

OpenSCENARIO 2.0 Concept Summary

P2019-02

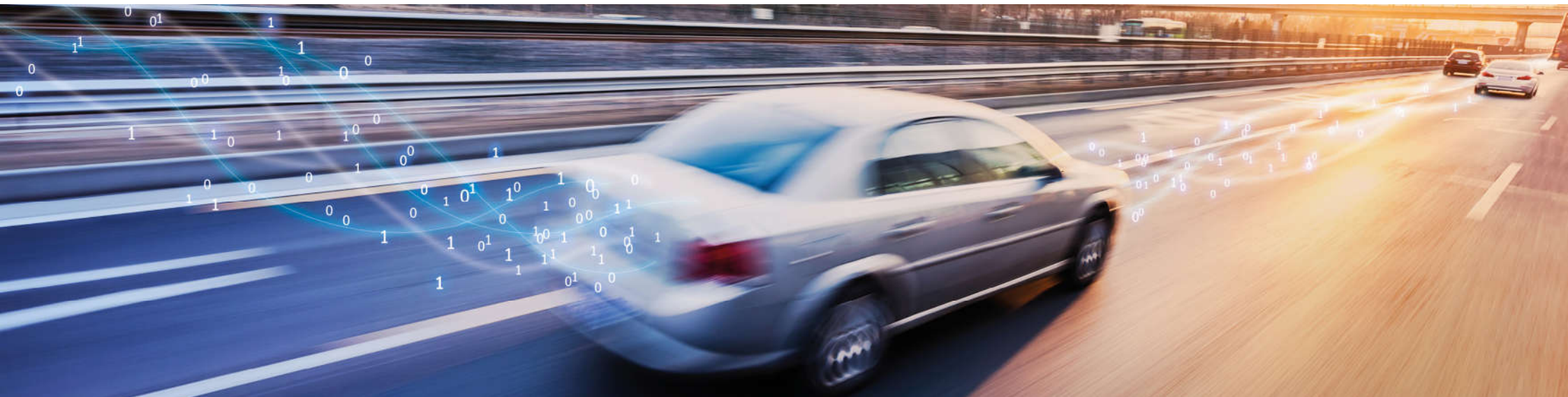
Overview for proposal workshop

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Motivation/ Background

- AV development and certification requires massive usage of scenario driven simulation. Exhaustive simulation is a MUST HAVE for development and qualification of AD and Autonomous driving systems
- OpenSCENARIO 1.x just completed its transfer to ASAM, and is in its stabilization phase.
 - during various workshops it became clear there are additional needs, which may not be met by evolution of the current format.
- OSC Overall Goal: A standard with all the required features to enable testing and validation of ADAS systems and autonomous vehicles.
- OpenSCENARIO 2.0 should serve as the format and mechanism to supply dynamic content and functional behavior to all testing and execution platforms, for all driving scenarios ranging from simple motor-way interactions to long-running, complex inner-city traffic scenarios.

Motivation/Background -cont.

- **From the concept project proposal:**
- “Concept project focus:
 - Focus on the set of 12 features as defined in the proposal workshop.
 - Define architecture for the main scenario models, and interface to other required models (e.g. Environment, Driver, Traffic)
 - Address varying levels of requirements for parametrization, accuracy
 - Address different use cases of scenarios.”
- “We must meet an aggressive schedule, and present something to the world toward the end of Q4/2019:
 - Core architecture and core concepts to be completed until Q4/2019
- Tentative project duration until Q2/2020, so that not so critical subgroups (or topics) can continue their work if needed, while standardization projects based on already clarified concepts can start earlier.”

A concept project of this size and scope is a novum for ASAM, hence there is increased timeline risk, which is taken into account in this tentative planning.

OpenSCENARIO Concept document

- Project included ~100 engineers from ~50 companies. (about 50% active – attending f2fs)
- OpenSCENARIO 2.0 Concept document was completed by end of February
 - Document was released to project review in January
 - Gitlab was used as issue filing and tracking system
 - A full day project review took place on Feb-17
 - Issues resolved and document is complete and available (more than 130)

Key Messages -Concept Project Completed

- Concept Document is released on ASAM web site.

Link: https://releases.asam.net/openscenario-2-0-concept/ASAM_OpenSCENARIO_2-0_Concepts.html

- Based on the considerations of the concept group, OpenSCENARIO 2.0 is proposed to be founded on the concept of a domain-specific language, that should support all levels of scenario description, from the very abstract to the very concrete in a suitable way.

Concept Document content

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Use Cases/User stories

- The intent of OpenSCENARIO 2.0 is to cover use cases at varying levels of autonomy. Hence, they should represent an adequate level of complexity including maneuvers and ODD features that are not accounted for otherwise
- Use Cases and user stories were developed using a template including

Summary

Title

Related user story(s)

Which user stories are related ([Section 3.1](#))?

Covered abstraction levels

Of the multiple abstraction levels, which are relevant?

Description

Detailed break down of the example use case

Example scenario

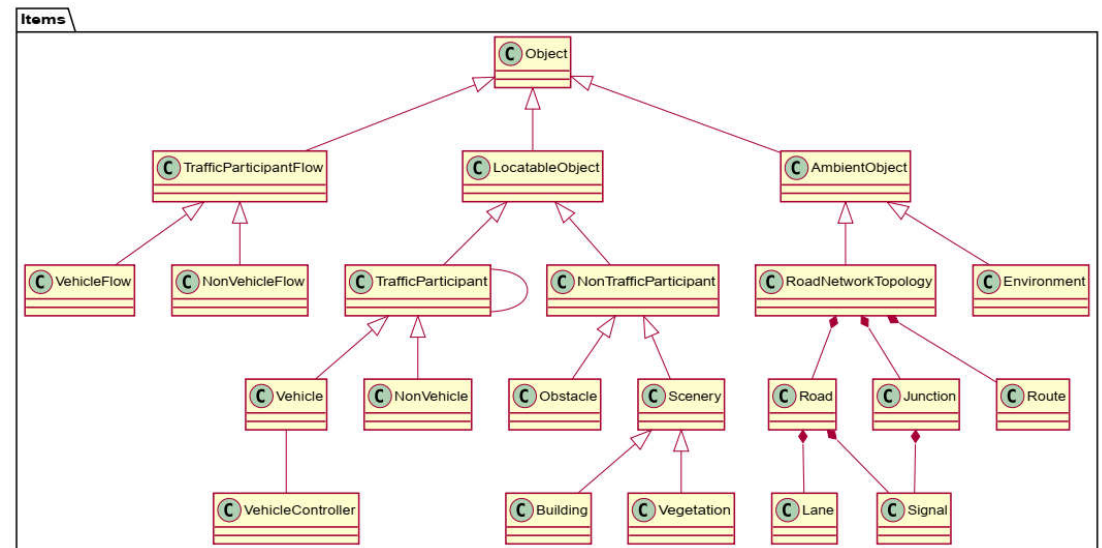
- Function description (not part of the scenario):
 - Customer function level:
 - System behavior level:
- Scenario description:
 - Abstract/concrete description:
- Test description (not part of the scenario):
 - Precondition:
 - Test description:

Additional information

DOMAIN MODEL & Entities

- A domain model foundation was developed, defining the key entities needed, and their relations.
- Further development is expected in the standardization project.
- In order to ensure sync with OpenSCENARIO 1.0, a UML diagram visualizing actions defined in OpenSCENARIO 1.0 is included in the document.

- High level Domain Model:



OSC 2.0 - DOMAIN SPECIFIC LANGUAGE

- The foundational concept of OpenSCENARIO 2.0 is to establish a domain specific language of a declarative nature.
- A declarative language describes what should happen on scenario execution (including the required parameterization/variation), rather than how to do it.
- A declarative language can also have a *dual interpretation*, i.e. provide a single scenario description which can be used to describe both how to make it and how to monitor that it *indeed* happened. (This is important if we want to condition some operation on the fact that some other scenario has happened before, without having to describe in detail *how* to cause that scenario.)
- Foretellix's M-SDL language is used to supply examples in the concept document, and in next slides. Reference manual available on ASAM site: https://releases.asam.net/openscenario-2-0-concept/M-SDL_LRM_OS.pdf

Summary Of Formalities – As Of Today

- TSC approved P2019-02 OpenSCENARIO 2.0 Concept project: Apr-2019
- On March-13th,2020 - TSC approved completion of the concept project, and release of the concept document,
- A development project proposal is ready (at first level) and pending future TSC approval (expected in May)
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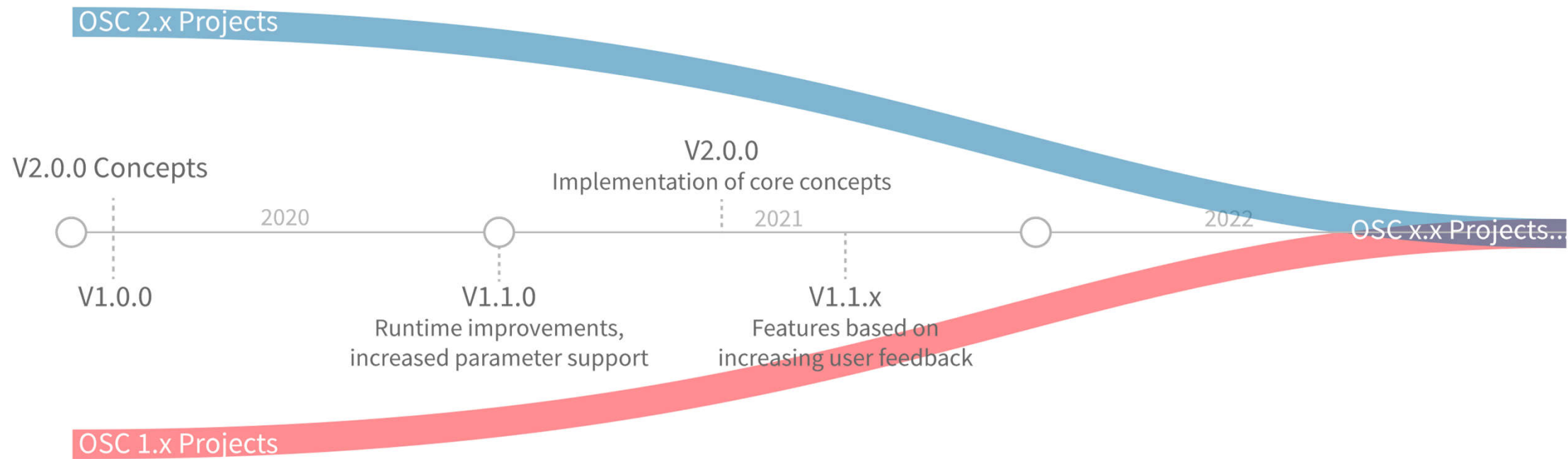
Key messages – next steps

- ASAM OpenSCENARIO 2.0 project is aimed at taking the concepts specified in the OpenSCENARIO concept document and continue and develop the next generation of the OpenSCENARIO standard: OpenSCENARIO 2.0.
- A rough estimate is that the development of such a standard can be achieved within a year, aiming at release in Q2 of 2021.
- Today – we are starting this exciting journey !!

Key messages OSC 1.0/ OSC 2.0

- OSC 1.x provides a very concrete scenario description format, usable now, that will be directly compatible with the 2.0 project
- OpenSCENARIO 2.0 provides a Domain Specific Language (DSL) and aims to significantly extend the domain addressed by 1.x to cover further use cases for AD development
- **The two groups will also jointly develop a migration mechanism that grants unchanged run-time behavior for OpenSCENARIO 1.x scenarios converted to OpenSCENARIO 2.0**
- **OSC 1.0 scenarios should be migratable to OSC 2.0, with run-time execution compability (i.e. same simulation results)**

Roadmap OpenSCENARIO



A convergence of the two versions will require further releases of OpenSCENARIO, which will be developed in subsequent OpenSCENARIO 1.x projects.

My analogy of the roadmap from USB 1.0 to type-C

OSC 2.

USB 1.0
12mbps

USB 2.0
480mbps

USB 3.2
Gen 1
(Previously 3.0,
then 3.1 Gen 1)

USB 3.2
Gen 2
(Previously 3.1
Gen 2)

USB 3.2
Gen 2x2
(Previously 3.2)

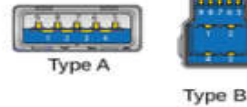
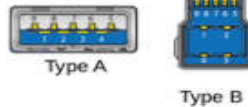
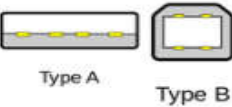
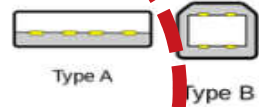
12mbps

480mbps

5gbps

10gbps

20gbps



*Many of these connectors are designed backwards compatible, for example a Type-A connector will function even at 10 Gbps.
*Connectors are shown represented here as when you commonly find a connector and it was designed to support.

OSC x.x Projects..

OSC 1.



BACKUP SLIDES

Deliverables - Planned vs. actual

- The overall expected outcome of the project is a wide set of concept documents.
It is expected that the content of these document will be close to a draft proposal for a standard.
- Full/Primary Concept document containing:
 - High-level description of the full system
 - Block diagram of the models and their interactions
 - ~~Description /Definition of a suite of tools (optional) that may be required for a complete solution (Architecture diagram)~~
 - Suite of Examples
 - Migration and/or backward compatibility concept description
 - Optional: Proposals for possible starting points and sources of IP – e.g. a number of participating companies might be interested in contributing existing in-house developments in terms of languages or frameworks to the standard.
- ~~Driver and Traffic model concept document.~~
- ~~Weather, Environment models and Localization/Geographies concept document(s).~~
- ~~Vehicle Dynamics Model concept document.~~
- ~~Parameters and constraints handling concept document.~~
- ~~Measurements, Grading and Success criteria concept document.~~
- ~~Scenario creations methods and reuse concept document.~~