - Distance traveled during races: 200,000km
  - Average humidity expected during the Malaysian Grand Prix: 77%
THE CLOUD: F1’s FUTURE?

In a sport where gaining tenths of a second is vital, teams are looking to advances in IT to give them the edge – and save money

Formula One may be a test of a driver’s ability, man and machine in harmony under extreme circumstances, but all those daring overtaking moves, fast qualifying laps and breathtaking straight-line speeds would not be possible without computers. Ever since the days when championship-winning cars were created in oily garages no larger than Caterham’s HPC room at Hingham, such as the shed in which Ken Tyrrell built his first car four decades ago, Formula 1 has been a test of the capabilities of computers. Ever since the days when engine speeds would not be possible without daring overtaking moves, fast qualifying laps and breathtaking straight-line speeds would not be possible without computers. Ever since the days when championship-winning cars were created in oily garages no larger than Caterham’s HPC room at Hingham, such as the shed in which Ken Tyrrell built his first car four decades ago, Formula 1 has been a test of the capabilities of computers.

“Ultimatey using the Cloud would mean having less physical equipment, so it would be very much a phased thing for an operation like an F1 team,” reasons Bill. “You would be using someone else’s equipment and have your applications hosted remotely, with users connecting into that remotely. Now obviously all that depends on having a very good communications infrastructure, but if you think about it, if we had everything hosted in the Cloud, managed by Dell, and it was accessible all over the world, we could feasibly get to the stage where we don’t have to take much kit to a race. It could reduce Caterham’s overheads massively.

“It may not happen within the next couple of years, but I can see it happening eventually. You’d probably always need a certain residual capability back at base so that you could carry on if you lost your communications for a period of time, but it’s certainly a very interesting thought.”

“We could feasibly get to the stage where we don’t have to take much IT kit to a race. It could reduce Caterham’s overheads massively.”

But in a sport as secretive as Formula One, are there any potential drawbacks of handing sensitive data to a third party? Bill Peters doesn’t think so. “We would embrace this! We already have a complete back-up email system in the Cloud. If our email system goes down in the factory you can failover to the Cloud and people can still get email and the trackside operation can still continue to work through that connectivity,” he says. “The way I can see it happening is that initially you use it for remote access and support as a form of back-up. But also you could use it for extra storage demands – we have huge amounts of data, for example, so if we ever run out of storage we could use some of the extra capacity on the Cloud, and archive things there to give us more storage in the factory. At the end of the day, all we’re trying to do is make our systems as bulletproof and available as possible. In a sport like Formula One, where a third of Caterham F1 staff can be traveling at any one time, that’s a huge benefit.”

Antony Smith, the team’s Senior IT Support Engineer, agrees. “The progress I’ve seen in IT in the last ten years has been incredible, in terms of the links and the WAN (wide area network) connections that we use,” he says. “The Cloud is incredible; the slight issue is that we don’t have control of the WAN connection at a racetrack. If we had everything in the Cloud and we lost our connection it would be tricky. The thing with the Cloud is that when you’re at a race you can’t control something like a digger ripping through a pipe into the circuit, which is what happened in India last year. “But there’s no doubt about it: the Cloud is a fantastic idea for reducing costs and equipment.”
Find the cloud you didn’t know you already had.

Do more with Efficient IT
You have cloud-ready systems already in place. Dell’s open virtualization and cloud solutions powered by Intel® create efficiencies within your existing infrastructure, giving you the tangible business benefits of the private cloud. Learn more at Dell.com/EfficientIT.