White Paper

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British Swimming – Winning data analysis powered by Intel® Xeon® Processors

Powering data analysis to deliver key insights for Team GB's swimming team

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Executive summary

Team GB's Olympic swimming team increasingly relies on Intel® Xeon® Edge processing and Intel® Xeon® Mobile Workstations to deliver a world-beating, data-led approach to training. The forensic attention to small performance details hidden within gigabytes of training performance data can contribute directly to improved competitiveness at a global level.

British Swimming is the national governing body for Swimming, Diving, Synchronised Swimming, Water Polo and Open Water Swimming in Great Britain and Northern Ireland. The organisation is responsible for the high-performance representation of the sport in all elite worldwide events such as the Olympics and the Swimming World Championships.

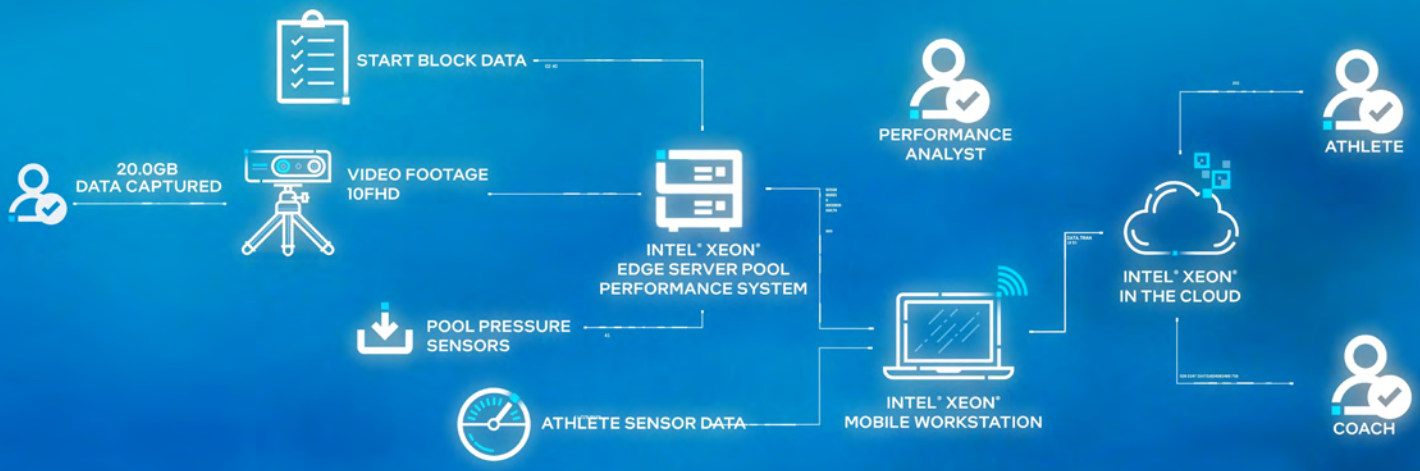
The pursuit of sporting glory is about fine margins. And in the world of elite swimming, the smallest differences in performance can win you a race or lose it. Every millisecond matters. Every stroke. Every turn. It's why British Swimming uses a data-led coaching strategy, tracking and analysing the technique of each swimmer from the starting block to the finish wall.

Using insights derived from this data, British Swimming seeks to enable its athletes to achieve gold medal success at future sporting events, including the Olympic Games Tokyo 2020. However, there are multiple challenges to be overcome. So, a key component of Team GB's future success relies on maintaining a technological edge, particularly in processing and managing performance data more efficiently.

Training for the Olympics

At Tokyo 2020, British swimmers competed across four major disciplines – freestyle, backstroke, breaststroke and butterfly. The swimmers raced across a variety of distances from 50m to 1500m, and in both individual events and relays. Performance data analysis, powered by Intel® Xeon® Processors, played a crucial role in coaching and preparing the team for competition.

As Olly Logan, Analysis Lead, Biomechanics, Race Analysis and Skill Acquisition at British Swimming explains: "If we take swimming in a wider context it's fairly data heavy and data-rich. We're an A to B sport, in that 'time' is the main metric that the coach reviews. From that perspective, data has been present ever since the stopwatch has been around. What's changed in the last 10 years or so is the amount of data we can provide to coaches."



From Edge to Cloud – British Swimming data flow

"If we think of 'time' as the top layer – the ultimate piece of information that coaches will use – then you can look at maybe stroke counts and stroke rates," Logan continues. "Then we can go down to things like velocities and stroke velocities. And drill down further into the higher levels of 3D biomechanics [i.e. the angle of a swimmer's body in the water]. There's a vast range of data and we understand performance probably a lot more today than we have ever done before. But there's a challenge in not overloading coaches with too much information."

Powered by Intel® Xeon® Processors

British Swimming currently relies on a data gathering and processing system that begins with a host of sensors in the training pool. These capture and send performance data to an Edge computing solution, powered by an Intel® Xeon® E5 Processor. That data is then mirrored to Xeon in the cloud. It is also made available for immediate analysis on mobile workstations running Intel® Xeon® E3 and W CPUs.

The in-pool sensors typically include a proprietary starting block (sampling 1,000 data points per second). This is joined by integrated pool pressure sensors, plus a number of Full HD video cameras. The camera system at the National Centre for Swimming, based at Loughborough University, uses 10 fully-synchronised cameras. There are four of these mounted underwater and four in the roof, looking down on the pool. In addition, one side camera is used to analyse starts, while a rear camera can record starts and head-on shots.

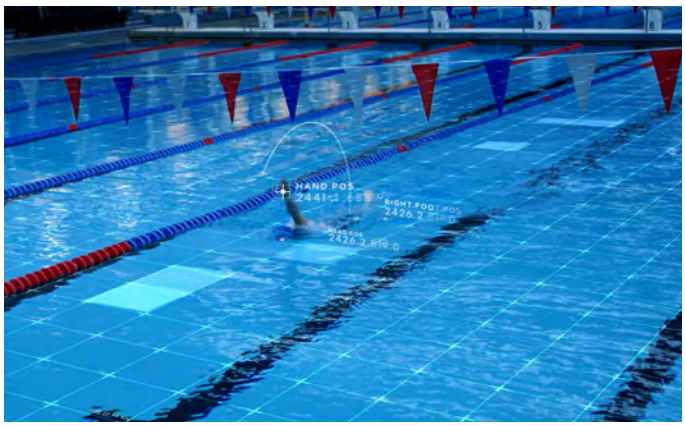
The underwater cameras are arguably the heart of British Swimming's data-gathering system, unlocking the hidden performance implications of each individual athlete's movements in the pool. And this visibility, combined with 3D biomechanics, can be crucial to improving a swimmer's overall competitive ability.

Capturing and visualising hidden data

"Swimming is a very unique sport in that a coach can't visually see what's going on underwater," says Emma Mosscrop, a PhD student/biomechanist with British Swimming. "If you can show [coaches] a different camera angle or a perspective they would never be able to view normally... just looking at that video without any deeper input from us is a huge asset to their coaching programme."

Of course, while video footage is a vital ingredient in unlocking improvements in elite swimmer performance, the

Analysing stroke data enables British Swimming to identify areas where a swimmer's performance can be improved.



The stats behind British Swimming

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Video clips can be captured, stored and made available for playback on poolside screens in around 15-20 seconds.

60,000

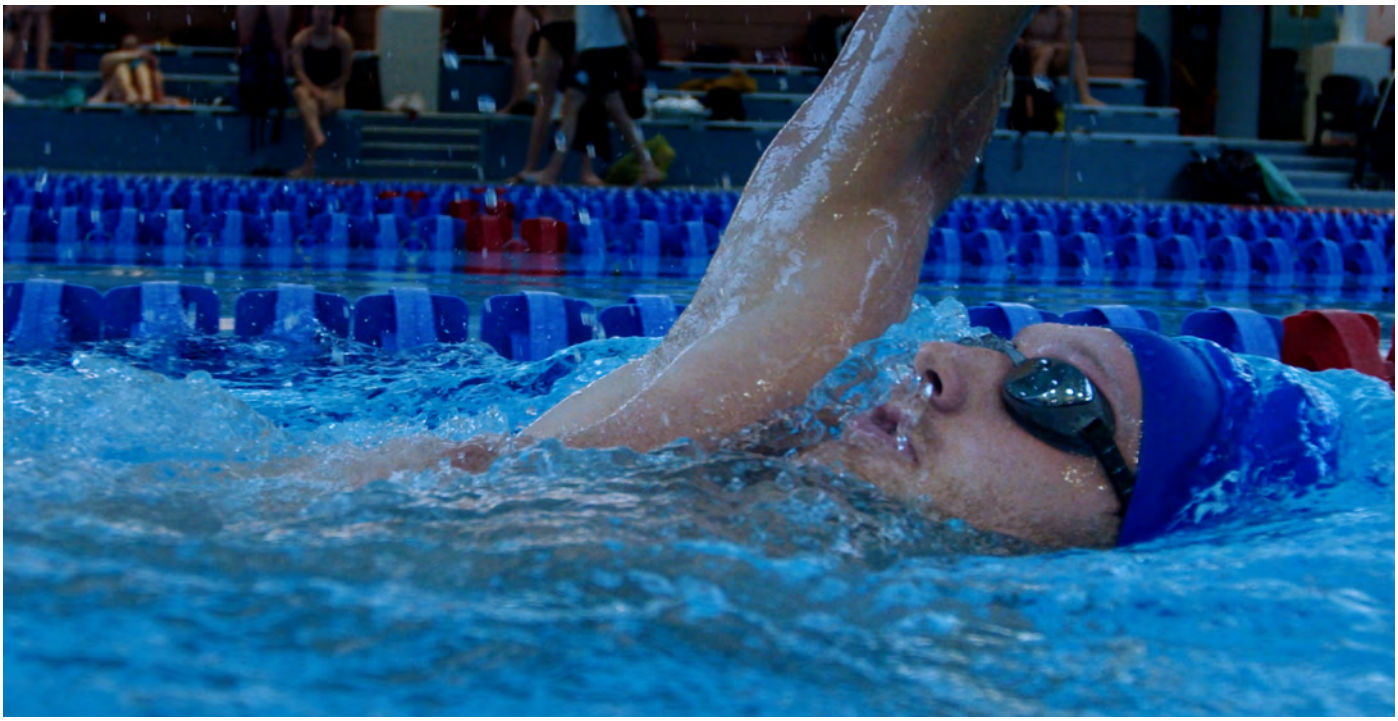
An instrumented start block can provide 12 channels of data at 1,000 samples a second. So, a 5 second clip can contain 60,000 data points.

200GB

British Swimming can amass more than 200GB of raw video per week.

30

British Swimming is able to measure up to 30 different metrics for start performance alone, including take-off angle, entry distance, time to 5 metres, and more.



data volumes generated in the process are considerable. As Olly Logan reveals: “For an example session with an athlete we might do 10 trials... So, that is up to 100 individual videos captured, with each video about 200MBs in size before compression. In an average week, we might work with 10 swimmers, so that’s 200GB of raw video data per week.”

Managing the huge volume of training data is an ongoing challenge for the team. Some manual cleaning processes are in place to manage the build-up of legacy information. In addition, the team operates a system of tagging important clips of individual swimmers that highlight improvements or particular issues that might need investigation.

A flexible and secure IT infrastructure

British Swimming's flexible data architecture has a series of benefits for Team GB. Not only does it ensure that vital data and raw footage is backed up to cloud storage powered by Intel Xeon, but that video is also available for immediate review by the data team, coaches and athletes.

“One of the main strengths of the systems that we've developed,” says Olly Logan, “is that we have two enclosed screens poolside. So, the swimmers can be recorded, and then stay in the pool and see whatever performance point is in question. They don't have to go off to another place to view footage. It can all be operated poolside. For each trial, we need the video to be captured, stored and available for replay by the time the swimmer is finished and moves back to the poolside display.”

“Additionally, the poolside is pretty warm,” says Logan, “and it’s a challenging environment to work in. So the Biomechanics, Race Analysis and Skill Acquisition team can all access our systems remotely, either from the office or when they're working at home."

This remote access was particularly important during the Covid-19 lockdowns, enabling the data gathering and analysis to continue. "It was really beneficial for us," adds Logan. "For example, when we were going to [the pool], running a session and then having to go home immediately. In that scenario, we didn't need to stay in the [swimming] centre to be able to run the post processing, the analysis and the feedback. So, the remote accessibility via [cloud storage powered by Intel Xeon] has been a real strength for us.”

Underwater Full HD cameras can track motion that coaches and athletes wouldn't normally be able to see.

"Intel's expertise will allow us to access technology that we wouldn't normally be able to, and that will place us in a unique position in terms of our capabilities."

Olly Logan

Analysis Lead, Biomechanics, Race Analysis and Skill Acquisition at British Swimming

Emma Mosscrop and the analysis team can break down granular elements of an athlete's underwater performance, showing where improvements can be made.

Team GB swimmer Sarah Vasey agrees: "For training, having the video analysis is really good, particularly to get quick feedback. My biggest weakness was my start... I was doing so much work on that. To be able to do a start and have feedback straight away, and to make tweaks straightaway, and then do another one and immediately see how much you've improved, is really important."

Proof of concept: Improved results

One particular success story concerns one member of Team GB, where detailed analysis of video and sensor data has led to measurable improvements.

"One of our main athletes was a lot slower underwater than their peers," reveals Emma Mosscrop. "To try and find out why, I took underwater video from multiple competitions – where we've been able to gain access to the elite underwater footage – and race data. I looked at the key body positions that the elite swimmers are able to achieve in comparison to our athlete. We analysed what [our swimmer] was doing differently, and thus what was causing the athlete to be significantly slower. Then a package was put together and presented to the coach and the staff members within the team."

The result was a dedicated project to rectify the problem, breaking down granular elements of the athlete's underwater performance. Then, the challenge was to devise changes to improve that performance, testing the theory, while assessing the progress with pre- and post-testing routines. In addition, Emma and the team were able to use a direct video feed to track, monitor and detail the differences in real time.

"The cherry on top is that [the athlete's] 50 metre time improved in competition," says Emma. "This was due to our ability to take the race timing data and the technical feedback sessions that are utilised during the underwater video, and to blend them into a technical presentation that could be presented to a coach."

British Swimming coach Dave Hemmings agrees that improved performance data is key to unlocking world beating performance. "Without data analytics," he says, "you [as a coach] are really just doing what you think, rather than what is actually real. From a sports science perspective, [data analytics] contributes massively to me. Because, when you're working with top athletes you're talking about achieving very marginal gains. That's the difference between winning and losing at this level."

Overcoming environmental challenges

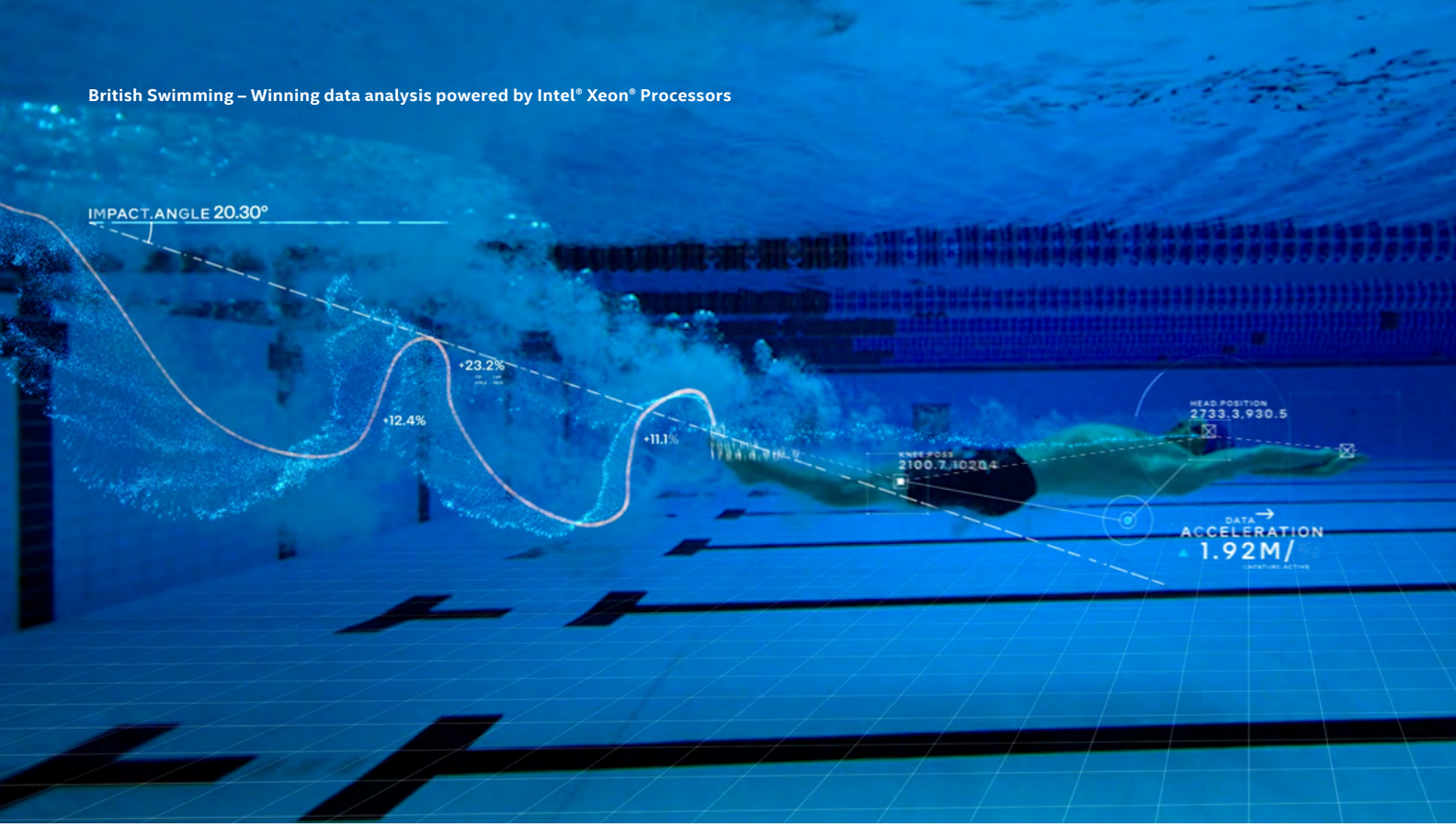
Beyond future capabilities, a key technology pressure point is handling the elite swimming environment. Swimming pools present unique challenges, with high humidity, corrosive chlorine and other biocides, as well as the obvious dangers of permanently wet areas.

As Olly Logan explains: "The environment we operate in is a challenging one, so the robustness of the systems is important. Hardware that is static and built into the pool is better. But any sensor or storage device you need to physically remove and replace gets a certain amount of wear and tear on it. That's always a point of concern. The volume of video data we collect is also quite high. So, the storage and processing of that data is quite an essential factor today and into the future."

The future of technology in sport

The current system, powered by Intel® Xeon® Processors, is delivering flexibility and vastly improved insights for Team GB's swimming team. But Olly Logan is bullish about the future part that technology can play.

"The key factor is how fast you can learn and adjust, and how you implement some of these data-based improvements with the athletes. Now we have a three-year cycle going into [Paris 2024], things are going to be even more squeezed. So, the ability to react and be adaptable is important. We've got a busy year next year with the European Championships and World Championships. And then it's only two years to Paris [2024], which is not a long time for people to develop."



“Longer term," says Logan, "there’s a huge knowledge base at Intel. They could change the whole way we operate potentially, through some of the new computing technologies. For example, Intel’s expertise will allow us to access technology we wouldn’t normally be able to. That will place us in a unique position in terms of our capabilities. It’ll set us aside from other countries that don’t have that expert technological assistance. It will allow us to be faster and more reactive and, as a result, learn faster and be more informed.”

The complex challenges faced by Team GB’s swimming team might be specific to elite athletes. But many of the technology and insight requirements have common roots. Most enterprises will be familiar with the everyday requirements of Big Data. Exponentially rising levels of data are being generated on a daily basis and there’s an intricate balance around managing and securely storing legacy data.

Like any forward-looking business, British Swimming seeks to unlock the value hidden in their data. For only by accessing, analysing and understanding this data can coaches and athletes hope to gain a competitive advantage with it. For businesses, that advantage might be increased sales or a better understanding of their customers. For British Swimming, that advantage could be the millisecond improvement that wins Team GB a medal.

Learn More

You may find the following resources useful:

- Intel® Xeon® Processors
- Edge Technology and Solutions
- Advanced Data Analytics

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