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Maximum Test Coverage

# Efficient Regression Tests with Diagnostic Simulation

The increasing complexity in the E/E networking of software-defined vehicles requires constant maintenance and updating of the tester software and, as a result, extensive test procedures to ensure the quality and reliability of the systems. Both the validation of new functionalities and ongoing regression tests of the software are crucial here. The large number of vehicle variants and their different software configurations and versions increase the testing effort considerably. An efficient solution is to combine regression tests with diagnostic simulation in order to achieve maximum test coverage.

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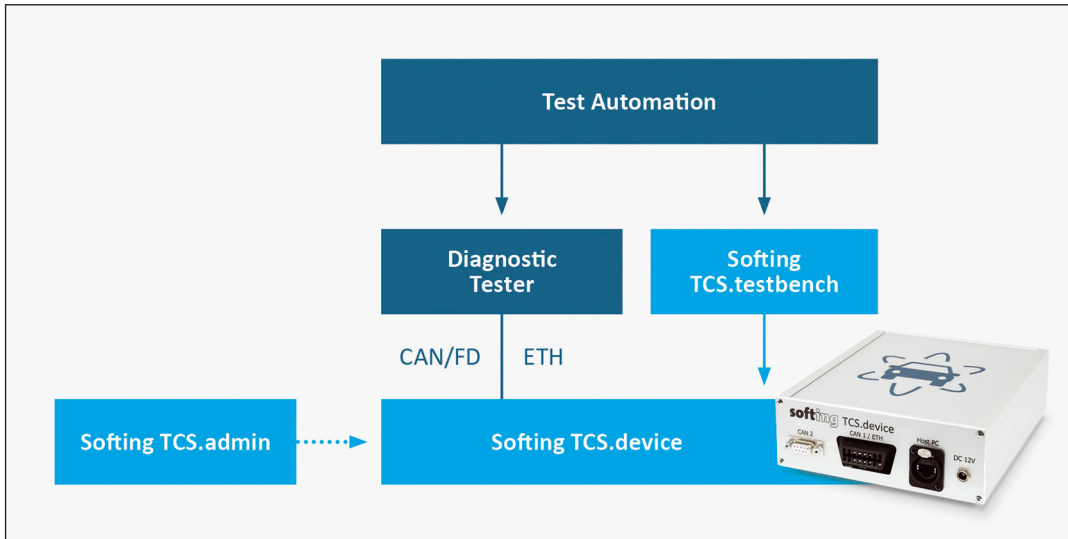
## Challenges of Modern Vehicle Diagnostics

Modern vehicles are characterized by a large number of variants that are created by different hardware and software configurations. For example, performance levels can be achieved not only by different engines, but also by coding the control units. Software-defined vehicles also offer a high degree of flexibility and adaptivity and therefore enormous potential over the entire vehicle life cycle.

The software-based and therefore programmable control units enable rapid troubleshooting, the integration of new functions and adaptation to changing legal requirements - theoretically at any time and from any location. Over time, new software versions are added that change the behavior of the entire vehicle. The result: an exponential increase in the number of scenarios to be tested and therefore a significant increase in testing effort.

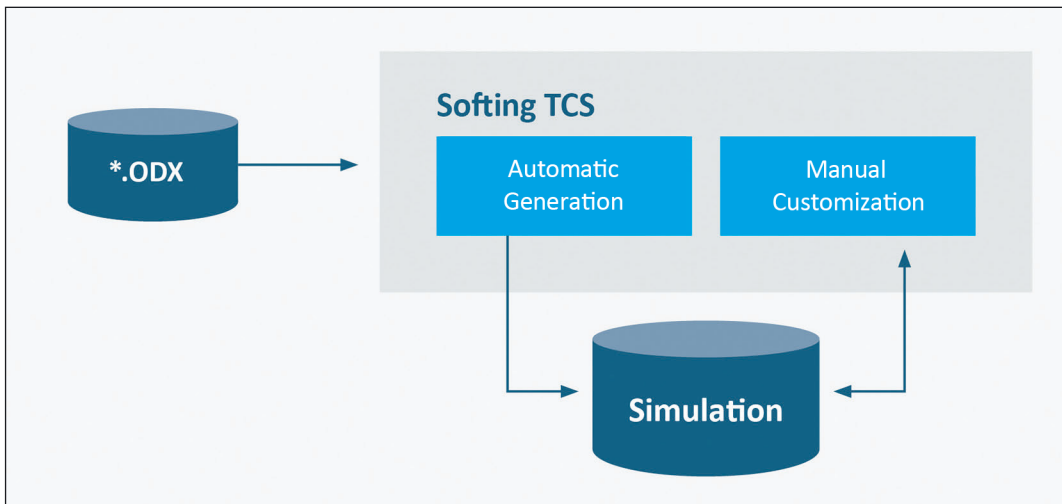
## Necessity of Regression Tests

In parallel to the increased requirements, the diagnostic software must be adapted in an agile manner to the constantly changing framework conditions. However, changing or adding functions to an application can lead to parts of the software no longer working or only working to a limited extent. To ensure that development continues and that the tester software works smoothly after roll-out,



**Softing TCS Components**

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**Simulation creation via ODX** © Softing

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developers must carry out regression tests. Various test procedures are aimed at quickly identifying and eliminating errors that occur due to function updates and code changes.

Extensive overall tests must therefore be carried out after each adaptation of the tester software to ensure that no new errors are introduced. Not only new but also existing functions must be tested. High test coverage is crucial to minimize the likelihood of errors and rework. Repeating the test cases ensures that modifications do not cause new errors. Due to the required test repetitions and test frequency, the use of test automation for regression testing makes sense. The crux of regression tests, however, is that in

practice it is hardly possible to keep all vehicle variants in all software versions and combinations available for testing. For a comprehensive test, however, all vehicle types and models with different software versions are required, which is almost impossible in reality, both logistically and for cost reasons. This results in test gaps.

**Maximum Test Coverage through Diagnostic Simulation**

An efficient solution is to simulate the electronic control units (ECU) or the entire vehicle. With Softing TCS, real vehicle communication can be recorded, saved in simulation files and integrated into the test sequence. The combination of hardware and software enables a realistic simulation of vehicle communication. Softing TCS consists of three main components:

▪ **Softing TCS.device:**

The hardware component that represents individual control units, subsystems or entire vehicles and enables realistic simulation of vehicle communication

▪ **Softing TCS.admin:**

The configuration application for creating, managing and customizing the simulation files

▪ **Softing TCS.techbench:**

the application that integrates the simulation into the test automation and enables seamless execution of automated regression tests

Simulation files can be loaded and started in the Softing TCS.device simulation device as part of the automation of the tester test. Communication parameters can be changed via the Softing TCS.admin interface in order to verify the tester's behavior.

## Generation of Simulation Files at the Push of a Button

After selecting the valid ODX data for a vehicle, the relevant control units and diagnostic services are selected. The required, immediately functional simulation is then generated automatically. Changes can be made in the intuitive Softing TCS.admin interface. This can affect communication content, for example, which can be changed further along the ODX data, but also special communication mechanisms such as session handling or multiple responses to a diagnostic request. Different ECU variants can be conveniently stored in a simulation file and only selected when loading them into the device. Different ECUs can also be combined to form an overall simulation in order to easily map any installation variants. Existing ECUs can also be integrated into the simulation if required. To do this, the communication is simply recorded with a tester (trace) and then converted into a simulation at the touch of a button.

## Advantages of Diagnostic Simulation in Regression Testing

By integrating diagnostic simulation into regression tests, all variants and scenarios can be covered, even if not all vehicles and ECUs are physically available. Maximum test coverage leads to a corresponding improvement in software quality. Multiple roll-outs of tester software are effectively prevented. There is no need to keep real vehicles available for testing, which massively reduces the costs of providing and maintaining the test environment.

After the initial, small amount of additional work involved in setting up the test scenarios, the effort required for troubleshooting loops and rework is reduced to a minimum. The high degree of automation of the tests also reduces the time required for manual testing and enables continuous monitoring of software quality. In addition, the roll-out of new software to the market is accelerated by faster and more efficient testing.

## Conclusion

With the efficient use of diagnostic simulations, regression tests in vehicle diagnostics can be optimized. Even without real ECUs or vehicles, functional overall tests can be performed, maximizing test coverage and reducing errors and rework. The regression test with the Softing TCS diagnostic simulation offers a solution that not only increases the quality of the software, but also enables considerable cost savings and efficiency gains. The case-oriented generation of the simulation through the trace import is particularly advantageous, making the application considerably easier and more efficient. In the increasingly complex vehicle world, this is a decisive step towards meeting the high demands of modern vehicle diagnostics



**Markus Steffelbauer** is Head of Product Management at Softing Automotive Electronics GmbH and is involved in standardization committees.

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## Softing Automotive Electronics GmbH

Softing Automotive specializes in the entire life cycle of electronic control units and vehicle systems - from development to production to service. For over 45 years, leading vehicle manufacturers, system and ECU suppliers worldwide have relied on Softing's proven solutions for testing, diagnosing and monitoring mechatronic systems and vehicles.

With the transition to software-defined vehicles, vehicle diagnostics is becoming increasingly important, from the individual ECU to the cloud. Our solutions integrate all major international standards and make a significant contribution to improving efficiency and quality in the process and in the end product. With over 100,000 installations, Softing has a leading position in the growth market for diagnostic and test systems in vehicle electronics.

We support companies on their path to digital excellence by optimizing processes for the development and management of vehicle software and accelerating time-to-market. With customized solutions and reliable expertise, we are your trusted partner for sustainable digital transformation.

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