stiEF Presentation
Motivation, overview and publication

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stiEF
Goals and Key Features

› stiEF („scenario-accompanied, textbased, iterative Evaluation of automated driving Functions“) is a textual domain-specific language for traffic scenario descriptions

› stiEF is based on
  › already existing manually created scenarios to provide a natural language style description format
  › the PEGASUS abstraction levels (functional, logical, concrete) and the content layers (1: road level, 2: traffic infrastructure, 3: temporary modifications, 4: objects & maneuvers, 5: environment conditions) to structure scenarios
  › the open-source framework JetBrains Meta Programming System (MPS)
  › Note: „Abstract scenario“ ⇔ „Functional scenario“

› stiEF is currently limited to freeway/highway descriptions
› stiEF provides the scenario descriptions in English and German
› stiEF provides generators/exporters for Word, Excel, JSON, PNG and animated GIF
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Problem definition

- Scenarios are used throughout the development process

- Scenario creations is done mainly by hand

- Scenario descriptions are often inconsistent or incomplete (also visualization)

- Support for multiple languages by manual translations

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DSLs in JetBrains MPS

› A DSL in JetBrains MPS includes three different aspects:
  › Structure: The data model of the language with all entities and their attributes
  › Editor: The visualization of the data model for the user based on rules
  › Generator: Rules to generate target artifacts out of the data model

1 JetBrains „Meta Programming System“ (MPS)
https://www.jetbrains.com/de-de/mps/
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Initial prototype – English representation

Road level

Infrastructure

Temporal changes

Objects

Maneuvers

Environment

Ego maneuvers

Goal: Review and discussion with the stakeholders

Live visualization of the scenario

Abstraction level: 01 abstract . Scenario workstep: 03 complete.

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(L1) Road level:
A straight road (ID: ROAD1) with a emergency lane. It has the following lanes:
A normal lane (ID: LANE0), which has the following vehicles on it: None.
A normal lane (ID: LANE1), which has the following vehicles on it: car 0, car 1.
A normal lane (ID: LANE2), which has the following vehicles on it: truck 2, truck 3.

Additional features:
No features defined.

(L2) Traffic infrastructure:
A traffic sign of type 'no overtaking'.

(L3) Temporal infrastructure changes:
Lane LANE0 is blocked by an accident.

(L4) Dynamic elements:
Vehicles:
A car (ID: 0).
A car (ID: 1).
A truck (ID: 2).
A truck (ID: 3).
A bicycle (ID: 4).

Relative vehicle positions:
car 0 is in front of car 1.
truck 2 is in front of truck 3.

Maneuver sequence:
Maneuver: car 1 accelerates [start] instantly until [end] the lane LANE1 is free.
Maneuver: truck 2 follows the road [start] instantly.
Maneuver: car 0 decelerates [start] after 5 s.

Ego-Vehicle: car 1

(L5) Environment conditions:
The current weather is: sunny. The scenario is set at day.

Ego behavior:
Maneuver sequence:
Maneuver: car 1 accelerates [start] instantly until [end] the lane LANE1 is free.
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**Initial prototype – German representation**

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**Abstraktionslevel:** 01 abstrakt, Szenarienarbeitszusammenstellung: 03 vollständig.

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**L1) Straßenebene:**
Eine gerade Straße (ID: ROAD1) mit einem Standstreifen. Sie hat folgende Fahrbahnen:
- Eine normale Fahrbahn (ID: LANE0), auf der sich folgende Fahrzeuge befinden: None.
- Eine normale Fahrbahn (ID: LANE1), auf der sich folgende Fahrzeuge befinden: PKW 0, PKW 1.
- Eine normale Fahrbahn (ID: LANE2), auf der sich folgende Fahrzeuge befinden: LEW 2, LEW 3.

**Zusätzliche Merkmale:**
- No features defined.

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**L2) Straßenausstattung:**
Ein Verkehrsschild vom Typ 'Überholverbot'.

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**L3) Temporäre Infrastrukturänderungen:**
Fahrbahn LANE0 ist durch einen Unfall blockiert.

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**L4) Dynamische Elemente:**
Fahrzeuge:
- Ein PKW (ID: 0).
- Ein PKW (ID: 1).
- Ein LEW (ID: 2).
- Ein LEW (ID: 3).
- Ein Fahrrad (ID: 4).

Relative Position der Fahrzeuge:
- PKW 0 ist vor PKW 1.
- LEW 2 ist vor LEW 3.

**Manöversegment:**
- Manöver: PKW 0 bremst [Start] nach 5 s.

**Ego-Fahrzeug:** PKW 1

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**L5) Umgebungsbedingungen:**
Das aktuelle Wetter ist: sonnig. Das Szenario findet tagsüber statt.

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**Egoverhalten:**
**Manöversegment:**

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**Goal:** Review and discussion with the stakeholders

Live visualization of the scenario
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Initial prototype – data model
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Final implementation – English representation

▷ Scenario description in English with the corresponding generated visualization:
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Final implementation – German representation

> Scenario description in German with the corresponding generated visualization:
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Final implementation – Table view

- Scenario description viewed as table:
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Final implementation – Generated artifacts

▷ Generated Work and Excel exports:
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Final implementation – Generated artifacts

- Generated JSON schema and JSON export for the scenario:
Complete ontology is planned to be published in the future.
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File location, documentation and installation steps

› Tool „stiEF“:
  › Currently AUDI IP, so only available internally at VW
  › Publication is currently discussed – no decision yet

› Language „stiEF“:
  › Publication of the language as a document is approved
  › Publication is currently prepared and will be available soon™

› Publications:
  › 2019 – “Advantageous Usage of Textual Domain-Specific Languages for Scenario-Driven Development of Automated Driving Functions”, SysCon 2019, Orlando
Thank you!

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