Optimized Test Preparation

Increase in Efficiency with Diagnostic Simulation

It is now a well-known fact that the growth in electronics in a vehicle increases the effort involved in testing. Having the additional electronics is not an end in itself: It is essential to increase the efficiency of the overall vehicle system, customers are demanding greater convenience and comfort, and increasing safety is an obligation companies have toward society. However, the effort required to test between 50 and 150 control units, depending on the vehicle, is becoming increasingly complex. It is no longer just individual systems that have to be tested, but also the interactions between the individual systems. The effort involved in testing is thus rising disproportionately.

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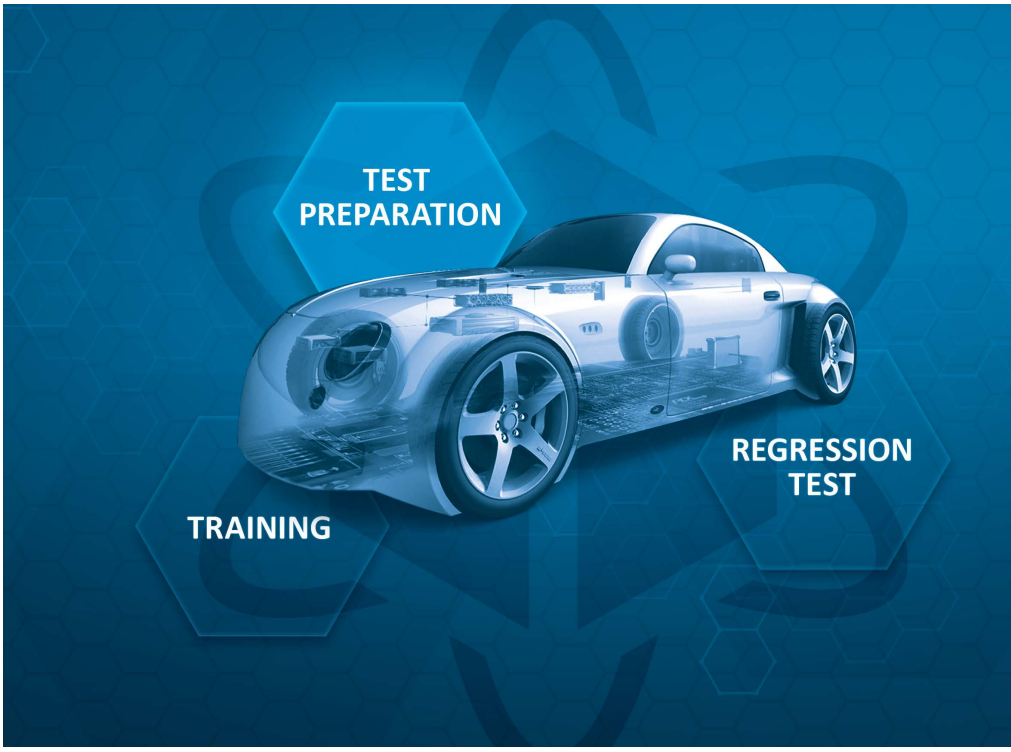
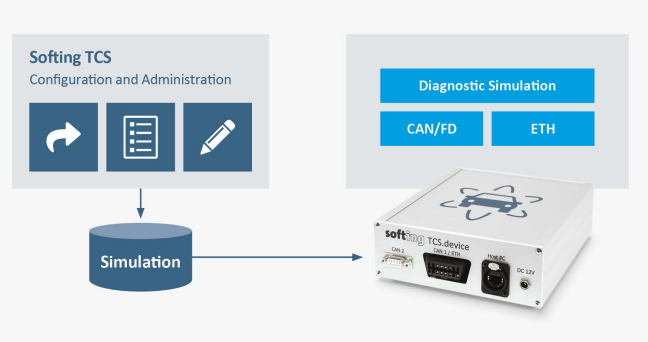
Test automation is without doubt a significant part of the solution, but effectiveness and efficiency need to be improved to ensure reliable results are available more quickly. In many areas of vehicle electronics, simulations are already helping to achieve good results. This step still has to be taken in vehicle diagnostics. And it is obviously necessary here: An external device, the diagnostic tester, is developed or adapted for test execution – but the counterpart necessary for testing the tester in the form of an ECU or vehicle is always missing.



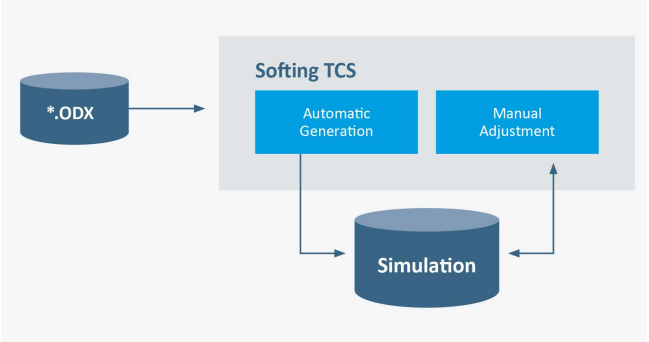
The use of a simulation in the test preparation enables a considerable gain in efficiency. ©Softing Automotive Electronics GmbH

Diagnostic Tests

It is a fact that numerous automated tests are run in diagnostics – in ECU engineering, at the level of communication and diagnostic function. These tests focus, for example, on whether the variable is transmitted correctly, whether the fault is entered correctly in the fault memory, and also whether it is entered at the correct time. In the development of the mechatronic system accordingly with the real or simulated sensors and loads. During integration, as soon as different functions are put into operation together, and, finally, in vehicle tests. Test automation is used today, whatever the case. The same applies in later phases in the manufacturing tester and repair shop systems: The more automation possible, the better. In general, the test is first set up for this purpose, consisting of test system, power supply, cables and connectors as well as the VCI (Vehicle Communication Interface). In addition, depending on the test, there are further components, such as loads, simulations and measurement technology. Then numerous test routines are created, some of which are very complex. Finally, the test can be performed with the DuT (device under test). The problem is obvious: If an error occurs in the test, it could now be in the DuT.



Softing TCS Components © Softing Automotive Electronics GmbH



Creating a simulation using ODX © Softing Automotive Electronics GmbH

It could, however, also be localized in the test setup or test routines, neither of which have been able to be formally verified to date. As a consequence, time-consuming troubleshooting is the next step.

Solution Approach with Simulation

This is easy to avoid with timely simulation. For this purpose, a counterpart is used from the outset when creating test automation that behaves like an ECU or vehicle in terms of diagnostics. This makes it possible to verify every test routine during implementation. Ideally, this takes place using a real device, not as a pure software simulation, because in this way the entire chain, including VCI and cables, can be verified. In addition, it is also important for the simulation to display good and bad cases so that every possible behavior to be expected in a real ECU test can be verified.

The greatest challenge is creating a reliable simulation. It has to support all required diagnostic protocols, make the entire range of diagnostic functions of different ECUs available, and be able to be converted easily to different variants of vehicles, whether as installed variants or software versions. Naturally, a parallel implementation of the simulation to the ECU should be avoided because this would counteract the desired efficiency gain. The only source for the implementation of the simulation is the diagnostic specification, which today is also usually available in the form of ODX data.

Softing TCS in Test Preparation

Softing TCS is a configurable diagnostic simulation with real communication which considerably accelerates automatic test creation. It consists of the actual device, which can act autonomously as an ECU and vehicle simulation, an automation interface, which enables integration in automatic tests, and an administrative interface under Windows. CAN, CAN FD and Ethernet are the supported bus systems. The physical connection takes place either via an OBD jack or the D-SUB connector typical in the CAN environment. The diagnostic protocols supported are UDS, OBD, KWP2000 on CAN along with SAE J1939 in the future. The simulation is configured via simulation files, which are loaded into the device in each case.

The simulation files are initially generated at the push of a button: Once the ODX data valid for one vehicle has been selected, the relevant ECUs and diagnostic services are selected, and finally the required simulation is generated automatically following some default settings. This is immediately operational. Any modifications are then easy to make in a convenient interface. This may, for example, concern communication content (which can continue to be changed along the ODX data), but also special communication mechanisms such as session handling or multiple replies to a diagnostic request.

There is no issue with keeping different ECU variants in a simulation file; these do not have to be selected until they are being loaded into the device.

Similarly, different ECUs can be merged to create a full simulation to make it easy to model installation variants. It is also easy to add existing ECUs: The communication is simply recorded with a tester, and the trace is then also converted into a simulation at the touch of a button.

Benefits of the Simulation

Using a simulation such as Softing TCS in test preparation makes a considerable gain in efficiency possible. While test routines are being developed, they can already be verified together with the entire test setup so that when the DuT arrives, the actual test can be started immediately. Elaborate loops for troubleshooting are obsolete. The integrated diagnostic protocols have already proved themselves which means that no new problems can arise here. The use of simulation files makes it easy to create variants while minimizing setup times. ■

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