Success Brief

Dual-Core Intel® Itanium® 2 Processor 9000 Series

Toyota Motorsport in Pole Position

Grand Prix Racecar Design Moves up a Gear with Dual-Core Intel® Itanium® 2 processors

Company	Toyota Motorsport is a relatively new, but ambitious, contender in the Formula One Championship.
Challenge	Toyota Motorsport wanted to increase the computational power supporting its virtual wind tunnel. This would further increase the ability of its engineers to collect and analyse data, resulting in faster and better racecar modifications.
Results	From the initial evaluation tests, Toyota anticipates that in comparison to a single-core Itanium® 2 processor, the new Dual-Core Intel® Itanium® 2 processor will speed the computational fluid dynamics (CFD) simulation software by up to 35%[1], when the solution stack is fully optimised.
Impact	The breakthrough performance of Dual-Core Intel® Itanium® 2 processors will increase both the speed and complexity of simulations, accelerating Toyota's design-to-manufacture cycle.
Next steps	Toyota is deploying Dual-Core Intel® Itanium® 2 processors to boost CFD simulations. This will enable the Toyota team to implement changes to the design of the car more rapidly, helping to ensure success on the circuit.

"The Dual-Core Intel® Itanium® 2 processor will enable even faster and more accurate race car modifications, critical to increasing our competitive edge."

Elmar Huebner,
Manager of IT
Toyota Motorsport

Challenge:

Despite a proud history in motorsport that dates back to the 1960s, Toyota Motor Corporation, one of the world's leading auto manufacturers, is a relative newcomer to the world of Grand Prix racing. It first entered Formula One in 2002 through its subsidiary Toyota Motorsport when it created its entire venture from scratch, building a new team, car, engine and chassis. The team has proven itself with consistently solid performances and in 2005, with drivers Ralf Schumacher and Jarno Trulli, it completed its most successful season to date.

For any Formula One team, the aerodynamics of the racecar is paramount to success and every surface of a Formula One car is carefully designed. Teams are challenged with optimising both the force pushing on the cars tyres for improved cornering and in minimising the drag caused by turbulence. Car testing and trackside data must be translated into design modifications that will improve the race-winning performance of the car. Traditionally, aerodynamic analysis has relied on expensive wind tunnels. Today however, much of the design testing and modifications are conducted virtually using computational fluid dynamics (CFD) simulation software such as ABAQUS* and CD-adapco Group's Star-CD*. By using a virtual wind tunnel, Toyota's engineers simulate designs and driving situations to predict the behaviour of the racecar in real life conditions and to refine their design accordingly.

1Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel® products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, reference http://www.intel.com/performance/resources/benchmark_limitations.htm or call (U.S.) 1-800-628-8686 or 1-916-356-3104.

Toyota has used a cluster of Itanium® 2-based servers to provide the computational power behind its CFD software since 2003. Following an in-depth review of alternative platforms, Toyota migrated from a RISC to Itanium® 2-based platform because of the massive computing power the processor provided as well as its superb price/performance ratio.

"Our current Intel® Itanium® 2 processor powered cluster has lived up to our high expectations. It's enabled us to reduce calculation times and to conduct more complex simulations," said Elmar Huebner, Manager of IT, Toyota Motorsport. "However, our business is all about speed, on and off the track. If Toyota is going to keep ahead and succeed in Formula One, we need to accelerate our design cycle even further. This is why we were so excited about testing the new Dual-Core Intel® Itanium® 2 processor. We wanted to know what possibilities it would open up to us."

Deployment:

Toyota Motorsport ran a number of benchmarking tests at its purpose built factory in Cologne, Germany. Engineers compared the performance of single-core Itanium® 2-based servers with Dual-Core Itanium® 2-based servers. These tests included a crash test simulation using ABAQUS* software and Red Hat Linux* operating system to reveal the rigidity of the car's monocoque. As the structure within the racecar that surrounds the driver, its design is imperative to driver safety.

Results:

Toyota was astonished by the results generated by the Dual-Core Intel® Itanium® 2 architecture in comparison with a single-core Itanium® 2 processor. In an environment where the full software stack hadn't been optimised, the benchmarking tests delivered up to 20% gains in CFD calculation speeds. "These impressive results are only based on our preliminary testing data. Our expectation is that when we have a fully optimised software environment, performance gains will reach 35%[1]."

Impact:

The dual-core technology and increased memory capacity of the Dual-Core Intel® Itanium® 2 processor has dramatically increased the calculation power of Toyota's data analysis software. On-die level 3 cache has increased from 9MB (single core Intel® Itanium® 2 processor) to a capacious 24MB, enabling the processor to handle the large datasets and complex calculations generated by Toyota's demanding CFD applications faster and better than before.

Increasing the speed of CFD simulations will significantly accelerate the design-to-manufacture cycle of the Toyota Motorsport team. This is critical throughout the year but even more so during race season when engineers have just two weeks between races to make critical design modifications to the Toyota Formula One car.

The increase in processor performance is accompanied by a reduction of energy requirements of up to 20%. When using such a large and powerful cluster to power Toyota's virtual wind tunnel around the clock, this improved energy efficiency will result in considerable savings in energy costs from both powering and cooling the servers.

Future:

Toyota is keen to start taking advantage of the new processor and is installing Dual-Core Intel® Itanium® 2 processors as part of its High Performance Computing platform that supports its virtual wind tunnel. "The volume of calculations we currently run with the virtual wind tunnel typically take almost a day. We have an internal goal to increase calculation speed by 33%, reducing run time by 33%. That way, we'll have more hours available a day to run more simulations. By upgrading just 25% of our cluster to Dual-Core Intel® Itanium® 2 processors, we should achieve this," said Huebner.

The ability of the team to collect and analyse data more quickly and more efficiently is critical for the success of Toyota Motorsport. It enables the team to make constant and rapid improvements to the Toyota Formula One car. With the new Dual-Core Itanium® 2 processors underpinning its powerful CFD simulations, Toyota is firmly in the driving seat.

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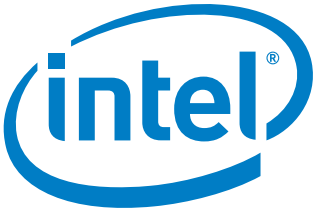

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