dSPACE Consulting

Optimizing processes in all development phases and for the validation of ECU software

Highlights

- Optimization of workflows throughout the entire development process
- Planning of development and test processes for functions for automated driving
- Modification of processes for ISO-26262-relevant projects

Challenges

Manufacturers and suppliers have to increasingly optimize their processes to be able to continue developing and testing ever more complex system and software architectures as for highly automated vehicles, for example. More than ever before, they have to coordinate the various development phases with each other, from system design to validation, and implement them in a process-reliable manner. dSPACE Consulting offers consultancy projects to support you in defining processes and optimizing them throughout all phases of ECU development, independent of whether dSPACE tools are used.

Key Benefits

To optimize processes, to reach goals faster and more efficiently, or to develop more complex products using existing tool chains, current processes must be analyzed and understood. dSPACE captures and structures complex processes and develops concepts to master new challenges. Therefore, the spectrum of the consultancy ranges from analyzing established processes and identifying the resulting optimization needs to suggestions for structuring new development processes and their implementation. The specialists also evaluate the suitability of processes for defined projects and examine how beneficial new processes or tools are for you. They also assist you with necessary adjustments.

Why dSPACE?

Decades of experience, particularly in the automotive industry, but also in many other areas, such as aerospace or medical engineering, make dSPACE a competent partner if you want to develop and test electric/electronic systems. Experienced specialists at dSPACE who are successfully working on projects around the world can quickly analyze your processes and identify potential for optimization. Their knowledge with regard to development tools and tool chains helps you establish lean and efficient processes.

Typical Services (Examples) | Description
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Benchmarking, process analysis and optimization | dSPACE Consulting analyzes existing customer processes and compares them with best practices from various industries. The specialists identify optimization potential and make suggestions for implementing new processes. If required, dSPACE also supports the implementation.
Creating and implementing standard-compliant processes | dSPACE Consulting advises on working with development and test environments to comply with standards such as ISO 26262, ISO/IEC 15504, and Automotive SPICE.
Proof of suitability for verification environments when working on safety-critical projects | dSPACE Consulting evaluates processes and makes necessary adjustments for safety-critical projects.
Introducing model-based development and virtual validation | dSPACE Consulting determines if and how you can profit from the benefits of model-based controller development and supports you in the implementation, if required.
Supporting the transition to agile development methods | dSPACE Consulting supports you in the implementation of agile software development so you are able to address the new challenges of the development of complex E/E systems and their embedded software, such as the introduction of continuous integration and the utilization of suitable tool chains.
Typical procedure for Process Consulting Projects

Customers contact dSPACE with specific concerns, intentions, and objectives, which is why content and scope generally are very individual for each process consulting project. Therefore, the procedures differ according to the customer’s demands.

In most projects, the first step is an analysis of the current situation, which is initially conducted on-site and includes interviewing all persons involved. To assess the current state, dSPACE then correlates this status with the development goals.

For this purpose, several facts are taken into account, for example:
- existing tool chains
- assigned roles
- specified requirements
- best practices derived from comparable processes

Based on the information gathered, dSPACE identifies the potential for improvement and derives a concept for process extensions or reorganizations. After implementing the proposed measures, it is essential for customer acceptance to be able to evaluate success by means of key figures.

To apply a standardized structure to customer discussions, dSPACE Consulting has developed an assessment model, which consists of several steps:

a) Defining the position of the project in the development process
b) Creating a tool chain overview and documenting its application
c) Discussing and analyzing established workflows
Use Cases

1. Verification and Validation Strategies

The Task
While functional safety is gaining importance in the automotive sector when developing complex E/E systems, the developed systems are becoming substantially more safety-critical due to increasingly autonomous driving. In the future, the simulation and virtual tests used today for the quality assurance of autonomous systems will become mandatory for the approval of automotive systems with automation level 2 and higher (according to the SAE J3016 standard). It is therefore crucial for OEMs and suppliers to define the appropriate verification and validation (V&V) concepts for the autonomous vehicles of the future.

The Challenge
Developing a V&V strategy for the driving functions poses the two challenges of how to test the performance of target functions in all conceivable scenarios and how to validate the functional safety of an intended function to be able to approve all functionalities. The V&V strategies no longer concern only the final verification of specifications but must be viewed as an integral part of the development processes. Standards for functional safety such as ISO 26262 and ISO/PAS 21448 (SOTIF) must be taken into account. The seamless integration of the new strategies into existing development processes and a closer integration of the system architecture and the V&V strategy are further core aspects.

Our Approach
dSPACE Consulting helps you develop an integrated V&V strategy. The main focus is on methods that will be used during the verification and validation of complex E/E systems and on how these methods can be gradually expanded in the face of the increasing automation of driving functions. The goal is to achieve more virtual testing while maintaining process reliability. Depending on the application, we extend established methods such as hardware-in-the-loop simulation with new approaches to ensure the functional safety of highly complex systems. To do this, we take scenario-based testing and the use of simulation models into account.
2. Standard Compliance

The Task
For the development and validation of safety-critical systems, compliance with functional safety standards, such as ISO 26262, is indispensable. The boost in the development of functions for automated driving and, in the future, autonomous vehicles, results in a rise in the number of safety-critical functionalities. This, in turn, increases the importance of standardized development processes and tests. To meet the requirements of these standards, including traceability throughout the entire development process, systematic test planning and execution, the use of qualified software tools, and detailed analyses of processes and workflows are a must.

The Challenge
The first question is which standards exist and which of them must be met in a specific development project. The second edition of ISO 26262 for ensuring functional safety is available and established in the industry. New safety standards, such as Safety of the Intended Functionality (SOTIF), are also emerging as part of the trend towards automated driving and the associated challenges. Adapting existing processes to the requirements of the relevant standards or establishing new standard-compliant processes requires not only precise knowledge of all the guidelines applicable to the development or test task at hand but also specialist technical knowledge. For example, tool requirements and admissible validation methods must be identified to be able to offer an efficient standard-compliant solution.

The Solution
dSPACE Consulting supports you in designing and implementing your processes in compliance with applicable standards. Our experience in numerous projects and our collaboration on the second edition of the ISO 26262 standard as well as the future standard ISO/PAS 21448 (SOTIF) makes us experts in the field of validating functions and functionalities. In collaboration with you, we define suitable test strategies including the decision on test focus, object, and level. Another aspect is the selection of test environments such as HIL simulators or PC-based validation environments and proof of their suitability in safety-critical projects. Additionally, dSPACE consultants help classify and qualify the software used to ensure that the tool chain is suitable for safety-critical applications from ASIL A to ASIL D.
3. Homologation

The Task
Presently, simulation and virtual testing are used for the approval and homologation of E/E systems in the automotive sector. The UNECE regulations, for example, describe the efficient use of these procedures for the approval of ESC (Electronic Stability Control) systems. The approval of automotive systems with Level 2 automation and higher according to the OICA/SAE J3016 classification is even more complex. Therefore, implementing simulation and virtual testing not only increases efficiency, it is also indispensable. The reason for this is that the operating points at which the systems begin to function can no longer be verified in driving tests alone.

The Challenge
In this context, complying with the ISO 26262 functional safety standard and the technical regulations of UNECE as well as observing the Safety of the Intended Functionality (SOTIF) are decisive factors, particularly because the maturity levels of the development and test processes will be used for future approvals. Presently, the UNECE regulations have not been completed and the standardization has not been finalized either with regard to which procedures are to be applied and how. Yet the use of simulation is mandatory. This results in the challenge to design a suitable and comprehensive test strategy that satisfies both ISO 26262 and ISO/PAS 21448 (SOTIF), and makes simulation usable as a central element. It is also important that the systems are designed for testability.

The Solution
dSPACE Consulting works on customer projects that support the approval of automotive E/E systems by means of simulation, including both the classic domains such as powertrain, vehicle dynamics and ADAS and predevelopment projects for AD systems. To create this approval process, a variety of building blocks is required. First, there are relevant procedures, such as hardware-in-the-loop simulation, software-in-the-loop simulation, test automation, and test management. However, compliance requirements with regard to applicable standards and process safety are equally important. We also focus on the definition of verification and validation criteria as well as coverage metrics. We combine all these elements in a meaningful and target-oriented way.