

## A Conformiq White Paper

# Not All MBT Tool Engines are Created Equal

## Parallelization is a key difference for test generation efficiency

ALL MBT TOOLS PROVIDE SOME MEASURE OF EFFICIENCY GAIN IN THE TEST DESIGN PROCESS. HOW MUCH BENEFIT, BOTH FOR initial and recurring test design, is probably the key issue that should be understood when selecting a Model Based Testing tool. Unfortunately for those doing the selecting, the engine core doing the processing is the most difficult to really understand. It controls the robustness of the test design, user flexibility, and most of the test design efficiency but is seldom properly exercised during an evaluation. To help understand more information about engine details and why Conformiq has focused so much of its engineering efforts on certain key engine capabilities and to also differentiate it from other MBT tools, this paper will explain just one key aspect of the Conformiq Designer™ engine.

The core of Conformiq Designer™ is a custom crafted semantics-driven, symbolic state space exploration algorithm for test generation from system models (because this is really the only known solution that robustly generates both test inputs and outputs from a system model without user intervention). On a very high level, this algorithm selects which execution paths in the model to expand and to what extent and Conformiq has carefully tuned our implementation during the last decade to make the operation more efficient, robust, comprehensive, and user tunable.

Using this fully algorithmic approach (rather than

inserting manual steps in the test design process), large test generation problems are computationally very complex and can take a long time to process on a single PC. Therefore, to help solve the problems of real world scalability, Conformiq has carefully crafted its test generation algorithm for fully distributed parallel test generation, allowing users to automatically split test generation tasks across multiple cores and PCs in, for example, a public or private cloud / cluster environment or just a large server. This unique technology enables users to create computational clusters for rapid test generation that can be shared across users. However, even without access to a cloud or a

cluster environment, users can still gain the benefits of parallel test generation with Conformiq Designer. Even on a single PC, Conformiq Designer automatically maximizes the use of computation resources to speed up the test generation process by distributing computational work across all the processor cores available on the local host.

On the surface, this may seem like a simple thing and not a huge technical effort to create, but that is wrong because the real trick is to do it deterministically. In the context of highly distributed test generation, guaranteeing deterministic test generation results is an extremely challenging technical issue to solve and is why Conformiq Designer is the only advanced technology MBT tool to deliver this important capability. Conformiq Designer is guaranteed to generate test cases deterministically, regardless of the number of processor cores, their speed, and load. Multiple test generation runs on the same model result in generation of the same test case set. Without being deterministic, the tool would be like a slot machine so every time you generate tests you could get completely different test coverage and test cases.

To provide some technical architecture detail, Conformiq uses a master/slave architecture and CORBA as middleware. The slaves are responsible for expanding a given part of the symbolic state space and reporting all their findings back to the master component which then coordinates the work of the slaves by assigning them more work. Since the Conformiq test generation server may be accessed from multiple users, the server also handles the distribution of the computation resources between any concurrently running tasks. This architecture involves high performance load balancing and recovery, meaning that the physical location and number of processor cores actually used may vary while test generation is running. The tool will always balance the available computational

resources between all ongoing computation tasks submitted from users.

This parallel test generation algorithm parallelizes relatively efficiently, providing savings of up to 90% of test generation time by scaling from one to sixteen processor cores, and even more efficiency gain when deployed on a computation cluster with tens or even hundreds of cores. This is important as it improves the productivity of automated test design by cutting down wait time before users see their newly generated tests. As this is typically an iterative process to achieve a validated model and desired test coverage and is the most time consuming part of the automated test generation process, delays during this part of the MBT process are multiplied with every iteration. Therefore, distributed test design processing is a key to MBT success.

#### ABOUT CONFORMIQ

Originally established in 1998, Conformiq is a leading solutions provider for automated test design and advanced model-based testing, dedicated to improving test design processes within software-intensive product companies operating in business-, mission- and life-critical industry segments.

Conformiq Designer™ is the company's fourth-generation test design tool, built upon a decade of advanced basic and applied research as well as testing and test design experience.

Privately held, independent and known for extraordinarily responsive customer service, Conformiq is the partner of choice for companies who are ready to step ahead of the curve.

For more information about Conformiq and the company's software and services, please visit [www.conformiq.com](http://www.conformiq.com).



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