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OPEN AUTO DRIVE FORUM

A NEW COOPERATION APPROACH FOR AN AUTOMATED DRIVING ECOSYSTEM

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SESSION OVERVIEW

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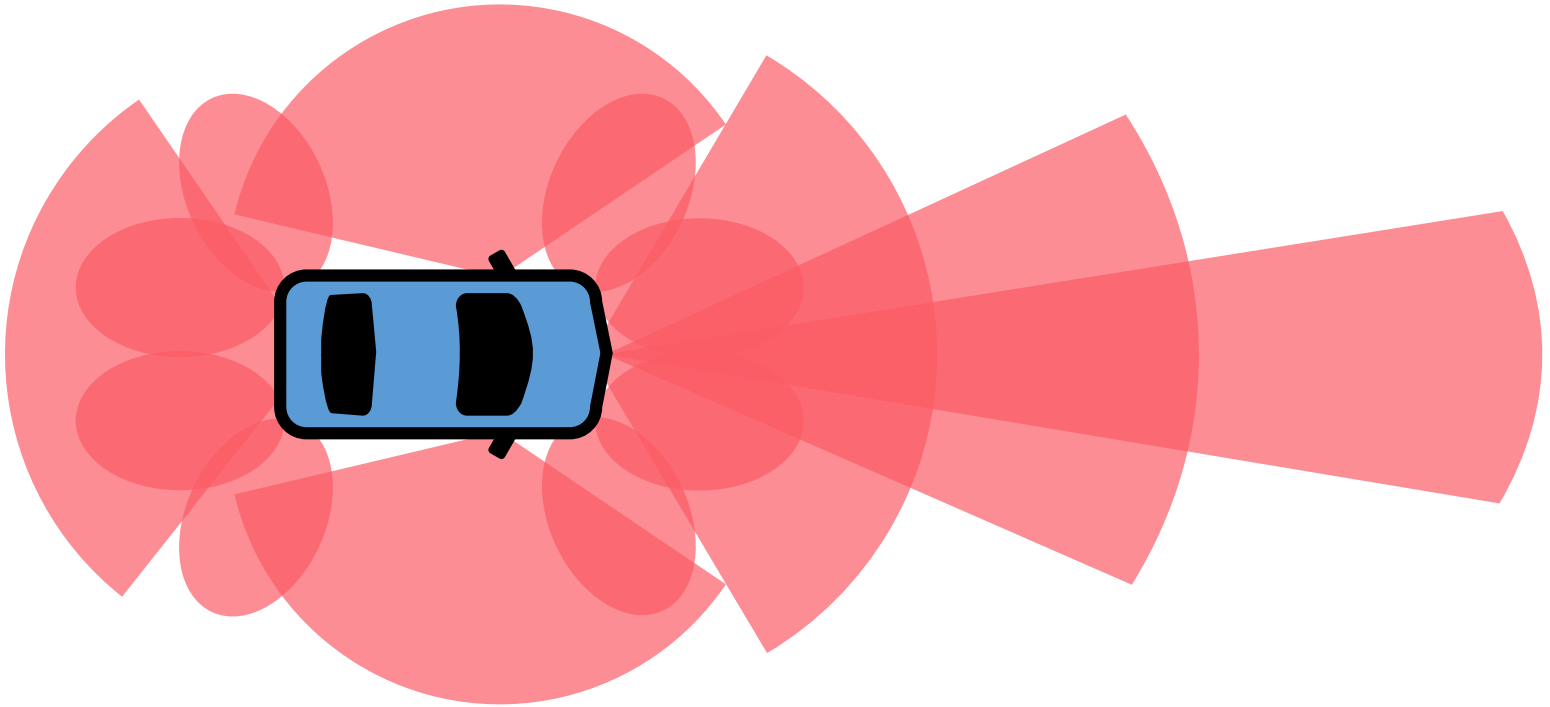
- Introduction
  - "AD Data-Exchange Challenge"
  - Questions for the Day
- OADF Activity Overviews
- Key Technical Challenges
- The Hard Part: Adoption and Evolution

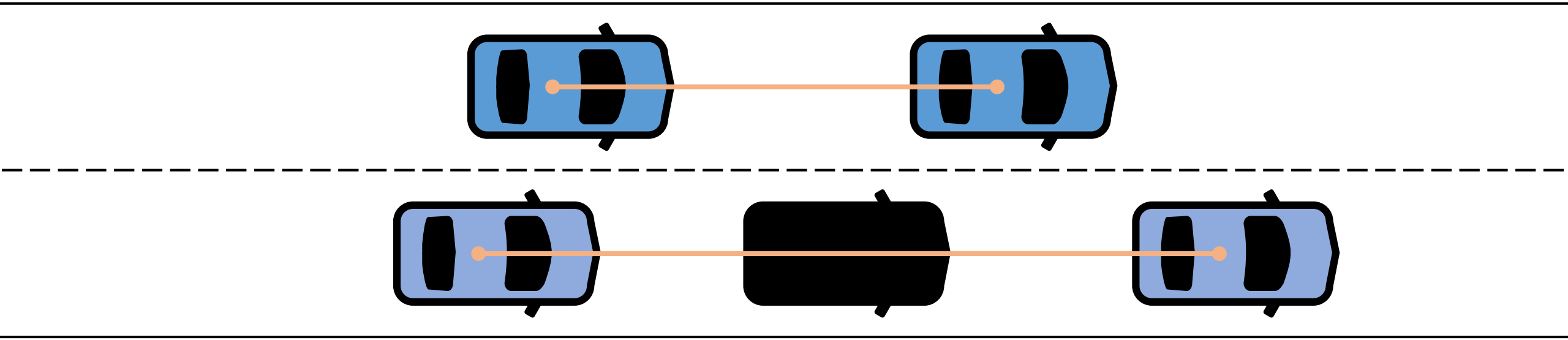
This is a CONVERSATION, not just a PRESENTATION!

AUTOMATED DRIVING NEEDS SENSOR DATA

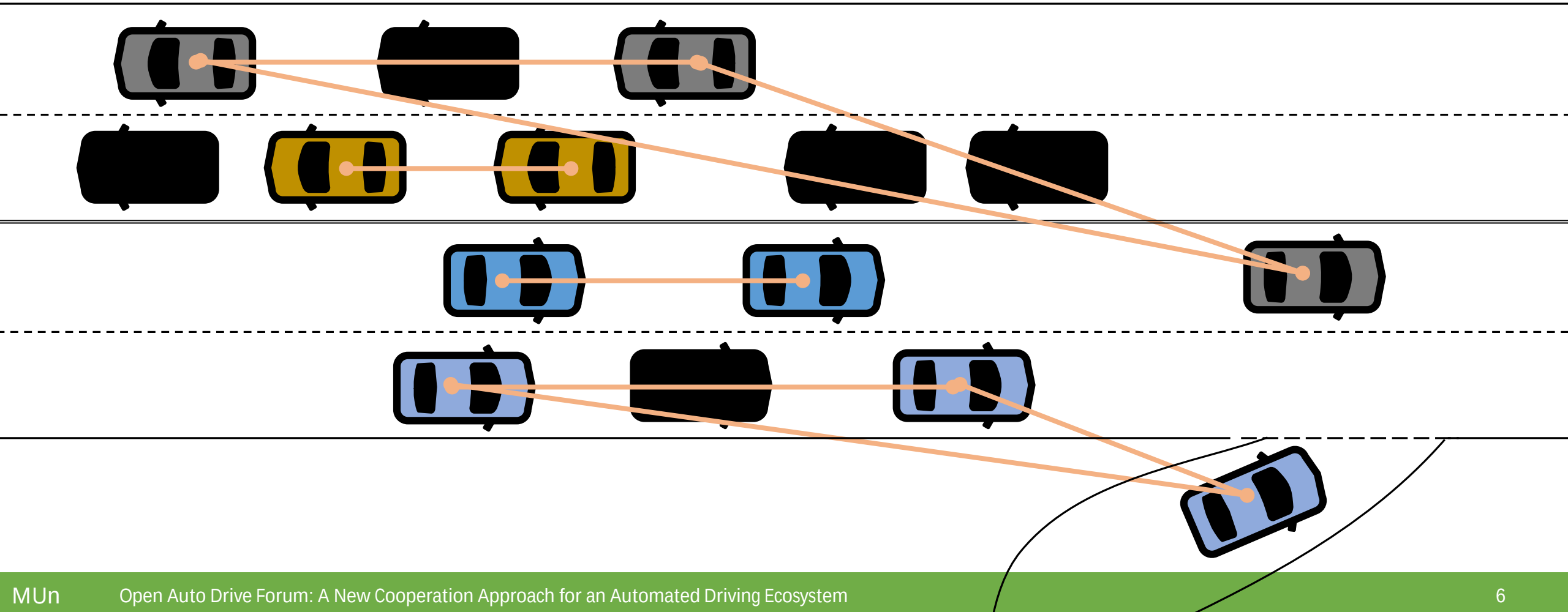


AUTOMATED DRIVING NEEDS SHARED DATA

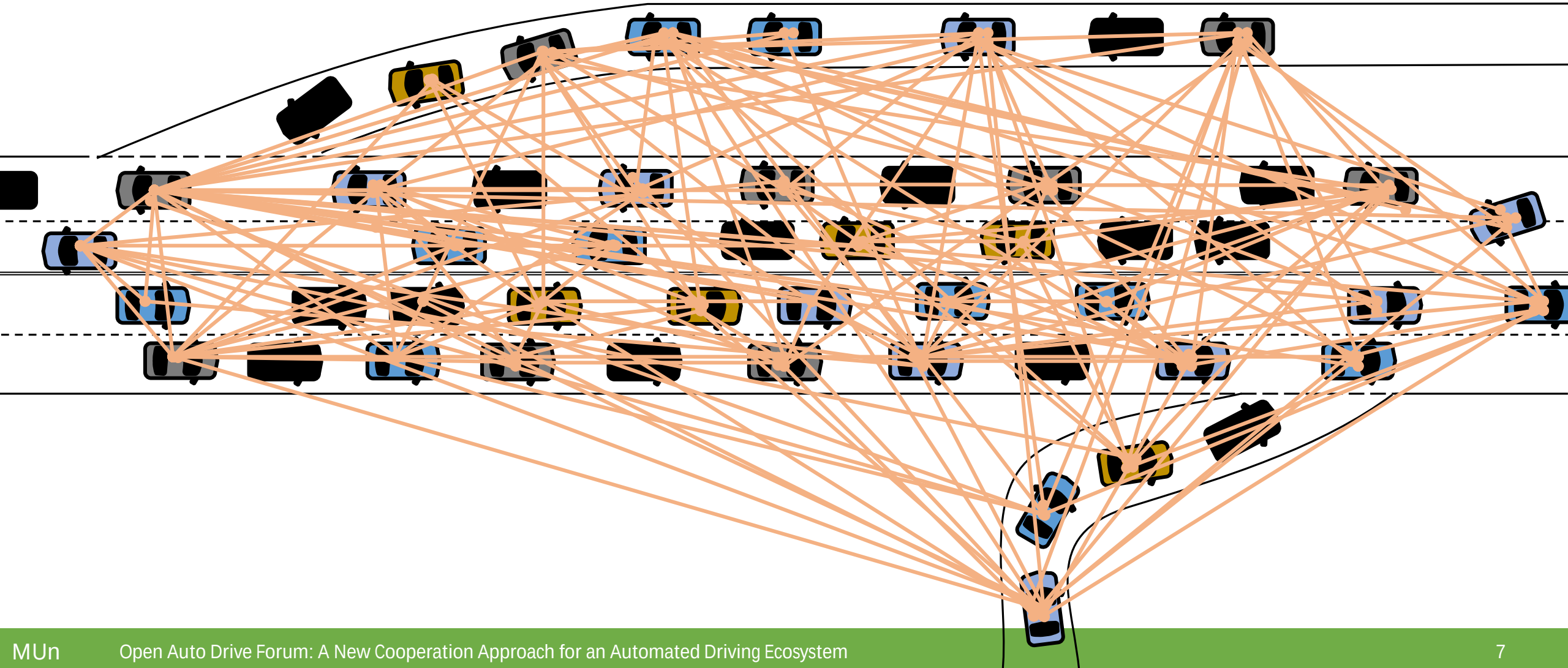
AUTOMATED DRIVING NEEDS SHARED DATA … AND CONNECTIVITY



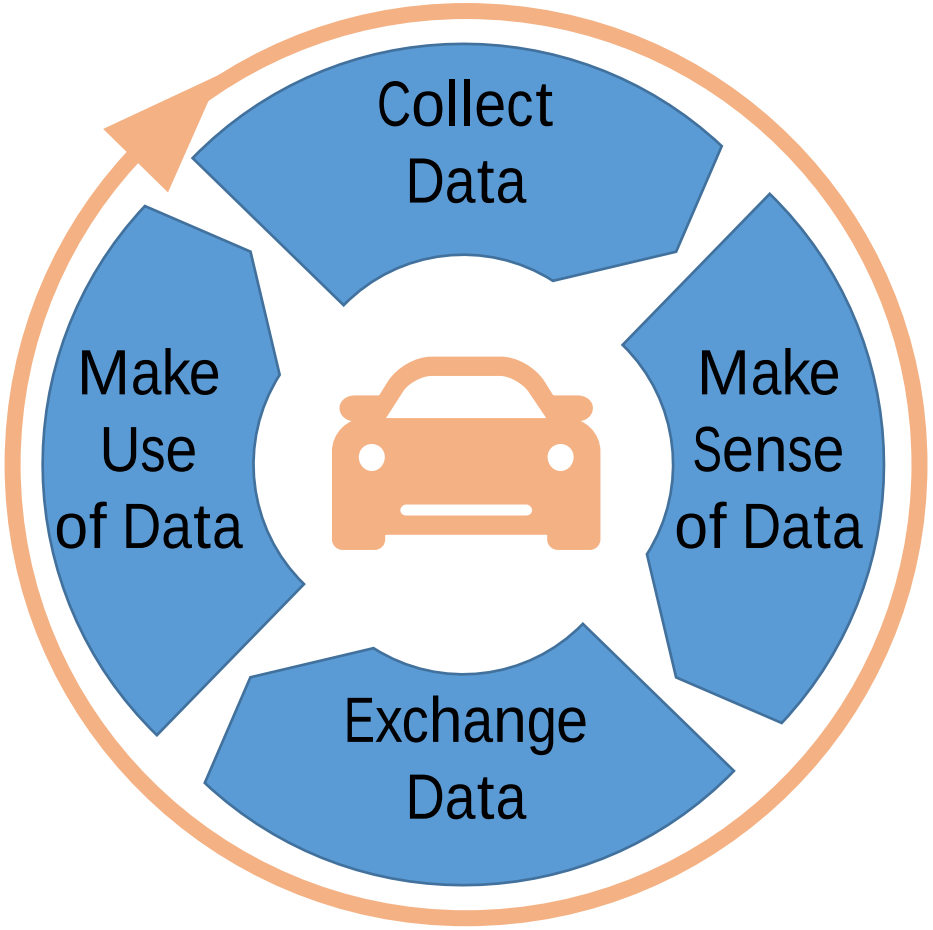
AUTOMATED DRIVING NEEDS SHARED DATA AND CONNECTIVITY



AUTOMATED DRIVING NEEDS SHARED DATA AND CONNECTIVITY



AUTOMATED DRIVING DATA FEEDBACK LOOP



Implementing the Automated Driving *Data Feedback Loop* requires a common **Ecosystem** for establishing the required **Digital Infrastructure**

QUESTIONS FOR THE DAY

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A. How do we develop standards in this space?

B. Which standards are required?

C. How will we get them adopted?

INTRODUCTIONS

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- Jean-Charles Pandazis, Head of Dept, ERTICO (ADASIS)
- Martin Schleicher, Chairman, NDS
- Prokop Jehlicka, Chairman, SENSORIS
- Matthias Unbehaun, Executive Director, TISA
- Satoru Nakajo, Founding Member, SIP-adus; ISO TC204

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ACTIVITY OVERVIEW

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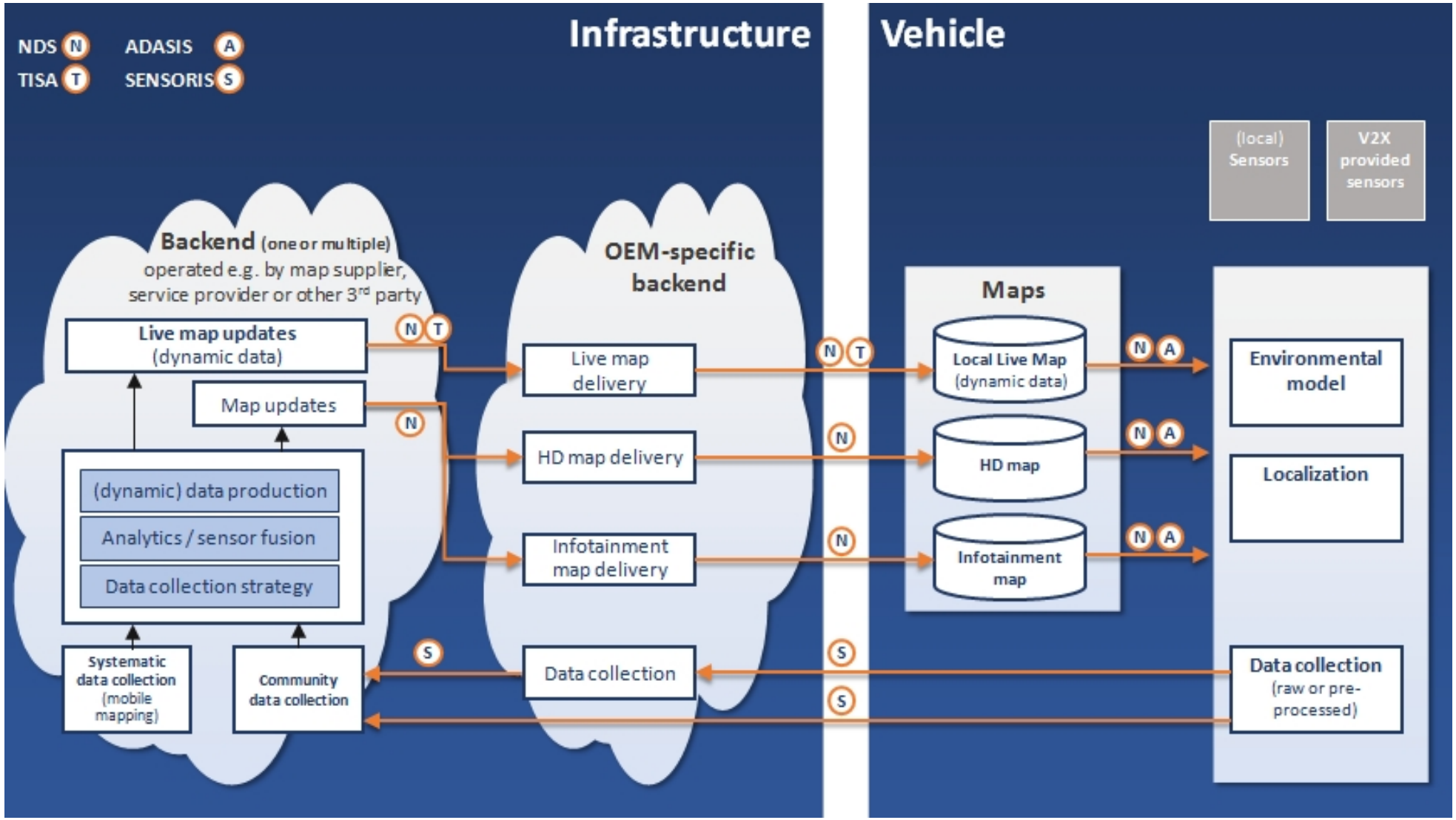
AUTOMATED DRIVING ECOSYSTEM



ADASIS

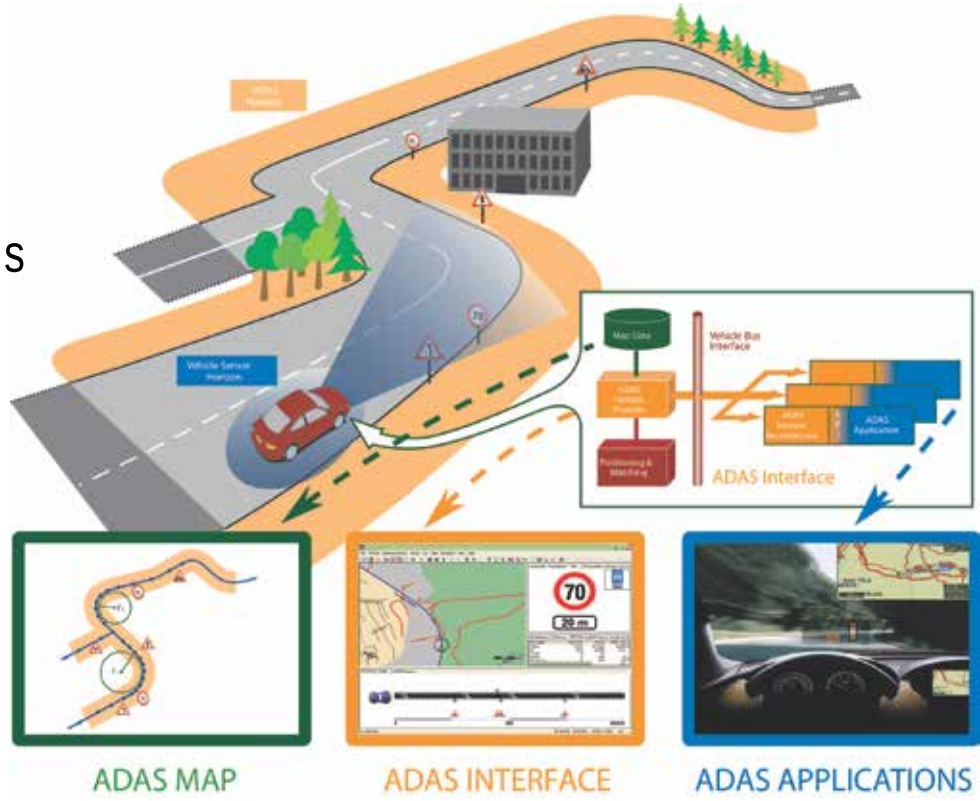
Navigation Data Standard

SENSORIS

TISA
Traveller Information Services Association

- Constituted 2002 by ERTICO industrial partners
- In 2012 ADASISv2 enabled first predictive applications on the road
- Since 2018 is a Non-Profit Association (55 members)
- In 2018 ADASISv3 is released to enable Automated Driving by
  - Supporting HAD maps (NDS)
  - Supporting long range horizon without restrictions
  - Update & erasure mechanism for dynamic data
- Reference implementation is available for ADASIS members only

ADASIS horizon addresses
all major future mobility trends:
connected, electrified and automated

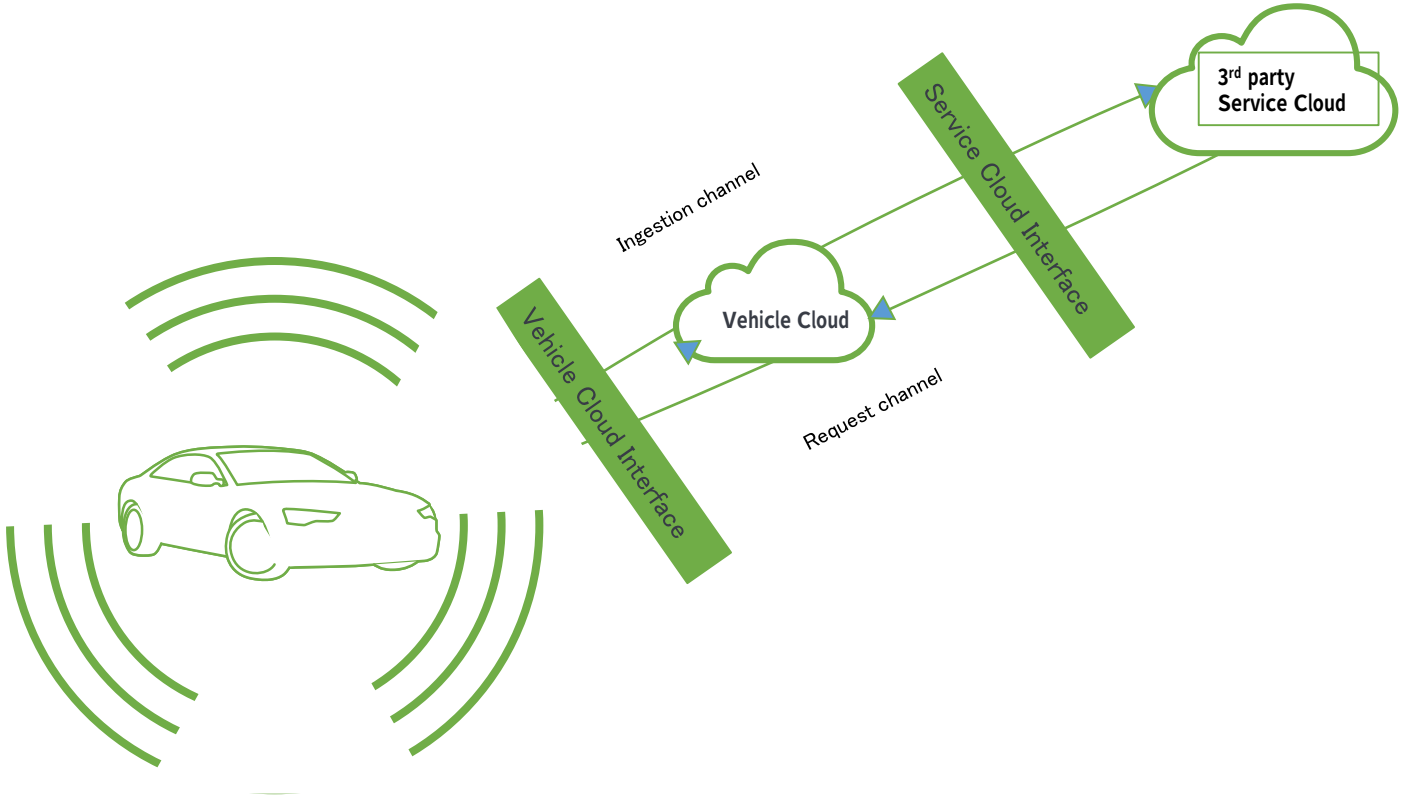


THE worldwide standard for map data in automotive eco-systems

- Specification defined by members of the NDS Association
  - OEMs
  - System Vendors
  - Solution Providers
  - Navigation Data Providers
- NDS members work together on
  - Map Format Specification
  - Cloud Integration
  - Automated Driving
  - Next Generation Architecture & Update Interfaces

SENSORIS

- Constituted 2016 (now 30 members)
- Flexible usage in focus
  - Use Case agnostic
  - Fixed Interpretation
  - Flexible Representation
- SENSORIS v1.0.0 released
  - Vehicle Data
  - Driving Behavior
  - Road Data
  - Traffic Information



TRAVELLER INFORMATION SERVICES ASSOCIATION

TISA
Traveller Information Services Association

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- Global membership (100), covering the entire value chain

Public authorities & private road operators

Information Provider

Service Provider

Communication

Devices

OEM

- TPEG2 toolbox is THE global standard for traffic information

SIP-adus

SIP-adus
Innovation of Automated Driving for Universal Services

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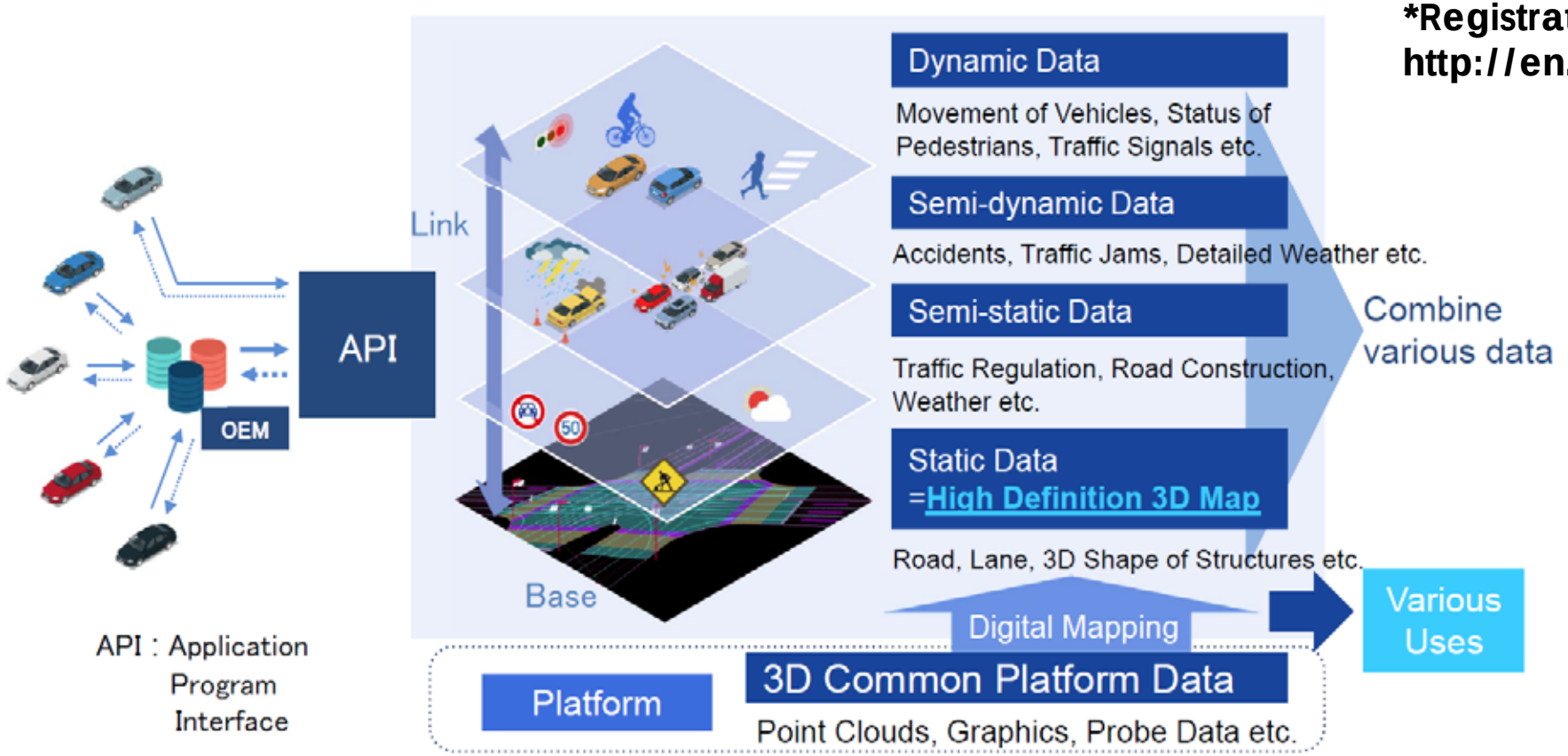
- PnP project in Japan. Started in FY2014 and **will continue till FY2022**.
- Had provided over 700km static data to FOT participants in 2017.
- Will report the result of the FOT at **SIP-adus WS in Tokyo, 13-15 Nov. 2018.**

***Registration is needed**
http://en.sip-adus.go.jp/evt/workshop2018/



Basic features supplied by SIP adus

- *** Road shoulder**
- *** Center line**
- *** Lane line**
- *** Lane edge**
- *** Stop line**
- *** Pedestrian crossing**
- *** Road marking**
- *** Traffic signal**
- *** Road sign**
- *** Carriageway link**
- *** Lane link**
- *** Intersection lane link**
- *** Area-formed intersection**
- *** CRP node**

14 features

OPEN AUTO DRIVE FORUM (OADF)

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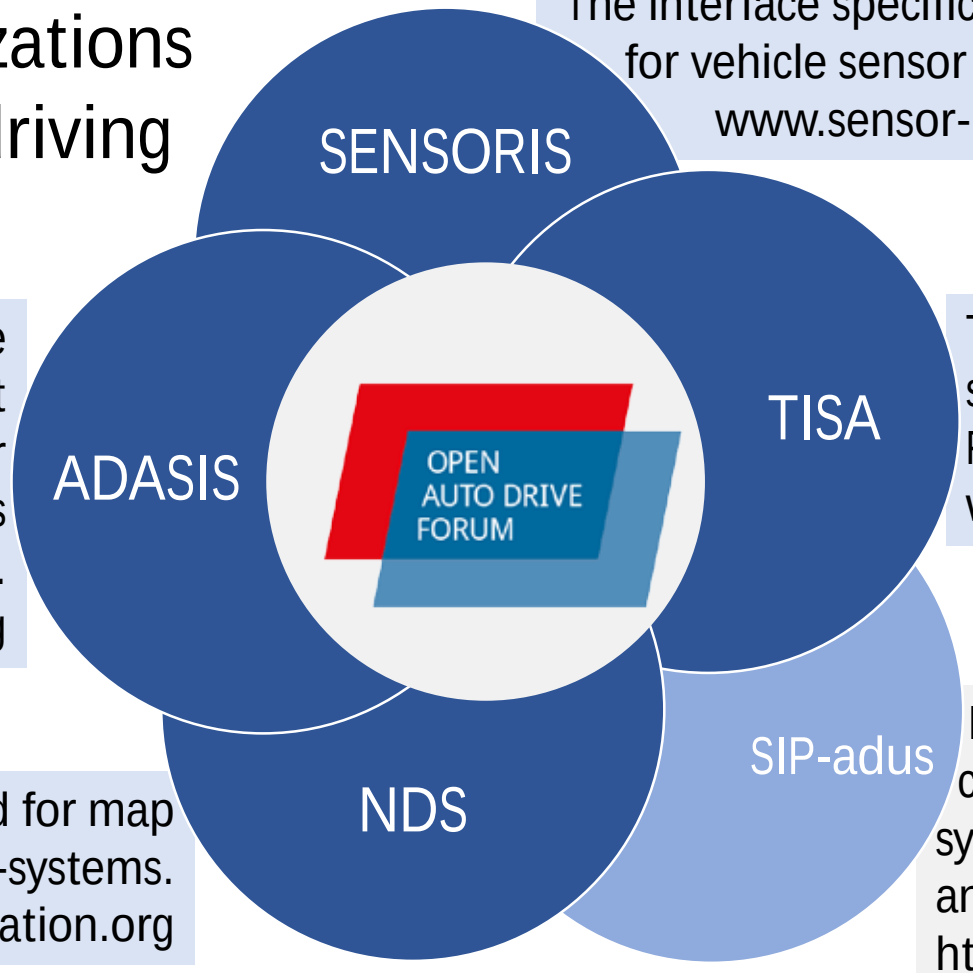
Cross-domain discussion platform driving standardizations in the area of automated driving



The interface specification for vehicle sensor data.
www.sensor-is.org

The data exchange interface to support Advanced Driver Assistance Systems (ADAS) applications.
www.adasis.org

Traffic and travel information services and products based on RDS-TMC and TPEG™.
www.tisa.org

The worldwide standard for map data in automotive eco-systems.
www.nds-association.org

Develops ITS as cross-ministerial collaboration, working on AD system implementation in Japan and next-gen urban transport.
http://en.sip-adus.go.jp

OpenDRIVE
managing the road ahead

OPEN AUTODRIVE FORUM (OADF)

- Founded by NDS and ADASIS in November 2015
  - SENSORIS and TISA joined shortly after
  - Collaboration with SIP-adus, OpenDRIVE, TN-ITS and ISO
- Objectives
  - … a platform to present the latest developments …
  - … discussion platform for cross-domain topics … in AD …
  - Generate … input for standardization …
  - Connect … authorities and … industry …
- Mission is to … develop … solutions for AD, which … work in the reference ecosystem

QUESTIONS FOR THE DAY

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A. How do we develop standards in this space?

- Stakeholder issues?
- Organizational issues?
- Technical issues?

B. Which standards are required?

C. How will we get them adopted?

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OPEN AUTO DRIVE FORUM

KEY TECHNICAL CHALLENGES

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OPEN AUTODRIVE FORUM (OADF) CHALLENGES

- OADF Ecosystem: relational and functional view
- Delivery of dynamic data:
  - Location referencing
  - Lane modeling
- Directory of attributes across individual standards for facilitating interfaces
- Highly Reliable Maps:
  - Map Backend Integrity
  - Map Quality Attributes

NDS – TISA COLLABORATION ON HARMONIZED LOCATION REFERENCING

Navigation Data Standard

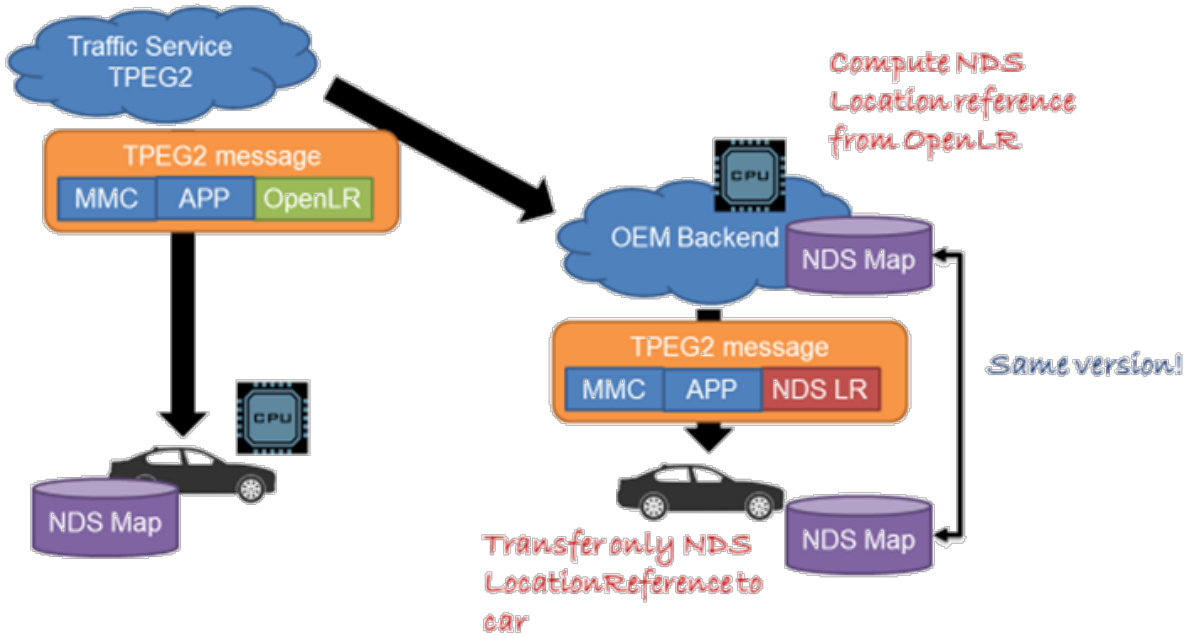
TISA Traveller Information Services Association

Motivation

- Embedding proven solutions and cross-referencing existing standards instead of 're-inventing the wheel'

Solution

- Replacing universal & flexible on-the-fly location referencing (TPEG) in the message container by a map- & OEM-specific, but efficient NDS reference



Benefits

- Maintain flexibility (TPEG) and efficiency (NDS) while addressing a wider range of use cases
- Both solutions (TPEG & NDS) are established in the automotive industry, coding best-practices and testing/validation solutions already exist

NDS – TISA – ADASIS COLLABORATION ON HARMONIZED LANE REFERENCING

Navigation Data Standard | TISA Traveller Information Services Association | ADASIS Advanced Driver Assistant Systems Interface Specifications

Motivation

- Reduce complexity of translation (cross-compilation) between standards by providing a harmonized lane enumeration

Solution

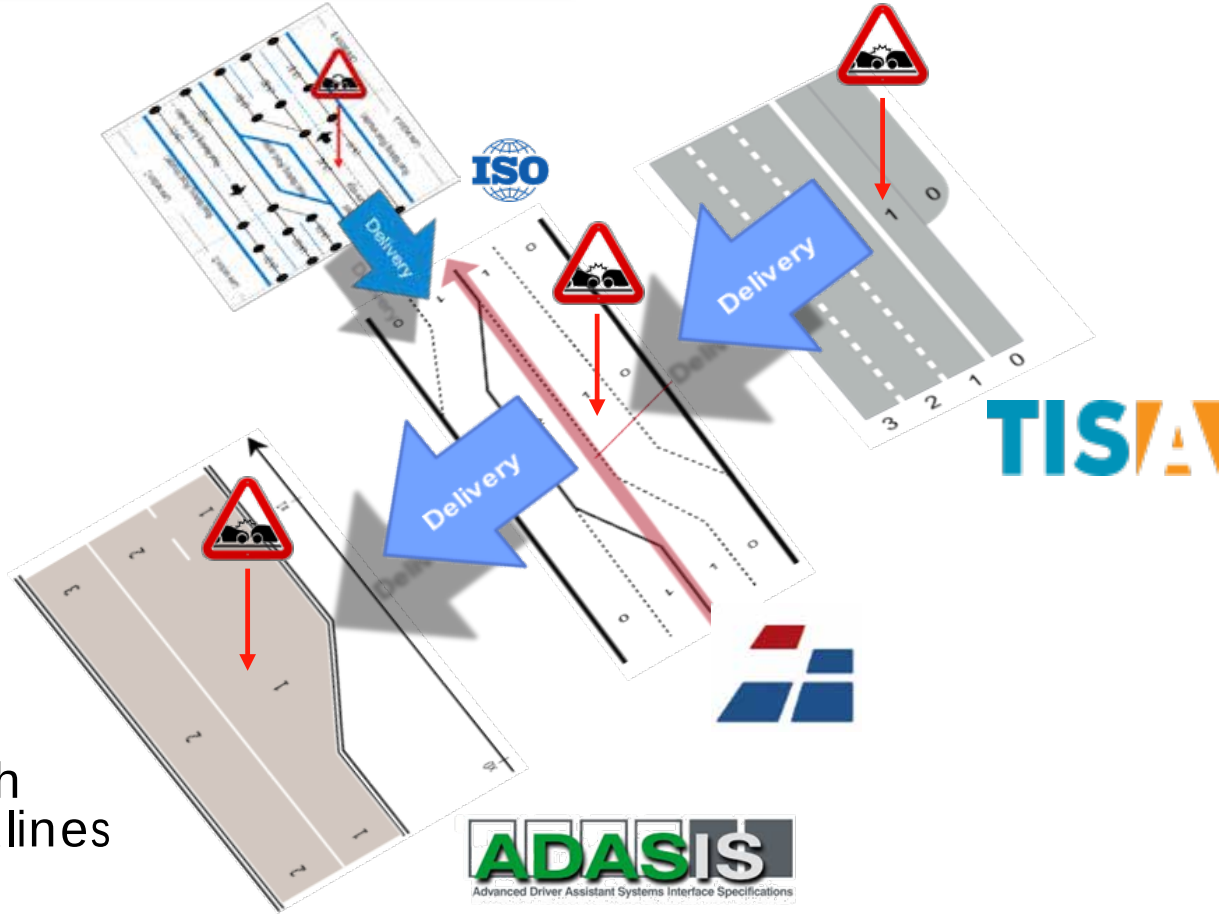
- Alignment of work in progress and/or future revisions/updates of existing standards

Benefit

- Lowering threshold for adoption because ‘everything fits well together’

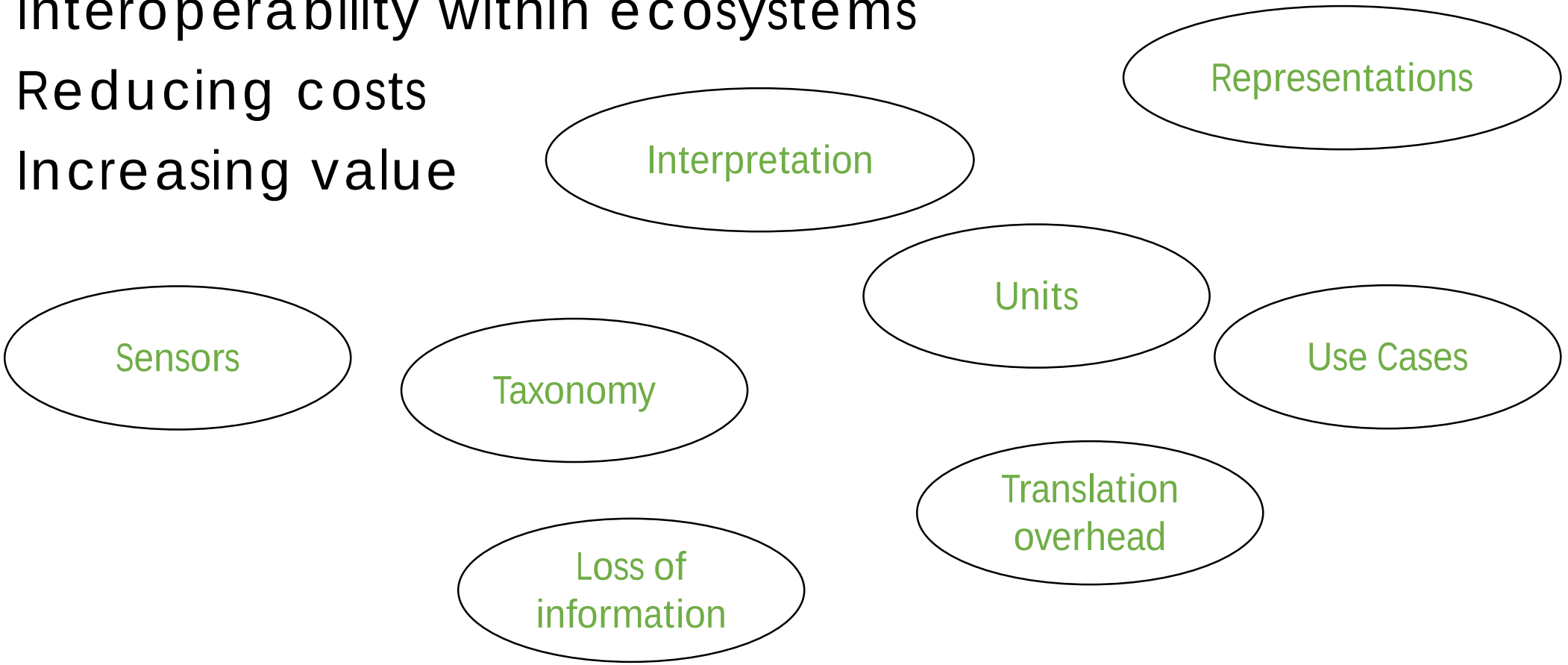
Drawback

- Alignment effort between groups working with different standardization processes and deadlines



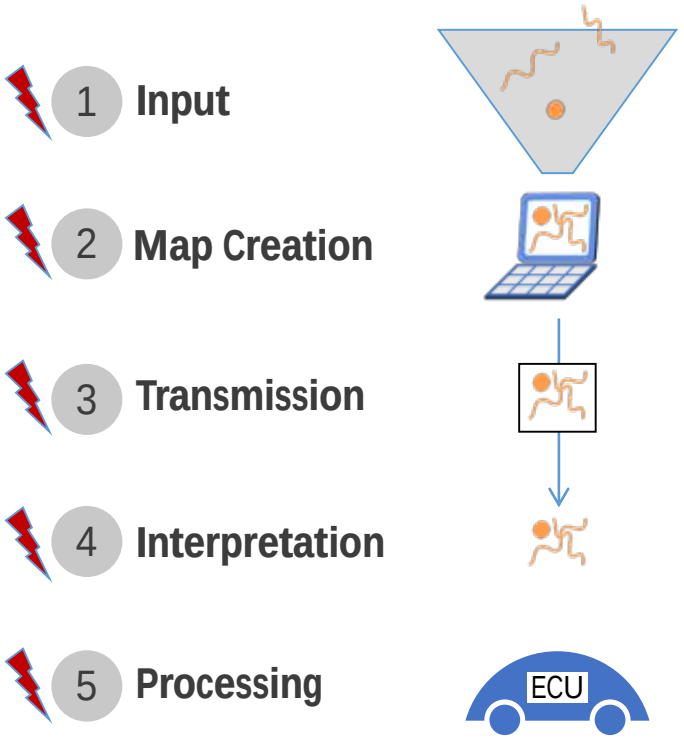
SENSORIS – NDS COLLABORATION ON OPEN ATTRIBUTE METADATA CATALOGUE

- Interoperability within ecosystems
- Reducing costs
- Increasing value



CROSS-ORGANIZATIONAL TOPICS ADDRESSED IN OADF

HIGHLY RELIABLE MAPS



Question	Measure	Status
How correct, precise and up-to-date is the input data used for the map creation?	Map input metadata	Open
How reliable is the map creation process?	Mab backend integrity level	Concrete approach in discussion
Was the data transmission correct?	End-to-end protection	Agreed: Security measures (encryption)
How correct, precise and up-to-date is the received map data?	Map output metadata	Two different approaches exist (TomTom & Here)
Does the automotive E/E system work according to the specification?	ASIL	State of the art
		Open: ASIL necessary for data acquisition?

MAP BACKEND INTEGRITY (MBIL)

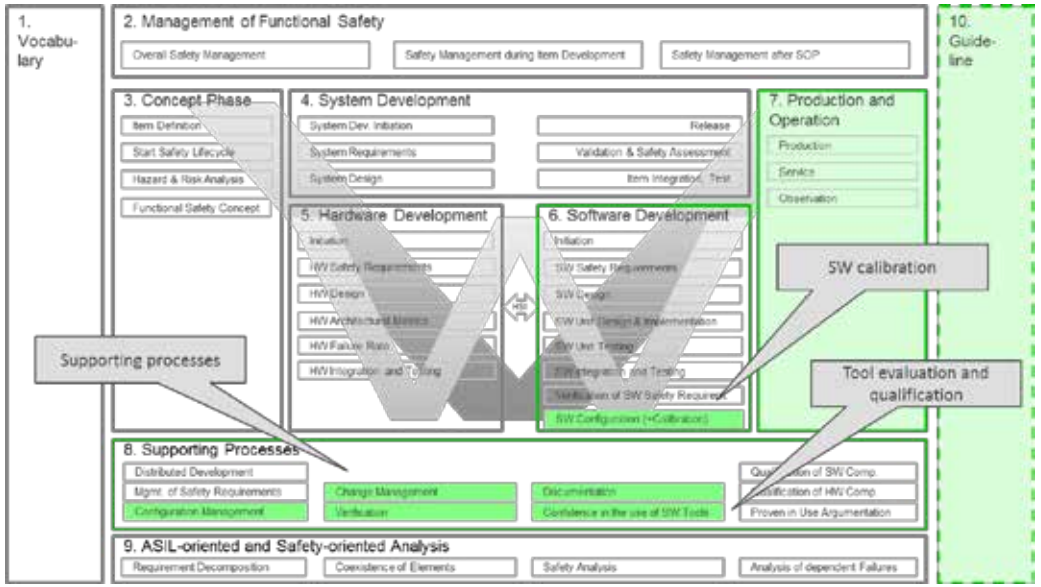
ISO 26262 may be fulfilled by seeing the backend as a tool

Approach: Treat map backend like a Tool Chain

General

- Map data download by vehicle can be seen as "continuous" calibration (during drive cycle)
- Differs from ISO 26262, which assumes infrequent update of calibration data (during production/maintenance)

Ongoing work:
Analysis of possibly applicable requirements from ISO 26262 for the map backend



MAP QUALITY ATTRIBUTES

Data quality aspects

1. **Completeness** (Commission, Omission)
2. **Logical Consistency** (Conceptual consistency, domain consistency, format consistency, topological consistency)
3. **Positional Accuracy** (Absolute or external accuracy, Gridded data position accuracy)
4. **Temporal Accuracy** (Accuracy of a time measurement, Temporal consistency, Temporal validity)
5. **Thematic Accuracy** (Classification correctness, Non-quantitative attribute correctness, Quantitative attribute accuracy)
6. **Aggregation Measures**

For each of the above aspects, ISO 19157 defines a set of measures that can be applied to evaluate data quality.

QUESTIONS FOR THE DAY

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A. How do we develop standards in this space?

B. Which standards are required?

- Right priorities?
- Anything missing?

C. How will we get them adopted?

THE HARD PART

IT'S PUBLISHED, WE'RE DONE…

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Models/Dictionaries/Registries

- ISO 20524 Geographic Data Files (GDF)
- CEN TN-ITS
- Navigation Data Standard (incl. Open Lane Model)
- OpenDRIVE 1.4
- ADASIS 3.0
- ISO 14296:2016 Extension of map database specifications
- ISO TR 21718 Spatio-temporal data dictionary
- *SAE J2945/10 Recommended Practices for MAP/SPaT Message Development*

- *CEN METR*
- ISO/TS 19321:2015 IVI Data Dictionary
- ISO/TS 17425:2016 Data exchange specification for in-vehicle presentation of external road and traffic related data
- ISO 21219 TPEG 2
- ISO 18750:2018: Local dynamic map
- CEN 16157-3 DATEX II Situation Publication
- ETSI EN 302 637-3 V1.2.1 DENM
- ISO/TS 19091:2017 Using V2I and I2V for signalized intersections
- SAE J2735™
- ITE TMDD
- IEEE 1512
- *TISA TPEG 3.0*
- *J2945/4: DSRC Messages for TIM and BIM (RSM)*
- *ISO 20078 Extended vehicle content*
- *FHWA WZDX*

- ISO 17419 Globally unique identification; *Management and operation of registries*

Terminology

- ISO 14812 Vocabulary
- SAE J3131 AD Reference Architecture

Location Referencing

- ISO 17572-1:2015 Location referencing for geographic databases
- ISO 21219 - TPEG2 Parts 11, 20-22
- OpenLR v1.4.2
- CEN EN 16157-2 DATEX II - Part 2: Location referencing
- OpenGIS® Location Services (OpenLS)
- J2266™: LRMS
- *CEN Location Referencing Harmonization for Urban-ITS*

Quality

- ISO 19157:2013, 2016 Geographic Information – Data quality
- ISO 19158:2012 Geographic Information – Quality assurance of data supply
- *OADF Highly Reliable Maps specifications*

Italic = in draft

Figure is In-Progress Material from FHWA Infrastructure and V2X Mapping Needs Assessment and Development project

QUESTIONS FOR THE DAY

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A. How do we develop standards in this space?

B. Which standards are required?

C. How will we get them adopted?

- Awareness
- Selection
- Correct implementation
- Evolution

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QUESTIONS OR SUGGESTIONS?

CONTACTS

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ADASIS Advanced Driver Assistant Systems Interface Specifications

Michael Klingsoehr

michael.klingsoehr@bosch-softtec.com

Navigation Data Standard

Martin Schleicher
martin.schleicher@elektrobit.com

SENSORIS

Prokop Jehlicka
prokop.jehlicka@here.com

SIP SIP-adus Innovation of Automated Driving for Universal Services

Satoru Nakajo
snakajo@csis.u-tokyo.ac.jp

TISA Traveller Information Services Association

Matthias Unbehaun

m.unbehaun@tisa.org