



THOMAS GUSTAFSSON (THOMAS.GUSTAFSSON@SCANIA.COM), SYSTEM AUTOMATION ENVIRONMENT, SCANIA

DANIEL FLEMSTRÖM (DANIEL.FLEMSTROM@RI.SE), RISE SICS

AVENIR KOBETSKI (AVENIR.KOBETKSI@RI.SE), RISE SICS

SITUATION-BASED TESTING USING GUARDED ASSERTIONS



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Outline

- SAGA toolbox
- Guarded Assertions and T-EARS
- Situations
- Situation-based testing
- Future work
- Conclusions




SAGA toolbox

Treo - Test Result Organizer Load jsondiff Load CAN (asc) Load CANDb Create data from CAN

```
1 while
2   var == |
3 x shall
4   var == 1
```

GAEditor: , Inputs:

Load GAs Save GA





SAGA toolbox, cont'd

- Situation-based Integration Testing of Automotive Systems using Guarded Assertions (SAGA)

Guard describing the testable state: *key in cranking position for at least 0.5 s*

```
1 while
2     KeyPosition[-1_3] == 3 for 0.5s
3 shall
4     n_Engine > 400 within 1s
```

Assert that *the electrical system starts the engine within 1s*



T-EARS

- A Guarded Assertion is a passive test independent from test stimuli
- Easy Approach to Requirements Syntax (EARS)
 - while – a state, when – an event, if – a fault
- T-EARS: Time EARS
 - EARS extended with keywords capturing time and order
- Domain-specific language on the abstraction level of time intervals
- Contemporary test scripts normally reason about individual events



What is needed in the "Regenerate" button?

- What shall the test stimuli be used for?
 - a real vehicle
 - in a S/M/HIL test environment
 - in the interactive work flow to verify a new test
- On what abstraction level is the test performed?
 - I/O, communication buses
 - driver actions



Situation-Based Testing

- Passive testing enables reasoning about test tracks and driver actions
 - What traffic situations are needed to cover a test of an ADAS function?
- In a simulated environment
 - the track can be generated
 - the driver actions can be generated
 - so the track can be generated according to some objective
- In a real environment
 - some of the track can be adapted
 - the driver actions can be reasoned about in advance

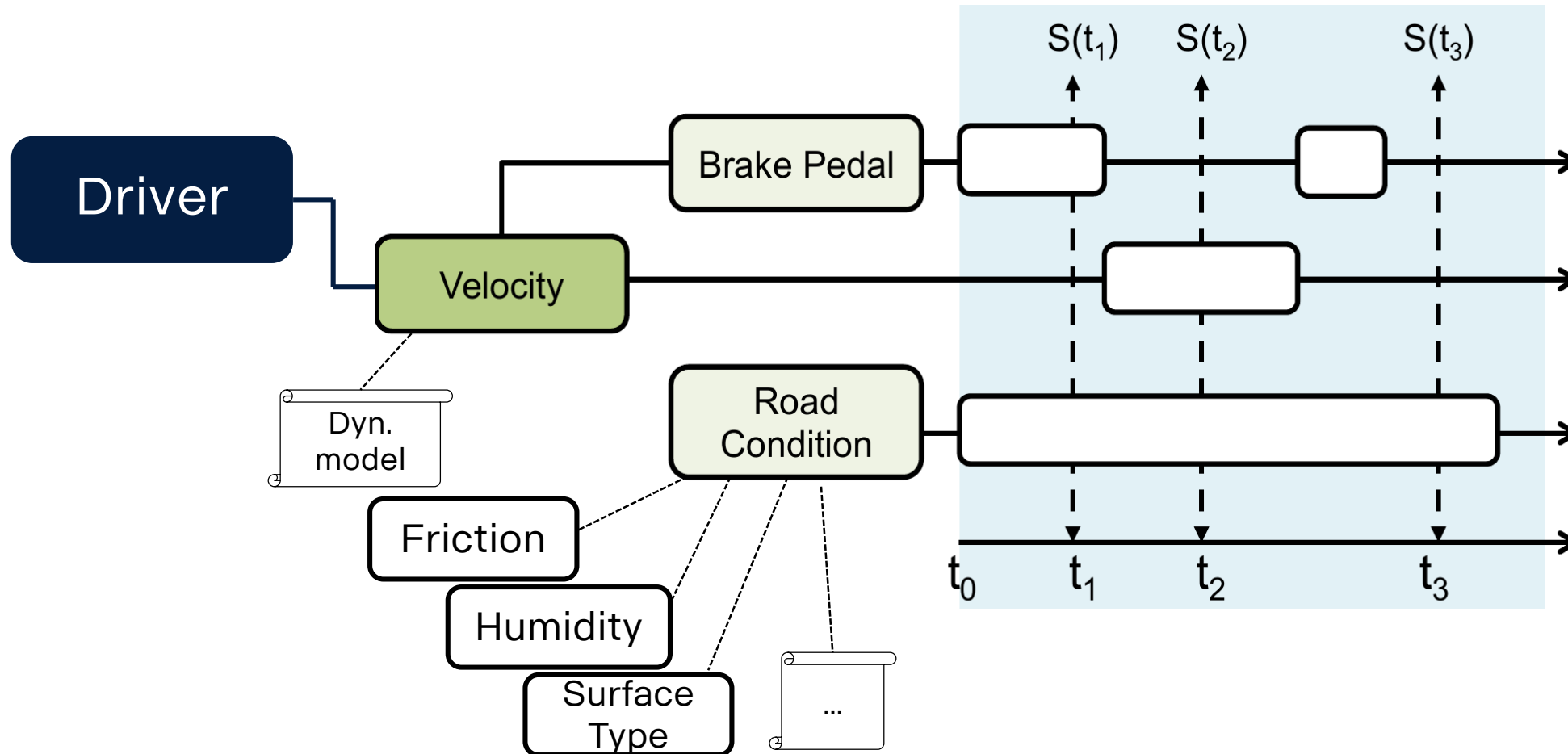


Situation

- A traffic situation can be described by contribution from three kinds of Situation Components (SCs)
 - driver and other vehicles (agents)
 - environment
 - fault injection
- A Situation Component
 - is active or inactive
 - is basic or hierarchically composed of other SCs
 - has linked dependencies



Situation, cont'd





What are important traffic situations

- for testing, e.g., ADAS and autonomous vehicles?
- Can we describe them in terms of Situation Components?
- Composability of traffic situations?
- Catalogue for computer-based test track generation?



Future work

- We want discussions about this. Who wants to collaborate?
 - Build an initial catalogue representing good traffic situations
 - Representing traffic situations in a machine readable format
 - Representation of domain-knowledge about traffic situations' composability
- Document adoption case study
- T-EARS adaptations based on case study results



Conclusions

- We have an interactive tool for user-friendly modeling of passive tests
- Passive testing enables thinking in terms of traffic situations
- Some traffic situations are much better than others for testing a functionality. Collecting these in a machine readable catalogue is a good start for higher quality systems