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Moving Forward into the Future

Diagnostics in Global Engineering Teams

The automotive industry is facing major challenges due to the complexity of electric and autonomous vehicles of the future. As a result, work is taking place in global teams, resulting in turn in massive changes in both engineering and the tool landscape used. The key to successful implementation is a diagnostic functionality unaffected by the limitations of computers.

Megatrends Drive Innovation

Providing there is a corresponding energy mix, electric vehicles generate considerably less noise and fewer emissions. This is why they are on the rise, at least in the world's growing metropolises. The energy users in the vehicle – alongside the engine, particularly all kinds of heating, the air conditioning and the large number of actuators – have to be coordinated centrally to enable practicable ranges. This inevitably leads to centralization in the E/E architectures.

This is further boosted by autonomous driving. The desired gain in convenience and safety achieved by cutting out man as a source of error means an enormously increased computing capacity which, in turn, is made available centrally for various advanced driver assistance systems.

This all leads to specialized teams working on development tasks which are more complex than ever before. For all kinds of reasons, these are usually distributed at manufacturers' and suppliers' all over the world.

More Than Error Memory

Diagnostics will play a much greater role in these scenarios than it does today. Naturally vehicle validation as well as the correct installation of components in manufacturing and work in the repair shop will continue to require diagnostics. But additionally each trip will comprise a number of extended tasks. These include analyzing errors in the running software or, in cases in which a driving function is distributed across several ECUs, the correct interplay of a function in its entirety. These kinds of new mechanisms are indispensable for the safety of the full system, the vehicle. Results of these diagnoses will regularly be stored in the cloud in the future, whether because they are important for quality assurance or whether they are in fact needed in V2X scenarios.

Furthermore, classic diagnostic functions continue to be important:

- Error memory operations:
  Reading and deleting the error memory as well as reading out environmental conditions
- Flash programming:
  In engineering to be able to load new software versions, in the repair shop to repair software errors
- Variant coding:
  Adaptation of a universal software to suit regional requirements or for different equipment options
- Addressing an actuator:
  Function test of routines without a real switch or controller
- Measuring:
  Reading out ECU-internal variables, including aggregate variables which are not available on the bus

The fact that the vehicles are networked with their environment means new application cases for diagnostics (not only) in After-Sales Service. A software update over the wireless interface is a genuine win-win functionality: The customer does not have to take a time-consuming trip to the repair shop, the manufacturer can remedy problems without having to initiate image-damaging recalls, and the repair shop keeps the auto hoist, where the tester is normally to be found, free for more lucrative repair work.

The ISO 20078 Extended Vehicle is a new standard which focuses on remote diagnostics in After-Sales Service. It enables fee-paying access to diagnostic data in the cloud structure of the OEM. Interested third parties, such as insurance companies, manufacturers of testers for independent repair shops as well as the legislator, can access information once the vehicle owner has given the relevant approval.

The Principle of Remote Engineering

Globally distributed development has now resulted in totally different challenges for vehicle engineering. The situation here may look something like this: One team might work on developing a particular function, another is responsible for the test procedures and a third for running the test. Working efficiently without the burden of inefficient travel time or a logistically difficult multiplication of the devices under test can only be achieved with remote access: Remote Engineering. For diagnostics, this means that the relevant software version is uploaded by the engineer in a remote software update, the test procedure is also adapted remotely and the tester then starts execution and shares the results accordingly. Changes can then be carried out fast within this collaboration and tested again. Naturally the infrastructure has to allow this. For the software update, there has to be plenty of bandwidth in particular; during test execution latency has to be low enough depending on the architecture. If the setting is changed slightly and a vehicle is used in a road test, the availability of the connection is an additional challenge in today’s networks. Consequently, to avoid test errors occurring because of interrupted connections, the architecture has to be selected so that the tests run autonomously in the vehicle, regardless of the connection, and only test sequences and results are exchanged at the right moment over the wireless interface. Technically, there are various ways of implementing remote engineering in diag-

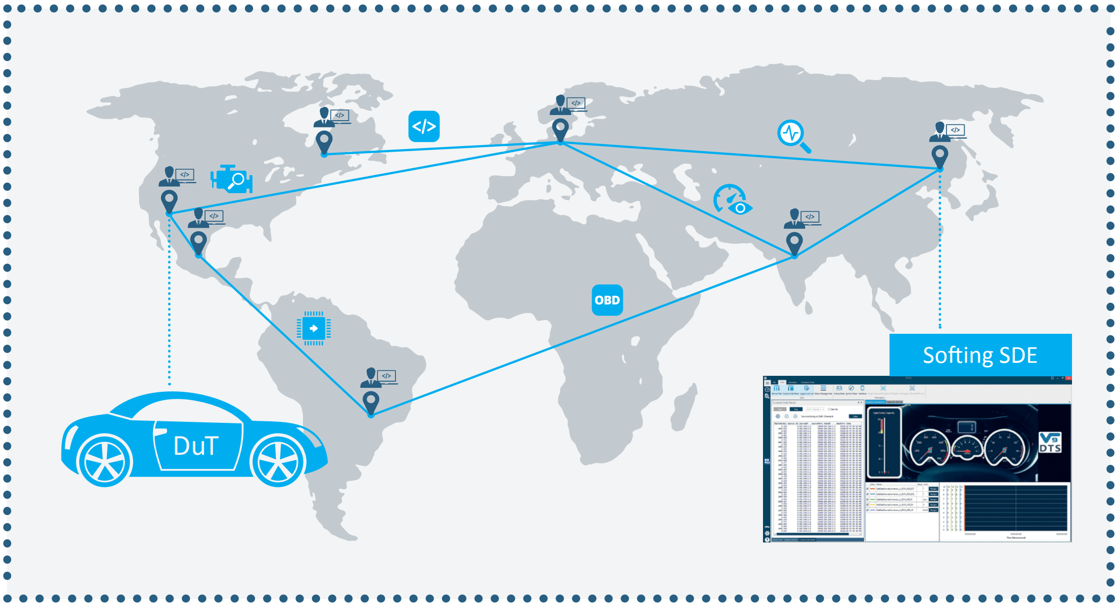

Figure 1: Efficient engineering through remote engineering – any time, any place
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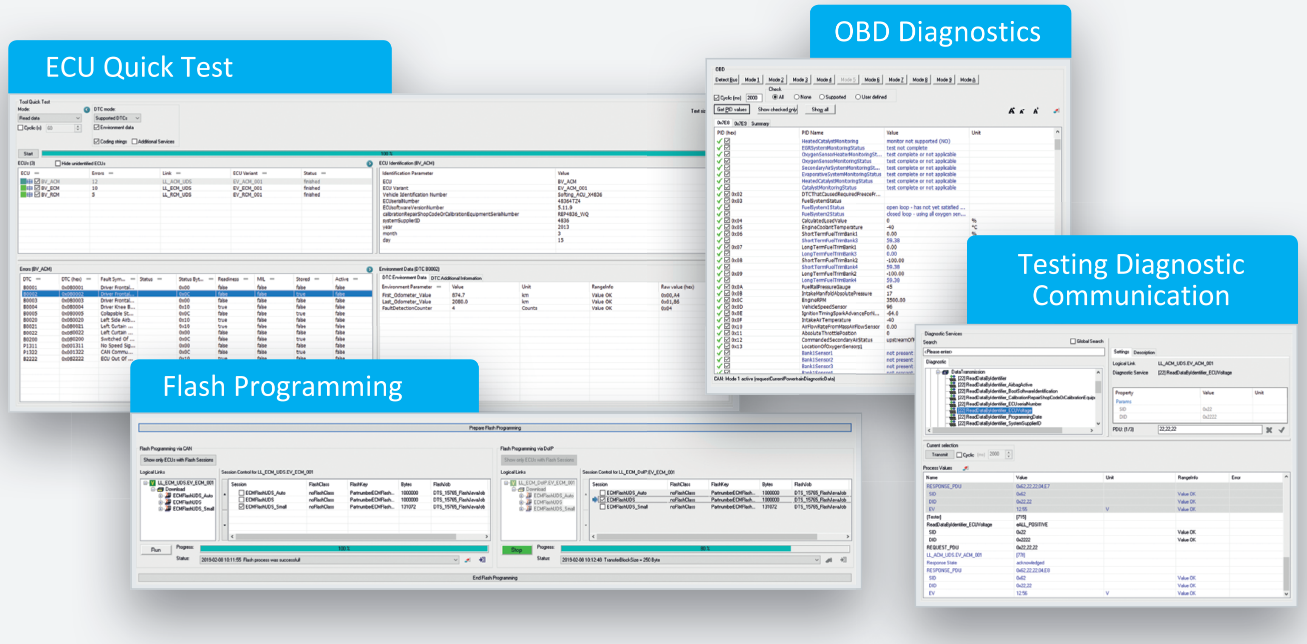

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Figure 2: Sample applications of the Softing DTS.monaco engineering tester

nostics. In some cases, engineers are already accessing a colleague's system today using RDPA (Remote Desktop Protocol Application), as is the case with Windows Remote Desktop and in external programs such as TeamViewer. By mirroring the screen, an engineer can see an exact image of what his colleague can see. This is a good approach if both colleagues are using the same or at least familiar applications and this complies with the security guidelines. An alternative approach uses a diagnostic base system which is integrated in several applications and offers a remote interface. This not only makes it possible to connect the same applications – possibly even with differently equipped interfaces, but also a range of tools. One example is an engineering tester with which an HiL tester (Hardware in the Loop) can be accessed to quickly remedy problems.

Softing DTS.monaco – A Sample Tool

Softing DTS.monaco is used here as an example of this approach. As a diagnostic engineering tester it is equipped for all the cited application cases (error memory operations, variant coding, flash programming, measuring, etc.) with special, configurable interface elements. To be able to analyze communication problems in the early stages of engineering, it features a number of trace possibilities. These work independently of the bus, in other words can be used just as well with DoIP on Ethernet as with UDS on CAN/CAN FD or KWP2000 on the K-line.
Softing SDE (Smart Diagnostic Engine) is used as the communication component. This combines ODX and OTX implementation modules with a functional interface which is also easy to integrate in test benches and test automations. The integrator then has access to functions which are easy to understand: "Read_error_memory", "Program_ECU", "Measure". This interface is remote-capable, once the corresponding authorizations have been assigned, an ECU engineer can access a test colleague's system and support him in troubleshooting. This is also true of the person responsible for the test bench who, in the case of a problem, can ask his engineering colleagues to access the integrated Softing SDE and analyze the problems.

Mastering Distributed Engineering

Megatrends such as electric and autonomous driving effectively work as innovation and complexity drivers. They facilitate new procedures in diagnostics, but also demand new mechanisms to satisfy the increased safety requirements. Remote Engineering with specialized teams spread out across the world is the right answer to some of the challenges, providing it is supported by the tools used. In this kind of engineering scenario, Softing DTS.monaco can be used to access devices under test remotely and diagnostic tasks can thus be processed extremely efficiently.

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Originally published in German in the section "Research and Development" of the technical magazine
HANSER automotive OEM Supplier 2019, published by Carl Hanser, Munich, Germany