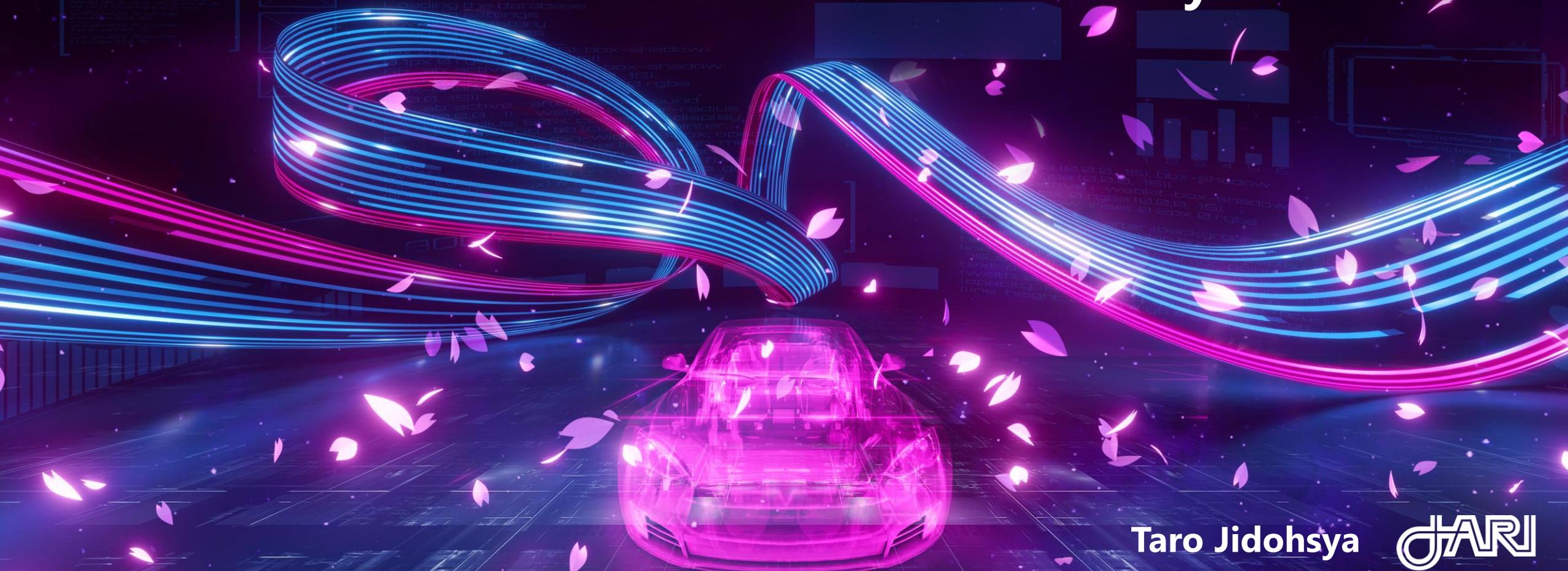


SAKURA Project

Review of International Harmonization Activity



Taro Jidohsya
Japan Automobile Research Institute



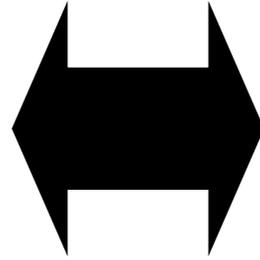
- 1. Background**
- 2. Scope of international harmonization in SAKURA**
- 3. ISO TC22/SC33/WG9 participation**
- 4. Safety criteria proposal in UN-R157**
- 5. Outreach**
- 6. Acknowledgement**

1. Background

1. Conventional Automotive Safety Related Regulations

Driver License

- Grant an exception to drive cars on public road for those with certain skills and expertise.
- Basically, Driver's licenses are issued by **each country** (or state).



Equipment and Parts

- 1958 Agreement
- It enables manufacturers to **obtain approval** in one country and have it accepted **across all participating nations**.

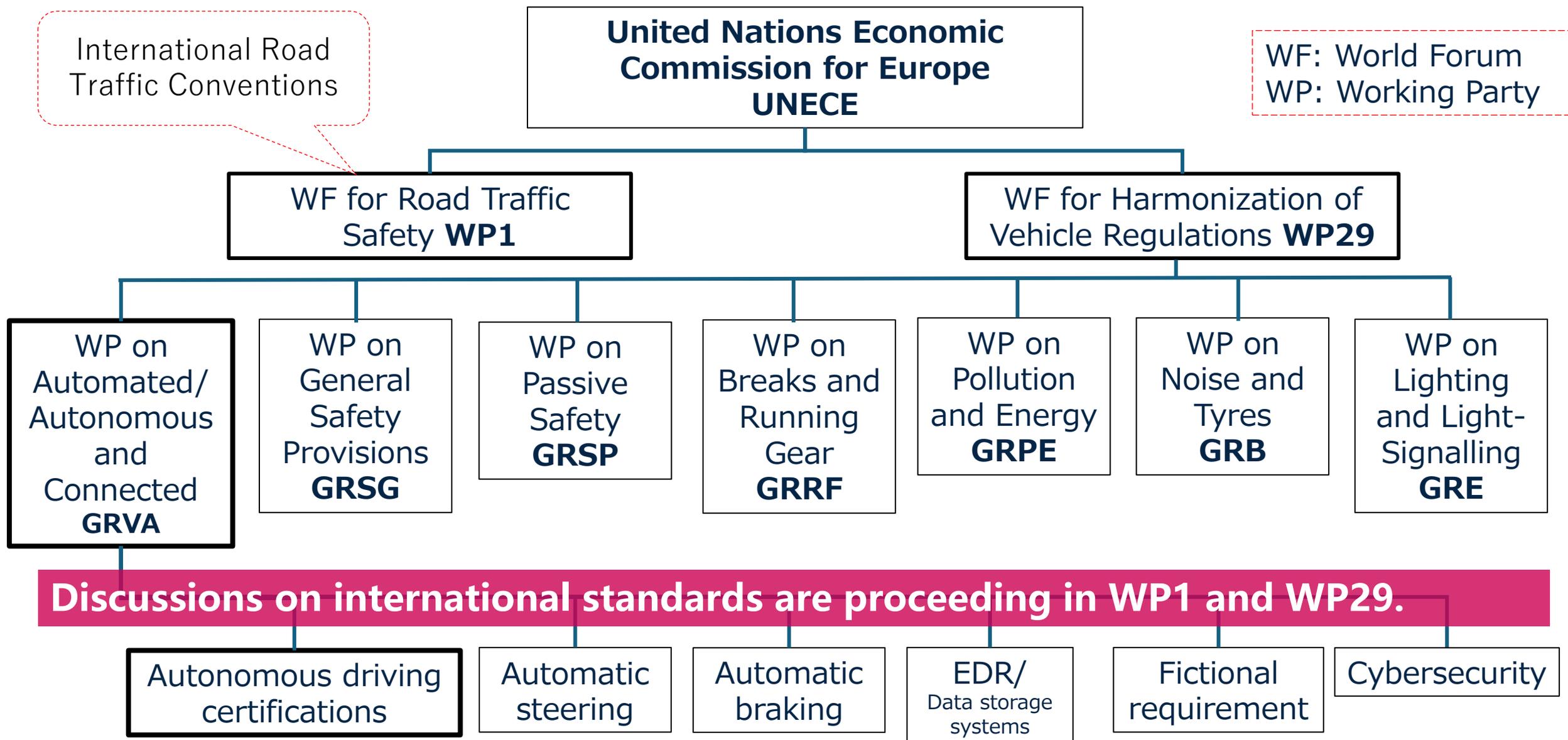
Boundary between driver and equipment become unclear
in ADAS/ADS



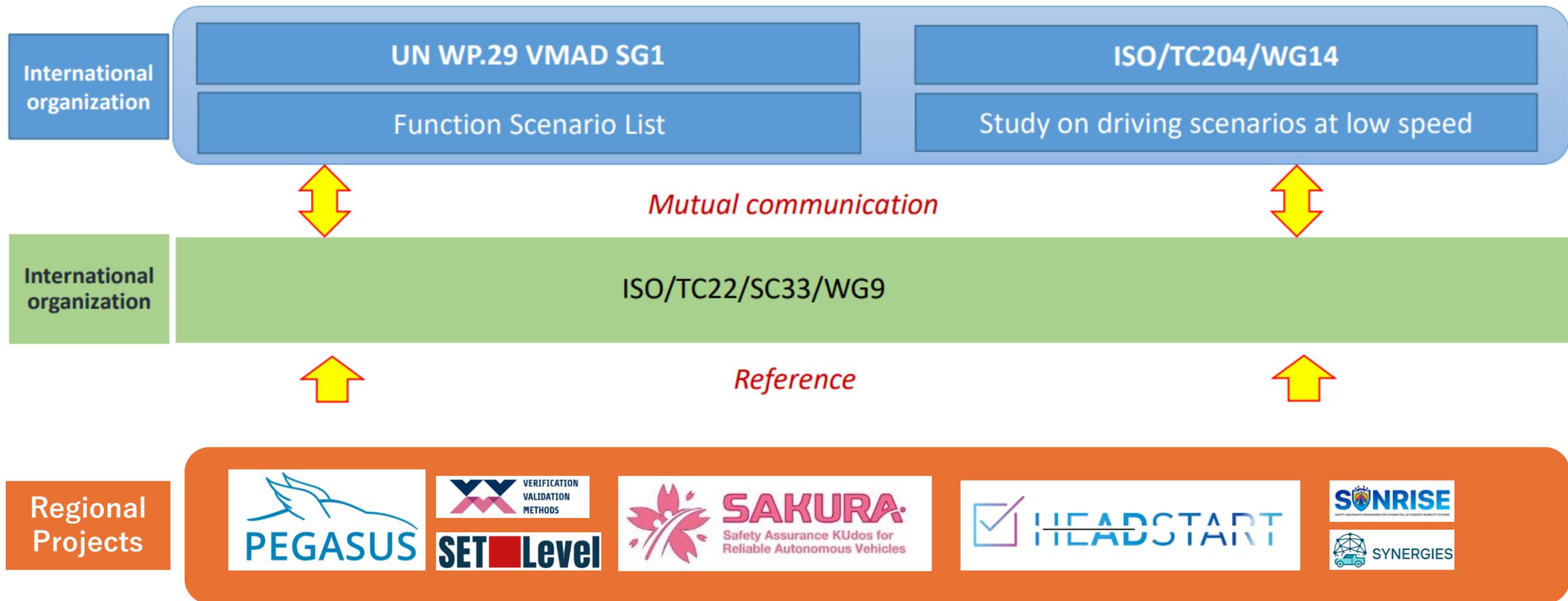
It's necessary to globally harmonize
safety requirement!



1. International Regulatory Framework for Automated Vehicle safety



1. Hierarchical structure of ADS safety evaluation regulation and standards



2. Scope of international harmonization in SAKURA



2. Scope of international harmonization activities in SAKURA project

- **Reflect Japanese safety evaluation framework to ISO TC22/SC33/WG9**
 - Leading ISO34502 with Japanese experts
 - Support ISO3450X establishment
- **Input safety criteria concept to regulation**
 - Specifying competent and careful human driver model in UN-R157
- **Outreach and communicate with international partners**
 - Publishing scientific journal articles and presenting in conferences
 - Communicating with international partners

3. ISO TC22/SC33/WG9 participation

- **Scope of ISO TC22/SC33/WG9**

Standardization of scenario-based development methods for driving automation systems.

This includes the definition, creation, usage, and maintenance of scenarios; validation and verification methods for the purpose of scenario-based evaluation.

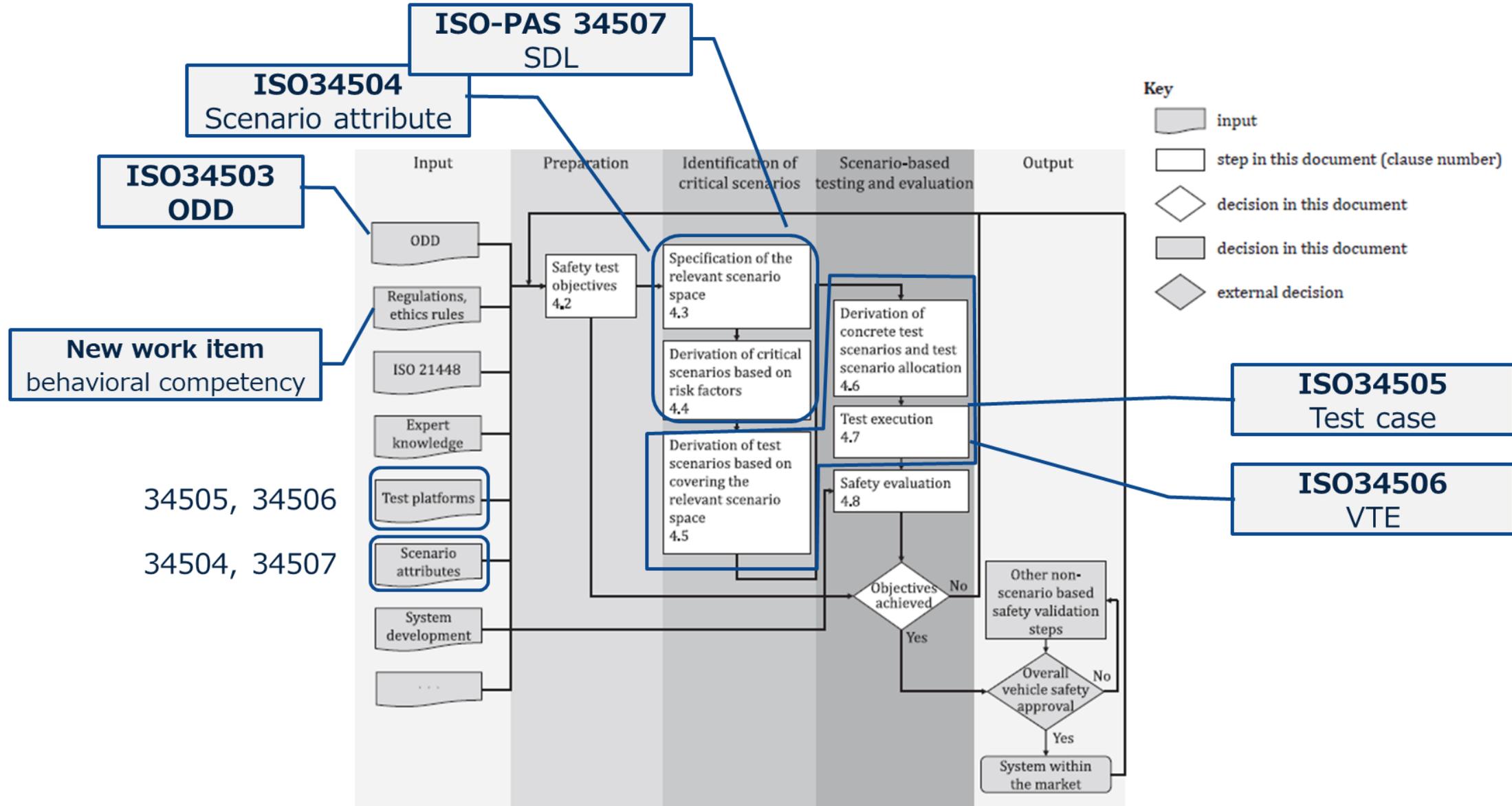
This does not include defining functional requirements of features.



3. ISO TC22/SC33/WG9 work items

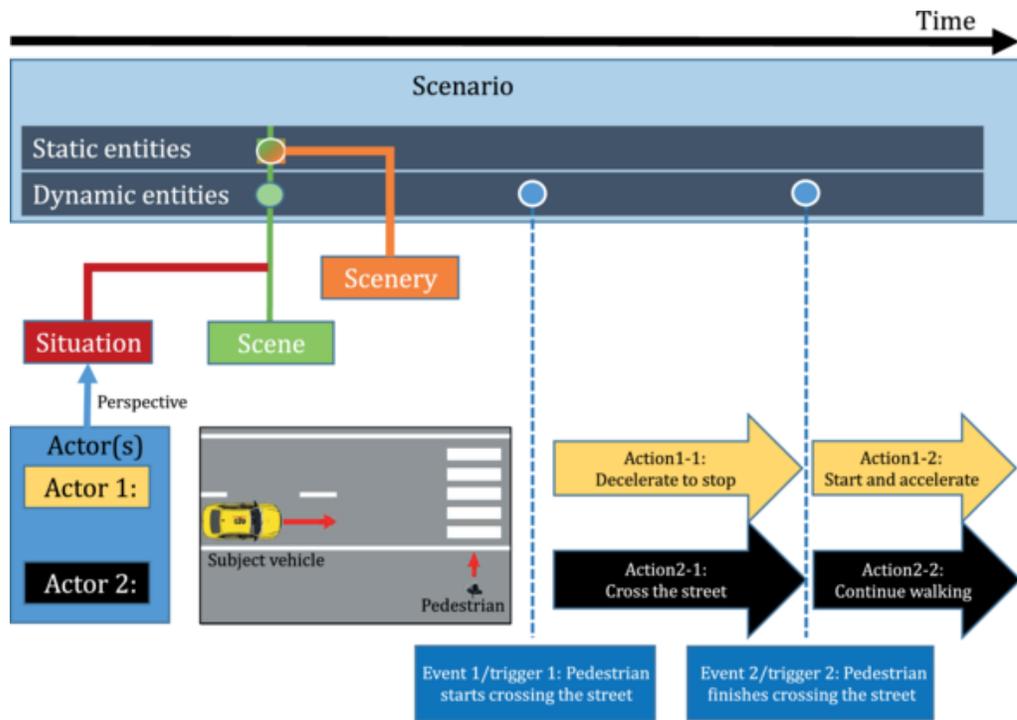
	Title	Contents	Progress
ISO 34501	Vocabulary	Define terms in the context of test scenarios for ADS	'22 IS published
ISO 34502	Scenario based safety evaluation framework	Provide guidance for a scenario-based safety evaluation framework	'22 IS published
ISO 34503	Specification for operational design domain	Specify requirements for the hierarchical taxonomy for operating conditions which enable the definition of an ODD	'23 IS published
ISO 34504	Scenario categorization	Provide guidance on categorizing scenarios in the testing and verification	'24 IS published
ISO 34505	Scenario evaluation and test case generation	Provides a procedure for extending test scenarios to test cases	'25 IS published
ISO-PAS34506	Qualification of Virtual Test Environments	Provide guidelines for a comprehensive qualification scheme for VTE	DPAS
ISO-PAS34507	Controlled Natural Language Description for ADS Scenario	specifies the overall structure of the controlled natural scenario description	WD ongoing
New work item	Behavioral taxonomy	Define terms in the context of test scenarios for ADS	NWIP

3. Relation of ISO3450X



3. Definition of scenario

A scenario is snapshots of a certain time period of a driving scene.



<https://www.iso.org/obp/ui/en/#iso:std:iso:34501:ed-1:v1:en>

Functional Scenario

- **Non-formal, human readable**
- **Behavior-based** description of a traffic scenario
- Possibly containing a visualization

Abstract Scenario

- **Formalized, machine readable**, and declarative description
- Closely **tied to an ontology**
- Efficient description of relations (e.g. cause-effect)

Logical Scenario

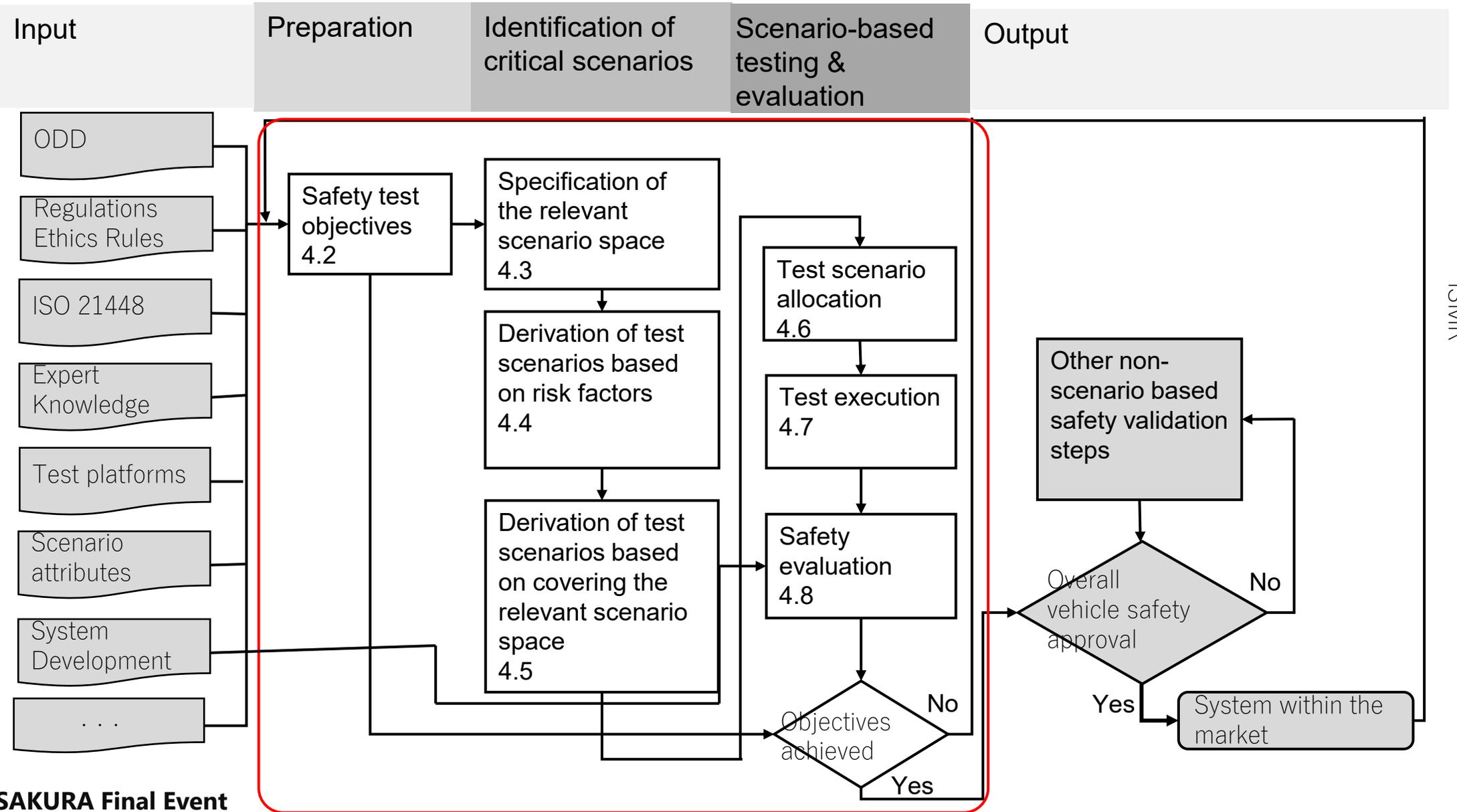
- **Parameterized representation** of a set of scenarios, where influencing factors are described by means of **parameter ranges** and **distributions**
- Enables parameter variation

Concrete Scenario

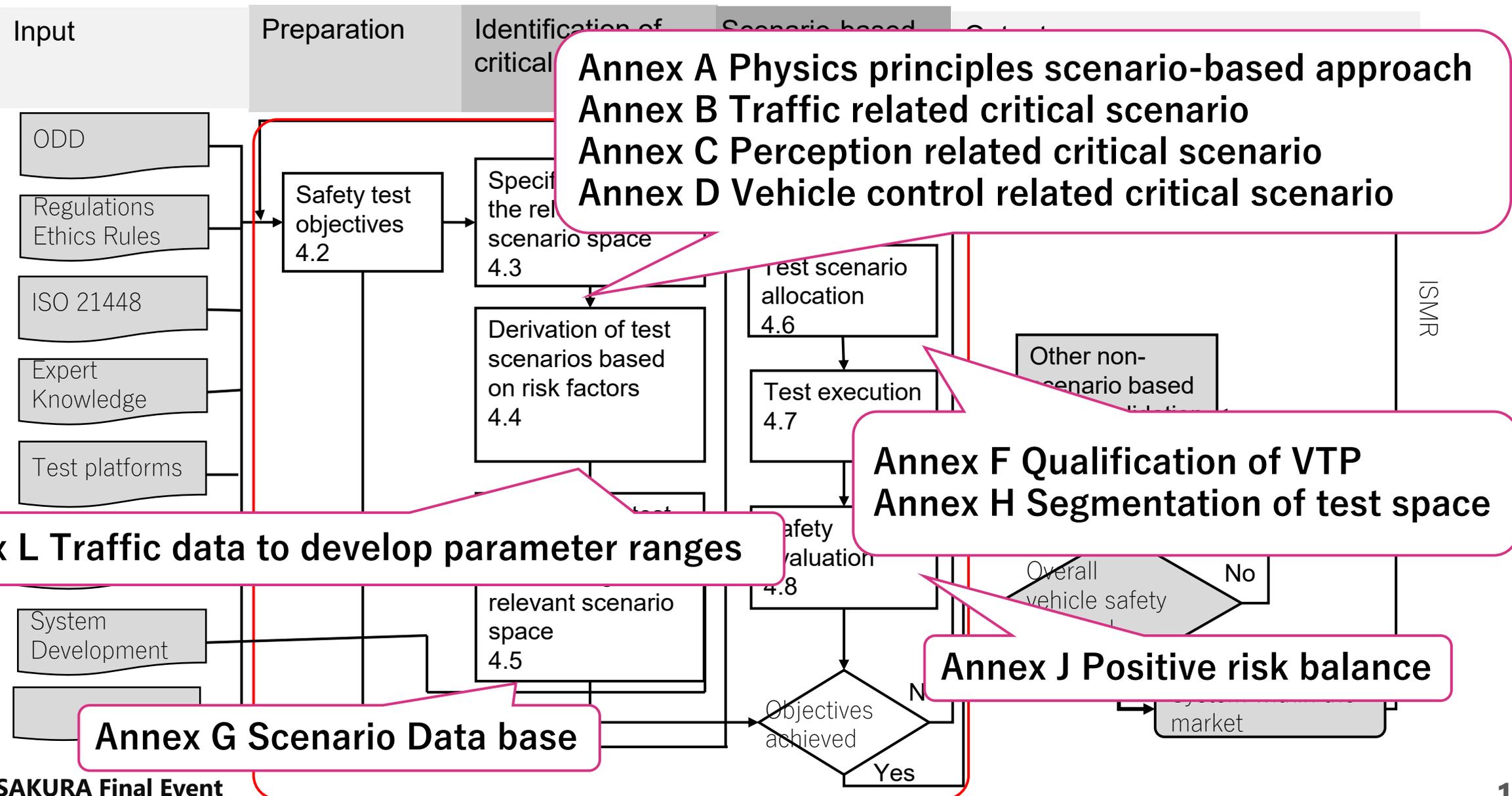
- **A single scenario**, describing exactly one specific scenery and chain of events **with fixed parameters**
- Can, or for example, be written as OpenDRIVE + OpenSCENARIO

<https://www.iso.org/standard/78951.html>

3. Overview of ISO34502



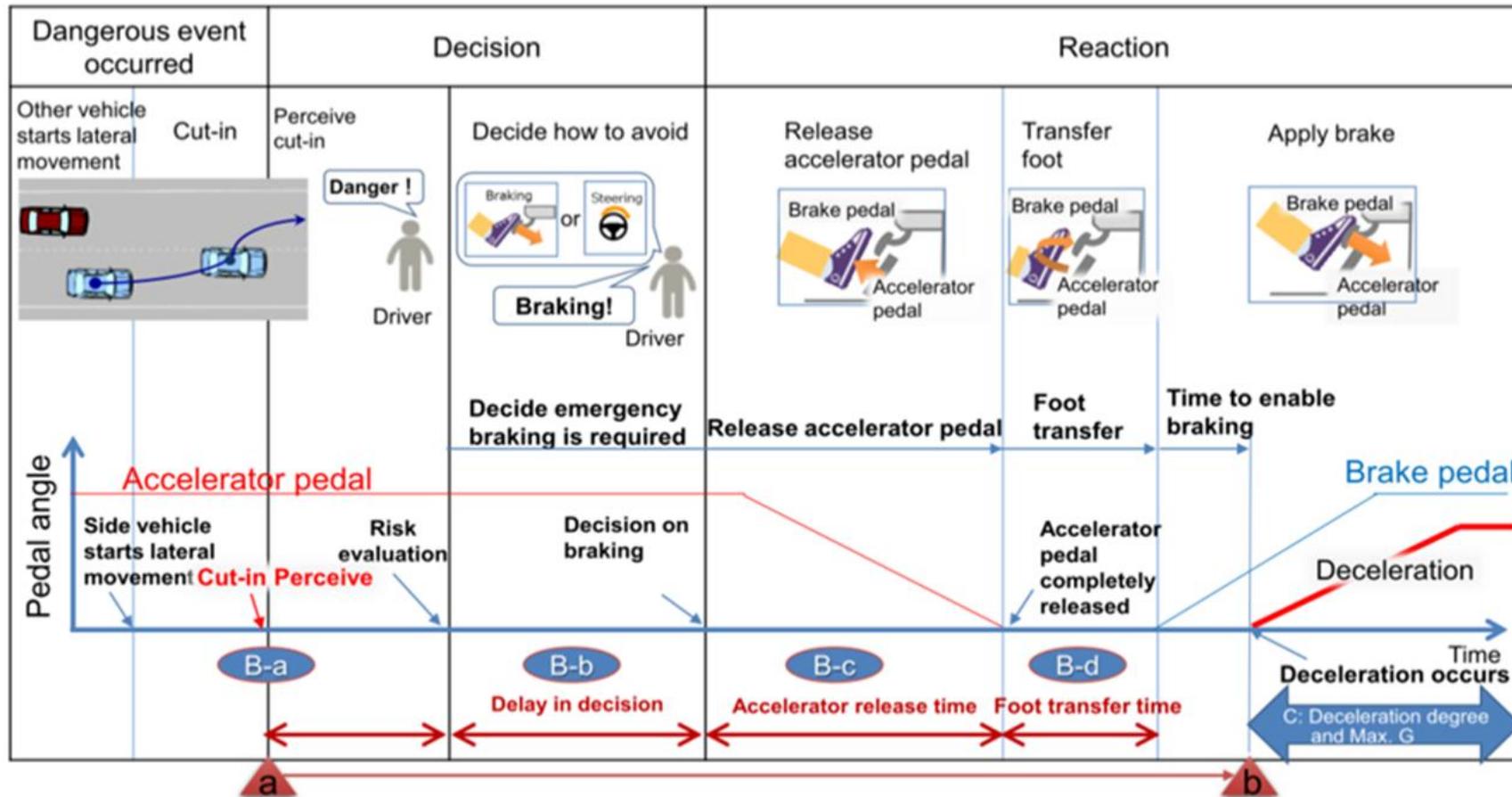
3. Overview of ISO34502



4. Safety criteria proposal in UN-R157

4. Safety criteria proposal in UN-R157

Competent and careful human behavior during Lane keeping

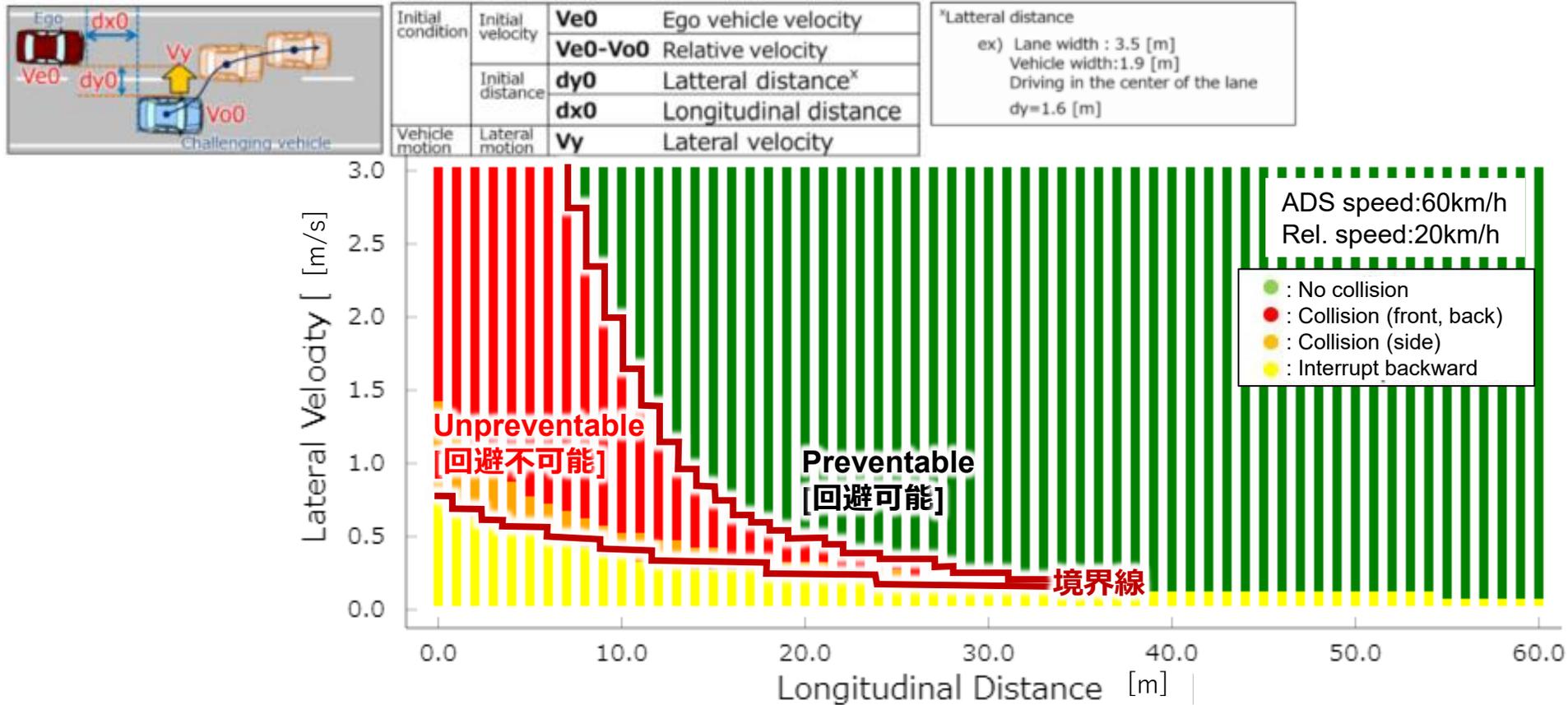


Collision avoidance braking behavior is decomposed in several phases to define C&C responding behavior

4. Safety criteria proposal in UN-R157

Preventable boundary of ALKS Cut in Scenario

- Reminding that the boundary is “minimum requirement”



(UNECE: Proposal for a new UN Regulation on uniform provisions concerning the approval of vehicles with regards to Automated Lane Keeping System)

Reasonably foreseeable and preventable boundary is reflected in UN-R157 Annex

5. Outreach

5. Outreach

- **Publications**

- Scientific papers: 6
- Others: 10

- **Outreach in international conferences**

- 20 presentations

- **Outreach in domestic conferences**

- 15 presentations

- **ISO WG9 meetings**

- 8 F2F meetings in 7 countries
- 18 online meetings

- **Extra facts**

- Traveled more than 450,000 km (<< 10 billion miles)

6. Acknowledgement

6. Acknowledgement

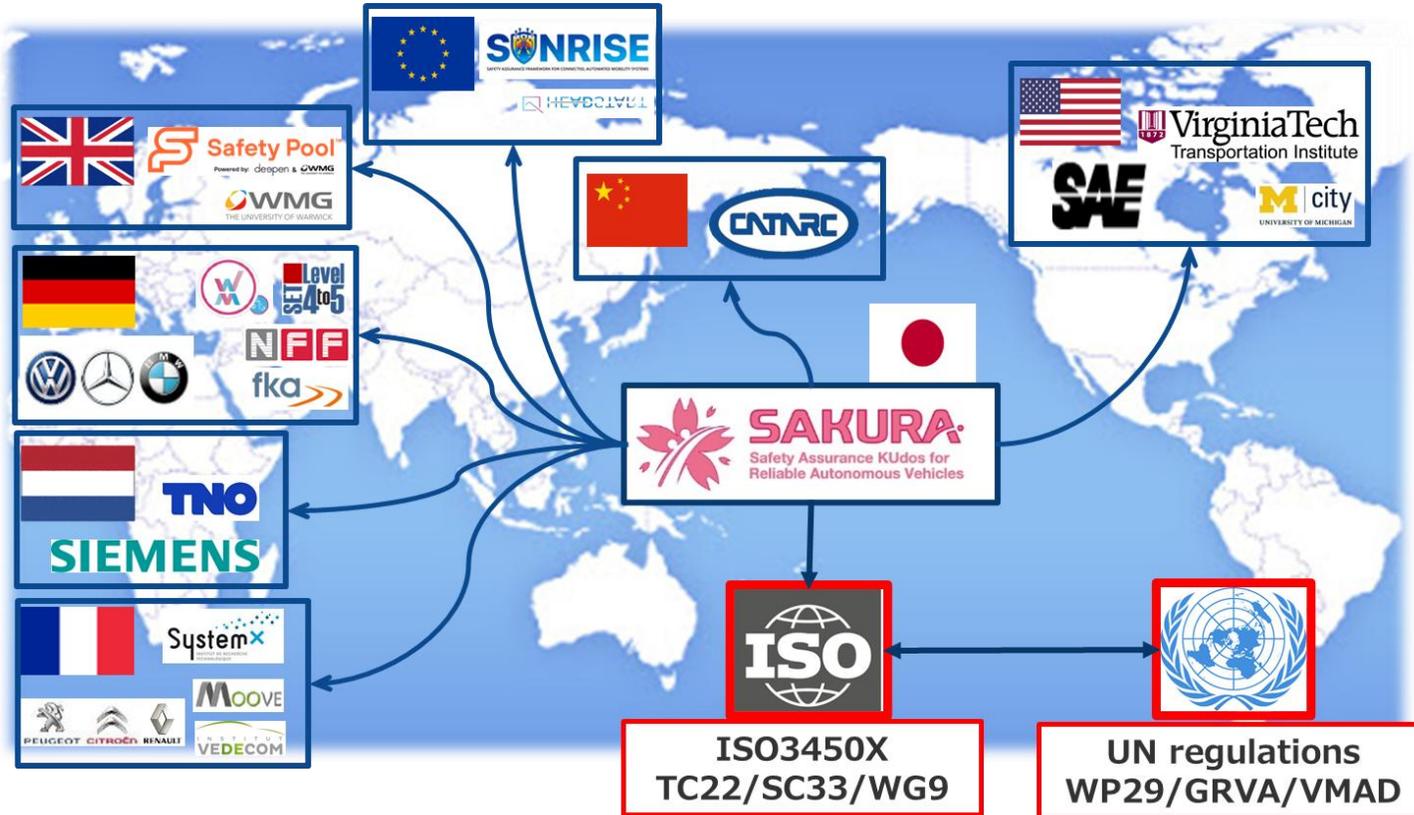
● Precious relationship establishment through SAKURA

✓ Europe

- Germany
- United Kingdom
- France
- Netherlands
- EU HORIZON
 - SUNRISE
 - SYNERGIES
 - CERTAIN

✓ Asia

- CARATC
- Combiner
- ISO WG9



✓ North America

- Government
 - NHTSA
 - DOT
- Industry
 - SAE
 - AVSC
 - Waymo
 - Aurora
 - TORC
 - VTTI
 - Mcity

etc.

**Deeply appreciate to
all international and domestic partners**

6. Acknowledgement

Special Thanks to “godfathers” of SAKURA

- **Mr. Satoshi Taniguchi (Toyota)**

Previously the chair of JAMA AD Safety Assurance WG, a lead of SIP-adus supported by Japanese Cabinet Office and SAKURA Project. Also since 2019, he was active in UNECE WP29 activity as an Expert in JASIC and in international standard activity as a project leader of ISO 34502

- **Dr. Jacobo Antona-Makoshi (VTTI)**

Previously the head of the Automated Vehicle Safety Standardization Group, JARI, and was one of the experts representing Japan at the related ISO working groups. He also led the international research activities of the SAKURA Project

Thank you for your attention.



SAKURA.
Safety Assurance KUDos for
Reliable Autonomous Vehicles

