

OPENSENARIO: A REGULATOR'S PERSPECTIVE ON THE REQUIREMENTS



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21ST MARCH 2019

CATAPULT
Transport Systems

OUTLINE

1. Overview of MUSICC project
2. Scenario-based regulatory approval: Use cases
3. Regulator's perspective on requirements
4. Technical points relating to OSC 1.0 / 2.0 compatibility

OBJECTIVES AND APPROACH

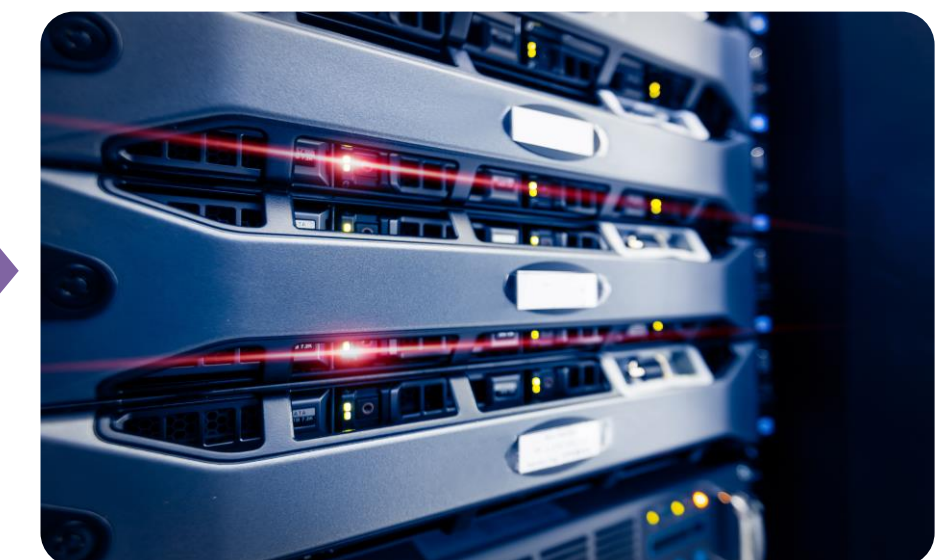


Objectives:

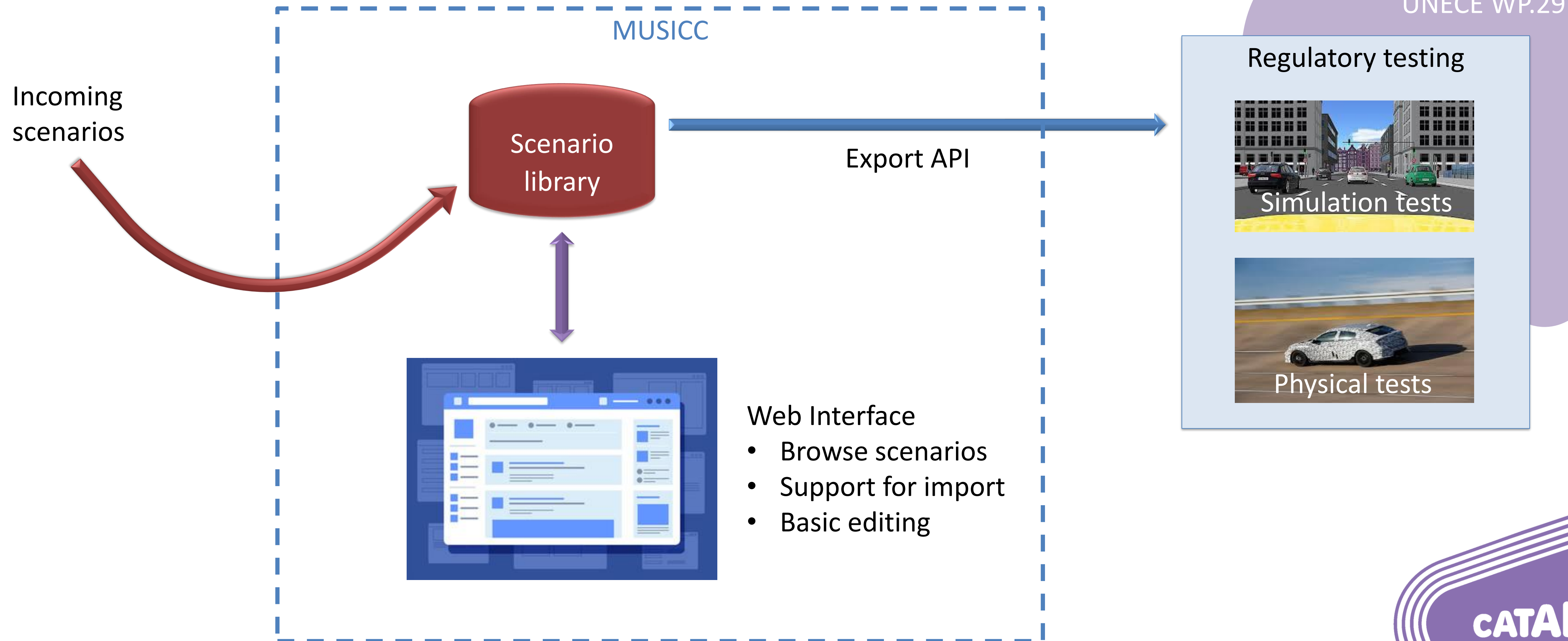
- Create a standard language to describe scenarios
- Build an open and extensible library of scenarios for CAV certification
- Focus on simulation testing environments

Approach:

- 12-month proof-of-concept demonstration project
- Close collaboration with vehicle manufacturers, developers, organisations with expertise in CAV validation and international regulators
- Define a scenario format based on a wide consultation
- Enable openly-accessible scenario platform



MUSICC SCOPE AND CONTEXT



MUSICC SYSTEM PREVIEW



Please login to see this page.

Username:

Password:

[Lost password?](#)

Hi musicc2!
[logout](#)

Filter

CountryCode

GB

OR

AND

DriveOnRightOrLeft

Right

OR

AND

UseCase

Urban

OR

AND

Exposure

E1

OR

AND

SituationDemand

Information

Executing query

Success

Query returned 21 results in 390ms

Estimated file size (unzipped) is:

371.8 kB

CountryCode = 'GB' AND UseCase = 'Urban'

Search

Download

id	label	updateDateTime
4	UK TSC-Demo highway_test_double_lane_change-179	2019-07-26T10:00:00
54	UK TSC-Demo highway_test_double_lane_change-78	2019-07-26T10:00:00
62	UK TSC-Demo highway_test_double_lane_change-12	2019-07-26T10:00:00
66	UK TSC-Demo highway_test_double_lane_change-27	2019-07-26T10:00:00
94	UK TSC-Demo highway_test_double_lane_change-117	2019-07-26T10:00:00
108	UK TSC-Demo highway_test_double_lane_change-94	2019-07-26T10:00:00
161	UK TSC-Demo highway_test_double_lane_change-148	2019-07-26T10:00:00
182	UK TSC-Demo highway_test_double_lane_change-116	2019-07-26T10:00:00
199	UK TSC-Demo highway_test_double_lane_change-188	2019-07-26T10:00:00
202	UK TSC-Demo highway_test_double_lane_change-3	2019-07-26T10:00:00
205	UK TSC-Demo highway_test_double_lane_change-187	2019-07-26T10:00:00

Showing 1 to 21 of 21 entries (filtered from 400 total entries) Show 25 entries First Previous 1 Next Last


upload

search

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(With apologies for
dummy data)

MUSICC SYSTEM PREVIEW



Multi User Scenario Catalogue for
Connected Autonomous Vehicles

Filter

sourceFilePath

OR AND

OwningOrganization

OR AND

label

OR AND

version

OR AND

updateDateTime

OR AND

updateUsername

OR AND

revision

CountryCode = 'GB' AND UseCase = 'Urban'

id	label	Exposure	RoadFeatures
	highway_test_double_lane_change-78		"Roadworks"] }
62	UK TSC-Demo highway_test_double_lane_change-12	E4	{ "RoadFeature": ["GiveWaySign", "SharpBend", "MoreThan4LegJunction", "4Lane", "RailwayCrossing", "Tunnel", "2Lane"] }

labelUK TSC-Demo highway_test_double_lane_change-12

UseCaseUrban

version3

ExposureE4

revision0.1.0

CountryCodeGB

Regulations

RegulationUNECE-GRVA-Res2135UK-RTA-2019-345

RealWorldMap

value true


mapDataValidDateTime2017-07-23T11:03:00Z

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Multi User Scenario Catalogue for
Connected Autonomous Vehicles

Hi musicc2!
[logout](#)

Filter

CountryCode = 'GB' AND UseCase = 'Urban'

EnvironmentalConditions

Rain OR AND

EgoManeuverTypes

RightTurn OR AND

KeyActorTypes

PassengerCar OR AND

KeyActorActions

ActorCrossingRoad OR AND

Regulations

OR AND

CountryCode = 'GB' AND UseCase = 'Urban'

Fields

CountryCode
DriveOnRightOrLeft
UseCase
Exposure
SituationDemand
CollisionCategory
InitialSpeedLimit
RealWorldMap__value
RealWorldMap__mapDataValidDateTime
RealWorldCoordinate__latitude
RealWorldCoordinate__longitude
RepresentsADASTest
ADASFeaturesTested__ADASFeature
RoadFeatures__RoadFeature
EnvironmentalConditions
EnvironmentalCondition

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	highway_test_double_lane_change-145	E3	{ "RoadFeature": ["TrafficLightControlledJunction", "MoreThan4Lanes", "StopSign", "Roundabout"] }
	highway_test_double_lane_change-145	E3	{ "RoadFeature": ["HighGradient", "SharpBend"] }
	highway_test_double_lane_change-145	E3	{ "RoadFeature": ["2Lane"] }
219	UK TSC-Demo highway_test_double_lane_change-145	E3	{ "RoadFeature": ["3Lane", "4Lane", "GiveWaySign", "BicycleLane", "2Lane"] }
	highway_test_double_lane_change-145	E3	{ "RoadFeature": ["Roadworks", "RailwayCrossing", "2Lane", "Roundabout", "TrafficLightControlledJunction"] }

Showing 1 to 21 of 21 entries (filtered from 400 total entries) Show 25 entries

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MUSICC NEXT STEPS

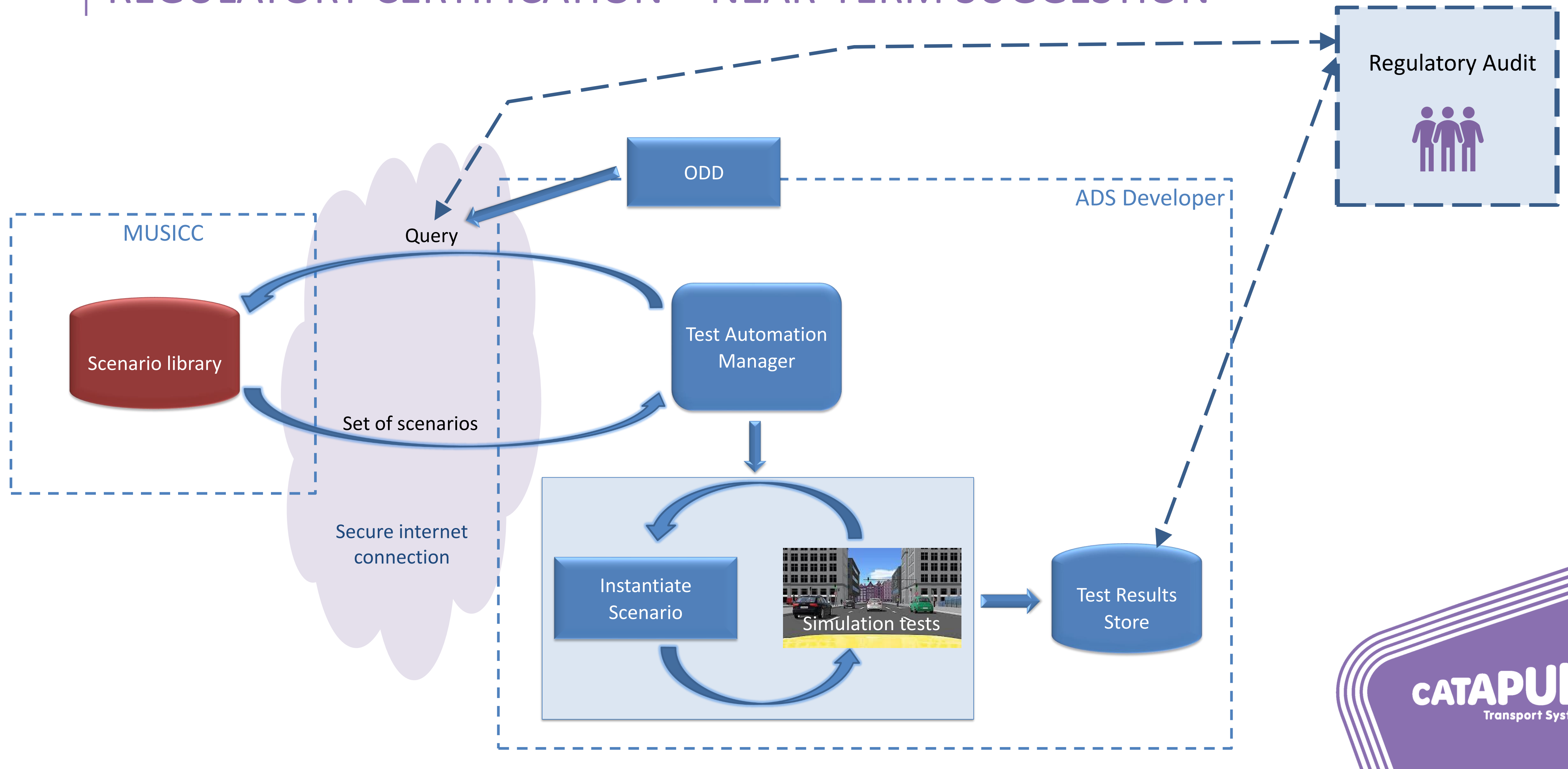
- Open beta phase, commencing late April
 - Interim scenario language: OSC 0.9.1 with some additions
 - Will align with OSC transfer and concept project outputs in future
- Proof-of-concept integrations with tool providers

Please get in touch if you'd like to be involved
zeyn.saigol@ts.catapult.org.uk

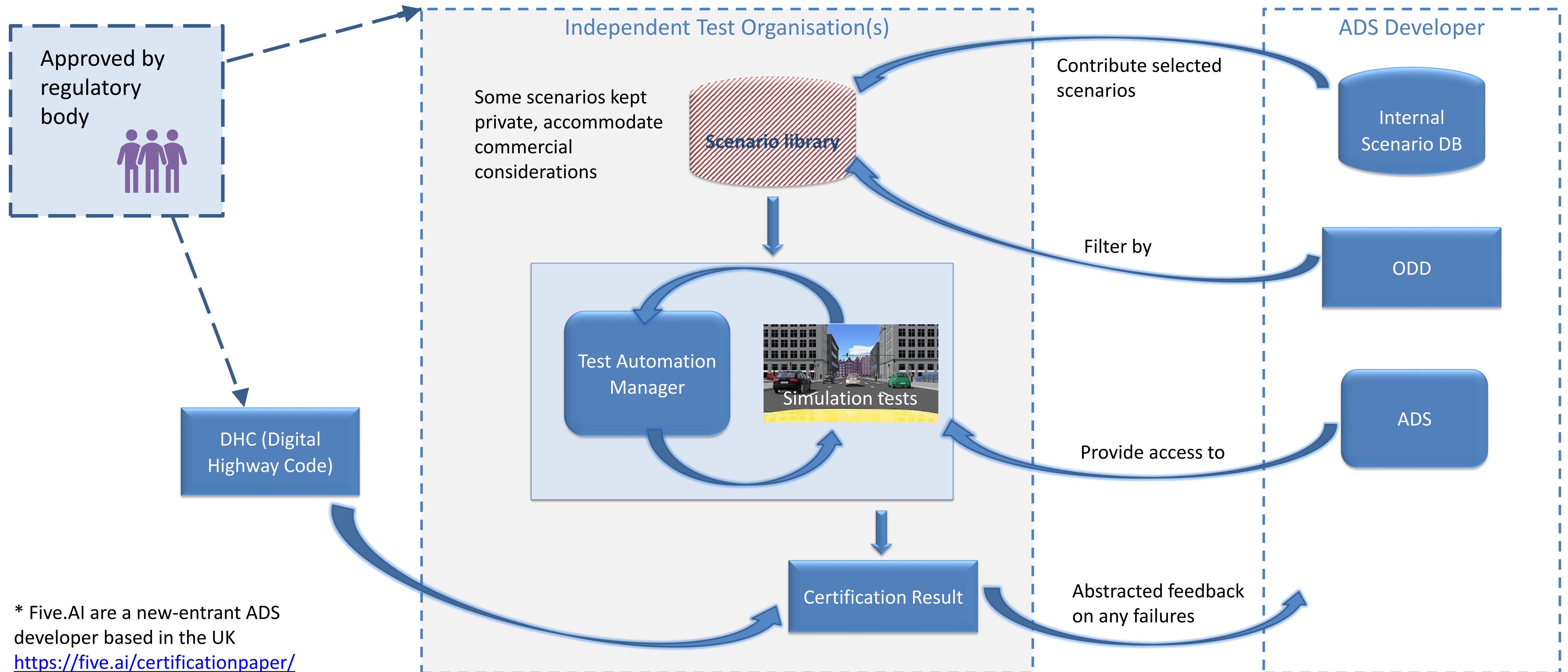
OUTLINE

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REGULATORY CERTIFICATION – NEAR-TERM SUGGESTION



FIVE.AI* REGULATORY CERTIFICATION SUGGESTION



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TRADITIONAL APPROACH OF EU & UNECE REGULATIONS

- Approval Authority led process
- Pre-market assessments & testing
- Defined tests & test conditions
- Defined pass/fail criteria (performance based and technology neutral)
- Based upon mutual recognition
- New types and new registration dates

These procedures can be transferred to CAV certification, given a carefully thought-out methodology with sufficient industry buy-in. This methodology is likely to make significant use of scenarios and simulation.

GENERAL REGULATORY REQUIREMENTS

Neutrality / Fairness

- Work with all ADS architectures and implementations
- Work with all sensor types
- Not be influenced by commercial goals
- Shouldn't constrain OEM USP features

May not require the full scope of development testing

- Different objectives & targets (safety focus)
- Results presented for different users
- Should support both randomisation and repeatability

Must work within the wider regulatory regime

Must work equally well across different regions

- For example, the UK drives on the left. Signage etc

REQUIREMENTS ESPECIALLY RELEVANT FOR OSC

Manageable database

- Vital to keep a high-relevancy, high-integrity set of certification scenarios
- Tight human oversight implies a limited number of scenarios (implies stochastics?)

Work easily with any simulation toolchain

- Different tools may use different internal representations
- Should support HIL and road tests

Able to select scenarios according to ODD

- Scenarios should have metadata tags to identify the ODD-elements they contain

Compatible with an ID-based storage system

- When scenarios go into a database, cannot use filenames to reference other entities
- Applies to scenarios and child/related documents (OpenDRIVEs + Catalogs especially)

CLEAR PASS/FAIL CRITERIA

May be specified per-scenario, or globally

- Globally => Digital Highway Code?
- Would need significantly more detail than existing rules of the road

May be encoded into the scenario, or elsewhere (test specification?)

- Not clear if this belongs in a scenario description language

- This is a complex topic
- Perhaps not realistic to resolve within OpenSCENARIO project

OUTLINE

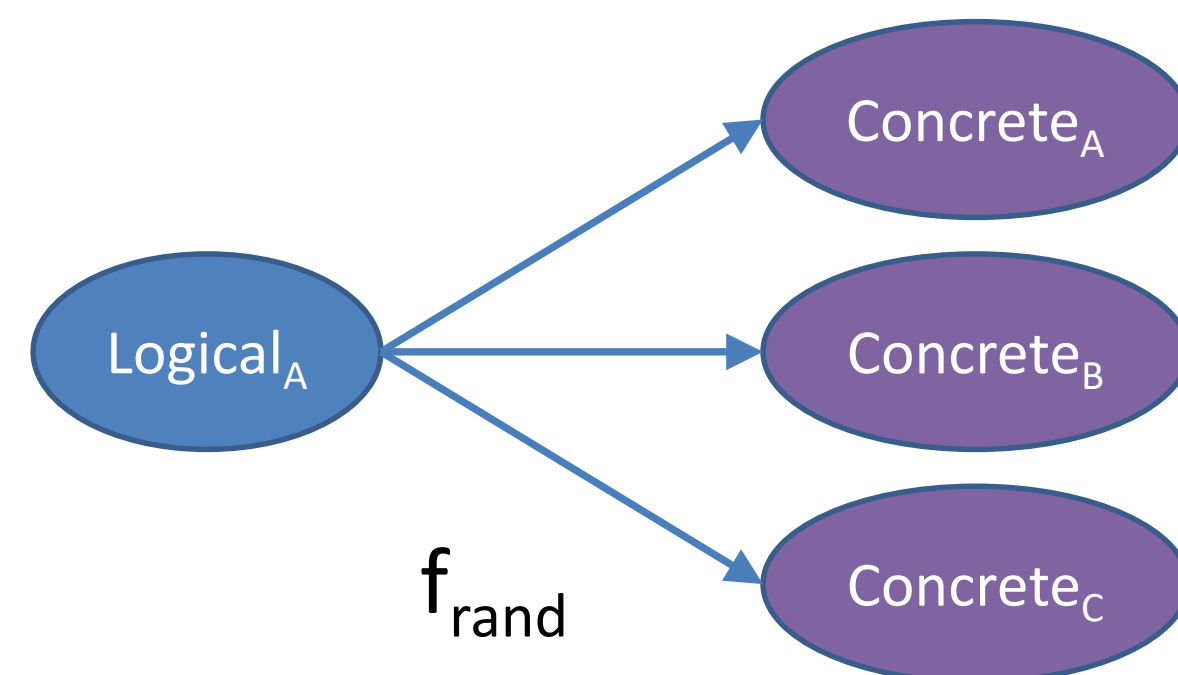
1. Overview of MUSICC project
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QUESTIONS ON 1.0 <-> 2.0 COMPATIBILITY & CONVERSION

- Important for us, as we're building MUSICC using current OpenSCENARIO, but we're aware of significant stakeholder demand for a high-level language
 - Therefore we hope to transfer the existing scenarios in MUSICC to the OSC high-level language as soon as possible
 - An automated way of doing this will be highly desirable
-
- Here I would simply like to articulate the key questions

QUESTIONS ON 1.0 \leftrightarrow 2.0 COMPATIBILITY & CONVERSION

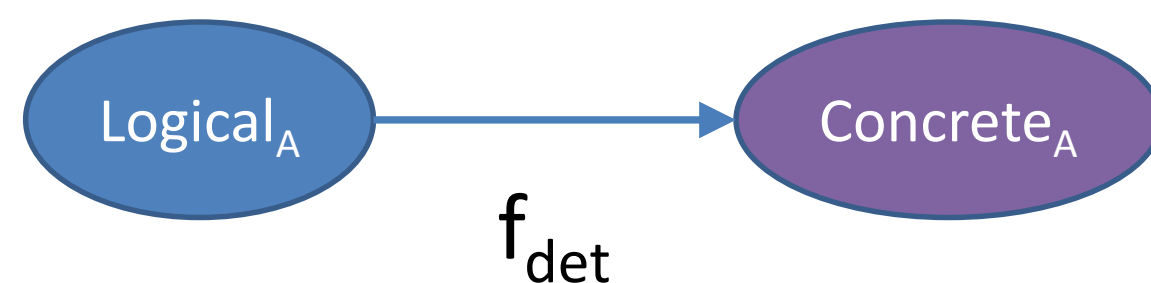
- Assume OSC 1.0 is concrete, 2.0 is logical
- Normally, expect to use a random-number-generator to create concrete scenarios from logical:



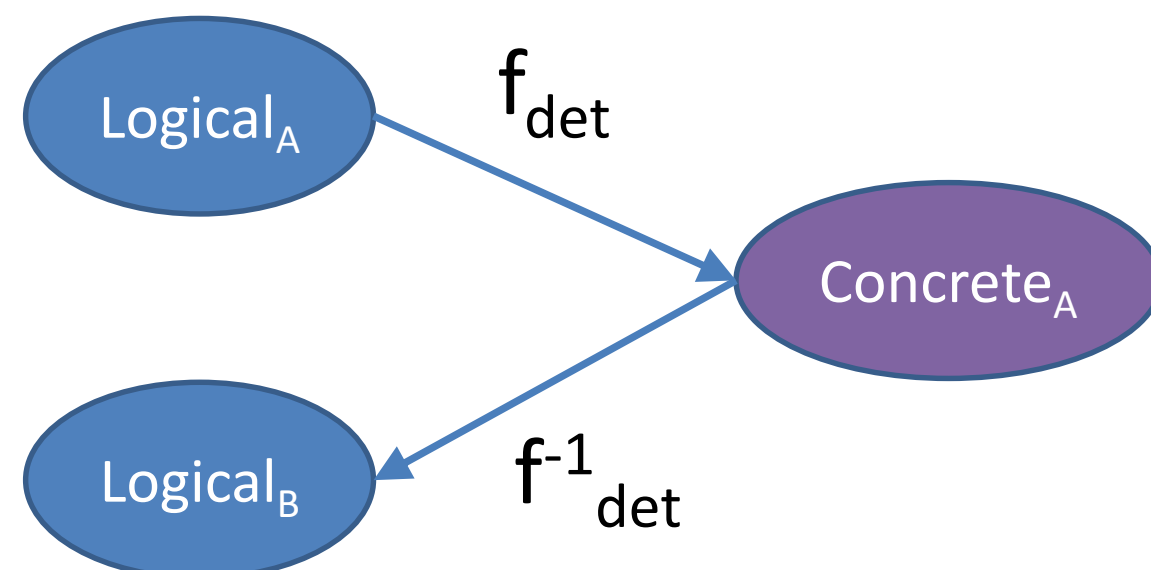
- This is clearly neither deterministic nor invertible

QUESTIONS ON 1.0 <-> 2.0 COMPATIBILITY & CONVERSION

- Can probably make this deterministic by defining rules
 - e.g., given a uniform distribution between X and Y, use the value $(X+Y)/2$



- Still not invertible, as cannot recover the range from a single value (e.g. values X and Y)



- If we can define the concrete format, could include ranges as comments? ...
- Is invertibility an important requirement?

EXECUTION INFORMATION VS. PARAMETERISATION

- Going from 2.0 to 1.x, there are two kinds of information lost:
 - Execution information: concepts that cannot be represented in 1.x
 - For example, perhaps you can't represent "adjust the speed of vehicle X to meet the ego vehicle at point P" in 1.x
 - Parameterisation information: lost through randomisation
 - As discussed, converting from logical to concrete scenarios requires selecting values according to specified distributions and ranges
 - As well as simple parameters like the speed of a traffic vehicle, this could cover trajectories; potentially many different low-level trajectories could satisfy a maneuver specified in OSC 2.0
- Siddartha Khastgir from WMG has some interesting suggestions relating to this in his presentation
- For MUSICC, the key thing is an easy migration path for scenarios stored in OSC 1.x

Thank you

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