SAF ENVIRONMENT BLOCK

Jobst Beckmann, Bernhard Hillbrand

SUNRISE
SAFETY ASSURANCE FRAMEWORK FOR CONNECTED, AUTOMATED MOBILITY SYSTEMS

Introduction

The **Environment** component of the Safety Assurance Framework (SAF) operationalizes test scenarios via 3 main blocks: Query & Concretise, Allocate and Execute.

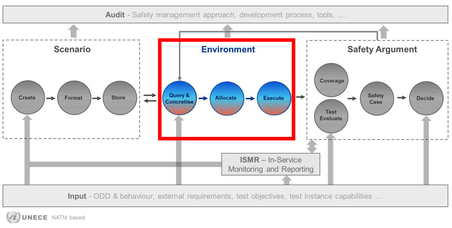

Figure 1. Environment component of the Safety Assurance Framework

Query & Concretise retrieves scenarios from databases with queries, based on requirements from the Input block for example related to Operational Design Domain (ODD) and behavior. Queries follow the OpenLABEL format. Logical scenarios with parameter ranges are concretised into specific values thereby creating the scenarios to be tested.

Allocate matches test scenarios with test environments ranging from virtual simulations to proving grounds. Test case requirements, are compared against the capabilities of available test instances. Lower-fidelity environments are prioritized, but reallocations might lead to testing in higher-fidelity environments.

Execute runs test scenarios in allocated test environments, with relevant data recorded for analysis. Feedback loops enable refining scenarios and optimizing test objectives.

Scenario selection

After logical scenarios have been queried using the SUNRISE Data Framework, **concrete scenarios are selected from these logical scenarios**. SUNRISE provides various sampling and selection approaches, for example based on scenario dimensionality or parameter distributions. These approaches allow for iterative exploration of parameter spaces, aiming to find interesting sub-spaces, the pass-fail boundary or regions of system failure.

Scenario allocation

The concrete scenarios derived in the scenario selection, need to be efficiently allocated to test instances.

SUNRISE developed a structured approach to compare test requirements to test instance capabilities in a tree-structure based on ISO 34503. This approach enables **efficient allocation of test cases** to appropriate test instances while balancing test execution efficiency with reliable safety assessment results.

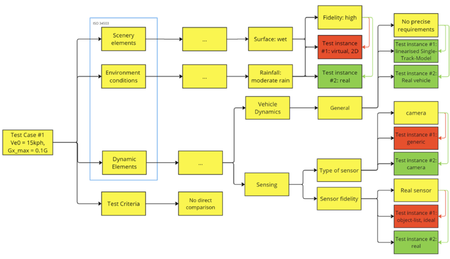

Figure 2. Example of an allocation using the SUNRISE structured approach

V&V simulation framework

Test execution can take place in virtual, hybrid or physical test environments. In the case of virtual testing, the SAF recommends a harmonised approach.

As shown in figure 3, the SUNRISE harmonised V&V simulation framework consists of a base layer with **4 interconnected subsystems**: Sensors, AD Function, Vehicle Dynamics and Environment.

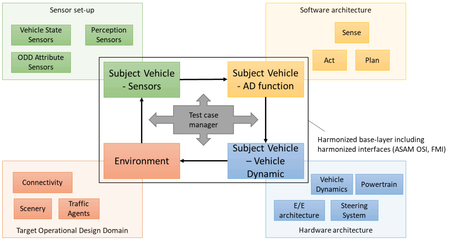

Figure 3. Design of the harmonized V&V simulation framework

The base layer is the core element that can be harmonised, because these 4 subsystems are **essential for all simulations**. For that reason, it is possible to use standardised interfaces between them. The framework can be extended by the user in all 4 dedicated dimensions.

Partners

For more information, please contact:

jobst.beckmann@ika.rwth-aachen.de, bernhard.hillbrand@v2c2.at

www.ccam-sunrise-project.eu

ccam-sunrise-project

The SUNRISE project is funded by the European Union's Horizon Europe Research & Innovation Actions under grant agreement No. 101069573

Funded by the European Union