FUNCTIONAL USE CASES

Characteristic Scenarios for the Evaluation of Urban Driving Automation

Lukas Westhofen, Christian Neurohr, DLR

Challenge: *An urban operational domain contains arbitrarily many complex traffic scenarios. How to create a common understanding of the <u>severe demands imposed by reality</u>?*

Concept: *Use examples of performing the dynamic driving task across <u>three representative urban intersections</u> with increasing complexity of actor-interaction.*
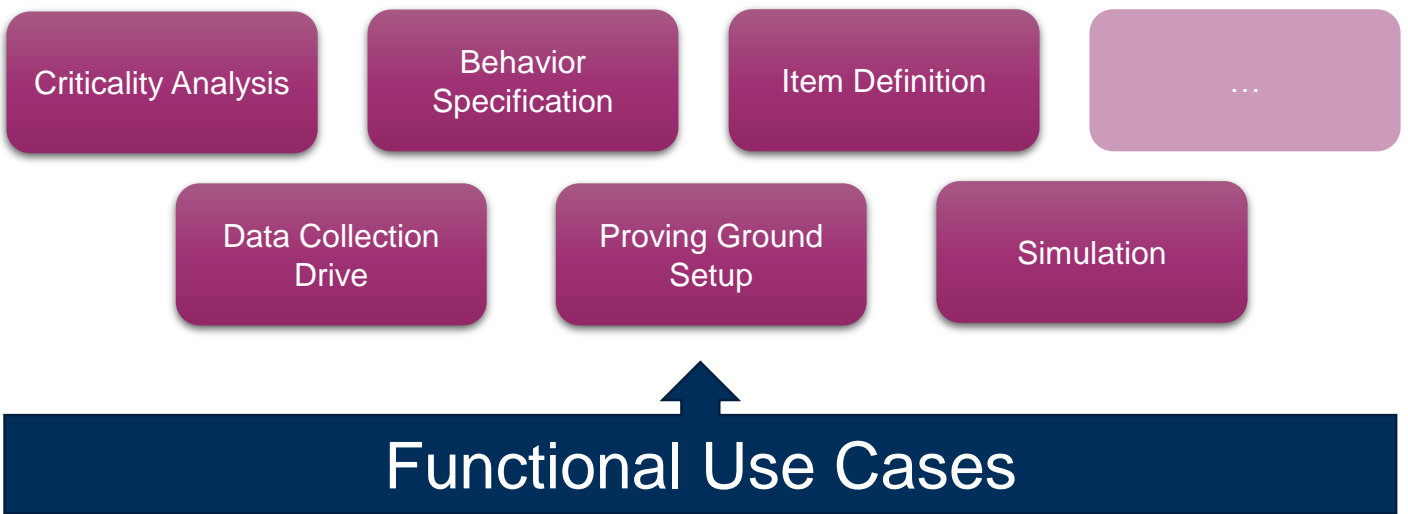
Functional Use Case 1	Functional Use Case 2	Functional Use Case 3
Left turn on an X-crossing with traffic lights	Straight passing of a T-crossing with pedestrian crossing	Left turn on a bending right of way X-crossing with an angled arm
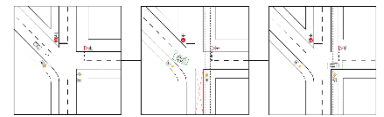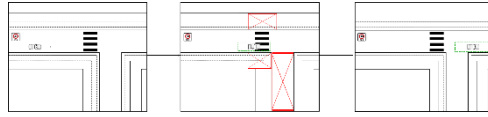
Variations of the Base Concepts:

#	FUC 1	FUC 2 (Complexity)	FUC 3 (Complexity)	#
#1	+ oncoming traffic with right of way	+ traffic from the right with right of way	+ traffic from the right with right of way	#1
#2	+ oncoming traffic + occlusion through oncoming crossing traffic	+ pedestrian using crosswalk + bicyclist crossing in same direction + oncoming traffic wants to cross left	+ traffic, needs to give right of way + pedestrian with right of way	#2
#3	+ non-functional traffic lights + rush hour traffic	+ parking cars + bicyclist using crosswalk + occlusion of bicyclist through parking cars	+ ambulance with right of way + following car, needs to give right of way	#3
#4		+ pedestrian using crosswalk + sensor blockage (dirt, etc.)		#4

Result: *Alignment of all developed methods & tools regarding these functional use cases. This leads to a <u>common understanding of the challenges</u> within the operational domain.*

- Criticality Analysis
- Behavior Specification
- Item Definition
- …
- Data Collection Drive
- Proving Ground Setup
- Simulation

Functional Use Cases

Stream presentations and posters refer to the Functional Use Cases (FUCs). Feel free to have a look at this poster for details.

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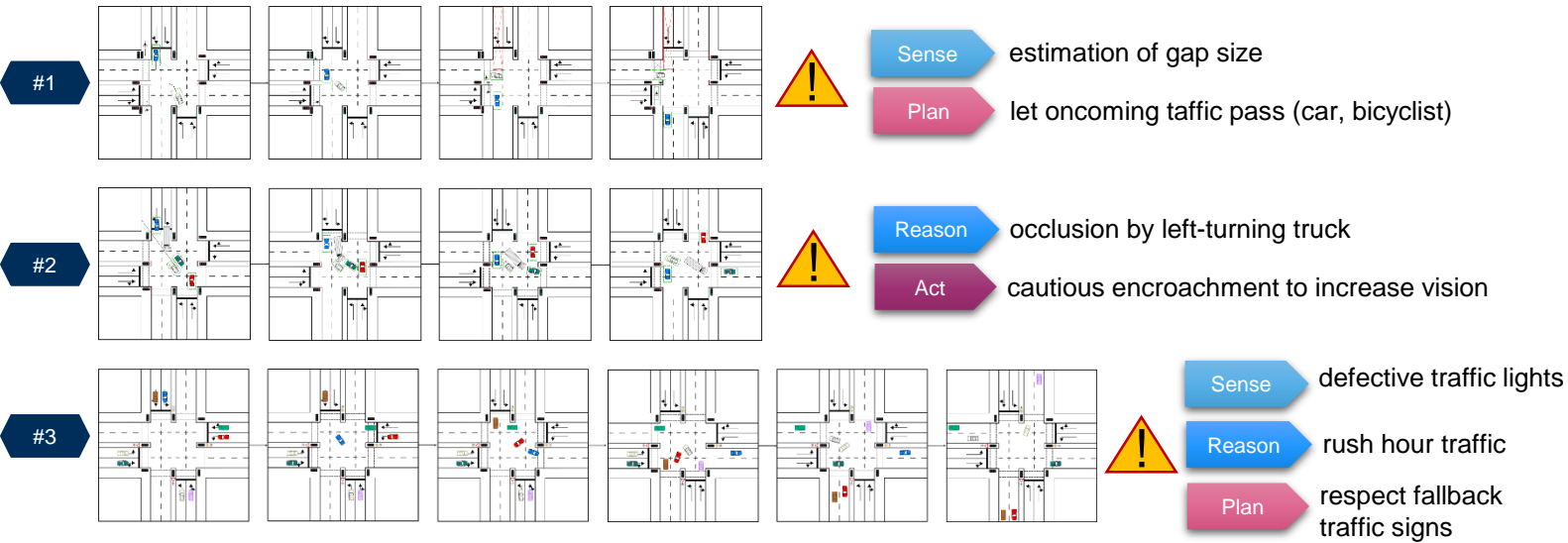
FUNCTIONAL USE CASES – DETAILS & CHALLENGES

⚠️ Challenges within the FUCs are structured along abstract functionality:

Sense → Reason → Plan → Act
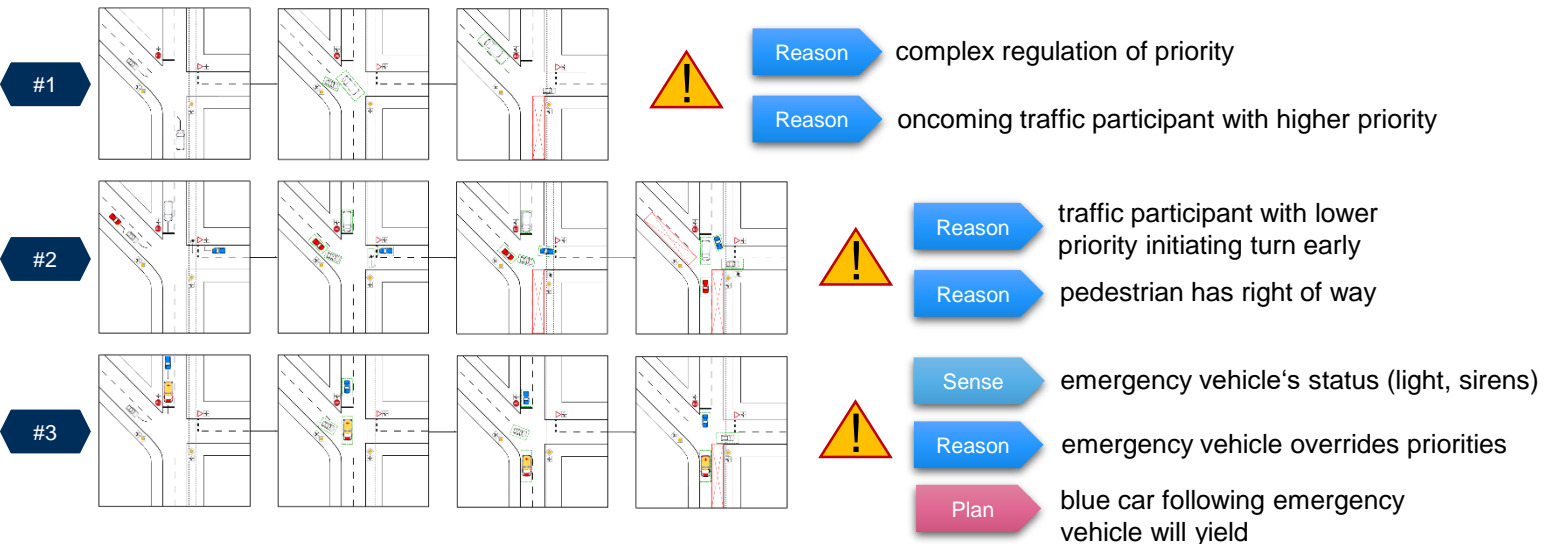
Functional Use Case 1 – Unprotected Left Turn on X-Crossing

#1 ⚠️
- Sense — estimation of gap size
- Plan — let oncoming taffic pass (car, bicyclist)

#2 ⚠️
- Reason — occlusion by left-turning truck
- Act — cautious encroachment to increase vision

#3 ⚠️
- Sense — defective traffic lights
- Reason — rush hour traffic
- Plan — respect fallback traffic signs

Functional Use Case 2 – Passing of T-Crossing with Pedestrian Crossing

#1 ⚠️
- Reason — no explicit signs, implicit priority rule
- Plan — yield to traffic from right

#2 ⚠️
- Reason — two vulnerable road users, one with higher priority
- Reason — one car with lower priority

#3 ⚠️
- Sense — occluded bicyclist
- Reason — illegitimately parking vehicles
- Reason — illegitimate use of pedestrian crossing
- Plan — (worst-case) assumptions regarding the existence and (mis-)behavior of others

#4 ⚠️
- Sense — sensor blockage by dirt
- Sense — redundancy & sensor fusion
- Reason — pedestrian has priority

Functional Use Case 3 – Left Turn with a Bending Right of Way

#1 ⚠️
- Reason — complex regulation of priority
- Reason — oncoming traffic participant with higher priority

#2 ⚠️
- Reason — traffic participant with lower priority initiating turn early
- Reason — pedestrian has right of way

#3 ⚠️
- Sense — emergency vehicle's status (light, sirens)
- Reason — emergency vehicle overrides priorities
- Plan — blue car following emergency vehicle will yield