Toward a Common Vehicle Data Model

Cloud & Connected Services Workshop Session One

Benjamin Klotz, Gunnar Andersson | 29 October 2019
✉ klotz@eurecom.fr

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Toward a Common Vehicle Data Model

Motivation

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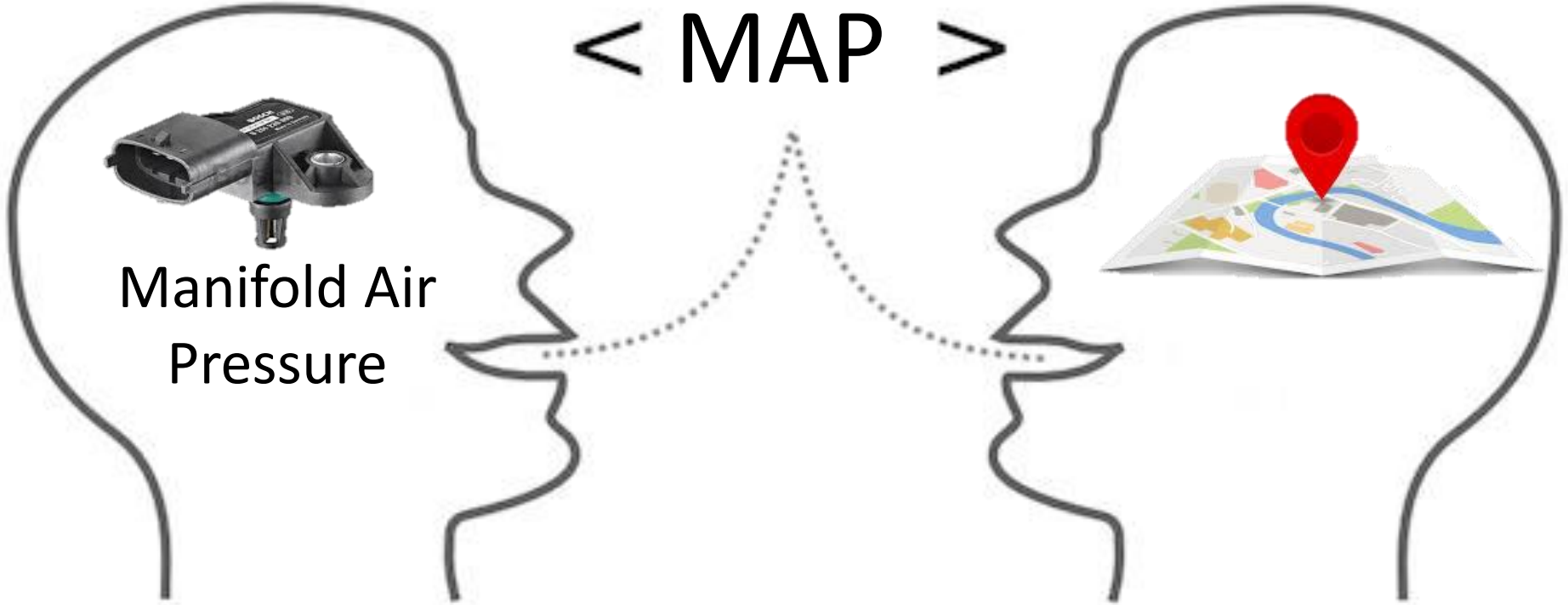
Motivation



Heterogeneous vehicle data

{"acceleratorPedal":{"position":"4095","ecoPosition":"3"},"brakeContact":"16","speedActual":"0“}, "timeStamp":"2018-01-10T17:01:27.297Z",}

{"name":"accelerator_pedal_position","value":0,"timestamp":1361454211.483000}
{"name":"fuel_level","value":23.478279,"timestamp":1361454211.485000}
{"name":"torque_at_transmission","value":1,"timestamp":1361454211.488000}

Signal name?
Units?
Timestamps?

Temperature sensor

Adaptive cruise control

Front camera

Radar

Blind spot detection

Wheel speed sensor

Oil temperature sensor

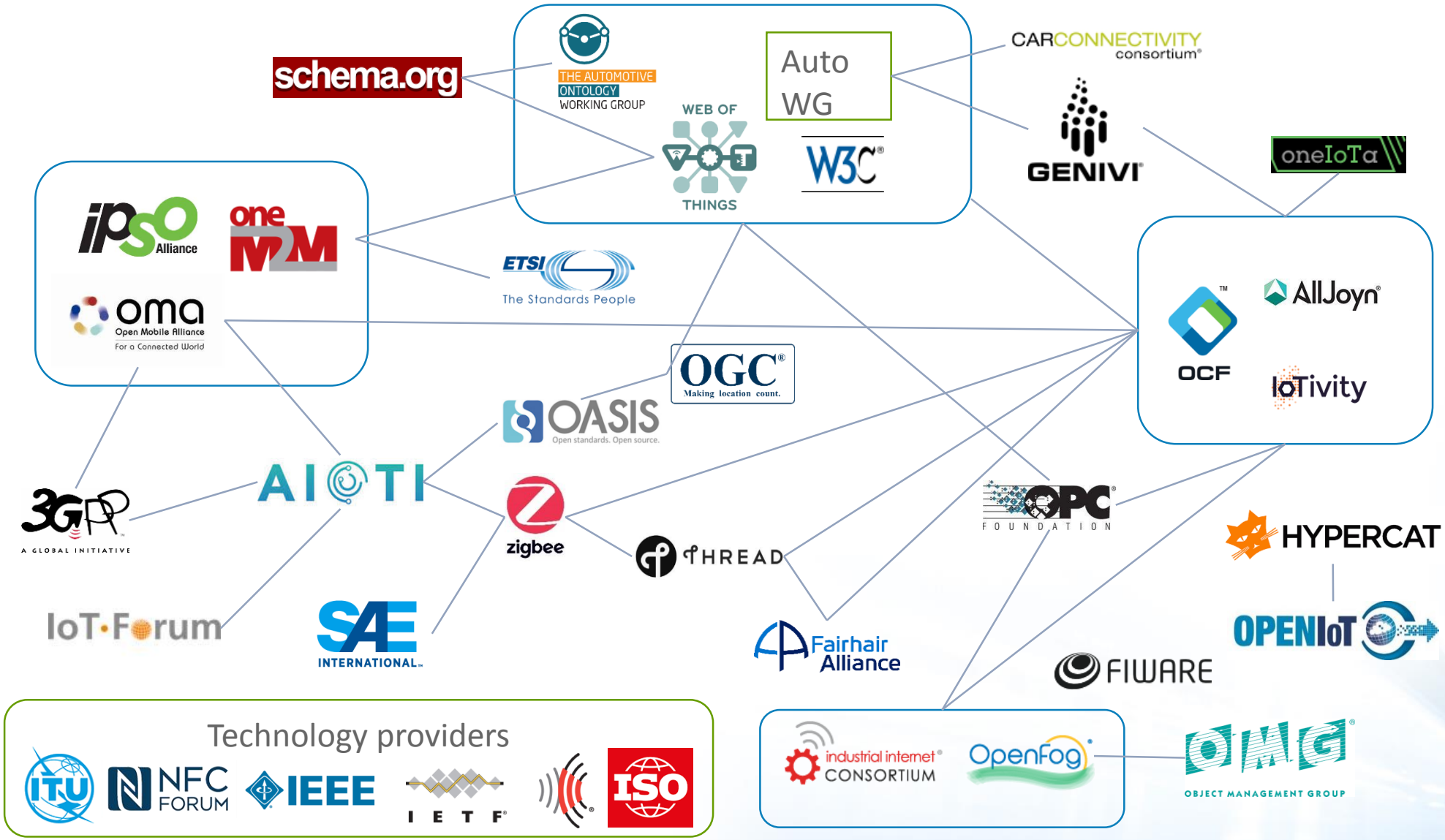
Tire pressure sensor

Steering angle sensor

Park assistant

Vehicle height sensor

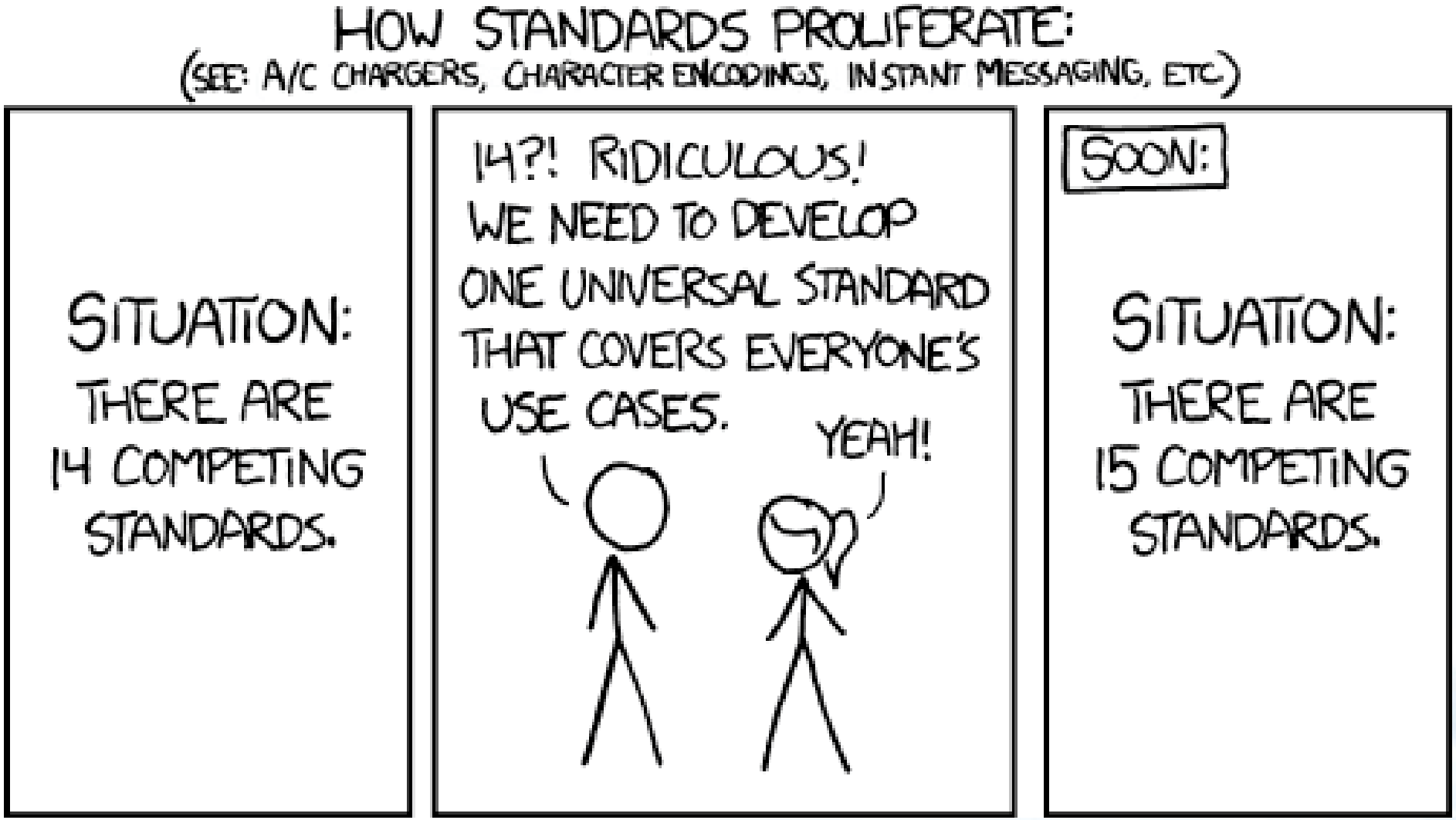
Fragmented IoT standard ecosystem



Challenges

- Heterogeneous data
  - Sources: vehicles, road infrastructure, external APIs…
  - Different brands and models
- Hard to standardize bus signals (OBDII)
- Access control independence (data model vs data instances)
  - Security
  - Privacy
  - Different implementations
- In-vehicle signals vs backend APIs

Avoid the “xkcd 927 effect”



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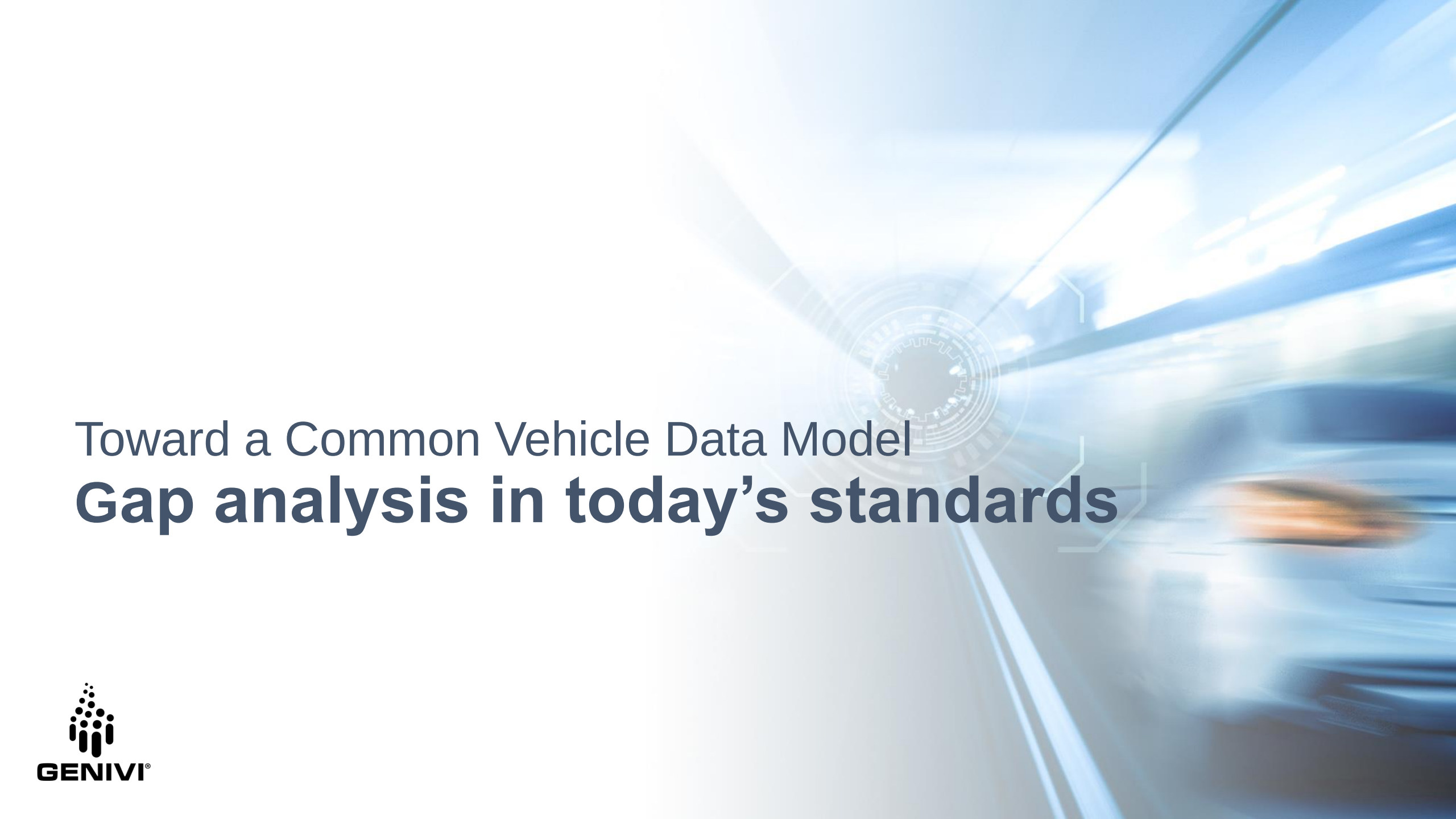
Gap analysis in today's standards



Some major standardization initiatives

- ISO 20078 Extended Vehicle
- W3C Vehicle Information Server
- SensorIS
- Android Auto Vehicle Interface (Vehicle HAL)
- AutoMat Common Vehicle Information Model
- Car Connectivity Consortium Car Data
- IoT initiatives…

ISO Extended Vehicle (ISO 20078)

Motivation

- Increasing demand from 3rd parties to access vehicle data and functionality
- OEMs already equipped vehicles with telematics units and IT-infrastructure to handle connectivity
- Need to define a design and requirements to ensure that security, safety and data privacy (best practices, common methods)

Data model

- For 3rd parties to implement
- RESTful with JSON or XML schema with requirements on several aspects:
  - URI definition,
  - error handling,
  - Naming,
  - interaction pattern

Stakeholders

European OEMs contributing

Metadata

Policies: requirements for 3rd parties on data modeling good practices (e.g. URI use)

SensorIS

Motivation

- Enable broad access, delivery and processing of vehicle sensor data
- Enable easy exchange of vehicle sensor data between all players
- Enable enriched location-based services
- Drive global growth in this field

Data model

- Data messages in categories (which you can create)
- Identifies of submitter, session, message, vehicle fleet, vehicle, and driver
- Developed in google Protocolbuf library

Stakeholders

SENSORIS

Audi

DAIMLER

here

BOSCH

Invented for life

VOLVO

BMW

And many more

Metadata

- Units explicitly defined (e.g. “deg_c” for Celsius degrees)
- Policy for category extension to be compatible

W3C Vehicle Information Server

Motivation

- Develop service specifications for exposing vehicle data and other information around vehicle centric functions.
- Not define or mandate implementation details including vehicle, network or sensor protocols

Data model

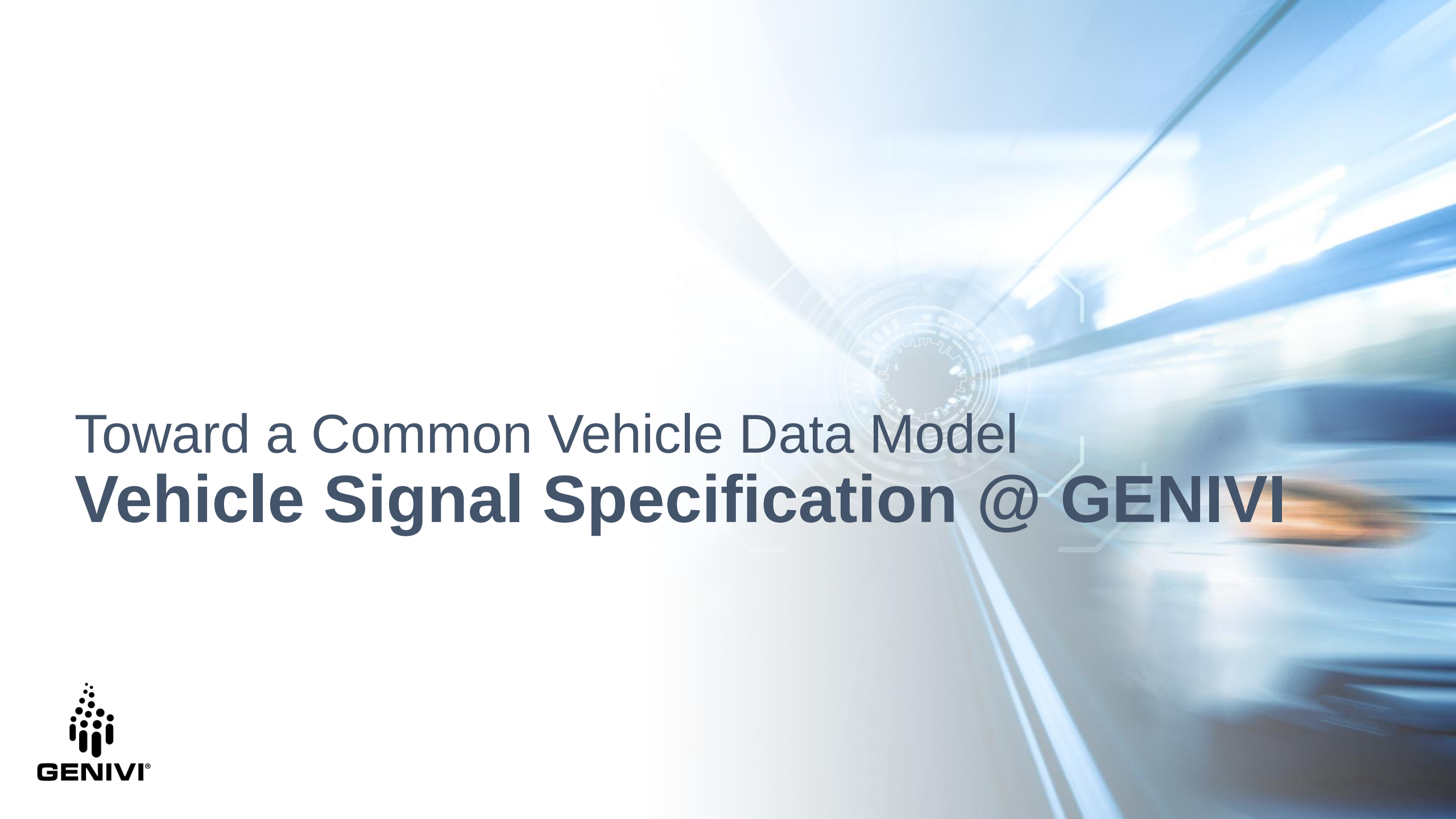
- Vehicle Signal Specification (VSS) as the per default model
- Alternative data models possible

Stakeholders

Metadata

Vehicle Signal Specification (VSS):

- Extension mechanism
- Modeling best practices for signals and attributes



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Vehicle Signal Specification @ GENIVI

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Vehicle signal specification (VSS)

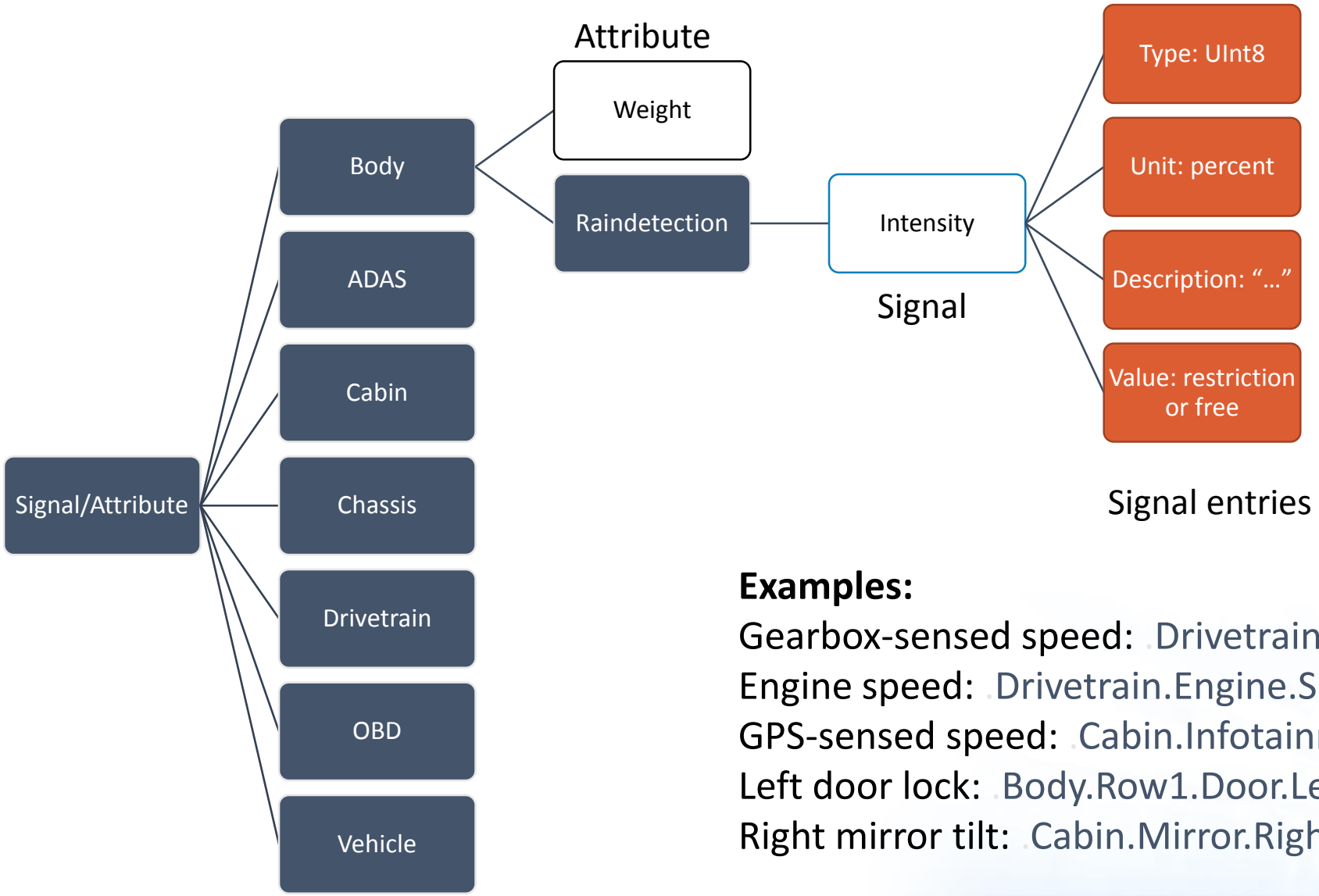


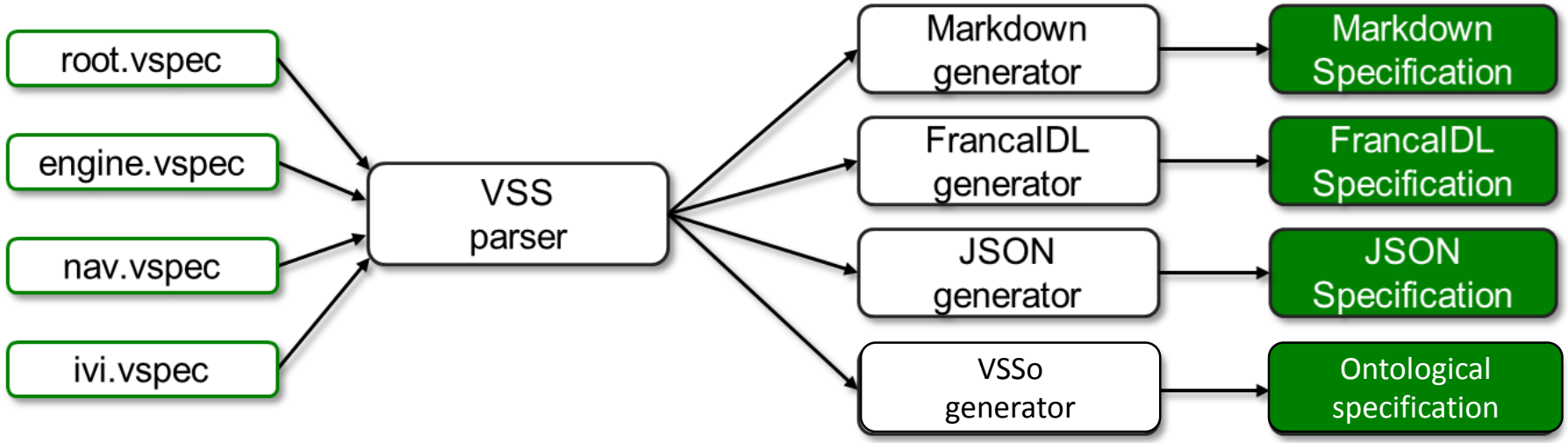
Figure:

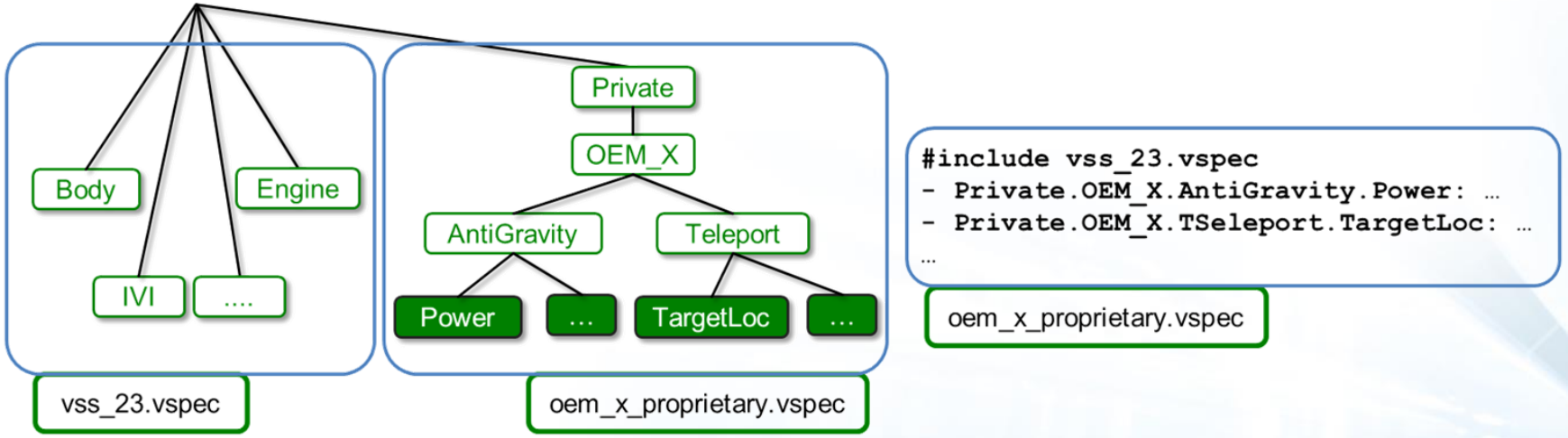
- 451 branches
- 1103 leaves:
  - 43 attributes
  - 1060 signals: including
    - (700 seat-related),
    - 268 with unit

Examples:

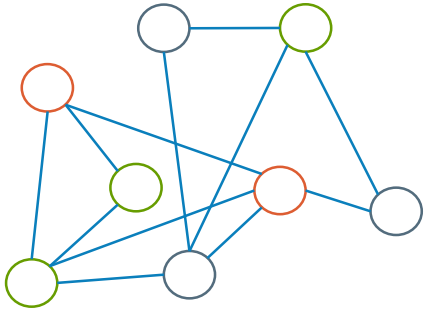
Gearbox-sensed speed: .Drivetrain.Transmission.Speed
Engine speed: .Drivetrain.Engine.Speed
GPS-sensed speed: .Cabin.Infotainment.Speed
Left door lock: .Body.Row1.Door.Left.IsLocked
Right mirror tilt: .Cabin.Mirror.Right.Tilt

Generation and extensions





VSSo: VSS ontology [1]

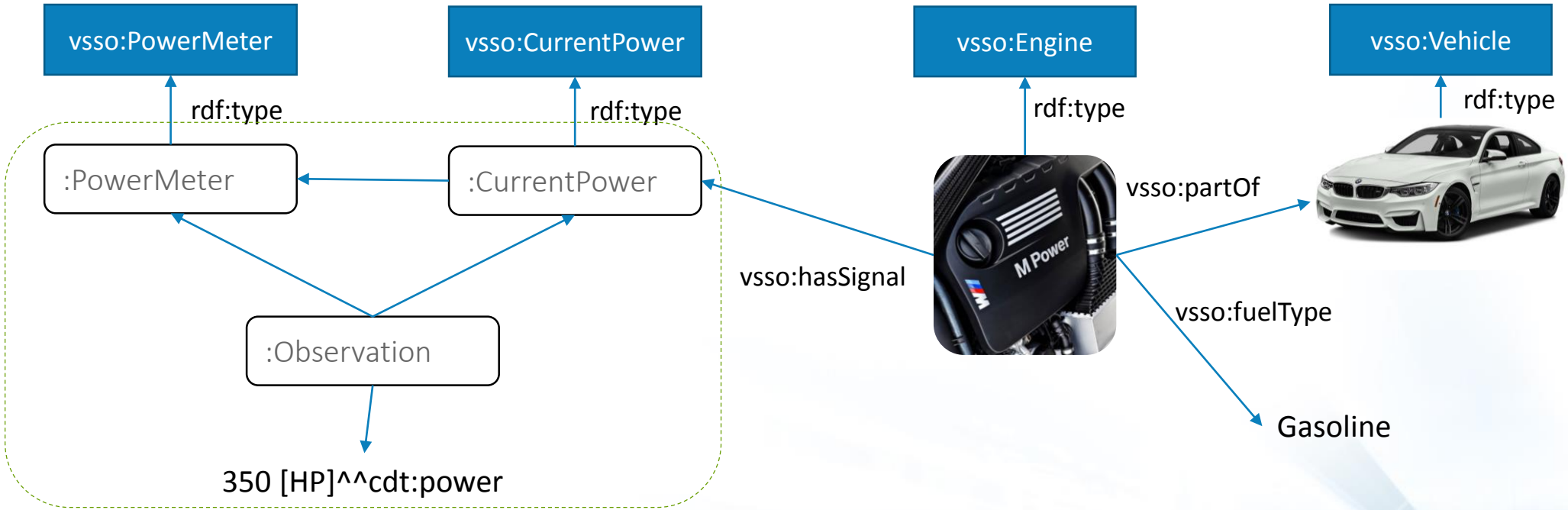


Graph representation of formal models of:

- Vehicles and their branches
- Sensors, actuators, signals and attributes

SOSA pattern [2]:

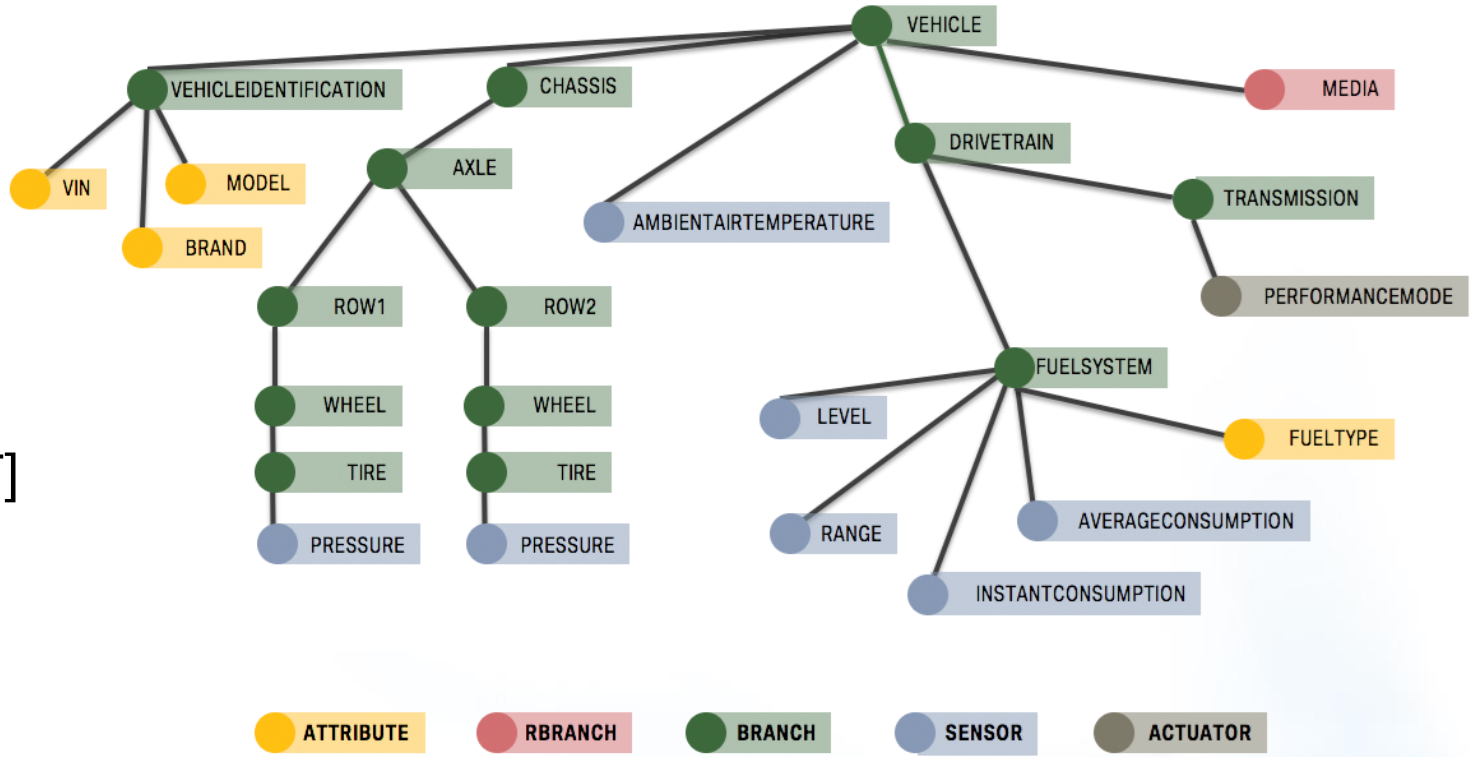
- Sensor,
- Observation,
- Sample,
- Actuator



[1] http://automotive.eurecom.fr/vsso
[2] https://www.w3.org/TR/vocab-ssn/

VSS 2.0

- A unified tree combining:
  - Static attributes
  - Sensors
  - Actuators
- Simpler position models:
  - Observe wheels in Row[1,2]
  - Get window position in [LEFT,RIGHT]
- Rbranch:
  - Resource branch
  - Adapted for collections



Toward a Common Vehicle Data Model

Discussion

Which data models are missing?

In standards and this gap analysis

Which access control solutions?

Implying technical requirements

For instance, which signal unit specifications?

Restricted to one, multiple or open

What parts of the VSS-based ecosystem should be based on a standard database of named signal?

A “core” specification, in opposition to private extensions

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How large parts are proprietary extensions?

To VSS or an equivalent specification

Which policies for future-proofing standards?

Scalability, flexibility, future needs…

How the choice of technical specification can affect the result?

Performance, feasibility

Thank you!

Visit GENIVI:

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Contact us:

help@genivi.org

Klotz@eurecom.fr

Next session at 13:45

“The Value of Vehicle Data to Enterprises”

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