Swift and efficient: Generating test cases automatically

Engineers have usually implemented all test cases for Electronic Control Units separately and manually in an automation tool. The NovaCarts Test Case Generator (TCG) from MicroNova automates this process, further streamlining test case generation many times over.

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Vehicle development is becoming ever faster and more varied, making component tests and valid results even more crucial. Up to now, engineers have usually implemented test cases for ECUs and associated software manually via the respective test automation solution, such as EXAM, which has been in use throughout the VW Group since 2006. Test specifications are used as the basis for this. These are generally not standardized, which makes it costlier to maintain the test cases. For example, subsequent changes must be made at several points in the written specifications, the requirements, and the test case itself. Moreover, manual procedures like these are time-consuming and error-prone.

This can now be addressed by a MicroNova solution, with which „TestCases" can be created in the EXAM test automation solution fully automatically from the test specifications: the NovaCarts Test Case Generator (TCG). A uniform and clearly structured procedure has been defined for this purpose, which substantially reduces costs for maintaining the test cases and significantly improves their reproducibility. Advantages that benefit companies across the board in ECU and software testing. Thanks to this new tool, all parties save considerable time and work, opening abundant savings potential in cost terms.

Creating test cases automatically

The actual trigger for developing the TCG was a project that MicroNova realized successfully for Porsche AG. The sports car manufacturer already had similar concepts, but only as isolated solutions for individual test benches. Accordingly, those responsible set out to find a single central tool to meet both the above challenges – more complexity, more tests – and the needs of the specialist departments.

As a reliable partner for EXAM, MicroNova was the first point of contact for development. To enable cases to be generated entirely automatically from existing specifications, the MicroNova team decided to adopt the following approach: The test specifications were understood as a sequence of commands. Mapping between commands and EXAM operations then creates the test cases automatically. This saves the additional effort needed to implement the test cases.

Test specifications as a starting point – central and standardized

The basis is a set of synchronized test cases from a corresponding specification tool such as DOORS. Test procedures and parameters are maintained

outside EXAM in the requirements management tool. Changes can therefore be made centrally in the respective EXAM library or the associated „TestSpec". Once made, the changes can then be easily applied to all test cases. The TCG is basically a functional extension to EXAM, from which numerous users benefit. It works as a script/plugin/add-on and supports many convenient EXAM functions, since it is based on well-known concepts such as Shortnames or TestCaseStates.

Commands are mapped centrally in the EXAM model. Those writing test specifications set out clear requirements for new test specs, while existing ones can be adapted with minimal effort. The TCG then creates a full, executable test case as a sequence diagram from the user's technical specifications in just a few seconds. Interpretations are not required and thus excluded. Since these diagrams always have a common structure, the procedure ensures both reproducibility and comparability of test runs. It also eliminates nesting in sequences or parameters as well as making errors easier to identify before the test is carried out.

The consistent structure of the TestCases designed in this way contributes significantly to quality assurance: Using the TCG for all test runs allows their results to be checked uniformly and the progressions to be reliably tracked – a clear advantage over the previous procedure. For manually created test cases, because each tester implements the specifications somewhat differently, different handwriting is more the rule than the exception. Previously, this has made every review more difficult. Standardizing test specifications will ensure consistently high quality in future.

More efficient maintenance

Porsche has been using the solution successfully since the end of 2017 and has already generated more than 2,000 test cases in productive use (as of March 2018). The experience gained in this process is used, among other things, to further refine tooling, but one thing is already certain: Compared to manual generation, test cases can be created far faster with the TCG. The high efficiency of the solution stands out, given the ever-increasing number of tests: „A test designer can manage many times more test cases with the TCG than with purely manual implementation, which means more results are available – and more quickly. This frees up time for the designers to focus on particularly complex cases," explains Andreas Zahn, Test Manager Chassis at Porsche AG. „The TCG could also be fully integrated into EXAM. No additional and cost-intensive interfaces were required."

The automated tests allowed Porsche to use the hardware-in-the-loop (HiL) systems to functionally develop the chassis even more efficiently: „Our HiL test benches are now at maximum capacity. The generator approach paves the way to respond quicker than ever to the rocketing rate of change in functional development. Adopting the conventional approach would render the constant adaptation in testing that goes hand-in-hand with development infeasible due to cost terms," says Andreas Zahn.

Another reason for the great satisfaction: The standardized department-wide solution enables central support and uniform maintenance. MicroNova has undertaken further development and is currently collaborating with the sports car manufacturer to expand the capability of the TCG even further. Other departments within the Group are also on the agenda. According to the current plan, this marks only the start of the success story – in future even more users will be able to automatically generate test cases.