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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Smart Machine-to-Machine communications (SmartM2M).

The present document is part 7 of a multi-part deliverable covering SmartM2M; Extension to SAREF, as identified below:

Part 1: "Energy Domain";

Part 2: "Environment Domain";

Part 3: "Building Domain";

Part 4: "Smart Cities Domain";

Part 5: "Industry and Manufacturing Domains";

Part 6: "Smart Agriculture and Food Chain Domain";

Part 7: "Automotive Domain";

Part 8: "eHealth/Ageing-well Domain";

Part 9: "Wearables Domain";

Part 10: "Water Domain";

Part 11: "Lift domain";

Part 12: "Smart Grid domain";

Part 13: "Maritime Domain".

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document presents SAREF4AUTO, an extension of SAREF for the Automotive Domain.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI TS 103 264: "SmartM2M; Smart Applications; Reference Ontology and oneM2M Mapping".

[2] ETSI TS 103 548: "SmartM2M; SAREF reference ontology patterns".

[3] ETSI TS 103 673: "SmartM2M; SAREF Development Framework and Workflow, Streamlining the Development of SAREF and its Extensions".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI TS 103 410-7 (V1.1.1) (07-2020): "SmartM2M; Extension to SAREF; Part 7: Automotive Domain".

[i.2] ETSI TR 103 781 (V1.1.1) (09-2023): "SmartM2M; Study for SAREF ontology patterns and usage guidelines".

[i.3] ETSI TR 103 508 (V1.1.1) (10-2019): "SmartM2M; SAREF extension investigation; Requirements for Automotive".

[i.4] SENSORIS: "Sensor Interface Specification".

[i.5] EN 16157-2:2019: "Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 2: Location referencing", produced by CEN.

[i.6] "The DATEX II Parking Publications Extension".

[i.7] OGC 11-052r4: "OGC GeoSPARQL - A Geographic Query Language for RDF Data". Version 1.0.

[i.8] ETSI TS 102 894-2: "Intelligent Transport Systems (ITS); Users and applications requirements; Part 2: Applications and facilities layer common data dictionary".

[i.9] SAE J3016™: "Taxonomy and Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems".

[i.10] ISO/IEC 11578:1996: "Information technology -- Open Systems Interconnection -- Remote Procedure Call (RPC)".

[i.11] Recommendation ITU-T X.667: "Information technology - Procedures for the operation of object identifier registration authorities: Generation of universally unique identifiers and their use in object identifiers".

[i.12] ISO/IEC 9834-8:2014: "Information technology -- Procedures for the operation of object identifier registration authorities -- Part 8: Generation of universally unique identifiers (UUIDs) and their use in object identifiers".

[i.13] European Agreement (Applicable as from 1 January 2011): "Concerning the International Carriage of Dangerous Goods by Road".

[i.14] United Nations: "Recommendations on the Transport of Dangerous Goods - Model Regulations", Twelfth revised edition.

[i.15] ISO 3779 (2011-07): "Road vehicles - Vehicle identification number (VIN) Content and structure".

[i.16] ETSI TS 103 301: "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Facilities layer protocols and communication requirements for infrastructure services; Release 2".

[i.17] UNECE/TRANS/WP.29/78/Rev.4: "Consolidated Resolution on the Construction of Vehicles (R.E.3)".

[i.18] ETSI TS 103 300-2 "Intelligent Transport Systems (ITS); Vulnerable Road Users (VRU) awareness; Part 2: Functional Architecture and Requirements definition; Release 2".

[i.19] ISO 8855: "Road vehicles -- Vehicle dynamics and road-holding ability -- Vocabulary".

[i.20] ISO 3833: "Road vehicles -- Types -- Terms and definitions".

[i.21] ISO/TS 19091:2019: "Intelligent transport systems -- Cooperative ITS -- Using V2I and I2V communications for applications related to signalized intersections".

[i.22] IETF RFC 3966: "The tel URI for Telephone Numbers".

[i.23] ENSEMBLE Project deliverable D2.3: "V2 Platooning use cases, scenario definition and Platooning Levels".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI TS 103 673 [3] and the following apply:

ontology: formal specification of a conceptualization, used to explicit capture the semantics of a certain reality

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ABS	Anti-lock Braking System
AEB	Autonomous Emergency Braking
ASD	Aftermarket Safety Device
AVP	Automated Valet Parking
CDD	Common Data Dictionary
DATEX	Data Exchange
DP	Datatype Property
ESP	Electronic Stability Program
GUID	Globally Unique Identifier
IRI	Internationalized Resource Identifier
ITS	Intelligent Transport Systems
OP	Object Property
OWL-DL	Ontology Web Language - Description Logics
PTW	Powered Two Wheelers
RPC	Remote Procedure Call
SAE	Society of Automotive Engineers
SAREF	Smart Applications REFerence ontology
SAREF4AUTO	SAREF extension for Automotive
SOSA	Sensor Observation Sampling Actuator
SSN	Semantic Sensor Network
STF	Specialists Task Force
TC	Technical Committee
TR	Technical Report
TS	Technical Specification
UUID	Universally Unique Identifier
V2V	Vehicle to Vehicle
V2X	Vehicle to Anything
VAM	VRU Awareness Messages
VDS	Vehicle Descriptor Section
VMS	Variable Message Systems
VRU	Vulnerable Road Users
W3C	World Wide Web Consortium
WGS84	World Geodetic System 1984
WMI	World Manufacturer Identifier

4 SAREF4AUTO ontology and semantics

4.1 Introduction and overview

The present document is a technical specification of SAREF4AUTO, an OWL-DL ontology that extends SAREF [1] for the Automotive domain.

The present document is a major revision of SAREF4AUTO ontology extension, developed in the context of the STF 653, using updated reference ontology patterns specified in ETSI TS 103 548 [2] to solve the harmonization needs identified in ETSI TR 103 781 [i.2], with updated development framework and tools defined in ETSI TS 103 673 [3].

ETSI TS 103 410-7 (V1.1.1) [i.1] has been developed in the context of the STF 566, an ETSI specialists task force that was established with the goal to extend SAREF for the domains of Automotive, eHealth/Ageing-well, Wearables and Water (see https://portal.etsi.org/STF/STFs/STF-HomePages/STF566).

The intention of SAREF4AUTO is to connect SAREF with existing ontologies (such as W3C SSN, W3C SOSA, GeoSPARQL [i.7], etc.) and important standardization initiatives and ontologies in the Automotive domain, as mentioned in the associated SAREF4AUTO requirements document ETSI TR 103 508 [i.3], including:

- ETSI TC ITS for V2V communications [i.8].

- The SENSORIS data model [i.4] for exchanging data between vehicles and cloud services.
- The DATEX II standard [i.5] for information exchange between traffic management centres, traffic information centres and service providers.
- The DATEX II Parking Publications [i.6] for specifying information about parking sites and individual parking vehicles.

To show the potential of SAREF4AUTO, the present document focuses on adapting the common data dictionary ETSI TS 102 894-2 [i.8] of ETSI TC ITS, and extend it with "platooning", and "Automated Valet Parking (AVP)" adapted from SAREF4AUTO V1.1.

As all the SAREF ontologies, SAREF4AUTO is a dynamic semantic model that is meant to evolve over time. Therefore, the stakeholders in the Automotive domain are invited to use, validate and provide feedback on SAREF4AUTO, collaborating with the SAREF ontology experts to improve and evolve SAREF4AUTO in an iterative and interactive manner, so that changes and additions can be incorporated in future releases of the present document.

The prefixes and namespaces used in SAREF4AUTO and in the present document are listed in Table 1.

Table 1: Prefixes and namespaces used within the SAREF4AUTO ontology

Prefix	Namespace
s4auto	https://saref.etsi.org/saref4auto/
s4syst	https://saref.etsi.org/saref4syst/
saref	https://saref.etsi.org/core/
dcterms	http://purl.org/dc/terms/
owl	http://www.w3.org/2002/07/owl#
om	http://www.ontology-of-units-of-measure.org/resource/om-2/
time	http://www.w3.org/2006/time#
rdf	http://www.w3.org/1999/02/22-rdf-syntax-ns#
rdfs	http://www.w3.org/2000/01/rdf-schema#
skos	http://www.w3.org/2004/02/skos/core#
xsd	http://www.w3.org/2001/XMLSchema#
geo	http://www.opengis.net/ont/geosparql#

4.2 SAREF4AUTO

4.2.1 General Overview

An overview of the SAREF4AUTO ontology is provided in Figure 1. For all the entities described in the present document, it is indicated whether they are defined in the SAREF4AUTO extension or elsewhere by the prefix included before their identifier, i.e. if the element is defined in SAREF4AUTO, the prefix is `s4auto`, while if the element is reused from another ontology, it is indicated by a prefix according to Table 1. Colour codes also help to distinguish the provenance of entities.

Diagrams are to be interpreted using the Chowlk notation [3], clause 9.7.2.

NOTE: Figure 1 aims at showing a global overview of the main classes of SAREF4AUTO and their mutual relations. More details on the different parts of Figure 1 are provided in clause 5 and clause 6 of the present document.

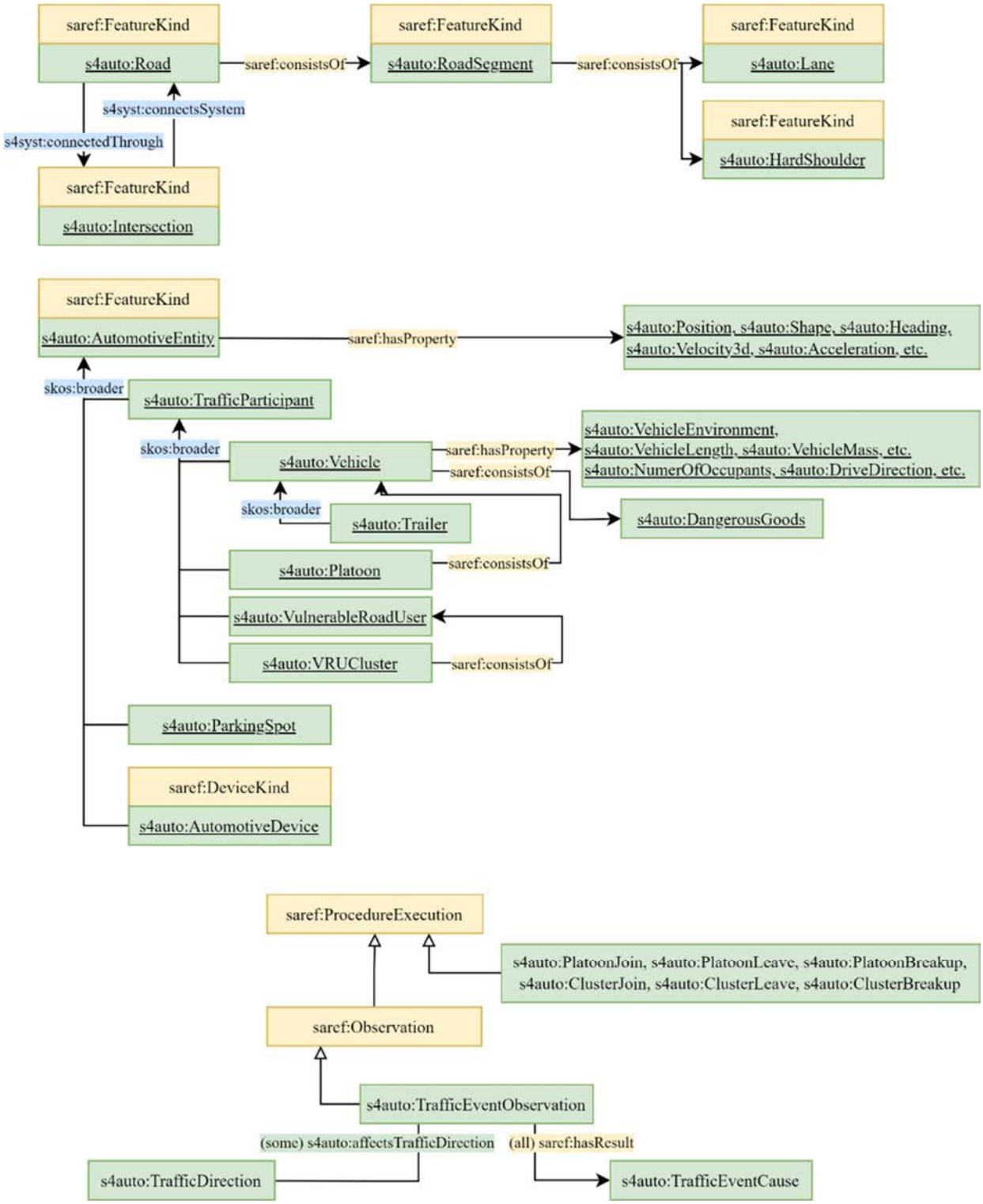

Figure 1: SAREF4AUTO overview

5 General additions to SAREF Core

5.0 Overview

The present clause describes general additions to SAREF Core, not specific to the automotive domain.

These additions could be incorporated in future versions of SAREF Core.

5.1 Confidence Value and Confidence Level

5.1.0 Overview

Figure 2 describes how a confidence value with a confidence level can be attached to a `saref:PropertyValue`.

As a shortcut, a confidence level can be directly attached to `saref:Observation` or `saref:PropertyValue`.

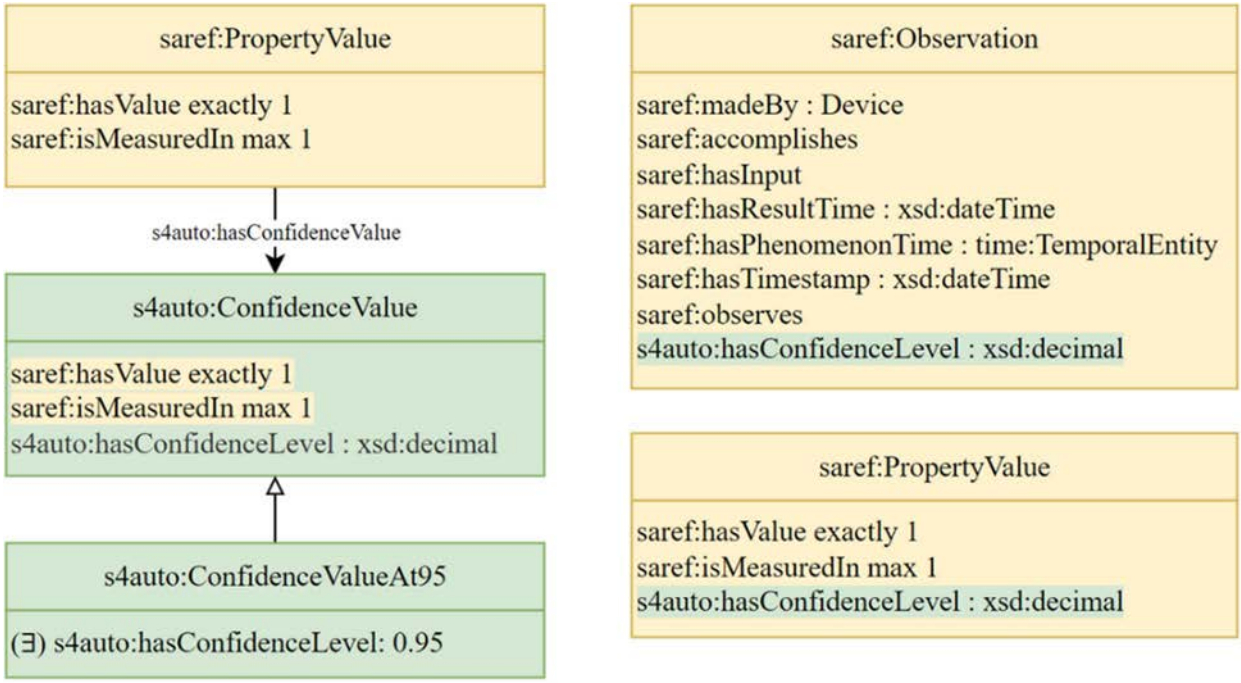

Figure 2: Confidence Value and Confidence Level

Figure 3 provides a practical example.

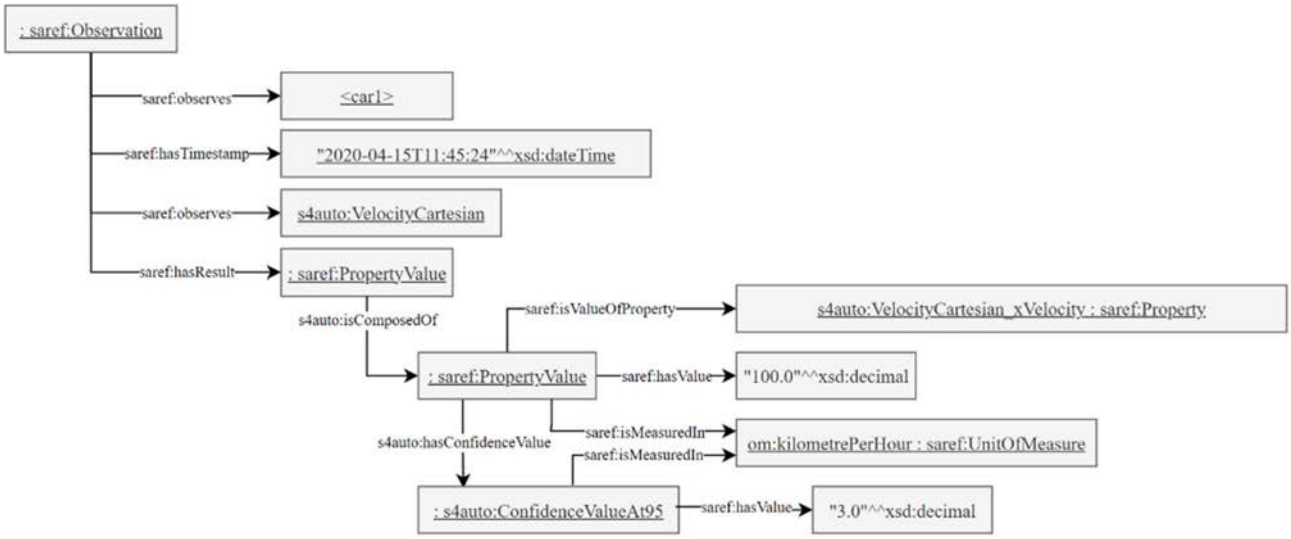

Figure 3: Example for Confidence Value and Confidence Level

5.2 General Purpose Property Categories

5.2.0 Overview

Figure 4 describes a number of general purpose property categories, that can be used to type instances of `saref:Property`.

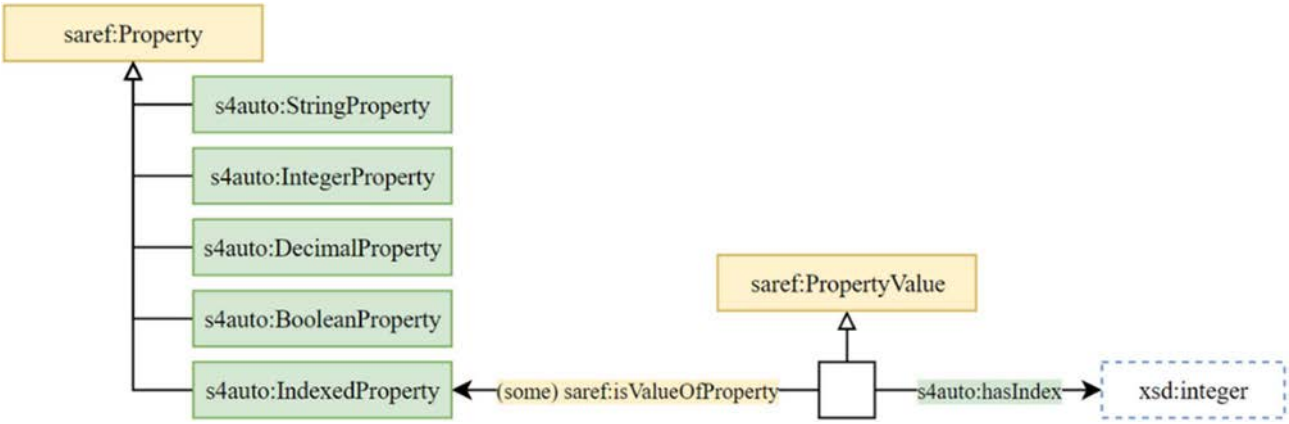

Figure 4: General Purpose Property Categories

5.2.1 Property category `s4auto:BooleanProperty`

The class of properties whose value (`saref:hasValue`) is typically expressed as a `xsd:boolean` literal.

5.2.2 Property category `s4auto:DecimalProperty`

The class of properties whose value (`saref:hasValue`) is typically expressed as a `xsd:decimal` literal.

5.2.3 Property category `s4auto:IndexedProperty`

The class of properties whose values (`saref:PropertyValue`) are organized in a sequence using an index (defined using `s4auto:hasIndex`).

5.2.4 Property category `s4auto:IntegerProperty`

The class of properties whose value (`saref:hasValue`) is typically expressed as a `xsd:integer` literal.

5.2.5 Property category `s4auto:StringProperty`

The class of properties whose value (`saref:hasValue`) is typically expressed as a `xsd:string` literal.

5.3 General Purpose Properties

5.3.0 Overview

Figure 5 describes some general purpose properties, which are instances of `saref:Property`.

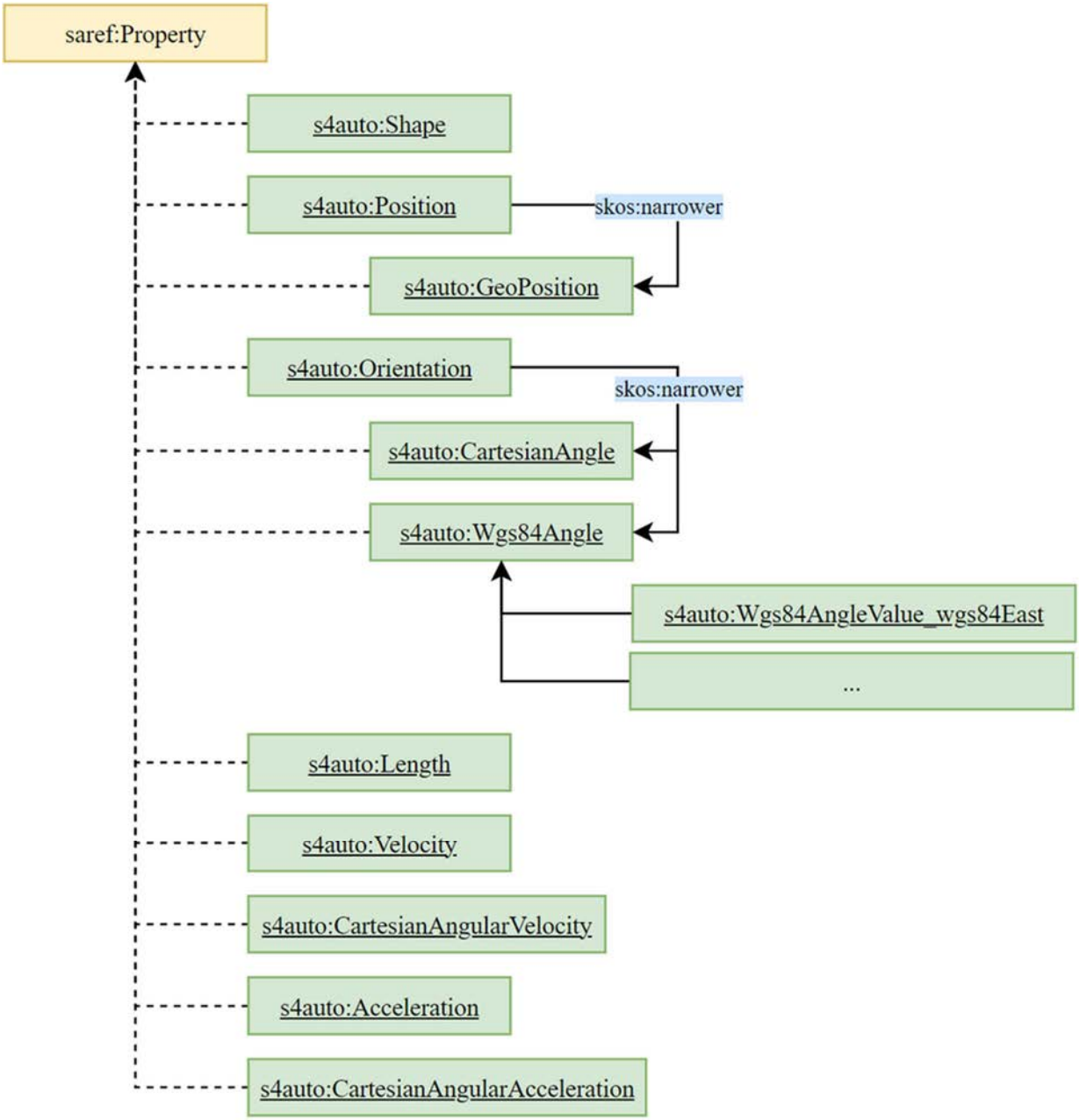

Figure 5: General Purpose Properties

5.3.1 Property `s4auto:Acceleration`

This property represents an acceleration component value in a defined coordinate system.

5.3.2 Property `s4auto:CartesianAngularAcceleration`

Is property of: `s4auto:Vehicle`

This property represents the angular acceleration, described in a local Cartesian coordinate system, per default counted positive in a right-hand local coordinate system from the abscissa.

5.3.3 Property `s4auto:CartesianAngularVelocity`

This property represents the angular velocity, described in a local Cartesian coordinate system, per default counted positive in a right-hand local coordinate system from the abscissa.

5.3.4 Property s4auto:Length

This property represents length as a measure of distance between points or as a dimension of an object.

5.3.5 Property s4auto:Orientation

This property represents the orientation of a feature of interest. Narrower properties further specify how the orientation is defined.

5.3.6 Property s4auto:CartesianAngle

Broader property: s4auto:Orientation

This property represents an angle described in a local Cartesian coordinate system, per default counted positive in a right-hand local coordinate system from the abscissa.

5.3.7 Property s4auto:Wgs84Angle

5.3.7.0 Definition

Broader property: s4auto:Orientation

This property represents an orientation as an angle with regards to the WGS84 north.

5.3.7.1 Property value s4auto:Wgs84AngleValue_wgs84North

Is value of property: s4auto:Wgs84Angle

Value: 0

Orientation to the WGS84 north.

5.3.7.2 Property value s4auto:Wgs84AngleValue_wgs84East

Is value of property: s4auto:Wgs84Angle

Value: 900

Orientation to the WGS84 east.

5.3.7.3 Property value s4auto:Wgs84AngleValue_wgs84South

Is value of property: s4auto:Wgs84Angle

Value: 1 800

Orientation to the WGS84 south.

5.3.7.4 Property value s4auto:Wgs84AngleValue_wgs84West

Is value of property: s4auto:Wgs84Angle

Value: 2 700

Orientation to the WGS84 west.

5.3.8 Property s4auto:Position

This property represents the position of a feature of interest. Narrower properties further specify how the position is defined.

5.3.9 Property s4auto:GeoPosition

Broader property: s4auto:Position

A position within a geographic coordinate system together with a confidence ellipse.
Values should be described as GeoSPARQL geometries.

Figure 6 provides a practical example.

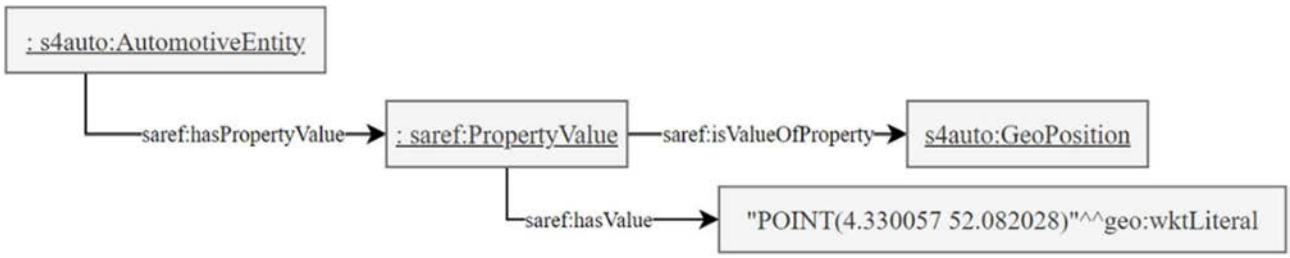

Figure 6: Example for Geo Position

5.3.10 Property s4auto:Shape

This property represents the shape of a feature of interest. i.e.: Sphere, Torus, Cylinder, Cone, Ellipsoid, Cube, Cuboid, Pyramid, Prism, Multiple shapes. Narrower properties further specify how the shape is defined.

5.3.11 Property s4auto:Velocity

This property represents a velocity component value in a defined coordinate system.

5.4 Addendum to saref:ProcedureExecution

Figure 7 describes a small addition to saref:ProcedureExecution.

s4auto:hasResultPosition links a procedure execution to the position where the activity was completed, expressed as a value of property s4auto:Position.

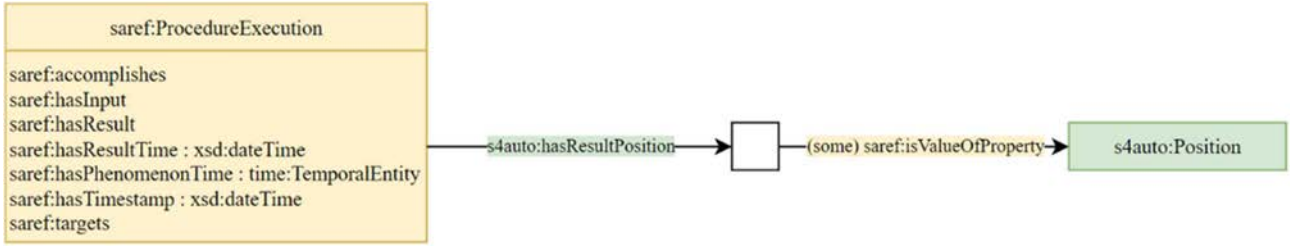

Figure 7: Addendum to saref:ProcedureExecution

6 Application of SAREF patterns

6.0 Overview

The present clause describes different applications of SAREF patterns, in conformance to ETSI TS 103 548 [2].

6.1 Specializations of saref:hasIdentifier

6.1.0 Overview

The datatype property saref:hasIdentifier is specialized in SAREF4AUTO as described in Figure 8.

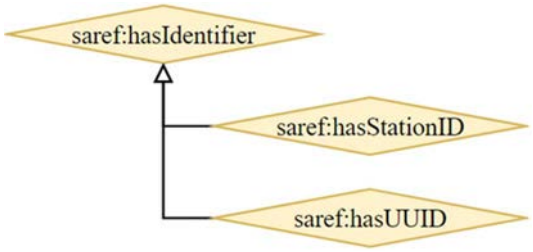

Figure 8: Specializations of saref:hasIdentifier

6.1.1 Identifier s4auto:hasStationID

Links automotive objects to their identifier as defined in ETSI TS 102 894-2 [i.8].

6.1.2 Identifier s4auto:hasUUID

A Universally Unique Identifier (UUID) is a 128-bit number used to identify items and is also known as: Globally Unique Identifier (GUID). In its canonical textual representation, the sixteen octets of a UUID are represented as 32 hexadecimal (base 16) digits, displayed in five groups separated by hyphens, in the form 8-4-4-4-12 for a total of 36 characters (32 alphanumeric characters and four hyphens). UUID are documented in ISO/IEC 11578 [i.10], Recommendation ITU-T X.667 [i.11] and in ISO/IEC 9834-8 [i.12].

6.2 Road topology

6.2.0 Overview

The present clause describes how the road topology can be represented with SAREF4AUTO, leveraging the SAREF4SYST extension of SAREF [2].

6.2.1 Roads and Road Segments

6.2.1.0 Overview

Figure 9 describes how roads consist of road segments, and intersections connect roads.

Different narrower kinds of road segment are defined following ETSI TS 102 894-2 [i.8].

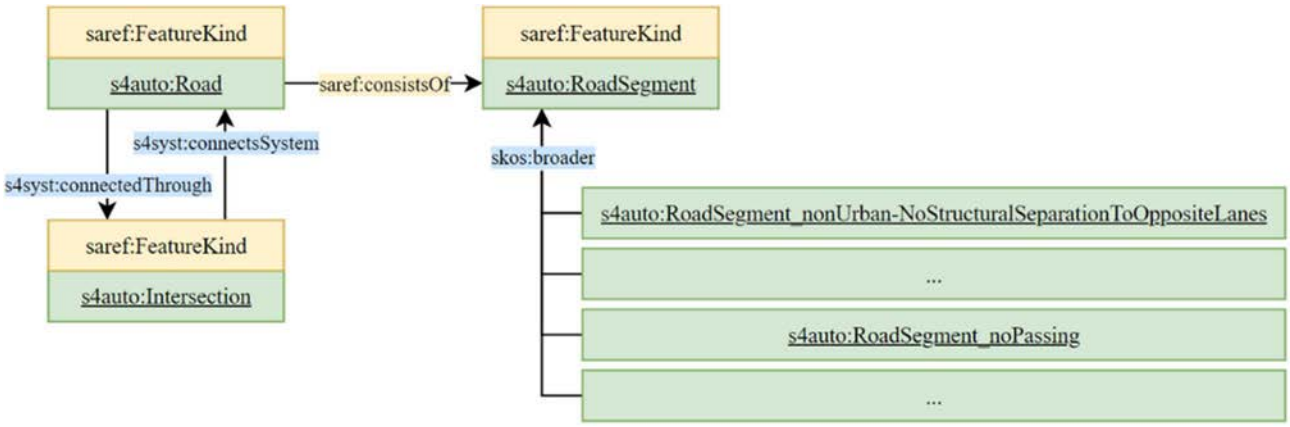

Figure 9:Roads and Road Segments

Figure 10 provides a practical example.

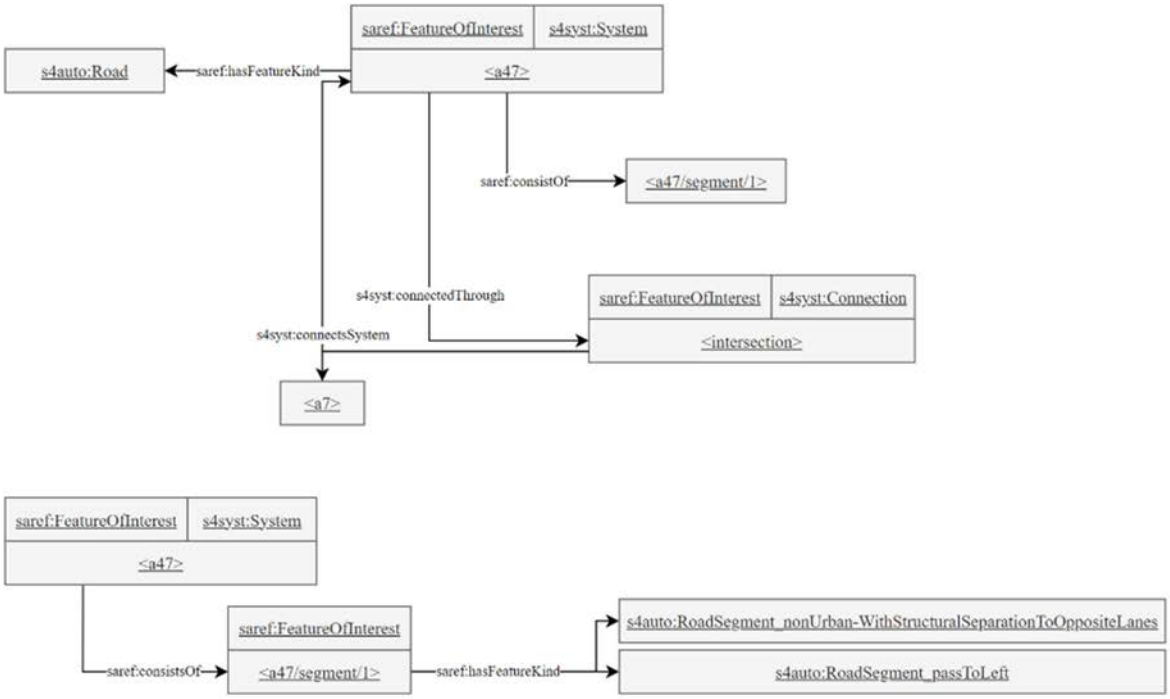

Figure 10: Example for Roads and Road Segments

6.2.1.1 Feature kind `s4auto:Intersection`

A unique intersection, identified in accordance with ETSI TS 103 301 [i.16].

6.2.1.2 Feature kind `s4auto:Road`

Roads consist of one or more `s4auto:RoadSegment` entities.

6.2.1.3 Feature kind `s4auto:RoadSegment`

6.2.1.3.0 Definition

A collection of road segments are used to describe a Road. Road segments consist of several lanes. a Road segment may consist of an inner hard shoulder and an outer hard shoulder.

6.2.1.3.1 Feature kind s4auto:RoadSegment_noPassing

Broader feature kind: s4auto:RoadSegment

Overtaking is prohibited for all vehicles.

6.2.1.3.2 Feature kind s4auto:RoadSegment_noPassingForTrucks

Broader feature kind: s4auto:RoadSegment

Overtaking is prohibited for trucks.

6.2.1.3.3 Feature kind s4auto:RoadSegment_nonUrban-NoStructuralSeparationToOppositeLanes

Broader feature kind: s4auto:RoadSegment

Non-urban road with no structural separation between lanes carrying traffic in opposite directions.

6.2.1.3.4 Feature kind s4auto:RoadSegment_nonUrban-WithStructuralSeparationToOppositeLanes

Broader feature kind: s4auto:RoadSegment

Non-urban road with structural separation between lanes carrying traffic in opposite directions.

6.2.1.3.5 Feature kind s4auto:RoadSegment_passToLeft

Broader feature kind: s4auto:RoadSegment

Vehicles should pass to the right lane.

6.2.1.3.6 Feature kind s4auto:RoadSegment_passToRight

Broader feature kind: s4auto:RoadSegment

Vehicles should pass to the left lane.

6.2.1.3.7 Feature kind s4auto:RoadSegment_urban-NoStructuralSeparationToOppositeLanes

Broader feature kind: s4auto:RoadSegment

Urban road with no structural separation between lanes carrying traffic in opposite directions.

6.2.1.3.8 Feature kind s4auto:RoadSegment_urban-WithStructuralSeparationToOppositeLanes

Broader feature kind: s4auto:RoadSegment

Urban road with structural separation between lanes carrying traffic in opposite directions.

6.2.2 Lanes

6.2.2.0 Overview

Figure 11 describes how road segments are composed of lanes. Lanes are identified by (saref:hasIdentifier) using integer numbers between 1 and n, being number 1 the lane to the right when going forwards. The forward direction is the direction denoted by the vector which goes from the segment's start point to the segment's endpoint.

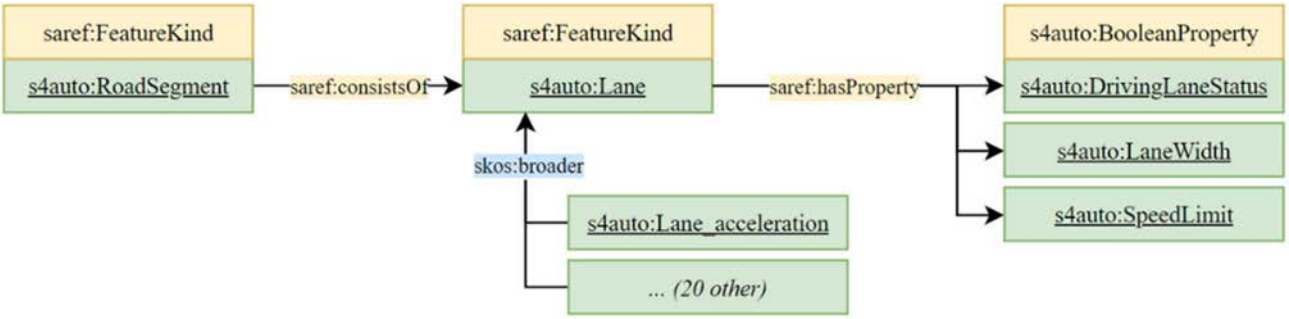

Figure 11: Lanes

Figure 12 provides a practical example.

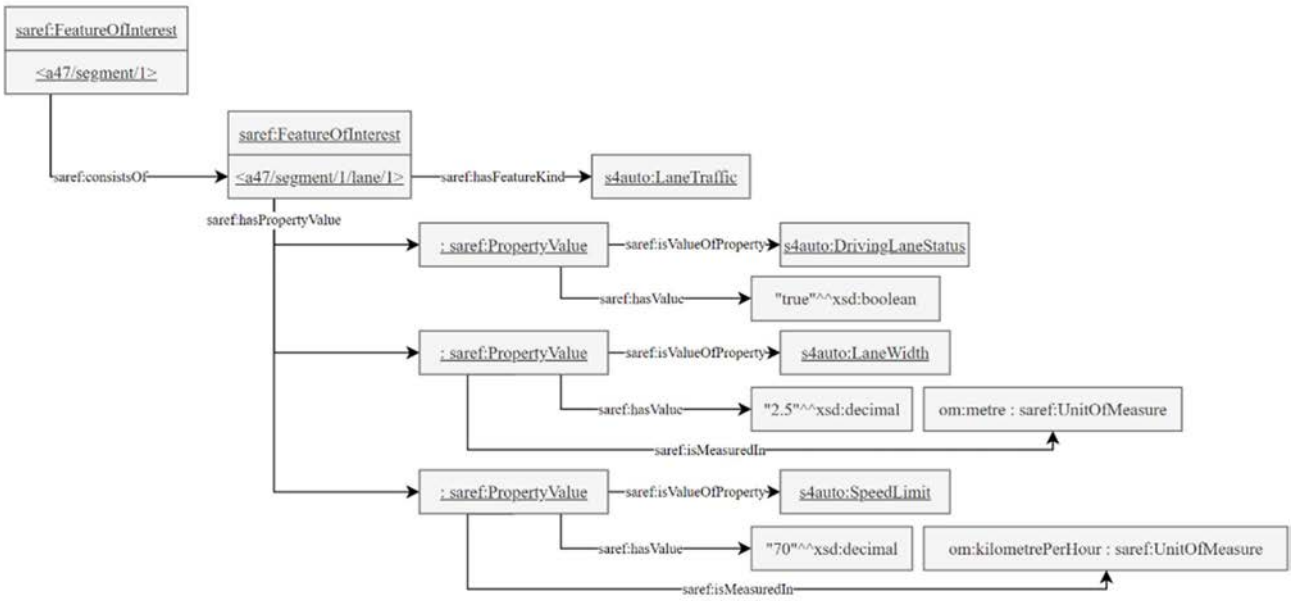

Figure 12: Example for Lanes

6.2.2.1 Feature kind `s4auto:Lane`

6.2.2.1.0 Definition

Lane of a road segment.

Lanes are identified by (`saref:hasIdentifier`) using integer numbers between 1 and n, being number 1 the lane to the right when going forwards. The forward direction is the direction denoted by the vector which goes from the segment's start point to the segment's endpoint.

6.2.2.1.1 Property `s4auto:DrivingLaneStatus`

In category: `s4auto:BooleanProperty`

Is property of: `s4auto:Lane`

This property indicates whether a driving lane is open to traffic.

If a lane is closed to traffic, the corresponding value shall be set to *TRUE*. Otherwise, it shall be set to *FALSE*.

6.2.2.1.2 Property `s4auto:LaneWidth`

Broader property: `s4auto:Length`

Is property of: s4auto:Lane

This property represents the width of a lane measured at a defined position.

6.2.2.1.3 Property s4auto:SpeedLimit

Broader property: s4auto:Velocity

Is property of: s4auto:Lane

This property represents a speed limitation applied to a geographical position, a road section or a geographical region.

6.2.2.1.4 Feature kind s4auto:Lane_acceleration

Broader feature kind: s4auto:Lane

Lane that allows vehicles entering a road to accelerate to the speed of through traffic before merging with it.

6.2.2.1.5 Feature kind s4auto:Lane_bus

Broader feature kind: s4auto:Lane

Lane dedicated to movement of buses providing public transport.

6.2.2.1.6 Feature kind s4auto:Lane_cycleLane

Broader feature kind: s4auto:Lane

Lane dedicated to exclusive or preferred use by bicycles.

6.2.2.1.7 Feature kind s4auto:Lane_deceleration

Broader feature kind: s4auto:Lane

Lane that allows vehicles exiting a road to decelerate before leaving it.

6.2.2.1.8 Feature kind s4auto:Lane_dedicatedVehicle

Broader feature kind: s4auto:Lane

Lane dedicated to movement of motor vehicles with specific characteristics, such as heavy goods vehicles, etc..

6.2.2.1.9 Feature kind s4auto:Lane_emergency

Broader feature kind: s4auto:Lane

Lane dedicated to vehicles in breakdown or to emergency vehicles also called hard shoulder.

6.2.2.1.10 Feature kind s4auto:Lane_hot

Broader feature kind: s4auto:Lane

Lanes that is allowed to be used without meeting the occupancy criteria by paying a toll.

6.2.2.1.11 Feature kind s4auto:Lane_hov

Broader feature kind: s4auto:Lane

Carpooling lane or high occupancy vehicle lane.

6.2.2.1.12 Feature kind s4auto:Lane_leftHandTurning

Broader feature kind: s4auto:Lane

Lane reserved for slowing down and making a left turn, so as not to disrupt traffic.

6.2.2.1.13 Feature kind s4auto:Lane_median

Broader feature kind: s4auto:Lane

Lane not dedicated to movement of vehicles but representing a median / central reservation such as the central median, separating the two directional carriageways of the highway.

6.2.2.1.14 Feature kind s4auto:Lane_minimumRiskManoeuvre

Broader feature kind: s4auto:Lane

Lane dedicated to automated vehicles making a minimum risk manoeuvre.

6.2.2.1.15 Feature kind s4auto:Lane_parking

Broader feature kind: s4auto:Lane

Lanes dedicated to vehicles parking, stopping and loading lanes.

6.2.2.1.16 Feature kind s4auto:Lane_pedestrian

Broader feature kind: s4auto:Lane

Lanes dedicated to pedestrians such as pedestrian sidewalk paths.

6.2.2.1.17 Feature kind s4auto:Lane_reversible

Broader feature kind: s4auto:Lane

Lane where the direction of traffic can be changed to match the peak flow.

6.2.2.1.18 Feature kind s4auto:Lane_rightHandTurning

Broader feature kind: s4auto:Lane

Lane reserved for slowing down and making a right turn so as not to disrupt traffic.

6.2.2.1.19 Feature kind s4auto:Lane_striping

Broader feature kind: s4auto:Lane

Lane not dedicated to movement of vehicles but covered with roadway markings.

6.2.2.1.20 Feature kind s4auto:Lane_taxi

Broader feature kind: s4auto:Lane

Lane dedicated to movement of taxis.

6.2.2.1.21 Feature kind s4auto:Lane_through

Broader feature kind: s4auto:Lane

Lane dedicated to the movement of vehicles travelling ahead and not turning.

6.2.2.1.22 Feature kind `s4auto:Lane_trackedVehicle`

Broader feature kind: `s4auto:Lane`

Lane dedicated to movement of trains, trams and trolleys.

6.2.2.1.23 Feature kind `s4auto:Lane_traffic`

Broader feature kind: `s4auto:Lane`

Lane dedicated to the movement of vehicles.

6.2.2.1.24 Feature kind `s4auto:Lane_verge`

Broader feature kind: `s4auto:Lane`

Lane representing the verge, i.e. a narrow strip of grass or plants and sometimes also trees located between the road surface edge and the boundary of a road.

6.2.3 Hard Shoulders

6.2.3.0 Overview

Figure 13 describes how road segments consist of hard shoulders.

Hard shoulders have a status property, that can therefore be observed or controlled.

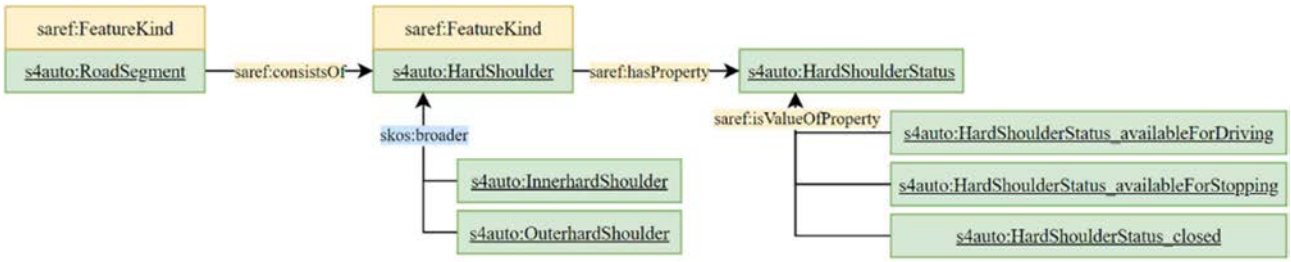

Figure 13: Hard Shoulders

Figure 14 provides a practical example.

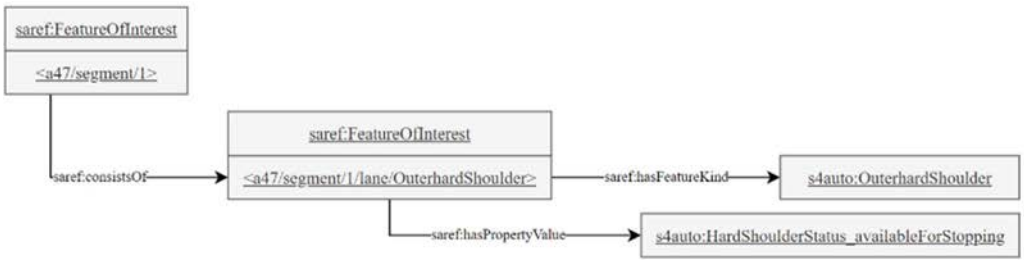

Figure 14: Example for Hard Shoulders

6.2.3.1 Feature kind `s4auto:HardShoulder`

6.2.3.1.0 Definition

A hard shoulder of a road segment. There are two main kinds of hard shoulders: inner hard shoulders, and outer hard shoulders.

6.2.3.1.1 Property s4auto:HardShoulderStatus

6.2.3.1.1.0 Definition

Is property of: s4auto:HardShoulder, s4auto:InnerhardShoulder, s4auto:OuterhardShoulder

This property indicates the current status of a hard shoulder: whether it is available for special usage (e.g. for stopping or for driving) or closed for all vehicles.

The following property values are defined:

0 availableForStopping - if the hard shoulder is available for stopping in e.g. emergency situations;

1 closed - if the hard shoulder is closed and cannot be occupied in any case;

2 availableForDriving - if the hard shoulder is available for regular driving.

6.2.3.1.1.1 Property value s4auto:HardShoulderStatus_availableForStopping

Is value of property: s4auto:HardShoulderStatus

Value: 0

0 availableForStopping - if the hard shoulder is available for stopping in e.g. emergency situations.

6.2.3.1.1.2 Property value s4auto:HardShoulderStatus_closed

Is value of property: s4auto:HardShoulderStatus

Value: 1

1 closed - if the hard shoulder is closed and cannot be occupied in any case.

6.2.3.1.1.3 Property value s4auto:HardShoulderStatus_availableForDriving

Is value of property: s4auto:HardShoulderStatus

Value: 2

2 availableForDriving - if the hard shoulder is available for regular driving.

6.2.3.1.2 Feature kind s4auto:InnerhardShoulder

Broader feature kind: s4auto:HardShoulder

The innerhard shoulder of a road segment.

6.2.3.1.3 Feature kind s4auto:OuterhardShoulder

Broader feature kind: s4auto:HardShoulder

The outerhard shoulder of a road segment.

6.3 Automotive Entities

6.3.0 Overview

Figure 15 describes the hierarchy of feature kinds defined by SAREF4AUTO.

Main kinds are also associated eponym classes (leveraging punning), such classes group the feature kind, narrower feature kinds, and features of interest of this kind.

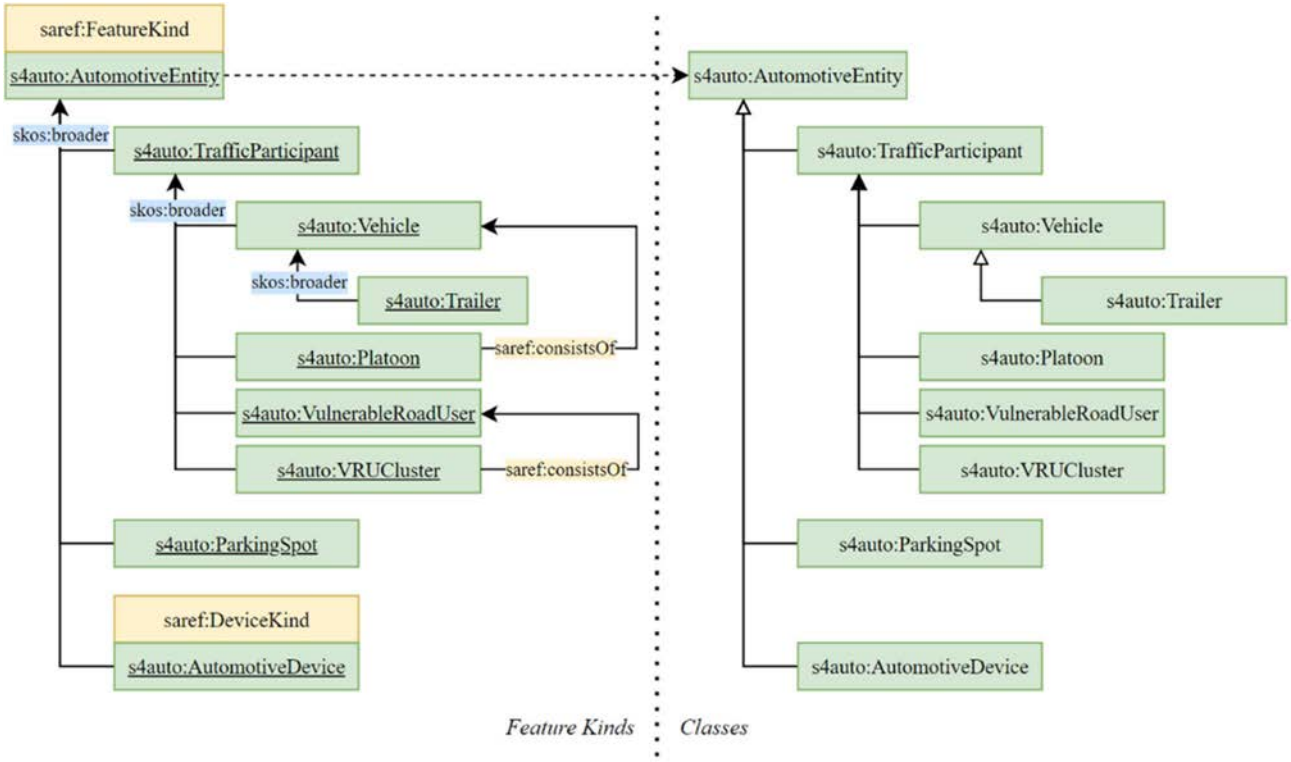

Figure 15: Automotive Entities

6.3.1 Feature kind `s4auto:AutomotiveEntity`

The main objects of interest in the automotive domain.

`s4auto:AutomotiveEntity` belongs to the eponym class `s4auto:AutomotiveEntity`. This class groups `s4auto:AutomotiveEntity`, narrower feature kinds, and features of interest of this kind.

6.3.2 Properties of Automotive Entities

6.3.2.0 Overview

The present clauses describes properties that apply to any automotive entity.

6.3.2.1 Position

6.3.2.1.0 Overview

Figure 16 illustrates the different ways the position of an automotive entity can be described.

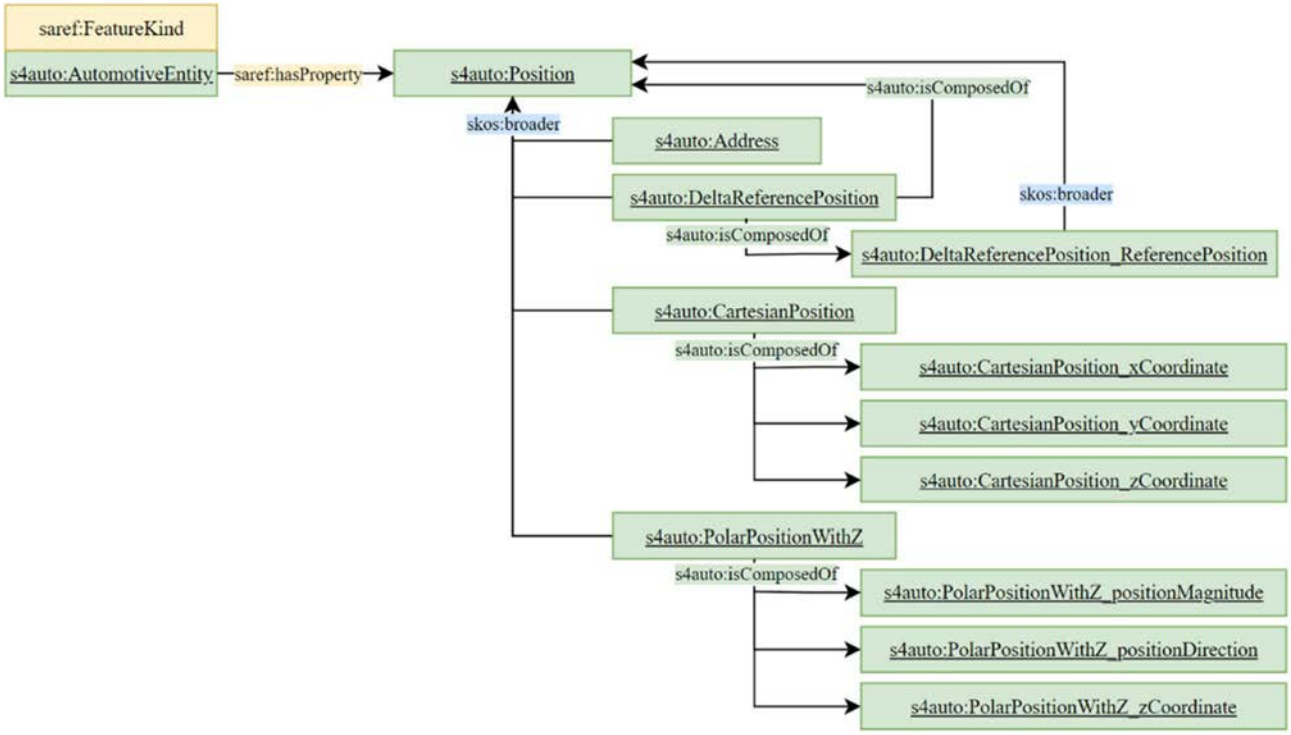

Figure 16: Position

6.3.2.1.1 Property `s4auto:Address`

Broader property: `s4auto:Position`

A position defined in terms of an address. It is out of scope of SAREF4AUTO to define the details of such an address. It is instead recommended to reuse existing ontologies that specify how to model an address in terms of Street, Postal Code, City, Region, Country, etc.

Figure 17 provides a practical example, using the vcard ontology.

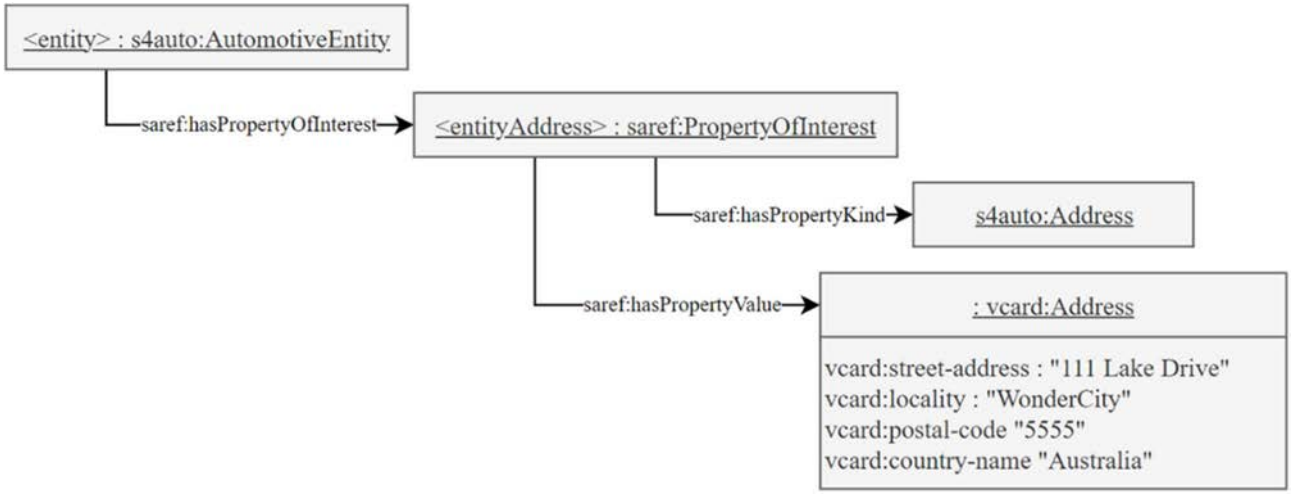

Figure 17: Example for Address

6.3.2.1.2 Property `s4auto:CartesianPosition`

6.3.2.1.2.0 Definition

Broader property: `s4auto:Position`

This property represents the position of an automotive object, expressed as a position vector in a cartesian coordinate system.

Figure 18 provides a practical example.

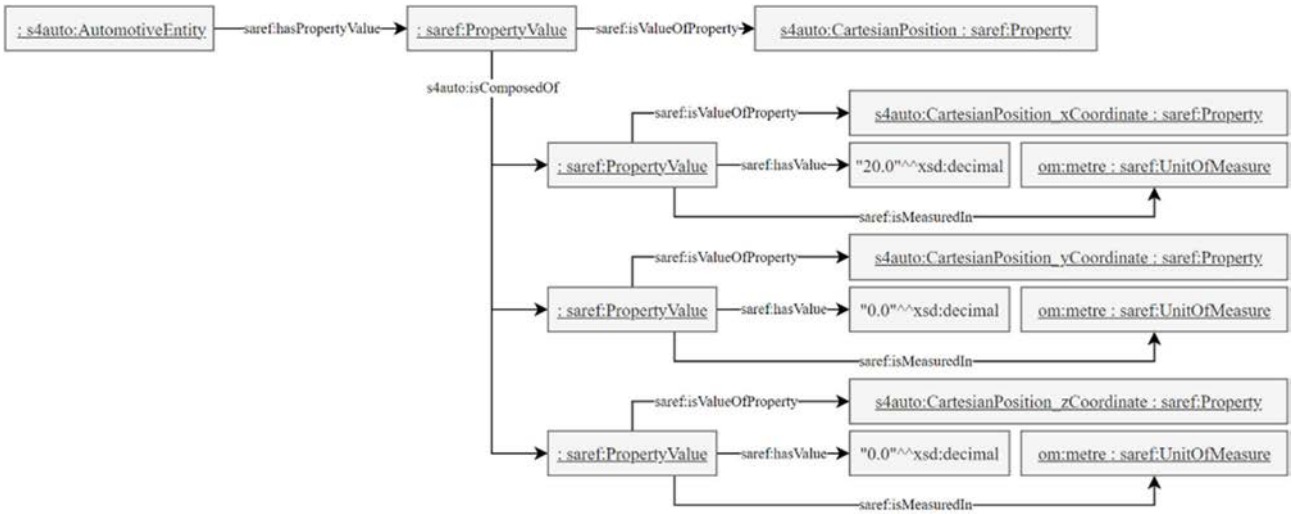

Figure 18: Example for Cartesian Position

6.3.2.1.2.1 Property `s4auto:CartesianPosition_xCoordinate`

Broader property: `s4auto:Length`

This property represents the x coordinate value.

6.3.2.1.2.2 Property `s4auto:CartesianPosition_yCoordinate`

Broader property: `s4auto:Length`

This property represents the y coordinate value.

6.3.2.1.2.3 Property `s4auto:CartesianPosition_zCoordinate`

Broader property: `s4auto:Length`

This property represents the z coordinate value.

6.3.2.1.3 Property `s4auto:DeltaReferencePosition`

6.3.2.1.3.0 Definition

Broader property: `s4auto:Position`

This property defines a geographical point position as a 3 dimensional offset position to a reference point.

Figure 19 provides a practical example.

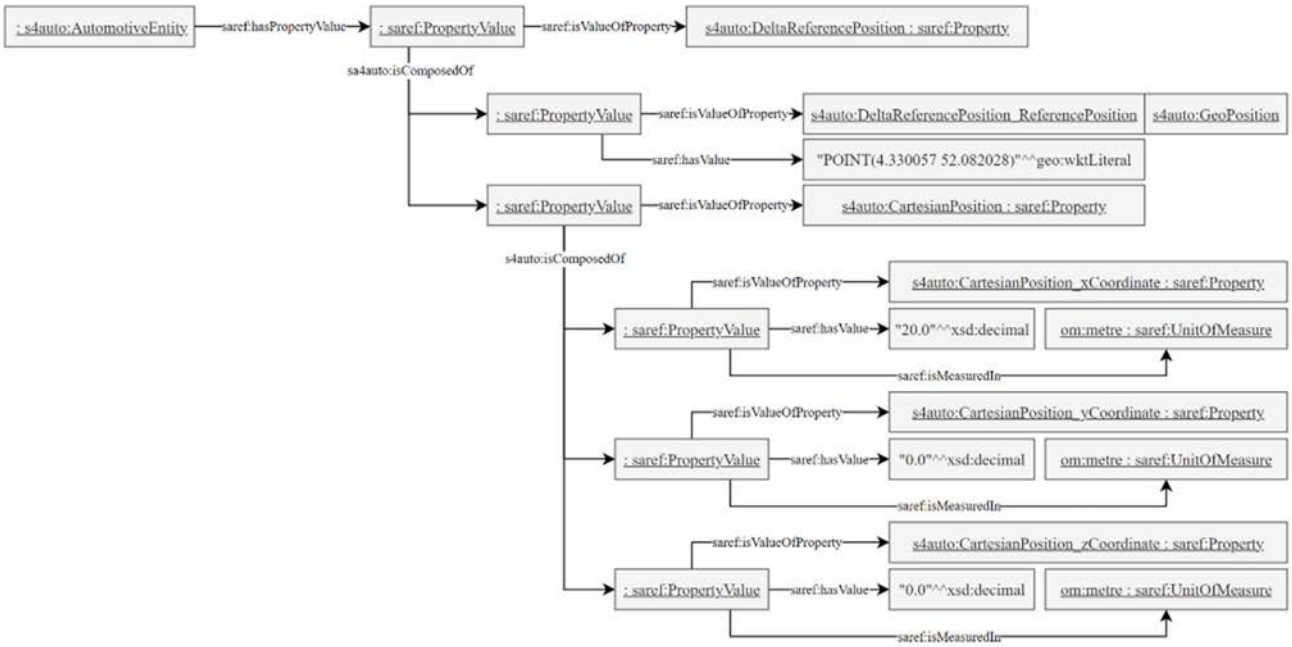

Figure 19: Example for Delta Reference Position

6.3.2.1.3.1 Property `s4auto:DeltaReferencePosition_ReferencePosition`

Broader property: `s4auto:Position`

This property represents the reference position for a delta reference position.

6.3.2.1.4 Property `s4auto:PolarPositionWithZ`

6.3.2.1.4.0 Definition

Broader property: `s4auto:Position`

This property represents the position of an automotive object, expressed in a polar or cylindrical coordinate system.

Figure 20 provides a practical example.

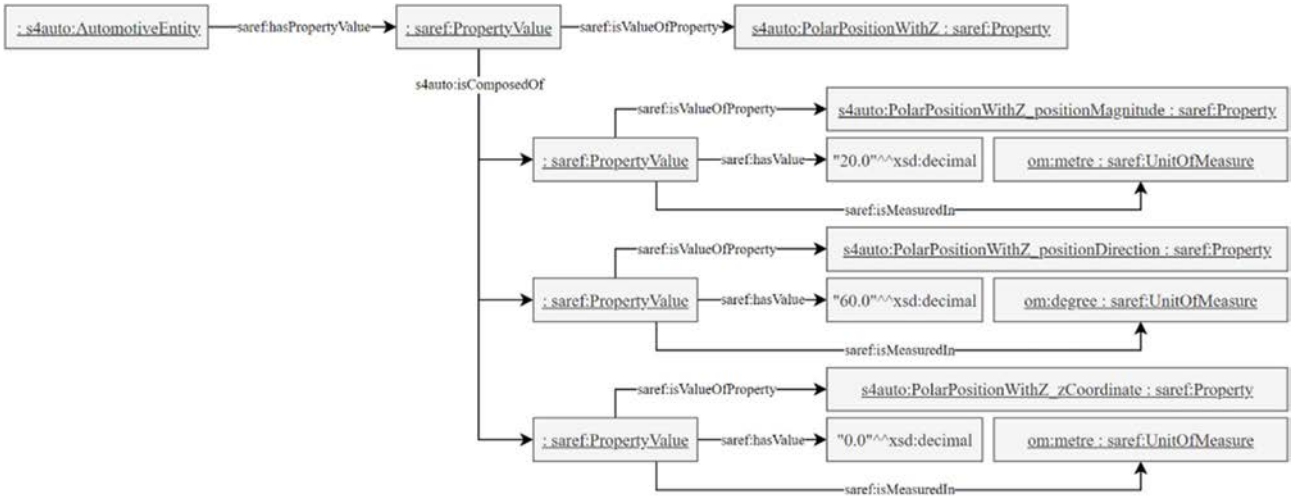

Figure 20: Example for Polar Position With Z

6.3.2.1.4.1 Property `s4auto:PolarPositionWithZ_positionDirection`

Broader property: `s4auto:CartesianAngle`

This property represents the polar angle of the position vector on the reference plane.

6.3.2.1.4.2 Property `s4auto:PolarPositionWithZ_positionMagnitude`

Broader property: `s4auto:Length`

This property represents the magnitude of the position vector on the reference plane. It should be a positive value.

6.3.2.1.4.3 Property `s4auto:PolarPositionWithZ_zCoordinate`

Broader property: `s4auto:Length`

This property represents the z coordinate value of the position vector along the reference axis of the cylindrical coordinate system.

6.3.2.2 Road Topology Position

6.3.2.2.0 Overview

Figure 21 illustrates how the position can be described relative to the road topology.

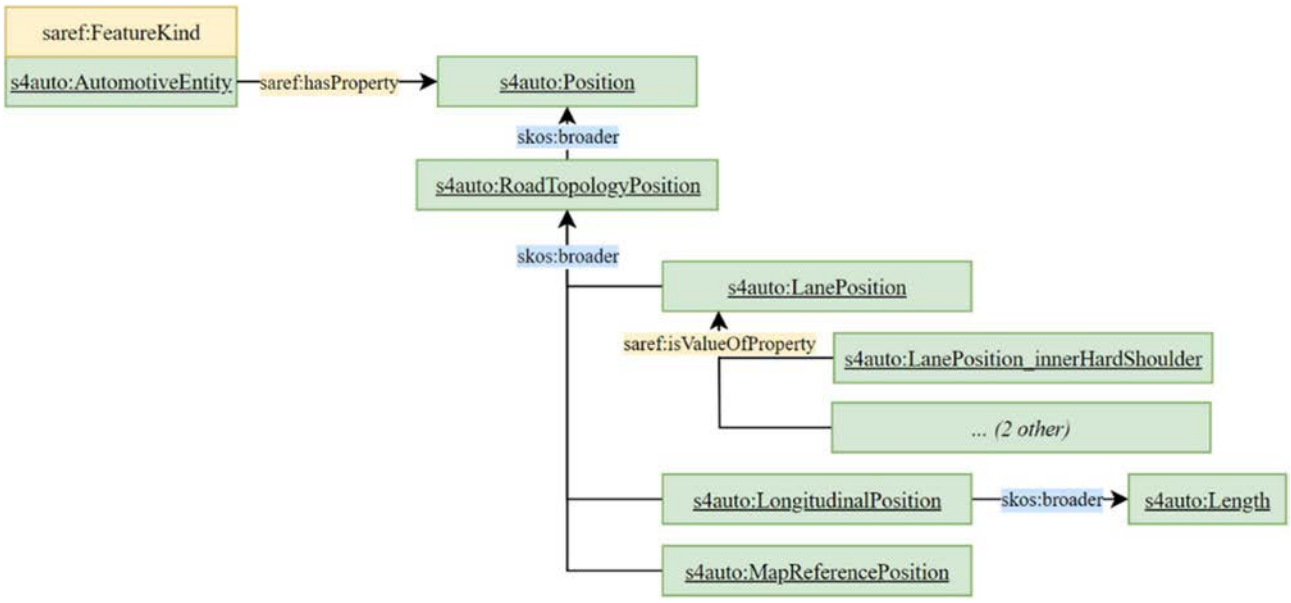

Figure 21: Road Topology Position

Figure 22 provides a practical example.

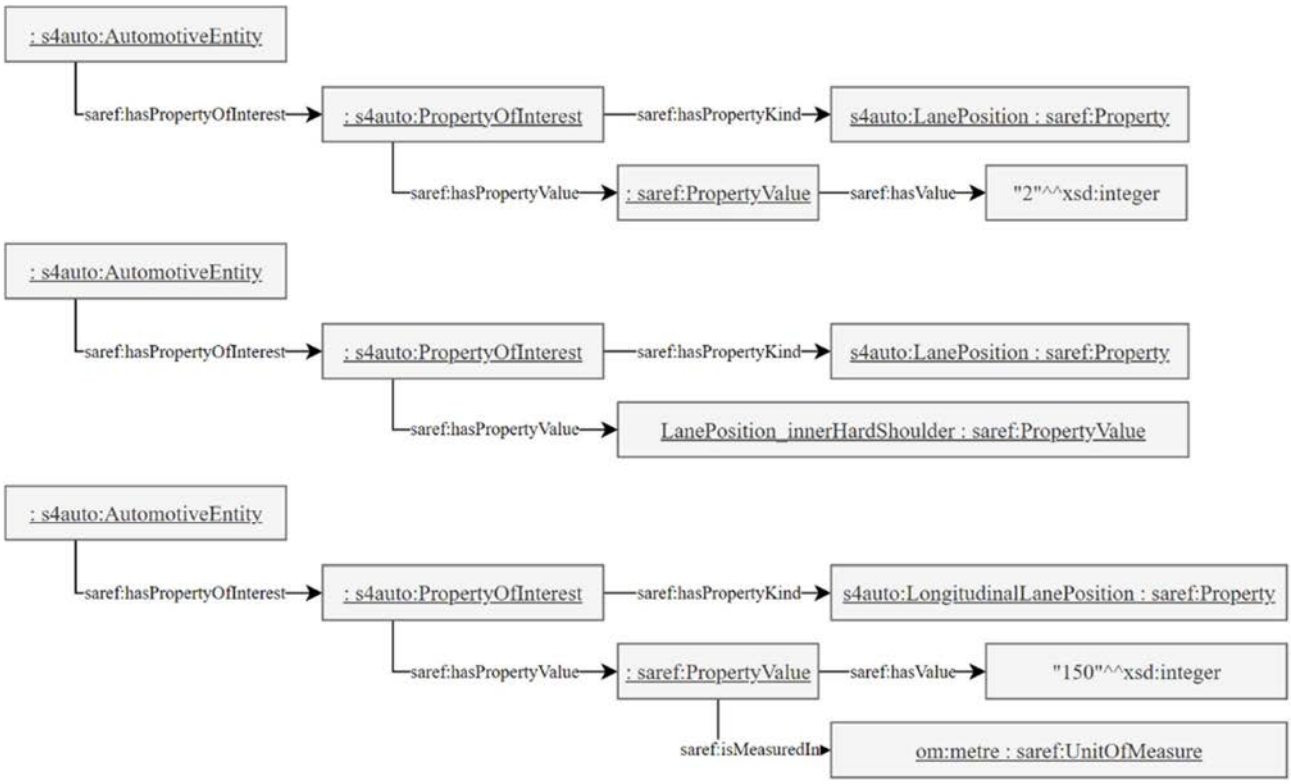

Figure 22: Example for Road Topology Position

6.3.2.2.1 Property `s4auto:RoadTopologyPosition`

Broader property: `s4auto:Position`

Position with respect to road topology (e.g. road, segment or lane) and lane characteristics (highway lane, road lane, bicycle lane, pavement, off-road).

6.3.2.2.2 Property `s4auto:LanePosition`

6.3.2.2.2.0 Definition

Broader property: `s4auto:Position`, `s4auto:RoadTopologyPosition`

This property indicates a transversal position on the carriageway at a specific longitudinal position, in resolution of lanes of the carriageway.

For right-hand traffic roads, the value shall be set to:

- `-1` if the position is off, i.e. besides the road;
- `0` if the position is on the inner hard shoulder, i.e. the hard should adjacent to the leftmost lane;
- `n` (`n > 0` and `n < 14`), if the position is on the n-th driving lane counted from the leftmost lane to the rightmost lane of a specific traffic direction;
- `14` if the position is on the outer hard shoulder, i.e. the hard should adjacent to rightmost lane (if present).

For left-hand traffic roads, the value shall be set to:

- `-1` if the position is off, i.e. besides the road;
- `0` if the position is on the inner hard shoulder, i.e. the hard should adjacent to the rightmost lane;
- `n` (`n > 0` and `n < 14`), if the position is on the n-th driving lane counted from the rightmost lane to the leftmost lane of a specific traffic direction;

- `14` if the position is on the outer hard shoulder, i.e. the hard should adjacent to leftmost lane (if present).

The following property values are defined:

- `s4auto:LanePosition_offTheRoad`;
- `s4auto:LanePosition_innerHardShoulder`;
- `s4auto:LanePosition_outerHardShoulder`.

6.3.2.2.2.1 Property value `s4auto:LanePosition_offTheRoad`

Is value of property: `s4auto:LanePosition`

Value: -1

`-1` the position is off, i.e. besides the road.

6.3.2.2.2.2 Property value `s4auto:LanePosition_innerHardShoulder`

Is value of property: `s4auto:LanePosition`

Value: 0

`0` if the position is on the inner hard shoulder, i.e. the hard should adjacent to the leftmost lane.

6.3.2.2.2.3 Property value `s4auto:LanePosition_outerHardShoulder`

Is value of property: `s4auto:LanePosition`

Value: 14

`14` if the position is on the outer hard shoulder, i.e. the hard should adjacent to leftmost lane (if present).

6.3.2.2.3 Property `s4auto:LongitudinalLanePosition`

Broader property: `s4auto:Length`, `s4auto:RoadTopologyPosition`

This property represents the estimated position along the longitudinal length of a particular lane.

6.3.2.2.4 Property `s4auto:MapReferencePosition`

Broader property: `s4auto:RoadTopologyPosition`

This property represents the estimated position as a reference to some road, road segment, lane, or intersection.

6.3.2.3 Shapes

6.3.2.3.0 Overview

Figure 28 describes how shapes of automotive entities can be described.

6.3.2.3.1 Property `s4auto:CircularShape`

6.3.2.3.1.0 Definition

Broader property: `s4auto:Shape`

Definition of a circular area or a right cylinder that is centred on the shape's reference point.

Figure 23 describes the definition of circular shapes. Figure 24 provides a practical example.

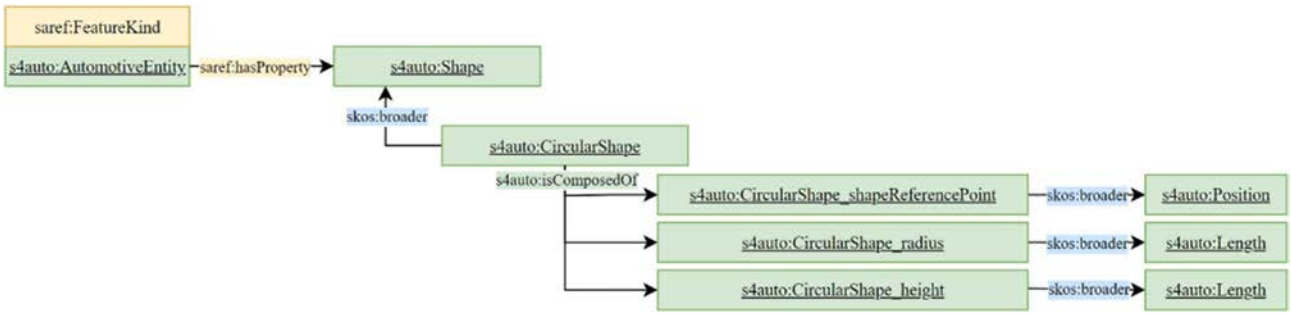

Figure 23: Circular Shapes

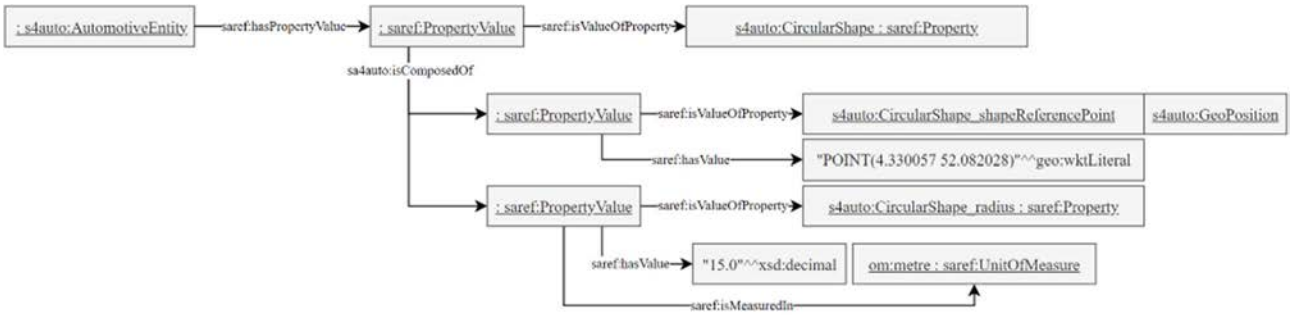

Figure 24: Example for Circular Shapes

6.3.2.3.1.1 Property `s4auto:CircularShape_height`

Broader property: `s4auto:Length`

Represents the height of a right cylinder extending in the positive z-axis.

6.3.2.3.1.2 Property `s4auto:CircularShape_radius`

Broader property: `s4auto:Length`

Represents the radius of the circular area.

6.3.2.3.1.3 Property `s4auto:CircularShape_shapeReferencePoint`

Broader property: `s4auto:Position`

Represents the centre of the base circle.

6.3.2.3.2 Property `s4auto:EllipticalShape`

6.3.2.3.2.0 Definition

Broader property: `s4auto:Shape`

Definition of an elliptical area or right elliptical cylinder that is centred on the shape's reference point.

Figure 25 describes the definition of circular shapes.

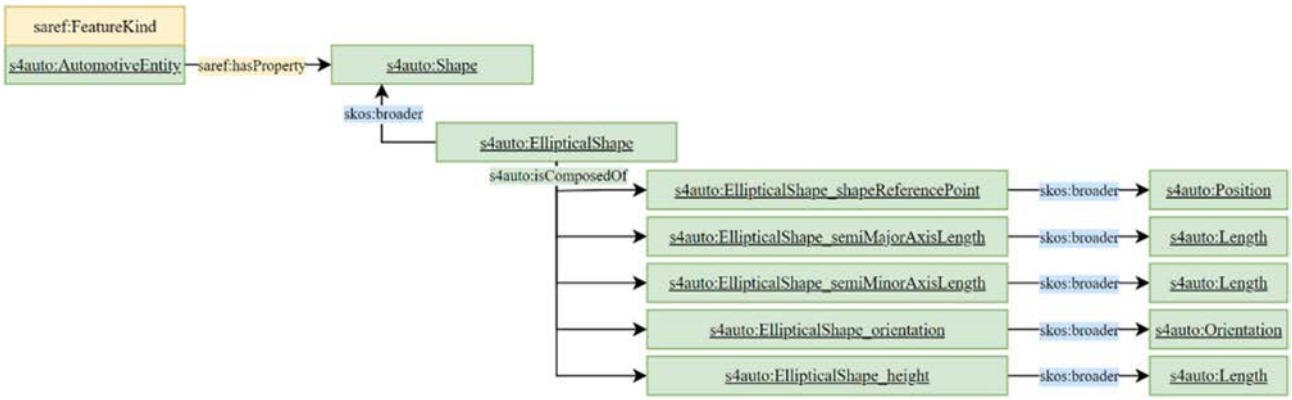

Figure 25: Elliptical Shapes

6.3.2.3.2.1 Property `s4auto:EllipticalShape_height`

Broader property: `s4auto:Length`

Represents the height of a right elliptical cylinder extending in the positive z-axis.

6.3.2.3.2.2 Property `s4auto:EllipticalShape_orientation`

Broader property: `s4auto:Orientation`

Represents the orientation of the major axis of the base ellipse.

6.3.2.3.2.3 Property `s4auto:EllipticalShape_semiMajorAxisLength`

In category: `s4auto:IndexedProperty`

Broader property: `s4auto:Length`

Represents half length of the major axis of the base ellipse.

6.3.2.3.2.4 Property `s4auto:EllipticalShape_semiMinorAxisLength`

In category: `s4auto:IndexedProperty`

Broader property: `s4auto:Length`

Represents half length of the minor axis of the base ellipse.

6.3.2.3.2.5 Property `s4auto:EllipticalShape_shapeReferencePoint`

Broader property: `s4auto:Position`

Represents the centre of the base ellipse.

6.3.2.3.3 Property `s4auto:PolygonalShape`

6.3.2.3.3.0 Definition

Broader property: `s4auto:Shape`

Definition of a polygonal area or of a right prism.

Figure 26 describes the definition of circular shapes. Figure 27 provides a practical example.

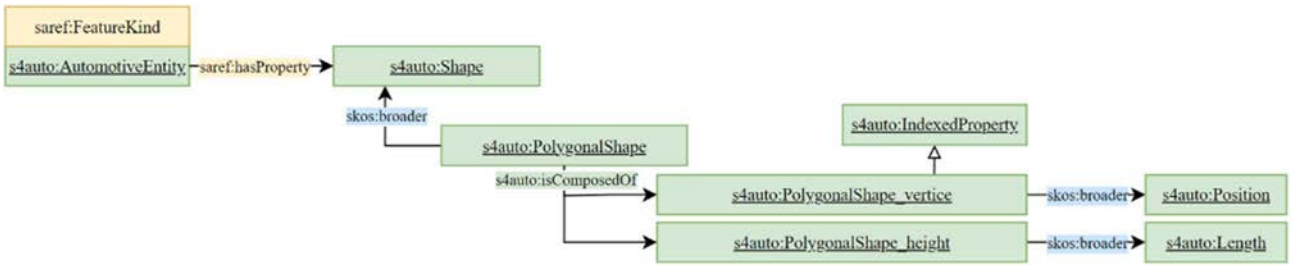

Figure 26: Polygonal Shapes

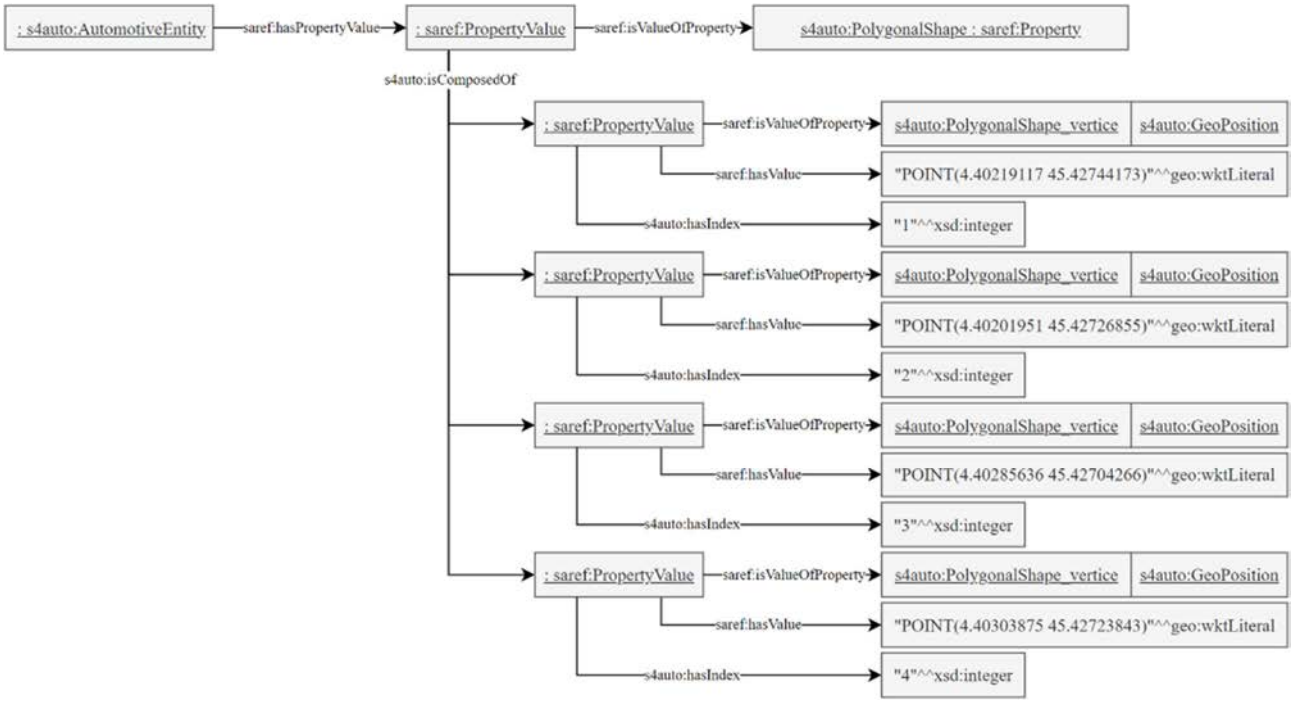

Figure 27: Example for Polygonal Shapes

6.3.2.3.3.1 Property `s4auto:PolygonalShape_height`

Broader property: `s4auto:Length`

Represents the height of a right prism extending in the positive z-axis.

6.3.2.3.3.2 Property `s4auto:PolygonalShape_vertice`

In category: `s4auto:IndexedProperty`

Broader property: `s4auto:Position`

Represents a vertice of the polygonal area or of the right prism base.

6.3.2.3.4 Property `s4auto:RectangularShape`

6.3.2.3.4.0 Definition

Broader property: `s4auto:Shape`

Definition of a rectangular area or a right rectangular prism (with a rectangular base) also called a cuboid, or informally a rectangular box.

Figure 28 describes the definition of circular shapes. Figure 29 provides a practical example.

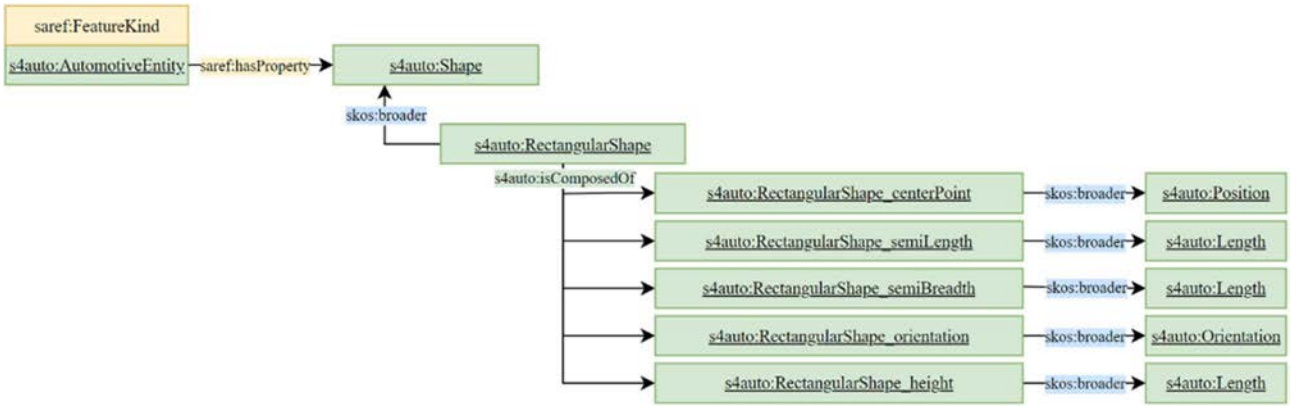

Figure 28: Rectangular Shapes

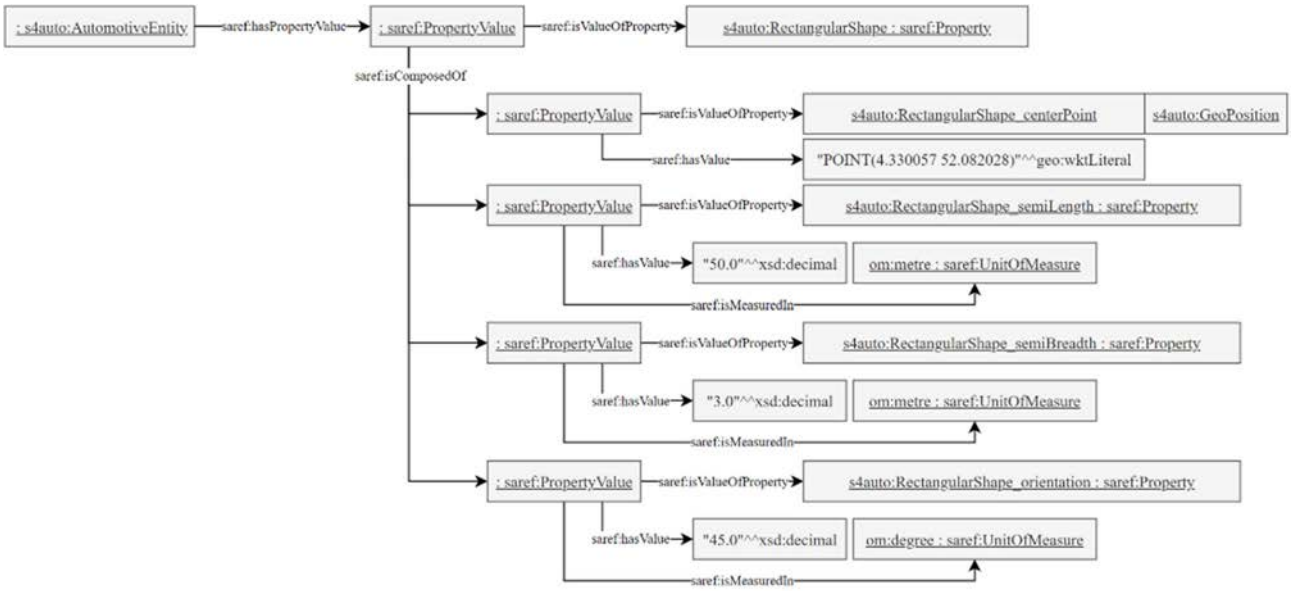

Figure 29: Example for Rectangular Shapes

6.3.2.3.4.1 Property `s4auto:RectangularShape_centerPoint`

Broader property: `s4auto:Position`

The centre point of a rectangular shape, expressed as a position.

6.3.2.3.4.2 Property `s4auto:RectangularShape_height`

Broader property: `s4auto:Length`

Represents the height of a right rectangular prism extending in the positive z-axis.

6.3.2.3.4.3 Property `s4auto:RectangularShape_orientation`

Broader property: `s4auto:Orientation`

Represents the orientation of the lenght of the base rectangle.

6.3.2.3.4.4 Property `s4auto:RectangularShape_semiBreadth`

Broader property: `s4auto:Length`

Represents half the breadth of the base rectangle.

6.3.2.3.4.5 Property `s4auto:RectangularShape_semiLength`

Broader property: `s4auto:Length`

Represents half the length of the base rectangle.

6.3.2.4 Velocity3d

6.3.2.4.0 Overview

Figure 30 illustrates how a velocity can be described.

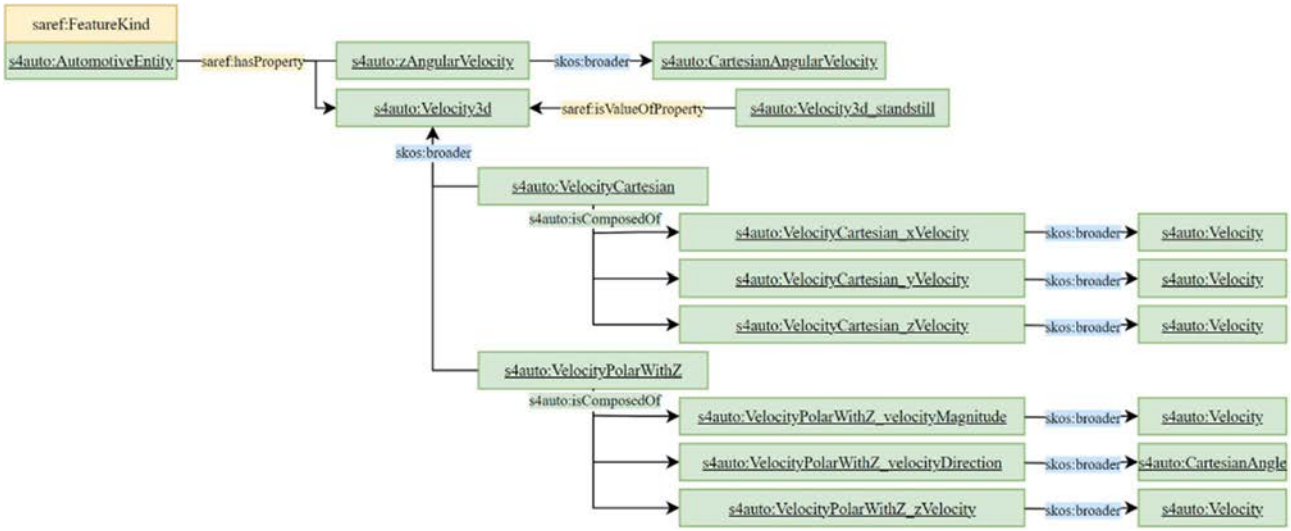

Figure 30: Velocity3d

6.3.2.4.1 Property `s4auto:Velocity3d`

6.3.2.4.1.0 Definition

Is property of: `s4auto:AutomotiveEntity`

This property represents the velocity of an automotive object.

6.3.2.4.1.1 Property value `s4auto:Velocity3d_standstill`

Is value of property: `s4auto:Velocity3d`

Value: 0

Named property value for velocity, when an object is in a standstill situation.

6.3.2.4.2 Property `s4auto:VelocityCartesian`

6.3.2.4.2.0 Definition

Broader property: `s4auto:Velocity3d`

This property represents the velocity of an automotive object, expressed as a velocity vector in a cartesian coordinate system.

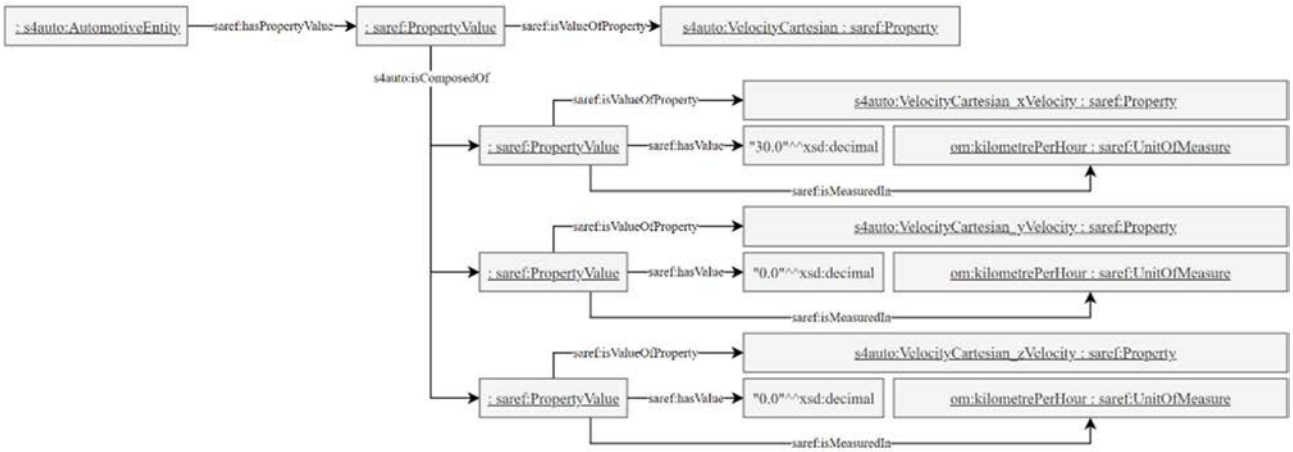

Figure 31: Example for Velocity Cartesian

6.3.2.4.2.1 Property `s4auto:VelocityCartesian_xVelocity`

Broader property: `s4auto:Velocity`

This property represents the x component of the velocity vector.

6.3.2.4.2.2 Property `s4auto:VelocityCartesian_yVelocity`

Broader property: `s4auto:Velocity`

This property represents the y component of the velocity vector.

6.3.2.4.2.3 Property `s4auto:VelocityCartesian_zVelocity`

Broader property: `s4auto:Velocity`

This property represents the z component of the velocity vector.

6.3.2.4.3 Property `s4auto:VelocityPolarWithZ`

6.3.2.4.3.0 Definition

Broader property: `s4auto:Velocity3d`

This property represents the velocity of an automotive object, expressed in a polar or cylindrical coordinate system.

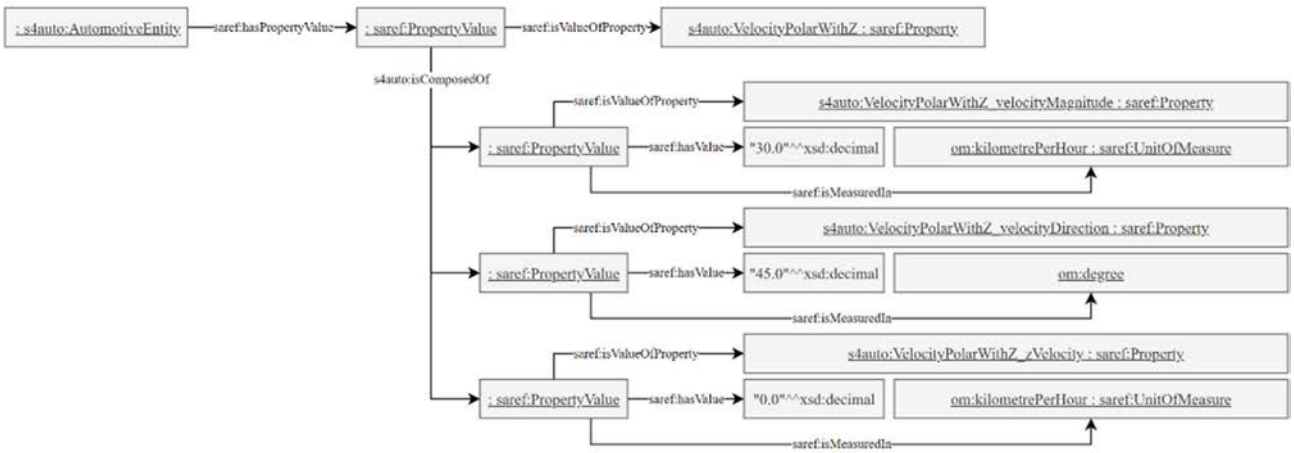

Figure 32: Example for Velocity Polar With Z

6.3.2.4.3.1 Property `s4auto:VelocityPolarWithZ_velocityDirection`

Broader property: `s4auto:CartesianAngle`

This property represents the polar angle of the velocity vector on the reference plane.

6.3.2.4.3.2 Property `s4auto:VelocityPolarWithZ_velocityMagnitude`

Broader property: `s4auto:Velocity`

This property represents the magnitude of the velocity vector on the reference plane. It should be a positive value.

6.3.2.4.3.3 Property `s4auto:VelocityPolarWithZ_zVelocity`

Broader property: `s4auto:Velocity`

This property represents the z component of the velocity vector along the reference axis of the cylindrical coordinate system.

6.3.2.4.4 Property `s4auto:zAngularVelocity`

Broader property: `s4auto:CartesianAngularVelocity`

Is property of: `s4auto:AutomotiveEntity`

This property represents the angular velocity of the object around the z-axis.
The angular velocity is measured with positive values considering the object orientation turning around the z-axis using the right-hand rule.

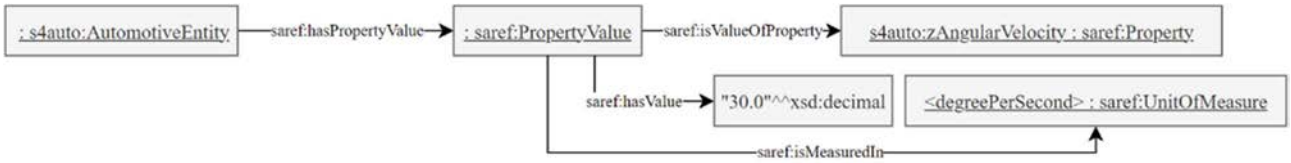

Figure 33: Example for z Angular Velocity

6.3.2.5 Heading

6.3.2.5.0 Overview

Figure 34 illustrates how heading can be described in SAREF4AUTO. Figure 35 provides practical examples.

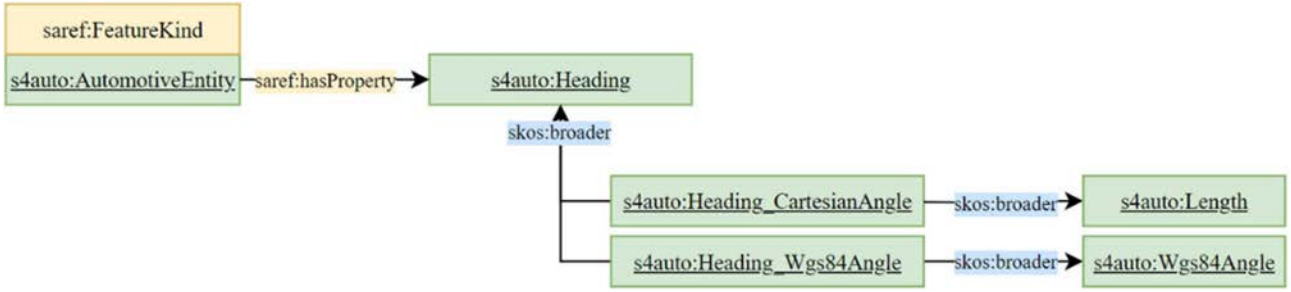

Figure 34: Heading

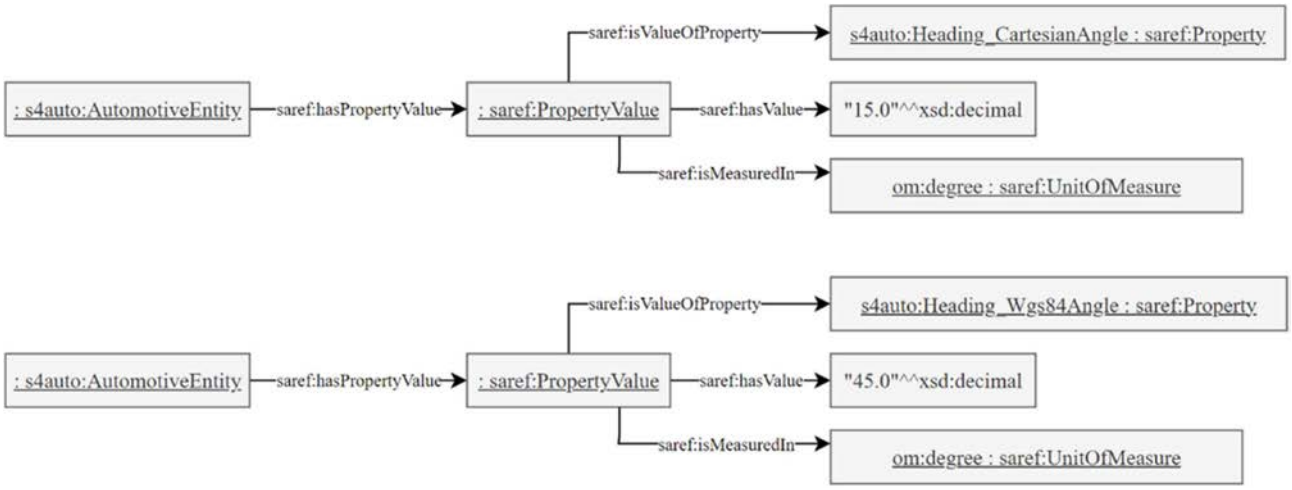

Figure 35: Example for Heading

6.3.2.5.1 Property `s4auto:Heading`

Is property of: `s4auto:AutomotiveEntity`

This property represents the orientation of the horizontal velocity vector of an automotive object.

6.3.2.5.2 Property `s4auto:Heading_CartesianAngle`

Broader property: `s4auto:CartesianAngle`, `s4auto:Heading`

This property represents the orientation of the horizontal velocity vector of an automotive object, expressed as an angle value described in a local Cartesian coordinate system, per default counted positive in a right-hand local coordinate system from the abscissa.

6.3.2.5.3 Property `s4auto:Heading_Wgs84Angle`

Broader property: `s4auto:Heading`, `s4auto:Wgs84Angle`

This property represents the orientation of the horizontal velocity vector of an automotive object, expressed as an angle value with regards to the WGS84 north.

6.3.2.6 Stationary Since

6.3.2.6.0 Overview

Figure 36 illustrates how heading can be described in SAREF4AUTO. Figure 37 provides practical examples.

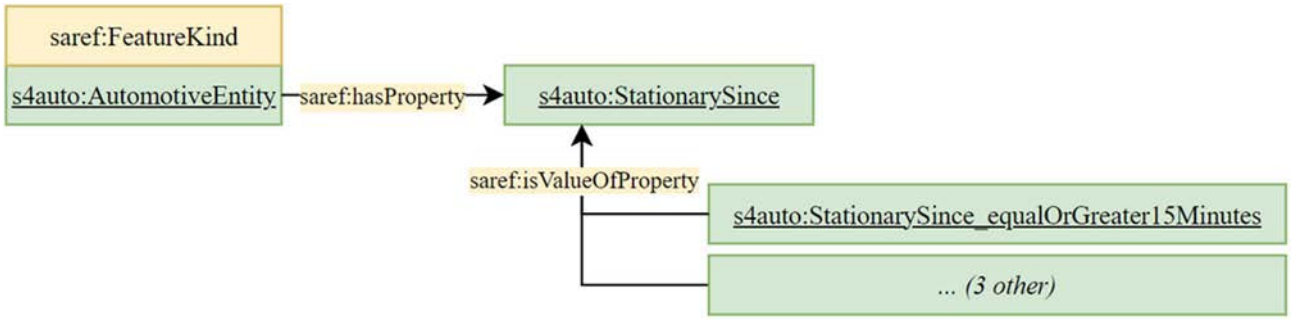

Figure 36: Stationary Since

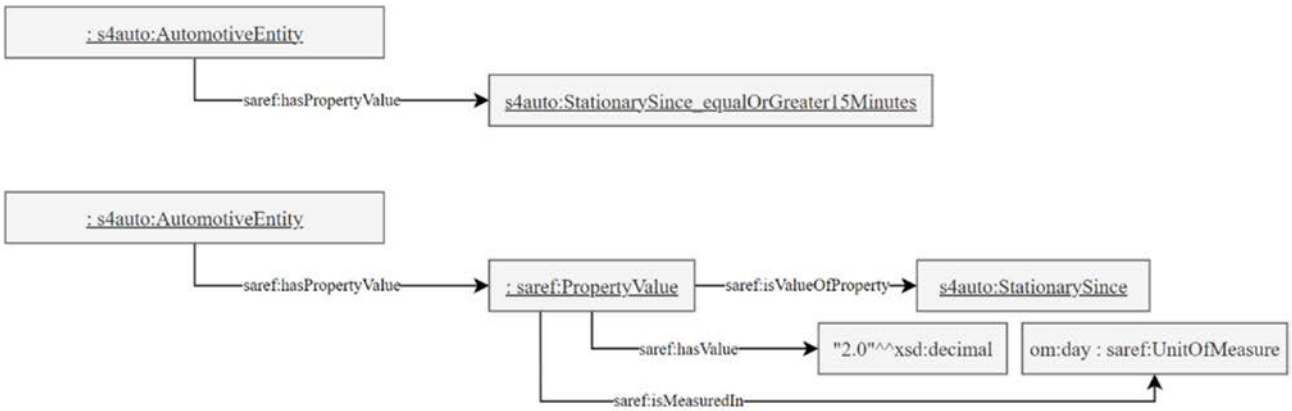

Figure 37: Example for Stationary Since

6.3.2.6.1 Property `s4auto:StationarySince`

6.3.2.6.1.0 Definition

Is property of: `s4auto:AutomotiveEntity`

This property indicates the duration since which an automotive object is stationary.

The following property values are defined:

- `s4auto:StationarySince_lessThan1Minute` - for being stationary since less than 1 minute;
- `s4auto:StationarySince_lessThan2Minutes` - for being stationary since less than 2 minute and for equal to or more than 1 minute;
- `s4auto:StationarySince_lessThan15Minutes` - for being stationary since less than 15 minutes and for equal to or more than 1 minute;
- `s4auto:StationarySince_equalOrGreater15Minutes` - for being stationary since equal to or more than 15 minutes.

6.3.2.6.1.1 Property value `s4auto:StationarySince_lessThan1Minute`

Is value of property: `s4auto:StationarySince`

Value: 0

0 `lessThan1Minute` - for being stationary since less than 1 minute.

6.3.2.6.1.2 Property value `s4auto:StationarySince_lessThan2Minutes`

Is value of property: `s4auto:StationarySince`

Value: 1

1 `lessThan2Minutes` - for being stationary since less than 2 minute and for equal to or more than 1 minute.

6.3.2.6.1.3 Property value `s4auto:StationarySince_lessThan15Minutes`

Is value of property: `s4auto:StationarySince`

Value: 2

2 `lessThan15Minutes` - for being stationary since less than 15 minutes and for equal to or more than 1 minute.

6.3.2.6.1.4 Property value `s4auto:StationarySince_equalOrGreater15Minutes`

Is value of property: `s4auto:StationarySince`

Value: 3

3 `equalOrGreater15Minutes` - for being stationary since equal to or more than 15 minutes.

6.3.2.7 Acceleration

6.3.2.7.0 Overview

Figure 38 illustrates how acceleration can be described in SAREF4AUTO. Figure 39 provides practical examples.

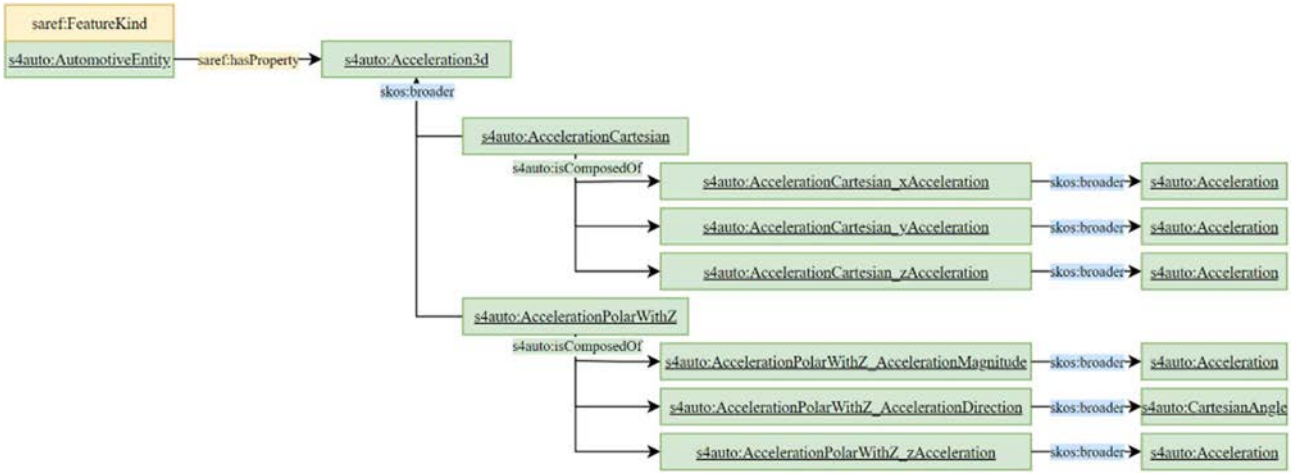

Figure 38: Acceleration

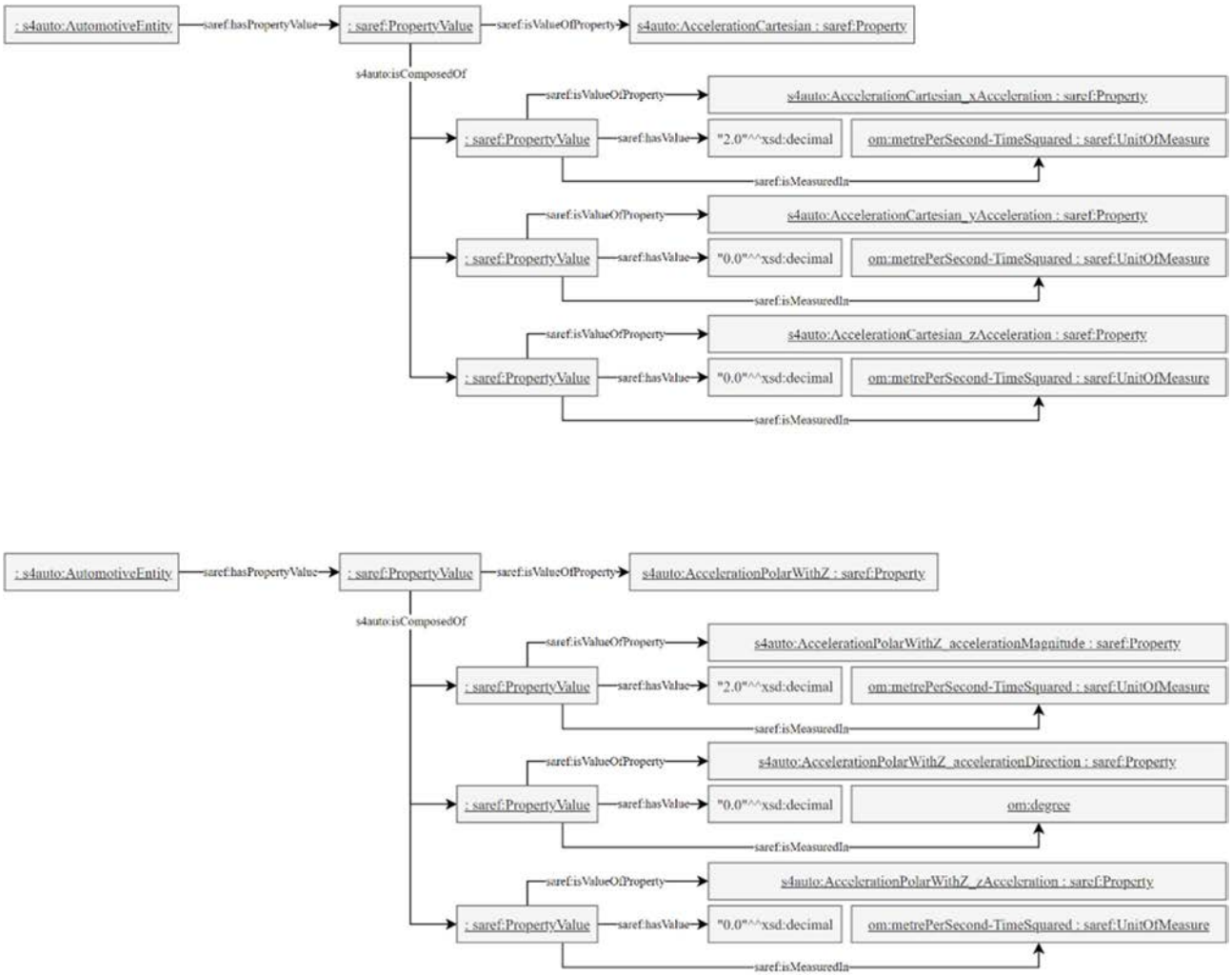

Figure 39: Example for Acceleration

6.3.2.7.1 Property `s4auto:Acceleration3d`

Is property of: `s4auto:AutomotiveEntity`

This property represents the acceleration of an automotive object.

6.3.2.7.2 Property `s4auto:AccelerationCartesian`

6.3.2.7.2.0 Definition

Broader property: `s4auto:Acceleration3d`

This property represents the acceleration of an automotive object, expressed as an acceleration vector in a cartesian coordinate system.

6.3.2.7.2.1 Property `s4auto:AccelerationCartesian_xAcceleration`

Broader property: `s4auto:Acceleration`

This property represents the x component of the acceleration vector.

6.3.2.7.2.2 Property s4auto:AccelerationCartesian_yAcceleration

Broader property: s4auto:Acceleration

This property represents the y component of the acceleration vector.

6.3.2.7.2.3 Property s4auto:AccelerationCartesian_zAcceleration

Broader property: s4auto:Acceleration

This property represents the z component of the acceleration vector.

6.3.2.7.3 Property s4auto:AccelerationPolarWithZ

6.3.2.7.3.0 Definition

Broader property: s4auto:Acceleration3d

This property represents the acceleration of an automotive object, expressed in a polar or cylindrical coordinate system.

6.3.2.7.3.1 Property s4auto:AccelerationPolarWithZ_accelerationDirection

Broader property: s4auto:CartesianAngle

This property represents the polar angle of the acceleration vector on the reference plane.

6.3.2.7.3.2 Property s4auto:AccelerationPolarWithZ_accelerationMagnitude

Broader property: s4auto:Acceleration

This property represents the magnitude of the acceleration vector on the reference plane. It should be a positive value.

6.3.2.7.3.3 Property s4auto:AccelerationPolarWithZ_zAcceleration

Broader property: s4auto:Acceleration

This property represents the z component of the acceleration vector along the reference axis of the cylindrical coordinate system.

6.3.3 AutomotiveObject

6.3.3.0 Overview

The present clause describes automotive objects, as narrower kinds of s4auto:AutomotiveEntity.

Figure 40 illustrates this relationship. Figure 41 provides a practical example.

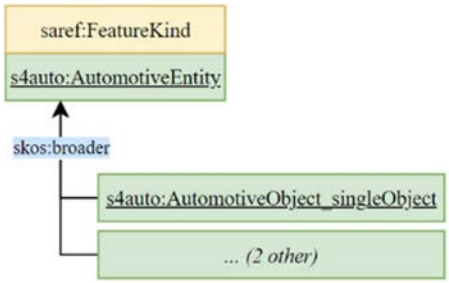

Figure 40: Automotive Object

Figure 41: Example for Automotive Object

6.3.3.1 Feature kind `s4auto:AutomotiveObject_bulkMaterial`

Broader feature kind: `s4auto:AutomotiveEntity`

The object is a bulk material.

6.3.3.2 Feature kind `s4auto:AutomotiveObject_multipleObjects`

Broader feature kind: `s4auto:AutomotiveEntity`

The object is a group of multiple objects.

6.3.3.3 Feature kind `s4auto:AutomotiveObject_singleObject`

Broader feature kind: `s4auto:AutomotiveEntity`

The object is a single object.

6.3.4 Traffic Participant

6.3.4.0 Overview

Traffic participants include vehicles of different kinds, vulnerable road users such as pedestrians and cyclists, roadside units. As illustrated in Figure 42, different narrower kinds are defined. Figure 43 provides a practical example.

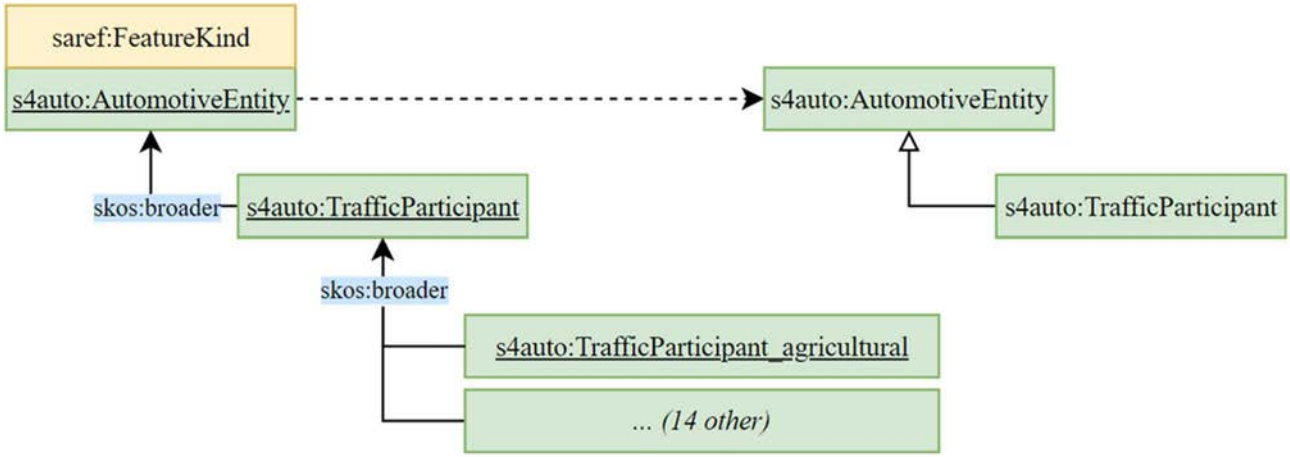

Figure 42: Traffic Participants

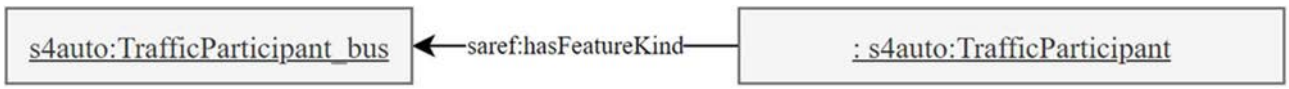

Figure 43: Example for Traffic Participant

6.3.4.1 Feature kind s4auto:TrafficParticipant

6.3.4.1.0 Definition

Broader feature kind: s4auto:AutomotiveEntity

Traffic participants include vehicles of different kinds, vulnerable road users such as pedestrians and cyclists, roadside units.

s4auto:TrafficParticipant belongs to the eponym class s4auto:TrafficParticipant. This class groups s4auto:TrafficParticipant, narrower feature kinds, and features of interest of this kind.

6.3.4.1.1 Feature kind s4auto:TrafficParticipant_agricultural

Broader feature kind: s4auto:TrafficParticipant

Agricultural and forestry vehicles as defined in UNECE/TRANS/WP.29/78/Rev.4 [i.17], class T.

6.3.4.1.2 Feature kind s4auto:TrafficParticipant_animal

Broader feature kind: s4auto:TrafficParticipant

Animal presenting a safety risk to other road users e.g. domesticated dog in a city or horse (VRU Profile 4).

6.3.4.1.3 Feature kind s4auto:TrafficParticipant_bus

Broader feature kind: s4auto:TrafficParticipant

Large passenger vehicles as defined in UNECE/TRANS/WP.29/78/Rev.4 [i.17], class M2, M3.

6.3.4.1.4 Feature kind s4auto:TrafficParticipant_cyclist

Broader feature kind: s4auto:TrafficParticipant

Non-motorized unicycles, bicycles , tricycles, quadracycles (VRU profile 2).

6.3.4.1.5 Feature kind s4auto:TrafficParticipant_heavyTruck

Broader feature kind: s4auto:TrafficParticipant

Heavy Goods Vehicles as defined in UNECE/TRANS/WP.29/78/Rev.4 [i.17], class N2 and N3.

6.3.4.1.6 Feature kind s4auto:TrafficParticipant_lightTruck

Broader feature kind: s4auto:TrafficParticipant

Light Goods Vehicles as defined in UNECE/TRANS/WP.29/78/Rev.4 [i.17], class N1.

6.3.4.1.7 Feature kind s4auto:TrafficParticipant_lightVruVehicle

Broader feature kind: s4auto:TrafficParticipant

Human being traveling on light vehicle, incl. possible use of roller skates or skateboards (VRU profile 2).

6.3.4.1.8 Feature kind s4auto:TrafficParticipant_moped

Broader feature kind: s4auto:TrafficParticipant

Light motor vehicles with less than four wheels as defined in UNECE/TRANS/WP.29/78/Rev.4 [i.17], class L1, L2 (VRU Profile 3).

6.3.4.1.9 Feature kind s4auto:TrafficParticipant_motorcycle

Broader feature kind: s4auto:TrafficParticipant

Motor vehicles with less than four wheels as defined in UNECE/TRANS/WP.29/78/Rev.4 [i.17], class L3, L4, L5, L6, L7 (VRU Profile 3).

6.3.4.1.10 Feature kind s4auto:TrafficParticipant_passengerCar

Broader feature kind: s4auto:TrafficParticipant

Small passenger vehicles as defined in UNECE/TRANS/WP.29/78/Rev.4 [i.17], class M1.

6.3.4.1.11 Feature kind s4auto:TrafficParticipant_pedestrian

Broader feature kind: s4auto:TrafficParticipant

Human being not using a mechanical device for their trip (VRU profile 1).

6.3.4.1.12 Feature kind s4auto:TrafficParticipant_roadSideUnit

Broader feature kind: s4auto:TrafficParticipant

Infrastructure typically positioned outside of the drivable roadway (e.g. on a gantry, on a pole, on a stationary road works trailer); the infrastructure is static during the entire operation period of the ITS-S (e.g. no stop and go activity).

6.3.4.1.13 Feature kind s4auto:TrafficParticipant_specialVehicle

Broader feature kind: s4auto:TrafficParticipant

Vehicles which have special purposes other than the above (e.g. moving road works vehicle).

6.3.4.1.14 Feature kind s4auto:TrafficParticipant_trailer

Broader feature kind: s4auto:TrafficParticipant

Unpowered vehicle that is intended to be towed by a powered vehicle as defined in UNECE/TRANS/WP.29/78/Rev.4 [i.17], class O.

6.3.4.1.15 Feature kind s4auto:TrafficParticipant_tram

Broader feature kind: s4auto:TrafficParticipant

Vehicle which runs on tracks along public streets.

6.3.4.2 Safe Distances and Collisions

6.3.4.2.0 Overview

As illustrated on Figure 44, safe distances and collisions are Boolean properties. Trajectory interception probability is a decimal property.

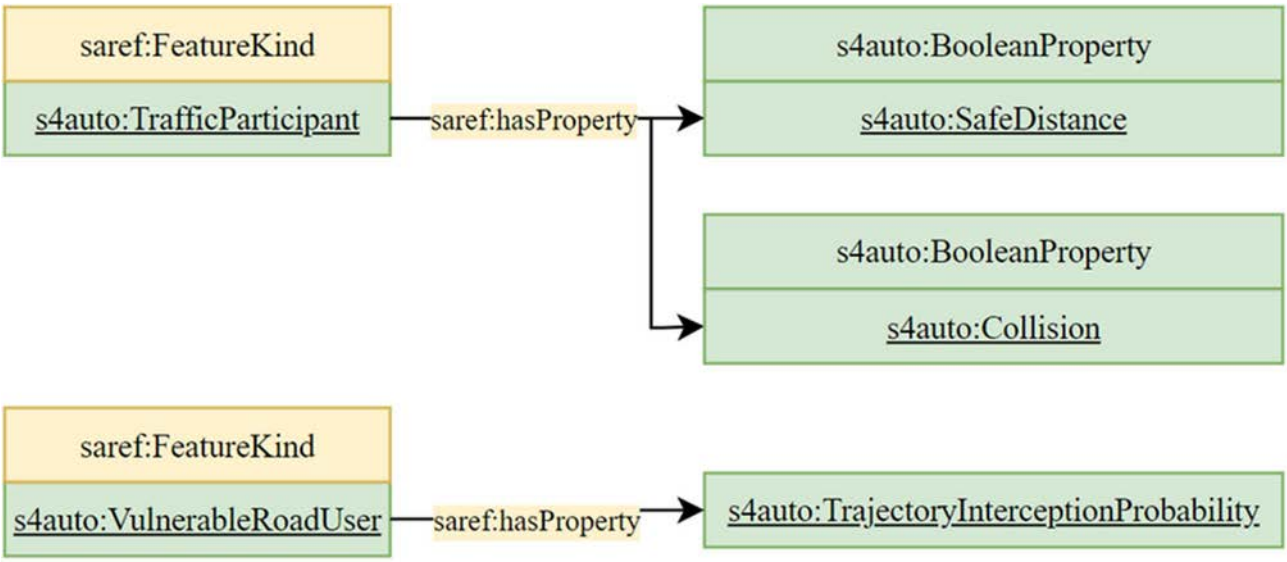

Figure 44: Safe Distances and Collisions

6.3.4.2.1 Property `s4auto:Collision`

In category: `s4auto:BooleanProperty`

Is property of: `s4auto:TrafficParticipant`

This property indicates if collision holds between an observer traffic participant and the traffic participant holding this property.

The value for this property is *TRUE* if the collision is expected to occur, or has occurred. The phenomenonTime indicates the time of the collision

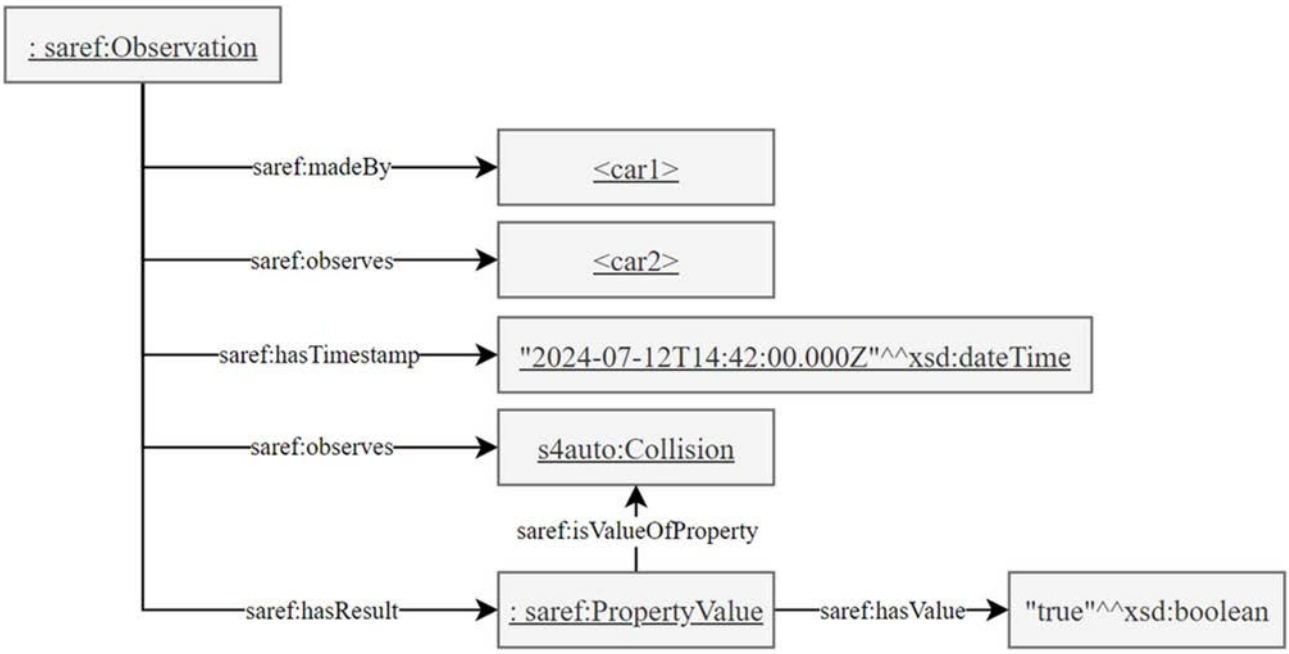

Figure 45: Example for Collision

6.3.4.2.2 Property `s4auto:SafeDistance`

In category: `s4auto:BooleanProperty`

Is property of: `s4auto:TrafficParticipant`

This property indicates if a distance from an observer traffic participant to the traffic participant holding this property is safe.

The value for this property is *FALSE* if the triple {LaD, LoD, VD} < {MSLaD, MSLoD, MSVD} is simultaneously satisfied with confidence level of 90 % or more.

The abbreviations used are Lateral Distance (LaD), Longitudinal Distance (LoD) and Vertical Distance (VD) and their respective thresholds, Minimum Safe Lateral Distance (MSLaD), Minimum Safe Longitudinal Distance (MSLoD), and Minimum Safe Vertical Distance (MSVD).

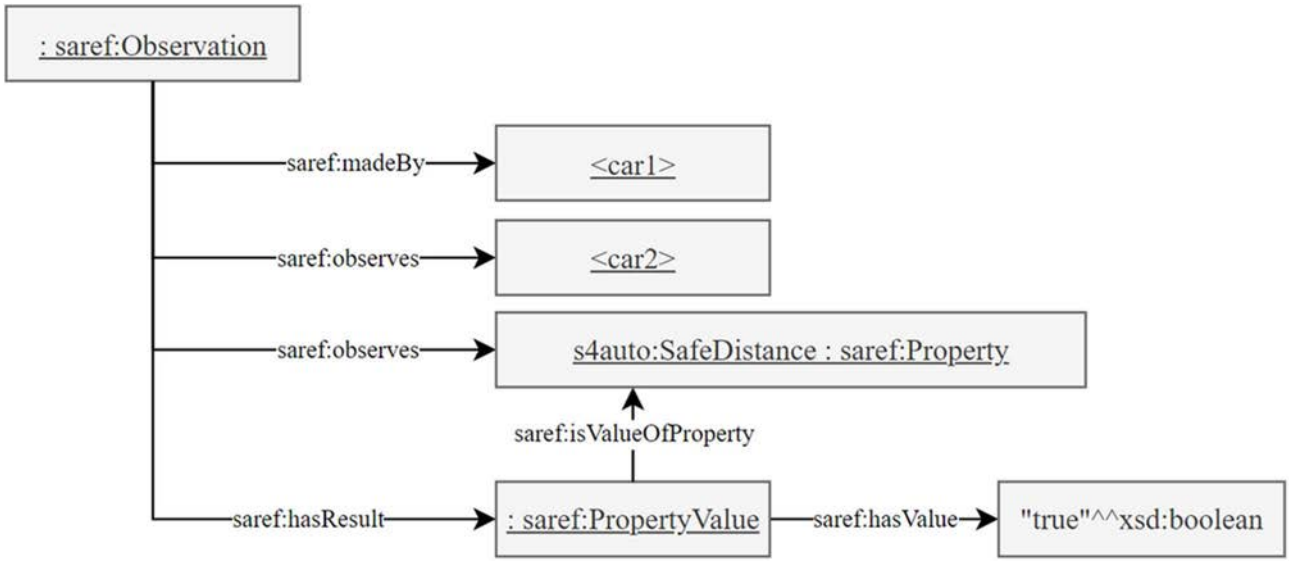

Figure 46: Example for Safe Distance

6.3.4.2.3 Property `s4auto:TrajectoryInterceptionProbability`

Is property of: `s4auto:VulnerableRoadUser`

This property indicates the probability that the observer's trajectory intercepts with the trajectory of the VRU holding this property.

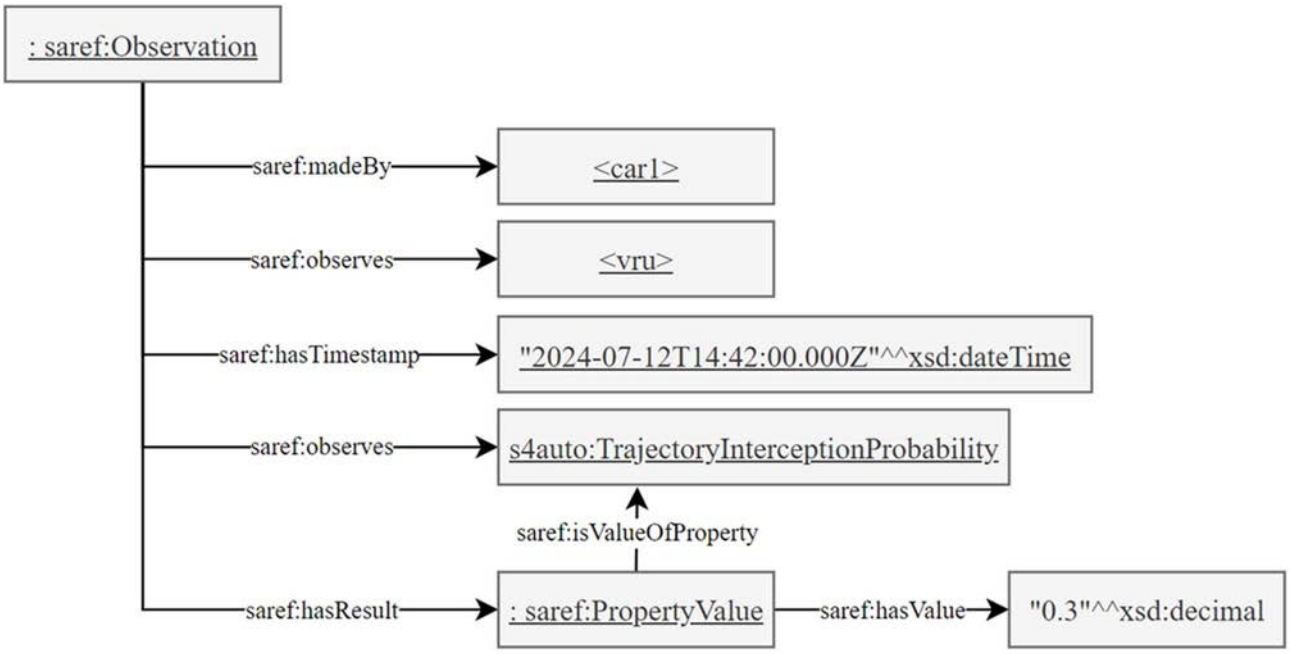

Figure 47: Example for Trajectory Interception Probability

6.3.5 Vehicle

6.3.5.0 Overview

SAREF4AUTO defines different narrower kinds of Vehicle, as illustrated on Figure 48.

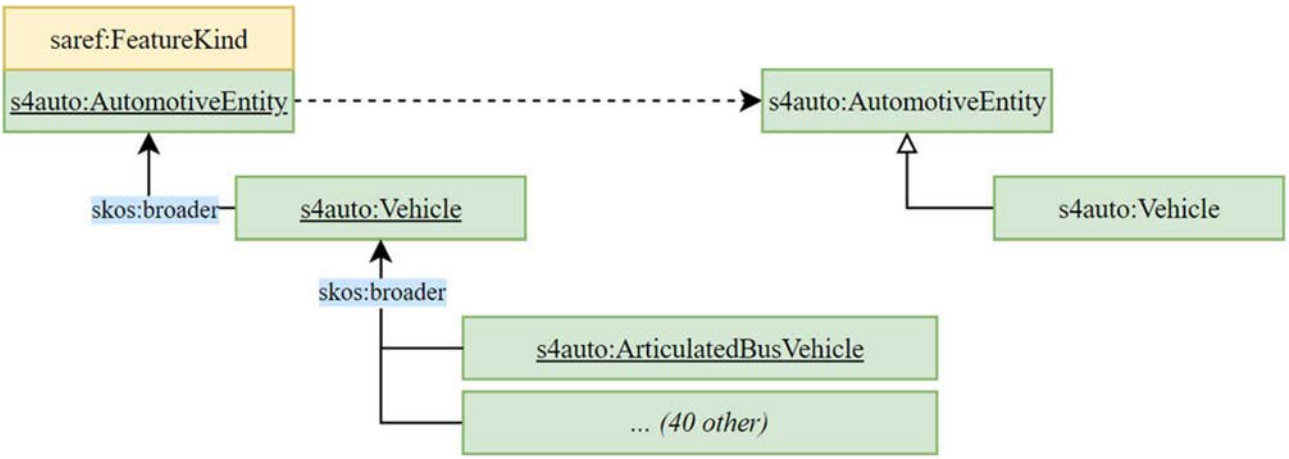

Figure 48: Vehicle

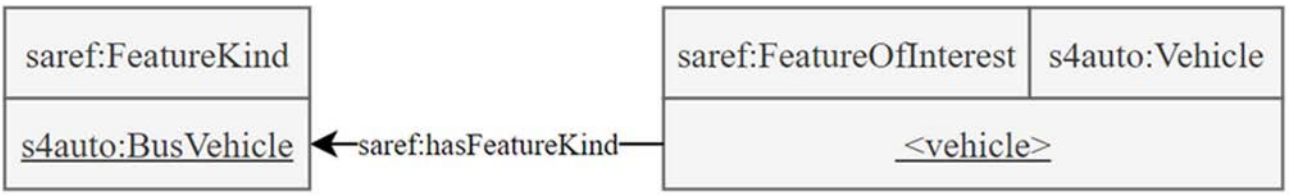

Figure 49: Example for Vehicle

6.3.5.1 Feature kind s4auto:Vehicle

6.3.5.1.0 Definition

Broader feature kind: s4auto:TrafficParticipant

Self-propelled transport device, along with any attachments, e.g. trailers, that is a legal user of the transportation network (source: term No 3.50 in ISO/TS 19091:2019 [i.21]).

s4auto:Vehicle belongs to the eponym class s4auto:Vehicle. This class groups s4auto:Vehicle, narrower feature kinds, and features of interest of this kind.

6.3.5.1.1 Feature kind s4auto:ArticulatedBusVehicle

Broader feature kind: s4auto:Vehicle

ArticulatedBus vehicle kind, as defined by term No 3.1.2.5 in ISO 3833 [i.20].

6.3.5.1.2 Feature kind s4auto:ArticulatedRoadTrainVehicle

Broader feature kind: s4auto:Vehicle

ArticulatedRoadTrain vehicle kind, as defined by term No 3.3.3 in ISO 3833 [i.20].

6.3.5.1.3 Feature kind s4auto:BusSemiTrailerVehicle

Broader feature kind: s4auto:Vehicle

BusSemiTrailer vehicle kind, as defined by term No 3.2.2.1 in ISO 3833 [i.20].

6.3.5.1.4 Feature kind s4auto:BusTrailerVehicle

Broader feature kind: s4auto:Vehicle

BusTrailer vehicle kind, as defined by term No 3.2.1.1 in ISO 3833 [i.20].

6.3.5.1.5 Feature kind s4auto:BusVehicle

Broader feature kind: s4auto:Vehicle

Bus vehicle kind, as defined by term No 3.1.2 in ISO 3833 [i.20].

6.3.5.1.6 Feature kind s4auto:CaravanVehicle

Broader feature kind: s4auto:Vehicle

Caravan vehicle kind, as defined by term No 3.2.1.3 in ISO 3833 [i.20].

6.3.5.1.7 Feature kind s4auto:CommercialVehicleVehicle

Broader feature kind: s4auto:Vehicle

CommercialVehicle vehicle kind, as defined by term No 3.1.3 in ISO 3833 [i.20].

6.3.5.1.8 Feature kind s4auto:CompositeRoadTrainVehicle

Broader feature kind: s4auto:Vehicle

CompositeRoadTrain vehicle kind, as defined by term No 3.3.5 in ISO 3833 [i.20].

6.3.5.1.9 Feature kind `s4auto:ConvertibleSaloonVehicle`

Broader feature kind: `s4auto:Vehicle`

ConvertibleSaloon vehicle kind, as defined by term No 3.1.1.2 in ISO 3833 [i.20].

6.3.5.1.10 Feature kind `s4auto:ConvertibleVehicle`

Broader feature kind: `s4auto:Vehicle`

Convertible vehicle kind, as defined by term No 3.1.1.6 (open tourer, roadster, spider) in ISO 3833 [i.20].

6.3.5.1.11 Feature kind `s4auto:CoupeVehicle`

Broader feature kind: `s4auto:Vehicle`

Coupe vehicle kind, as defined by term No 3.1.1.5 (coupe) in ISO 3833 [i.20].

6.3.5.1.12 Feature kind `s4auto:DoubleRoadTrainVehicle`

Broader feature kind: `s4auto:Vehicle`

DoubleRoadTrain vehicle kind, as defined by term No 3.3.4 in ISO 3833 [i.20].

6.3.5.1.13 Feature kind `s4auto:ForwardControlPassengerCarVehicle`

Broader feature kind: `s4auto:Vehicle`

ForwardControlPassengerCar vehicle kind, as defined by term No 3.1.1.8 in ISO 3833 [i.20].

6.3.5.1.14 Feature kind `s4auto:GeneralPurposeSemiTrailerVehicle`

Broader feature kind: `s4auto:Vehicle`

GeneralPurposeSemiTrailer vehicle kind, as defined by term No 3.2.2.2 in ISO 3833 [i.20].

6.3.5.1.15 Feature kind `s4auto:GeneralPurposeTrailerVehicle`

Broader feature kind: `s4auto:Vehicle`

GeneralPurposeTrailer vehicle kind, as defined by term No 3.2.1.2 in ISO 3833 [i.20].

6.3.5.1.16 Feature kind `s4auto:InterurbanCoachVehicle`

Broader feature kind: `s4auto:Vehicle`

InterurbanCoach vehicle kind, as defined by term No 3.1.2.3 in ISO 3833 [i.20].

6.3.5.1.17 Feature kind `s4auto:LongDistanceCoachVehicle`

Broader feature kind: `s4auto:Vehicle`

LongDistanceCoach vehicle kind, as defined by term No 3.1.2.4 in ISO 3833 [i.20].

6.3.5.1.18 Feature kind `s4auto:MinibusVehicle`

Broader feature kind: `s4auto:Vehicle`

Minibus vehicle kind, as defined by term No 3.1.2.1 in ISO 3833 [i.20].

6.3.5.1.19 Feature kind `s4auto:MopedVehicle`

Broader feature kind: `s4auto:Vehicle`

Moped vehicle kind, as defined by term No 3.4 in ISO 3833 [i.20].

6.3.5.1.20 Feature kind `s4auto:MotorCycleVehicle`

Broader feature kind: `s4auto:Vehicle`

MotorCycle vehicle kind, as defined by term No 3.5 in ISO 3833 [i.20].

6.3.5.1.21 Feature kind `s4auto:MultipurposePassengerCarVehicle`

Broader feature kind: `s4auto:Vehicle`

MultipurposePassengerCar vehicle kind, as defined by term No 3.1.1.7 in ISO 3833 [i.20].

6.3.5.1.22 Feature kind `s4auto:PassengerCarVehicle`

Broader feature kind: `s4auto:Vehicle`

PassengerCar vehicle kind, as defined by term No 3.1.1 in ISO 3833 [i.20].

6.3.5.1.23 Feature kind `s4auto:PassengerRoadTrainVehicle`

Broader feature kind: `s4auto:Vehicle`

PassengerRoadTrain vehicle kind, as defined by term No 3.3.2 in ISO 3833 [i.20].

6.3.5.1.24 Feature kind `s4auto:PullmanSaloonVehicle`

Broader feature kind: `s4auto:Vehicle`

PullmanSaloon vehicle kind, as defined by term No 3.1.1.3 in ISO 3833 [i.20].

6.3.5.1.25 Feature kind `s4auto:RoadTrainVehicle`

Broader feature kind: `s4auto:Vehicle`

RoadTrain vehicle kind, as defined by term No 3.3.1 in ISO 3833 [i.20].

6.3.5.1.26 Feature kind `s4auto:SaloonVehicle`

Broader feature kind: `s4auto:Vehicle`

Saloon vehicle kind, as defined by term No 3.1.1.1 (sedan) in ISO 3833 [i.20].

6.3.5.1.27 Feature kind `s4auto:SemiTrailerTowingVehicleVehicle`

Broader feature kind: `s4auto:Vehicle`

SemiTrailerTowingVehicle vehicle kind, as defined by term No 3.1.6 (fifth wheel tractor) in ISO 3833 [i.20]

6.3.5.1.28 Feature kind `s4auto:SemiTrailerVehicle`

Broader feature kind: `s4auto:Vehicle`

SemiTrailer vehicle kind, as defined by term No 3.2.2 in ISO 3833 [i.20].

6.3.5.1.29 Feature kind `s4auto:SpecialBusVehicle`

Broader feature kind: `s4auto:Vehicle`

SpecialBus vehicle kind, as defined by term No 3.1.2.7 in ISO 3833 [i.20].

6.3.5.1.30 Feature kind `s4auto:SpecialCommercialVehicleVehicle`

Broader feature kind: `s4auto:Vehicle`

SpecialCommercialVehicle vehicle kind, as defined by term No 3.1.3.1 in ISO 3833 [i.20].

6.3.5.1.31 Feature kind `s4auto:SpecialPassengerCarVehicle`

Broader feature kind: `s4auto:Vehicle`

SpecialPassengerCar vehicle kind, as defined by term No 3.1.1.9 in ISO 3833 [i.20].

6.3.5.1.32 Feature kind `s4auto:SpecialRoadTrainVehicle`

Broader feature kind: `s4auto:Vehicle`

SpecialRoadTrain vehicle kind, as defined by term No 3.3.6 in ISO 3833 [i.20].

6.3.5.1.33 Feature kind `s4auto:SpecialSemiTrailerVehicle`

Broader feature kind: `s4auto:Vehicle`

SpecialSemiTrailer vehicle kind, as defined by term No 3.2.2.3 in ISO 3833 [i.20].

6.3.5.1.34 Feature kind `s4auto:SpecialTrailerVehicle`

Broader feature kind: `s4auto:Vehicle`

SpecialTrailer vehicle kind, as defined by term No 3.2.1.4 in ISO 3833 [i.20].

6.3.5.1.35 Feature kind `s4auto:SpecialVehicleVehicle`

Broader feature kind: `s4auto:Vehicle`

SpecialVehicle vehicle kind, as defined by term No 3.1.4 in ISO 3833 [i.20].

6.3.5.1.36 Feature kind `s4auto:StationWagonVehicle`

Broader feature kind: `s4auto:Vehicle`

StationWagon vehicle kind, as defined by term No 3.1.1.4 in ISO 3833 [i.20].

6.3.5.1.37 Feature kind `s4auto:TrailerVehicle`

Broader feature kind: `s4auto:Vehicle`

Trailer vehicle kind, as defined by term No 3.2.1 in ISO 3833 [i.20].

6.3.5.1.38 Feature kind `s4auto:TrailingTowingVehicleVehicle`

Broader feature kind: `s4auto:Vehicle`

TrailingTowingVehicle vehicle kind, as defined by term No 3.1.5 (draw-bar tractor) in ISO 3833 [i.20].

6.3.5.1.39 Feature kind `s4auto:TrolleyBusVehicle`

Broader feature kind: `s4auto:Vehicle`

TrolleyBus vehicle kind, as defined by term No 3.1.2.6 in ISO 3833 [i.20].

6.3.5.1.40 Feature kind `s4auto:TruckStationWagonVehicle`

Broader feature kind: `s4auto:Vehicle`

TruckStationWagon vehicle kind, as defined by term No 3.1.1.4.1 in ISO 3833 [i.20].

6.3.5.1.41 Feature kind `s4auto:UrbanBusVehicle`

Broader feature kind: `s4auto:Vehicle`

UrbanBus vehicle kind, as defined by term No 3.1.2.2 in ISO 3833 [i.20].

6.3.5.2 Static Vehicle Properties

6.3.5.2.0 Overview

Figure 50 describes the different static properties of vehicles. Figure 51 provides practical examples.

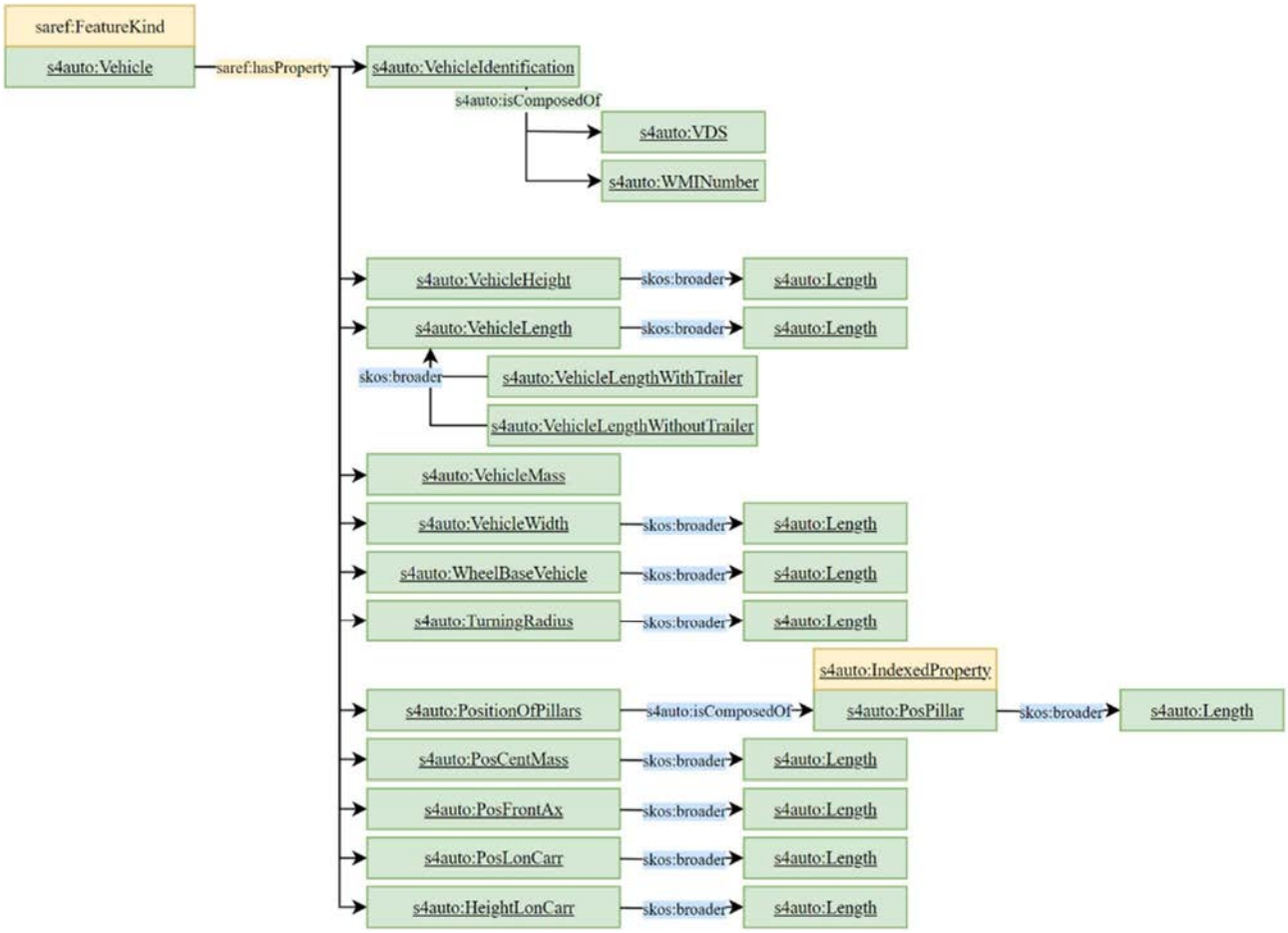

Figure 50: Static Vehicle Properties

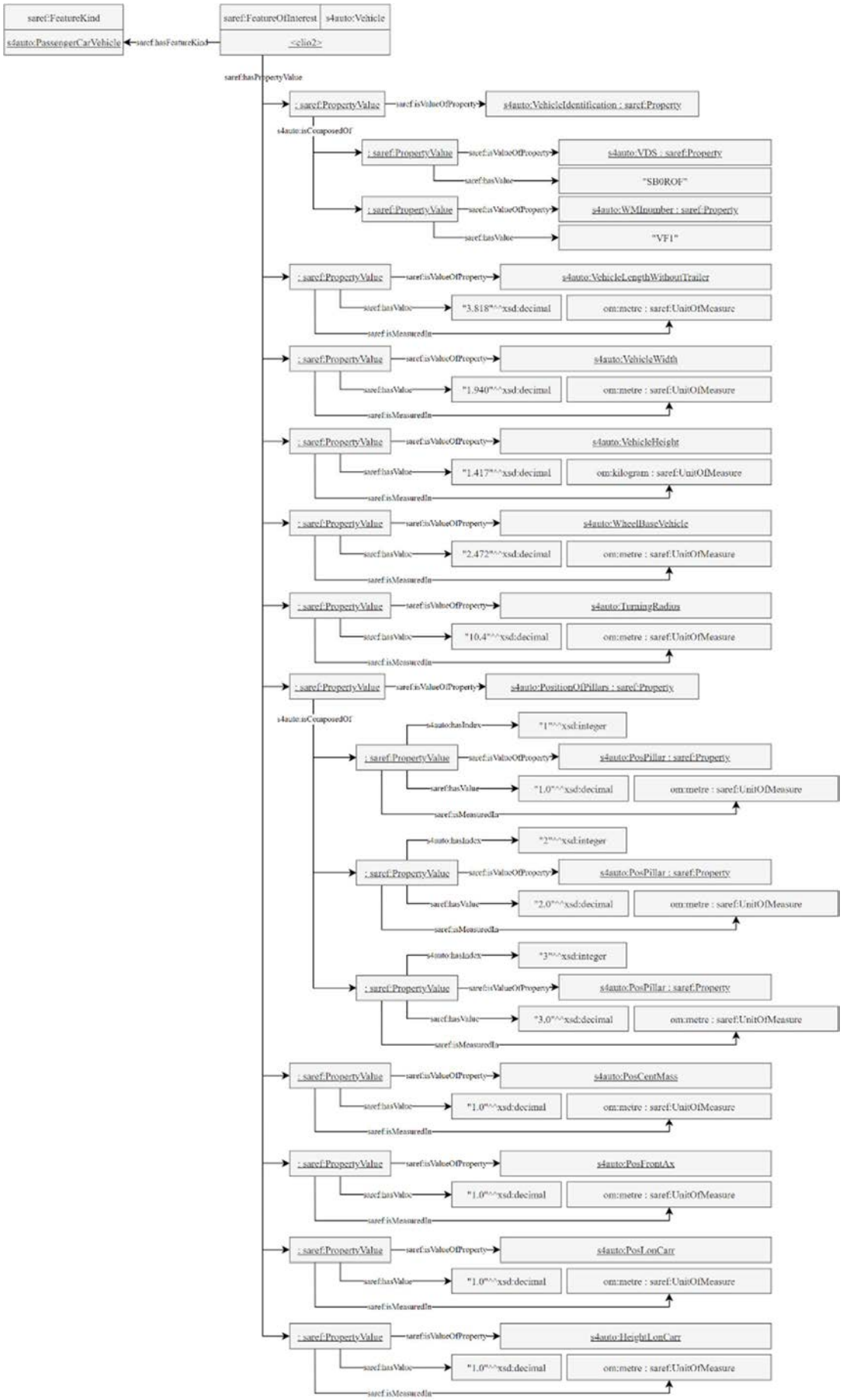

Figure 51: Example for Static Vehicle Properties

6.3.5.2.1 Property s4auto:HeightLonCarr

Is property of: s4auto:Vehicle

This property represents the height of the left or right longitude carrier of vehicle from base to top (left or right carrier seen from vehicle rear to front).

6.3.5.2.2 Property s4auto:PosCentMass

Broader property: s4auto:Length

Is property of: s4auto:Vehicle

This property indicates the perpendicular distance from the centre of mass of an empty load vehicle to the front line of the vehicle bounding box of the empty load vehicle.

6.3.5.2.3 Property s4auto:PosFrontAx

Broader property: s4auto:Length

Is property of: s4auto:Vehicle

This property indicates the perpendicular distance between the vehicle front line of the bounding box and the front wheel axle.

6.3.5.2.4 Property s4auto:PosLonCarr

Is property of: s4auto:Vehicle

This property represents the distance from the centre of vehicle front bumper to the right or left longitudinal carrier of vehicle.
The left/right carrier refers to the left/right as seen from a passenger sitting in the vehicle.

6.3.5.2.5 Property s4auto:PositionOfPillars

6.3.5.2.5.0 Definition

Is property of: s4auto:Vehicle

This property and values for this property are composed of (s4auto:isComposedOf) a sequence of distances s4auto:PosPillar that refer to the perpendicular distance between centre of vehicle front bumper and vehicle pillar A, between neighbour pillars until the last pillar of the vehicle.

Vehicle pillars refer to the vertical or near vertical support of vehicle, designated respectively as the A, B, C or D and other pillars moving inside profile view from the front to rear.

The first value of the property refers to the perpendicular distance from the centre of vehicle front bumper to vehicle A pillar. The second value refers to the perpendicular distance from the centre position of A pillar to the B pillar of vehicle and so on until the last pillar.

6.3.5.2.5.1 Property s4auto:PosPillar

In category: s4auto:IndexedProperty

Broader property: s4auto:Length

This property represents the perpendicular inter-distance of neighbouring pillar axis of vehicle starting from the middle point of the front line of the vehicle bounding box.

6.3.5.2.6 Property s4auto:TurningRadius

Broader property: s4auto:Length

Is property of: s4auto:Vehicle

This property represents the smallest circular turn (i.e. U-turn) that the vehicle is capable of making.

For vehicle with tracker, the turning radius applies to the vehicle only.

6.3.5.2.7 Property s4auto:VehicleHeight

Is property of: s4auto:Vehicle

This property represents the height of the vehicle, measured from the ground to the highest point, excluding any antennas.

In case vehicles are equipped with adjustable ride heights, camper shells, and any other equipment which may result in varying height, the largest possible height shall be used.

6.3.5.2.8 Property s4auto:VehicleIdentification

6.3.5.2.8.0 Definition

Is property of: s4auto:Vehicle

This property provides information related to the identification of a vehicle.

It shall include the following components:

- WMInumber: World Manufacturer Identifier (WMI) code.
- VDS: Vehicle Descriptor Section (VDS).

6.3.5.2.8.1 Property s4auto:VDS

In category: s4auto:StringProperty

This property represents the Vehicle Descriptor Section (VDS). The values are assigned according to ISO 3779 [i.15].

6.3.5.2.8.2 Property s4auto:WMInumber

In category: s4auto:StringProperty

This property represents the World Manufacturer Identifier (WMI). The values are assigned according to ISO 3779 [i.15].

6.3.5.2.9 Property s4auto:VehicleLength

Broader property: s4auto:Length

Is property of: s4auto:Vehicle

This property represents the length of a vehicle.

6.3.5.2.10 Property s4auto:VehicleLengthWithTrailer

Broader property: s4auto:VehicleLength

This property represents the length of a vehicle, including the length of a potential trailer.

6.3.5.2.11 Property s4auto:VehicleLengthWithoutTrailer

Broader property: s4auto:VehicleLength

This property represents the length of a vehicle, excluding the length of a potential trailer.

6.3.5.2.12 Property s4auto:VehicleMass

Is property of: s4auto:Vehicle

This property represents the mass of an empty loaded vehicle.

6.3.5.2.13 Property s4auto:VehicleWidth

Broader property: s4auto:Length

Is property of: s4auto:Vehicle

This property represents the width of a vehicle, excluding side mirrors and possible similar extensions.

6.3.5.2.14 Property s4auto:WheelBaseVehicle

Broader property: s4auto:Length

Is property of: s4auto:Vehicle

This property indicates the perpendicular distance between front and rear axle of the wheelbase of vehicle.

6.3.5.3 Dynamic Vehicle Properties

6.3.5.3.0 Overview

Figure 52 and Figure 53 describe the different dynamic properties of vehicles.

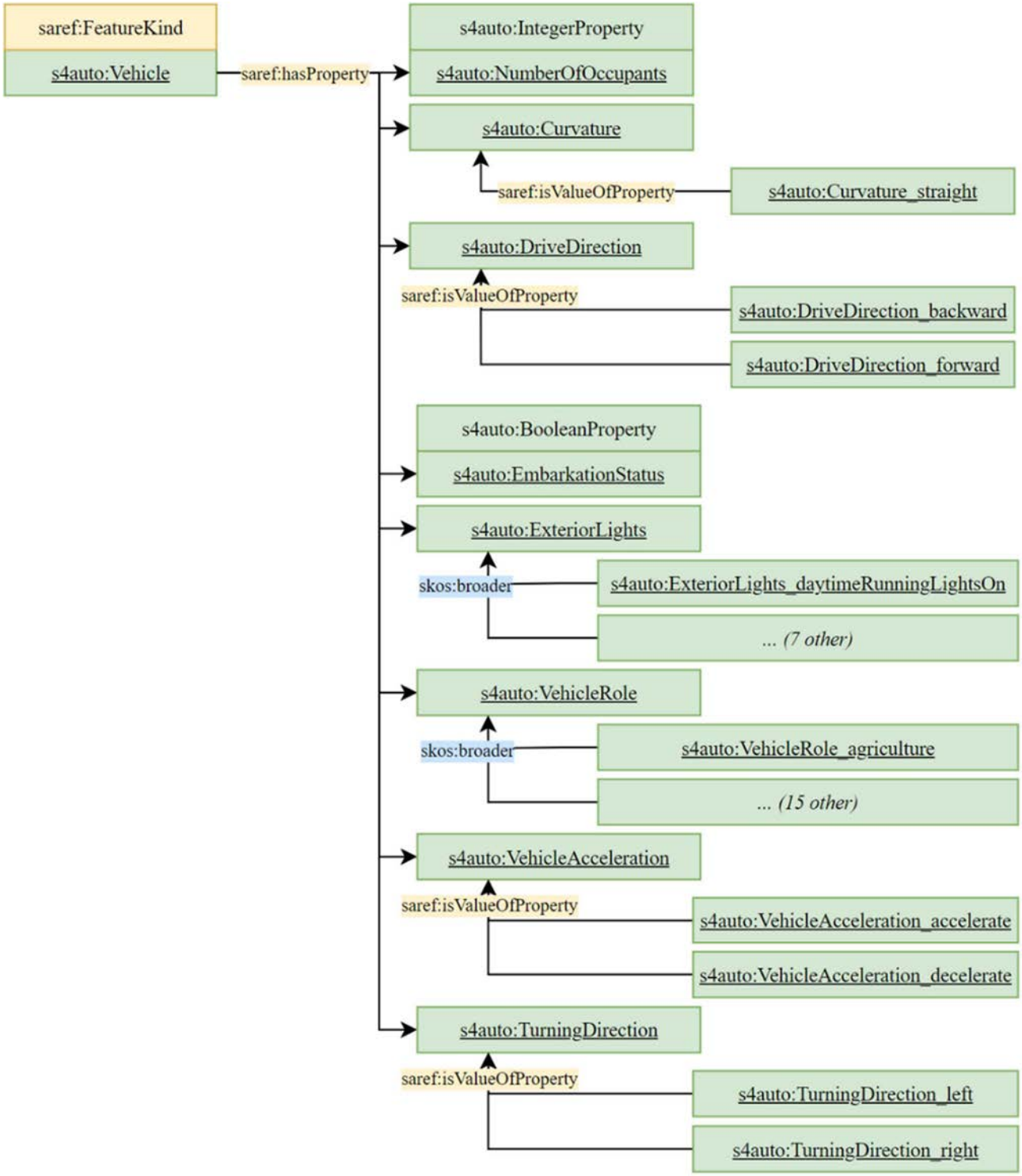

Figure 52: Dynamic Vehicle Properties (1/2)

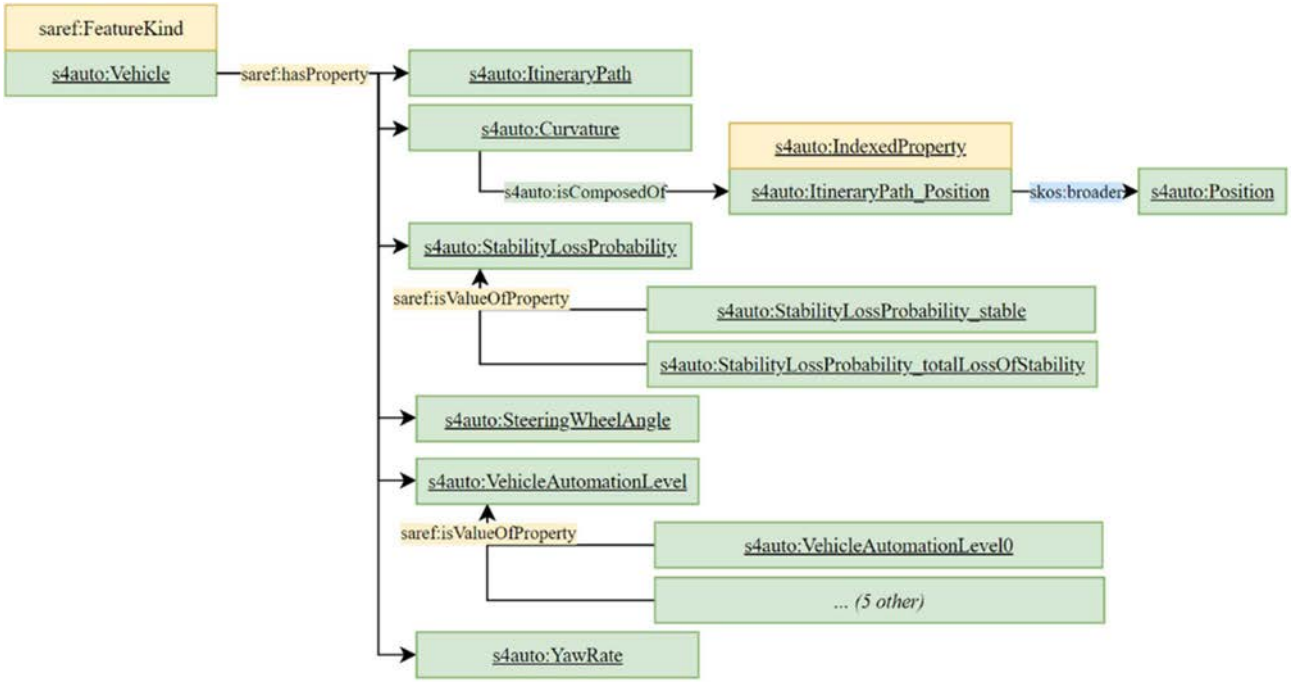

Figure 53: Dynamic Vehicle Properties (2/2)

Figure 54, Figure 55 and Figure 56, provide practical examples.

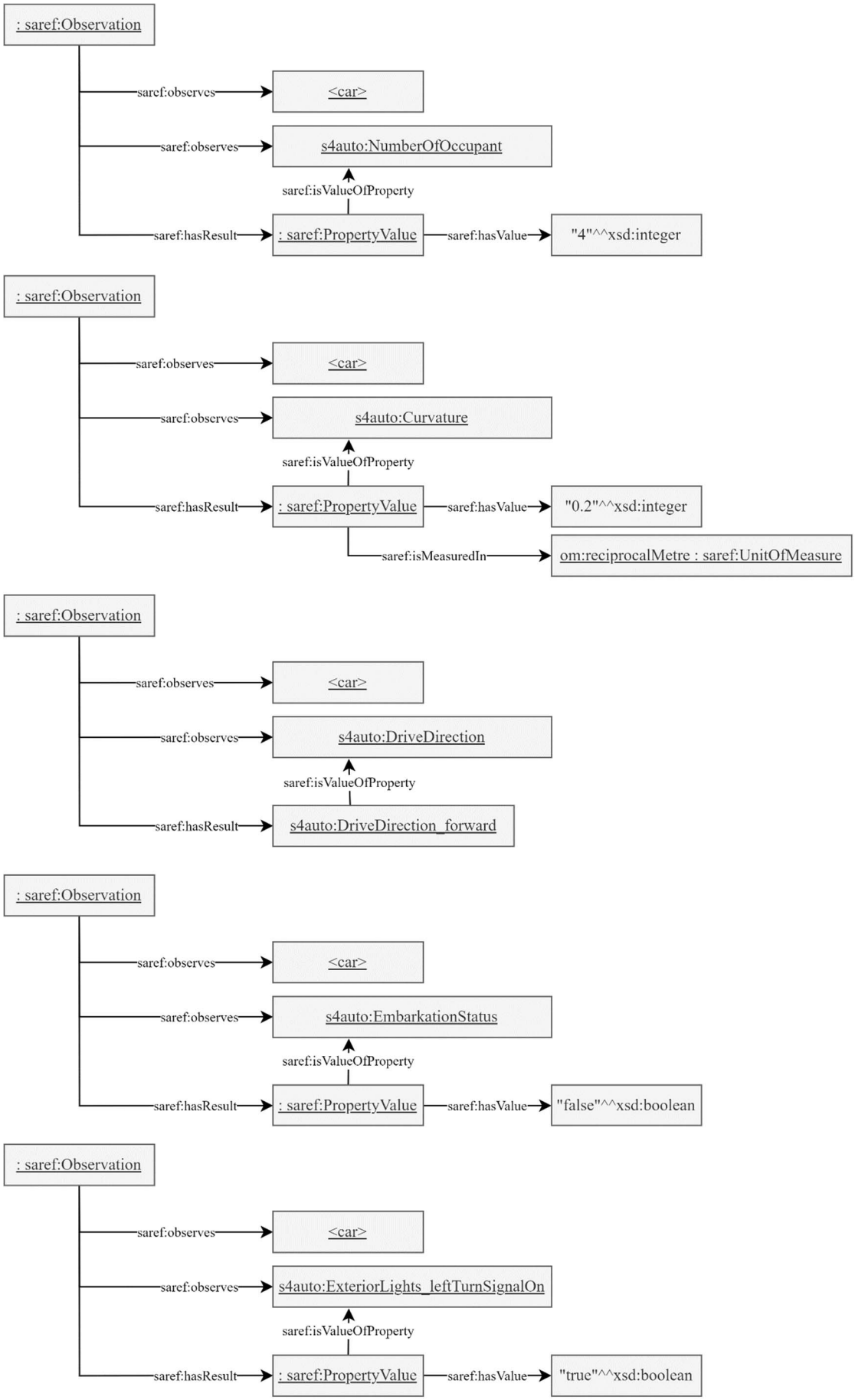

Figure 54: Example for Dynamic Vehicle Properties (1/3)

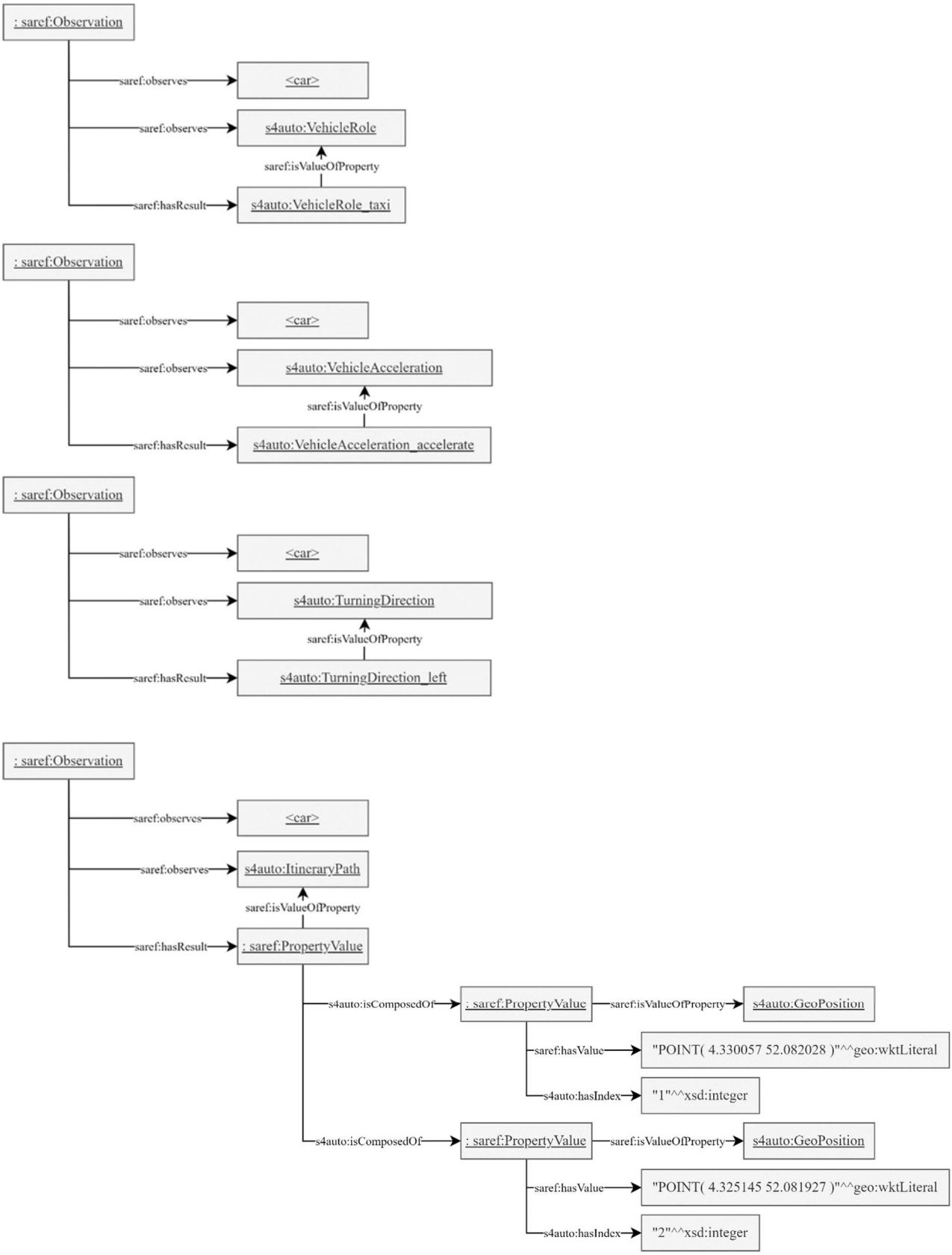

Figure 55: Example for Dynamic Vehicle Properties (2/3)

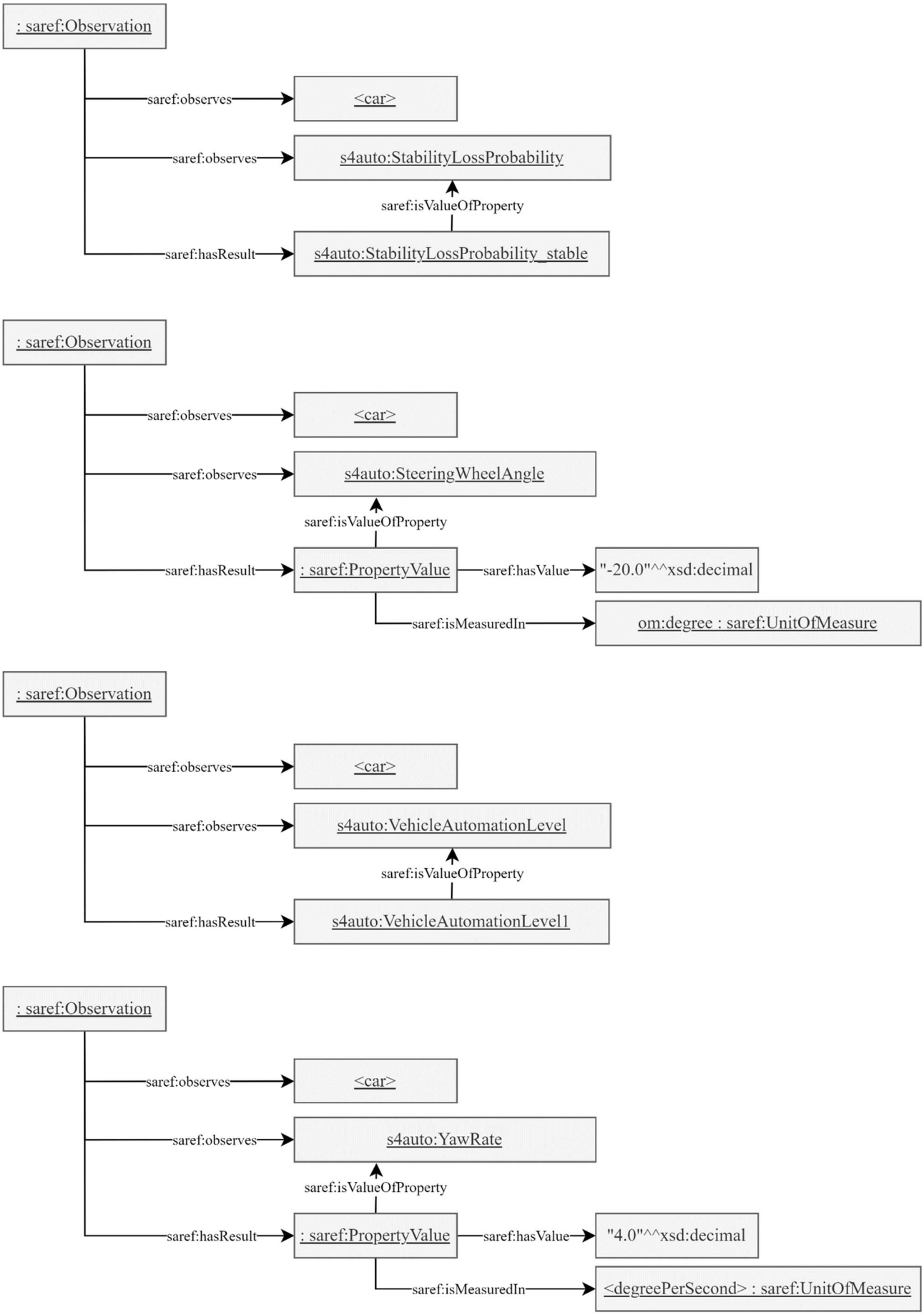

Figure 56: Example for Dynamic Vehicle Properties (3/3)

6.3.5.3.1 Property s4auto:Curvature

6.3.5.3.1.0 Definition

Is property of: s4auto:Vehicle

This property represents the curvature of the vehicle trajectory, as the inverse of the vehicle turning curve radius.

Positive values indicate a turning curve to the left hand side of the driver. It corresponds to the vehicle coordinate system as defined in ISO 8855 [i.19].

The curvature detected by a vehicle represents the curvature of actual vehicle trajectory.

6.3.5.3.1.1 Property value s4auto:Curvature_straight

Is value of property: s4auto:Curvature

Value: 0

0 when the vehicle is moving straight.

6.3.5.3.2 Property s4auto:DriveDirection

6.3.5.3.2.0 Definition

Is property of: s4auto:Vehicle

This property indicates in which direction something is moving.

The following property values are defined:

- s4auto:DriveDirection_backward - to indicate it is moving forward,
- s4auto:DriveDirection_forward - to indicate it is moving backwards.

6.3.5.3.2.1 Property value s4auto:DriveDirection_forward

Is value of property: s4auto:DriveDirection

Value: 0

Indicates it is moving forward.

6.3.5.3.2.2 Property value s4auto:DriveDirection_backward

Is value of property: s4auto:DriveDirection

Value: 1

Indicates it is moving backwards.

6.3.5.3.3 Property s4auto:EmbarkationStatus

In category: s4auto:BooleanProperty

Is property of: s4auto:Vehicle

This property indicates whether a vehicle (e.g. public transport vehicle, truck) is under the embarkation process. If that is the case, the value is *TRUE*, otherwise *FALSE*.

6.3.5.3.4 Property s4auto:ExteriorLights

Is property of: s4auto:Vehicle

This property describes the status of some exterior light switches of a vehicle incl. VRU vehicles.

Narrower properties indicate the type of exterior light switch of interest:

- s4auto:ExteriorLights_lowBeamHeadlightsOn - *TRUE* when the low beam head light switch is on;
- s4auto:ExteriorLights_highBeamHeadlightsOn - *TRUE* when the high beam head light switch is on;
- s4auto:ExteriorLights_leftTurnSignalOn - *TRUE* when the left turn signal switch is on;
- s4auto:ExteriorLights_rightTurnSignalOn - *TRUE* when the right turn signal switch is on;
- s4auto:ExteriorLights_daytimeRunningLightsOn - *TRUE* when the daytime running light switch is on;
- s4auto:ExteriorLights_reverseLightOn - *TRUE* when the reverse light switch is on;
- s4auto:ExteriorLights_fogLightOn - *TRUE* when the tail fog light switch is on;
- s4auto:ExteriorLights_parkingLightsOn - *TRUE* when the parking light switch is on.

6.3.5.3.5 Property s4auto:ExteriorLights_daytimeRunningLightsOn

In category: s4auto:BooleanProperty

Broader property: s4auto:ExteriorLights

TRUE when the daytime running light switch is on.

6.3.5.3.6 Property s4auto:ExteriorLights_fogLightOn

In category: s4auto:BooleanProperty

Broader property: s4auto:ExteriorLights

TRUE when the tail fog light switch is on.

6.3.5.3.7 Property s4auto:ExteriorLights_highBeamHeadlightsOn

In category: s4auto:BooleanProperty

Broader property: s4auto:ExteriorLights

TRUE when the high beam head light switch is on.

6.3.5.3.8 Property s4auto:ExteriorLights_leftTurnSignalOn

In category: s4auto:BooleanProperty

Broader property: s4auto:ExteriorLights

TRUE when the left turn signal switch is on.

6.3.5.3.9 Property s4auto:ExteriorLights_lowBeamHeadlightsOn

In category: s4auto:BooleanProperty

Broader property: s4auto:ExteriorLights

TRUE when the low beam head light switch is on.

6.3.5.3.10 Property s4auto:ExteriorLights_parkingLightsOn

In category: s4auto:BooleanProperty

Broader property: s4auto:ExteriorLights

TRUE when the parking light switch is on.

6.3.5.3.11 Property s4auto:ExteriorLights_reverseLightOn

In category: s4auto:BooleanProperty

Broader property: s4auto:ExteriorLights

TRUE when the reverse light switch is on.

6.3.5.3.12 Property s4auto:ExteriorLights_rightTurnSignalOn

In category: s4auto:BooleanProperty

Broader property: s4auto:ExteriorLights

TRUE when the right turn signal switch is on.

6.3.5.3.13 Property s4auto:ItineraryPath

6.3.5.3.13.0 Definition

Is property of: s4auto:Vehicle

This property shall contain a list of waypoints s4auto:Position.

6.3.5.3.13.1 Property s4auto:ItineraryPath_Position

In category: s4auto:IndexedProperty

Broader property: s4auto:Position

One Position item in a sequence ItineraryPath.

6.3.5.3.14 Property s4auto:NumberOfOccupants

In category: s4auto:IntegerProperty

Is property of: s4auto:Vehicle

This property represents the number of occupants in a vehicle.

6.3.5.3.15 Property s4auto:StabilityLossProbability

6.3.5.3.15.0 Definition

Is property of: s4auto:Vehicle

This property indicates the estimated probability of a stability level and conversely also the probability of a stability loss.

The following property values are defined:

- 0 to indicate an estimated probability of a loss of stability of 0 %, i.e. "stable";
- n (n > 0 and n < 50) to indicate the actual stability level;

- `50` to indicate a estimated probability of a loss of stability of 100 %, i.e. "total loss of stability";
- the values between 51 and 62 are reserved for future use;
- `63`: this value indicates that the information is unavailable.

6.3.5.3.15.1 Property value `s4auto:StabilityLossProbability_stable`

Is value of property: `s4auto:StabilityLossProbability`

Value: 0

`0` to indicate an estimated probability of a loss of stability of 0 %, i.e. "stable".

6.3.5.3.15.2 Property value `s4auto:StabilityLossProbability_totalLossOfStability`

Is value of property: `s4auto:StabilityLossProbability`

Value: 50

`50` to indicate an estimated probability of a loss of stability of 100 %, i.e. "total loss of stability".

6.3.5.3.16 Property `s4auto:SteeringWheelAngle`

Is property of: `s4auto:Vehicle`

This property represents the steering wheel angle of the vehicle at certain point in time.

The value shall be provided in the vehicle coordinate system as defined in ISO 8855 [i.19], clause 2.11.

6.3.5.3.17 Property `s4auto:TurningDirection`

6.3.5.3.17.0 Definition

Is property of: `s4auto:Vehicle`

This property provides the turning direction.

The following property values are defined:

- `left` for turning to the left;
- `right` for turning to the right.

6.3.5.3.17.1 Property value `s4auto:TurningDirection_left`

Is value of property: `s4auto:TurningDirection`

Value: 0

`left` for turning to the left.

6.3.5.3.17.2 Property value `s4auto:TurningDirection_right`

Is value of property: `s4auto:TurningDirection`

Value: 1

`right` for turning to the right.

6.3.5.3.18 Property s4auto:VehicleAcceleration

6.3.5.3.18.0 Definition

Is property of: s4auto:Vehicle

This property indicates the acceleration of a vehicle.

The following property values are defined:

- s4auto:VehicleAcceleration_accelerate - if the magnitude of the horizontal velocity vector increases.
- s4auto:VehicleAcceleration_decelerate - if the magnitude of the horizontal velocity vector decreases.

6.3.5.3.18.1 Property value s4auto:VehicleAcceleration_accelerate

Is value of property: s4auto:VehicleAcceleration

Value: 0

The magnitude of the horizontal velocity vector increases.

6.3.5.3.18.2 Property value s4auto:VehicleAcceleration_decelerate

Is value of property: s4auto:VehicleAcceleration

Value: 1

The magnitude of the horizontal velocity vector decreases.

6.3.5.3.19 Property s4auto:VehicleAutomationLevel

6.3.5.3.19.0 Definition

Is property of: s4auto:Vehicle

According to SAE J3016, there are five levels of automation for a vehicle:

- Level 0: No Driving Automation.
- Level 1: Driver assistance.
- Level 2: Partial driving automation.
- Level 3: Conditional driving automation.
- Level 4: High driving automation.
- Level 5: Full Driving automation.

6.3.5.3.19.1 Property value s4auto:VehicleAutomationLevel0

Is value of property: s4auto:VehicleAutomationLevel

Value: 0

Vehicle Automation Level 0: No Driving Automation [Source: SAE J3016 [i.9]].

6.3.5.3.19.2 Property value s4auto:VehicleAutomationLevel1

Is value of property: s4auto:VehicleAutomationLevel

Value: 1

Vehicle Automation Level 1: Driver assistance [Source: SAE J3016 [i.9]].

6.3.5.3.19.3 Property value s4auto:VehicleAutomationLevel2

Is value of property: s4auto:VehicleAutomationLevel

Value: 2

Vehicle Automation Level 2: Partial driving automation [Source: SAE J3016 [i.9]].

6.3.5.3.19.4 Property value s4auto:VehicleAutomationLevel3

Is value of property: s4auto:VehicleAutomationLevel

Value: 3

Vehicle Automation Level 3: Conditional driving automation [Source: SAE J3016 [i.9]].

6.3.5.3.19.5 Property value s4auto:VehicleAutomationLevel4

Is value of property: s4auto:VehicleAutomationLevel

Value: 4

Vehicle Automation Level 4: High driving automation [Source: SAE J3016 [i.9]].

6.3.5.3.19.6 Property value s4auto:VehicleAutomationLevel5

Is value of property: s4auto:VehicleAutomationLevel

Value: 5

Vehicle Automation Level 5: Full Driving automation [Source: SAE J3016 [i.9]].

6.3.5.3.20 Property s4auto:VehicleRole

6.3.5.3.20.0 Definition

Is property of: s4auto:Vehicle

This property indicates the role played by a vehicle at a point in time.

The following property values are defined:

- 0 default - to indicate the default vehicle role as indicated by the vehicle type;
- 1 publicTransport - to indicate that the vehicle is used to operate public transport service;
- 2 specialTransport - to indicate that the vehicle is used for special transport purpose, e.g. oversized trucks;
- 3 dangerousGoods - to indicate that the vehicle is used for dangerous goods transportation;
- 4 roadWork - to indicate that the vehicle is used to realize roadwork or road maintenance mission;
- 5 rescue - to indicate that the vehicle is used for rescue purpose in case of an accident, e.g. as a towing service;
- 6 emergency - to indicate that the vehicle is used for emergency mission, e.g. ambulance, fire brigade;
- 7 safetyCar - to indicate that the vehicle is used for public safety, e.g. patrol;
- 8 agriculture - to indicate that the vehicle is used for agriculture, e.g. farm tractor;
- 9 commercial - to indicate that the vehicle is used for transportation of commercial goods;

- 10 `military` - to indicate that the vehicle is used for military purpose;
- 11 `roadOperator` - to indicate that the vehicle is used in road operator missions;
- 12 `taxi` - to indicate that the vehicle is used to provide an authorized taxi service.

6.3.5.3.20.1 Property value `s4auto:VehicleRole_default`

Is value of property: `s4auto:VehicleRole`

Value: 0

0 `default` - to indicate the default vehicle role as indicated by the vehicle type.

6.3.5.3.20.2 Property value `s4auto:VehicleRole_publicTransport`

Is value of property: `s4auto:VehicleRole`

Value: 1

1 `publicTransport` - to indicate that the vehicle is used to operate public transport service.

6.3.5.3.20.3 Property value `s4auto:VehicleRole_specialTransport`

Is value of property: `s4auto:VehicleRole`

Value: 2

2 `specialTransport` - to indicate that the vehicle is used for special transport purpose, e.g. oversized trucks.

6.3.5.3.20.4 Property value `s4auto:VehicleRole_dangerousGoods`

Is value of property: `s4auto:VehicleRole`

Value: 3

3 `dangerousGoods` - to indicate that the vehicle is used for dangerous goods transportation.

6.3.5.3.20.5 Property value `s4auto:VehicleRole_roadWork`

Is value of property: `s4auto:VehicleRole`

Value: 4

4 `roadWork` - to indicate that the vehicle is used to realize roadwork or road maintenance mission.

6.3.5.3.20.6 Property value `s4auto:VehicleRole_rescue`

Is value of property: `s4auto:VehicleRole`

Value: 5

5 `rescue` - to indicate that the vehicle is used for rescue purpose in case of an accident, e.g. as a towing service.

6.3.5.3.20.7 Property value `s4auto:VehicleRole_emergency`

Is value of property: `s4auto:VehicleRole`

Value: 6

6 `emergency` - to indicate that the vehicle is used for emergency mission, e.g. ambulance, fire brigade.

6.3.5.3.20.8 Property value s4auto:VehicleRole_safetyCar

Is value of property: s4auto:VehicleRole

Value: 7

7 safetyCar - to indicate that the vehicle is used for public safety, e.g. patrol.

6.3.5.3.20.9 Property value s4auto:VehicleRole_agriculture

Is value of property: s4auto:VehicleRole

Value: 8

8 agriculture - to indicate that the vehicle is used for agriculture, e.g. farm tractor.

6.3.5.3.20.10 Property value s4auto:VehicleRole_commercial

Is value of property: s4auto:VehicleRole

Value: 9

9 commercial - to indicate that the vehicle is used for transportation of commercial goods.

6.3.5.3.20.11 Property value s4auto:VehicleRole_military

Is value of property: s4auto:VehicleRole

Value: 10

10 military - to indicate that the vehicle is used for military purpose.

6.3.5.3.20.12 Property value s4auto:VehicleRole_roadOperator

Is value of property: s4auto:VehicleRole

Value: 11

11 roadOperator - to indicate that the vehicle is used in road operator missions.

6.3.5.3.20.13 Property value s4auto:VehicleRole_taxi

Is value of property: s4auto:VehicleRole

Value: 12

12 taxi - to indicate that the vehicle is used to provide an authorized taxi service.

6.3.5.3.20.14 Property value s4auto:VehicleRole_reserved1

Is value of property: s4auto:VehicleRole

Value: 13

13 reserved - is reserved for future usage.

6.3.5.3.20.15 Property value s4auto:VehicleRole_reserved2

Is value of property: s4auto:VehicleRole

Value: 14

14 reserved - is reserved for future usage.

6.3.5.3.20.16 Property value `s4auto:VehicleRole_reserved3`

Is value of property: `s4auto:VehicleRole`

Value: 15

15 `reserved` - is reserved for future usage.

6.3.5.3.21 Property `s4auto:YawRate`

Is property of: `s4auto:Vehicle`

This property represents the vehicle rotation around z-axis of the coordinate system centred on the centre of mass of the empty-loaded vehicle. The leading sign denotes the direction of rotation.

The yaw rate value shall be a raw data value, i.e. not filtered, smoothed or otherwise modified. The reading instant should be the same as for the vehicle acceleration.

6.3.5.4 Vehicle Environment

6.3.5.4.0 Overview

Figure 57 illustrates the feature kinds and properties that compose the vehicle environment.

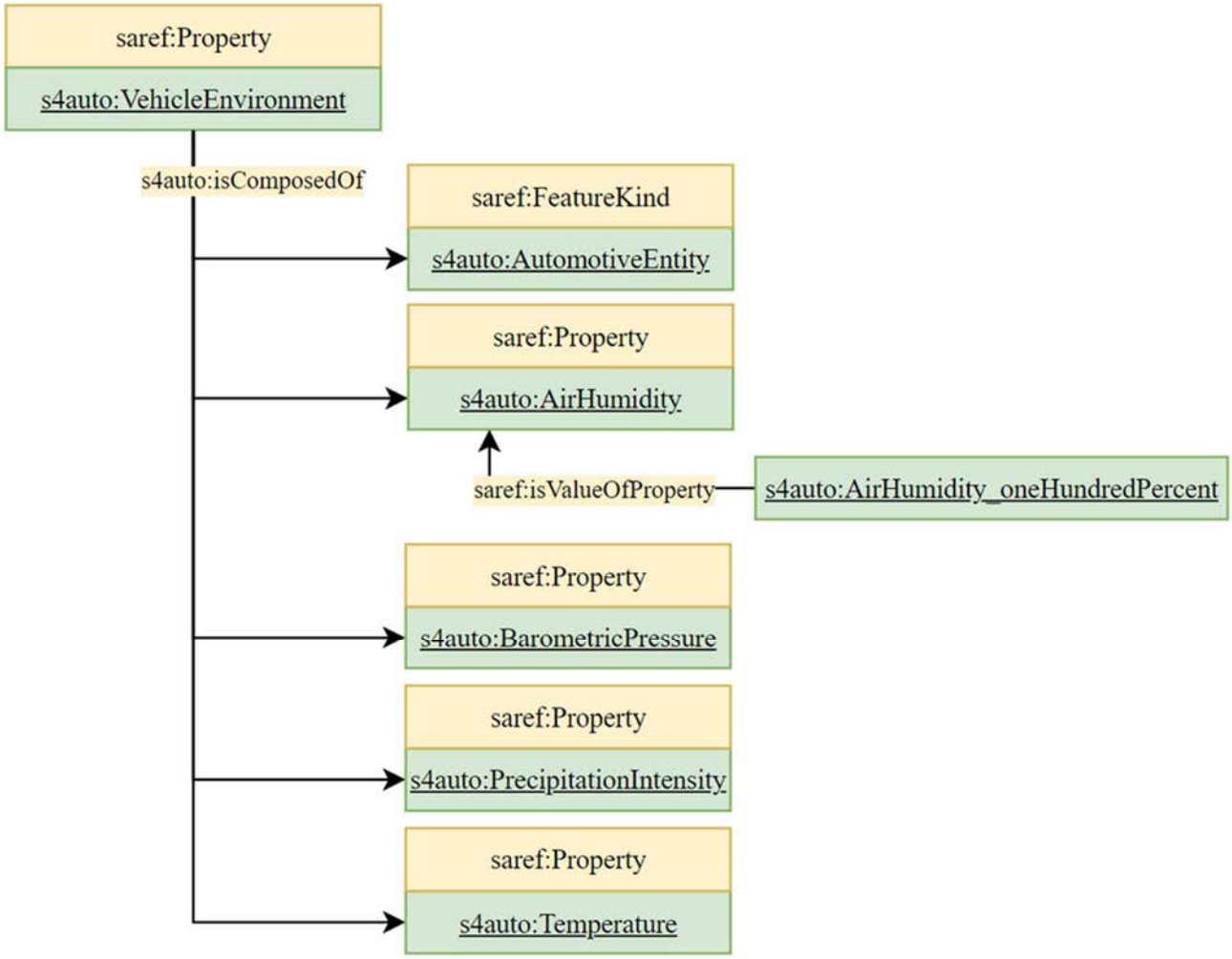

Figure 57: Vehicle Environment

Figure 58 provides practical examples.

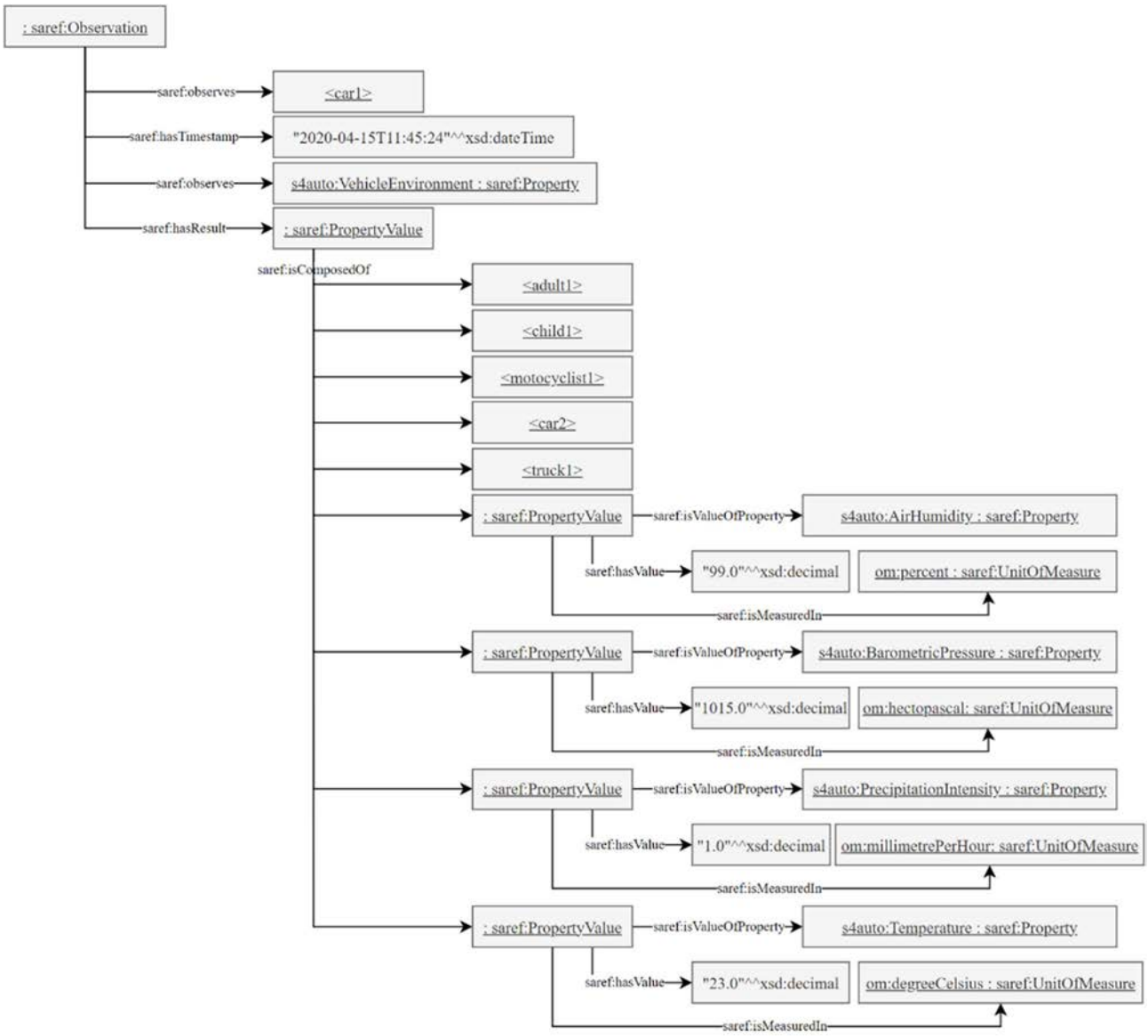

Figure 58: Example for Vehicle Environment

6.3.5.4.1 Property `s4auto:VehicleEnvironment`

6.3.5.4.1.0 Definition

Is property of: `s4auto:Vehicle`

The vehicle environment consists of entities which are present on the road in the area around a vehicle, and is composed of other properties such as the air humidity and temperature.

6.3.5.4.1.1 Property `s4auto:AirHumidity`

6.3.5.4.1.1.0 Definition

This property represents the air humidity.

6.3.5.4.1.1.1 Property value `s4auto:AirHumidity_oneHundredPercent`

Is value of property: `s4auto:AirHumidity`

Value: 1 000

Defined property value for air humidity of 100 %.

6.3.5.4.1.2 Property `s4auto:BarometricPressure`

This property represents the measured uncompensated atmospheric pressure.

6.3.5.4.1.3 Property `s4auto:PrecipitationIntensity`

This property represent the total amount of rain falling during one hour. It is measured in mm per hour at an area of 1 square metre.

6.3.5.4.1.4 Property `s4auto:Temperature`

This property indicates a temperature value.

6.3.6 Trailer

6.3.6.0 Overview

Figure 59 describes how vehicles may consist of trailers, and the list of properties for trailers.

Figure 59: Trailer

Figure 60 provides a practical example.

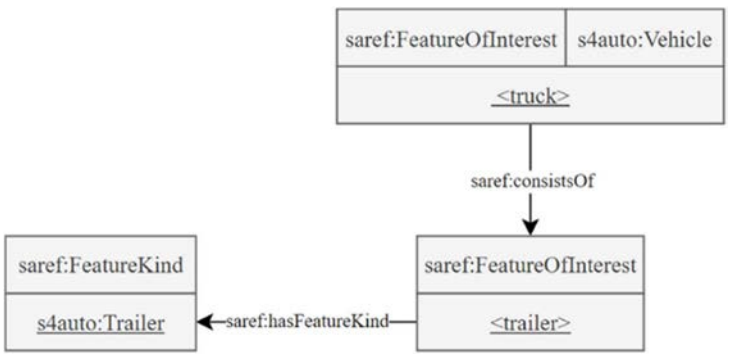

Figure 60: Example for Trailer

6.3.6.1 Feature kind s4auto:Trailer

6.3.6.1.0 Definition

Broader feature kind: s4auto:Vehicle

Non-self propelled vehicle that is designed and constructed to be towed by a power driven vehicle as defined in UNECE/TRANS/WP.29/78/Rev.4 [i.17], class O.

s4auto:Trailer belongs to the eponym class s4auto:Trailer. This class groups s4auto:Trailer, narrower feature kinds, and features of interest of this kind.

6.3.6.1.1 Property s4auto:Trailer_frontOverhang

Broader property: s4auto:Length

Is property of: s4auto:Trailer

Length of the trailer overhang in the positive x direction (according to ISO 8855 [i.19]) from the trailer reference point. The value defaults to 0 in case the trailer is not overhanging to the front with respect to the trailer reference point.

6.3.6.1.2 Property s4auto:Trailer_hitchAngle

Broader property: s4auto:CartesianAngle

Is property of: s4auto:Trailer

Value and confidence value of the angle between the trailer orientation (corresponding to the x direction of the ISO 8855 [i.19] coordinate system centred on the trailer) and the direction of the segment having as end points the reference point of the trailer and the reference point of the pulling vehicle, which can be another trailer or a vehicle looking on the horizontal plane xy, described in the local Cartesian coordinate system of the trailer. The angle is measured with negative values considering the trailer orientation turning clockwise starting from the segment direction. The angle value accuracy is provided with the confidence level of 95 %.

6.3.6.1.3 Property s4auto:Trailer_hitchPointOffset

Broader property: s4auto:Length

Is property of: s4auto:Trailer

Position of the hitch point in negative x-direction (according to ISO 8855 [i.19]) from the vehicle Reference Point.

6.3.6.1.4 Property s4auto:Trailer_rearOverhang

Broader property: s4auto:Length

Is property of: s4auto:Trailer

length of the trailer overhang in the negative x direction (according to ISO 8855 [i.19]) from the trailer reference point.

6.3.6.1.5 Property s4auto:Trailer_trailerWidth

Broader property: s4auto:VehicleWidth

Is property of: s4auto:Trailer

Width of the trailer.

6.3.7 Dangerous Goods

6.3.7.0 Overview

Figure 61 describes how vehicles, including trailers, may consist of dangerous goods. SAREF4AUTO defines different narrower kinds of dangerous goods, a set of properties that apply to dangerous goods, and object and datatype properties used to further describe transported dangerous goods.

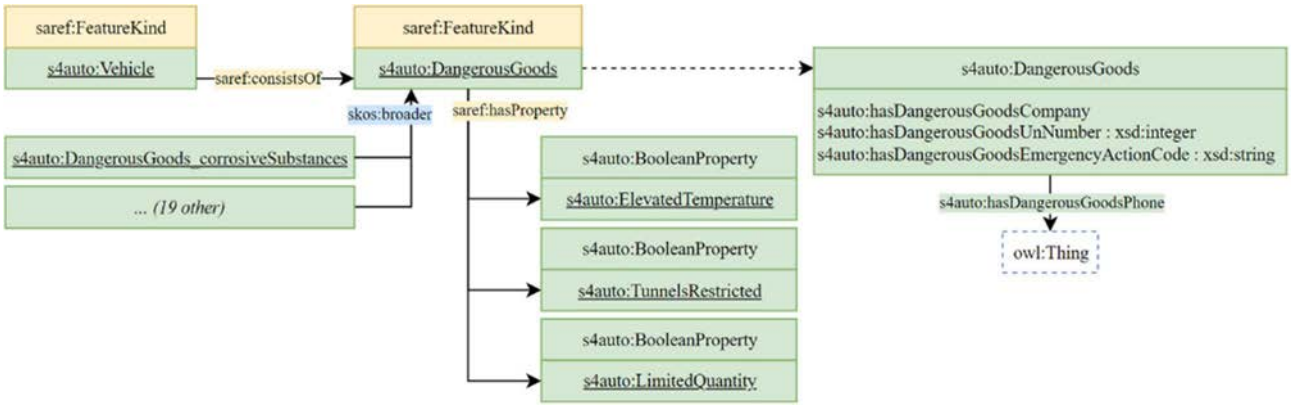

Figure 61: Dangerous Goods

Figure 62 provides a practical example.

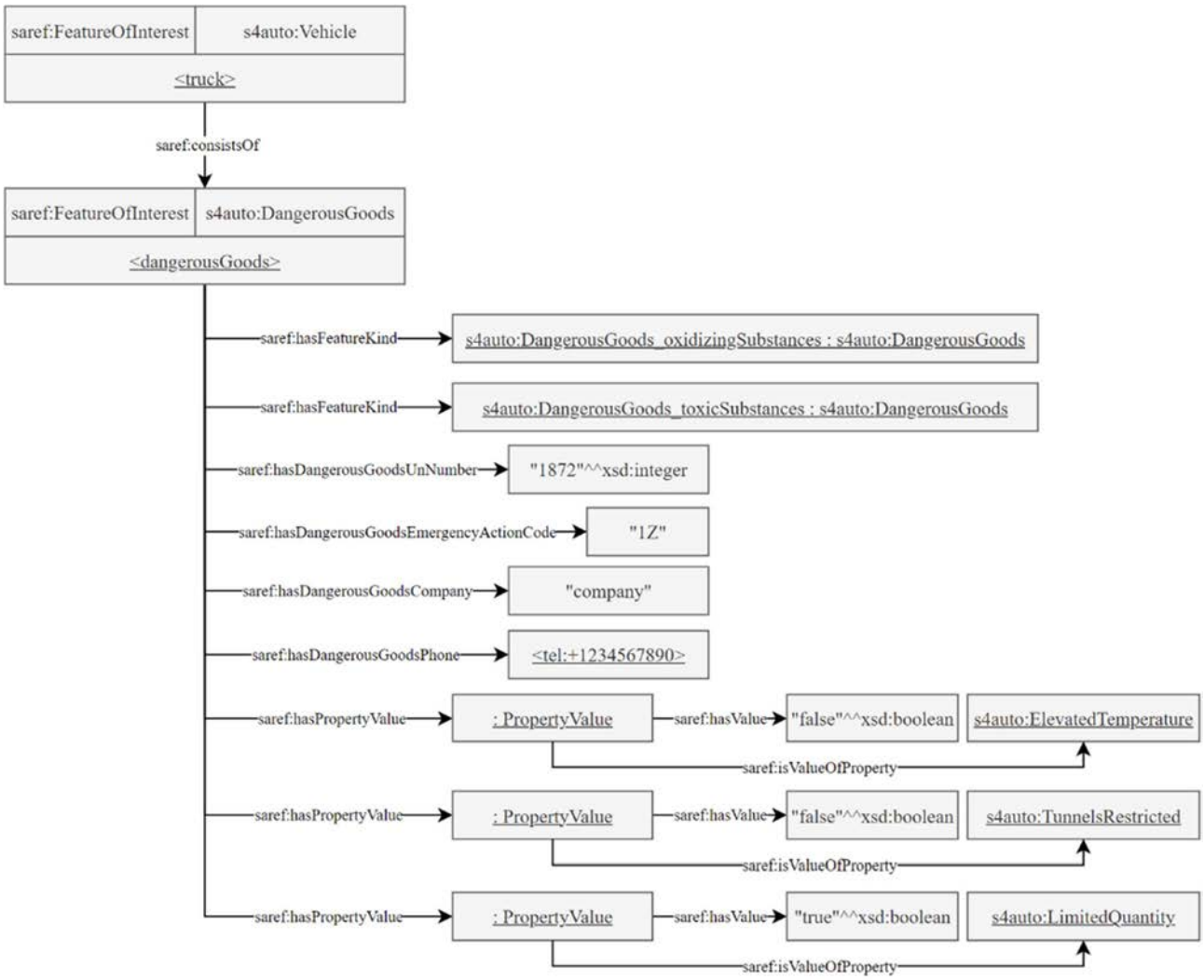

Figure 62: Example for Dangerous Goods

6.3.7.1 Feature kind `s4auto:DangerousGoods`

6.3.7.1.0 Definition

Kind of dangerous goods being carried by a heavy vehicle. Narrower kinds are defined according to `class` and `division` definitions of dangerous goods as specified in part II, chapter 2.1.1.1 of European Agreement concerning the International Carriage of Dangerous Goods by Road [i.13]."@en ; skos:historyNote "Adapted from ETSI TS 102 894-2 [i.8] V2.2.1 - ITS Common Data Dictionary (CDD): term definition DangerousGoodsExtended in https://forge.etsi.org/rep/ITS/asn1/cdd_ts102894_2/-/blob/V2.2.1/ETSI-ITS-CDD.asn#L5068.

`s4auto:DangerousGoods` belongs to the eponym class `s4auto:DangerousGoods`. This class groups `s4auto:DangerousGoods`, narrower feature kinds, and features of interest of this kind.

6.3.7.1.1 Property `s4auto:hasDangerousGoodsCompany`

Is a: owl:DatatypeProperty

Company that manages the transportation of the dangerous goods.

6.3.7.1.2 Property s4auto:hasDangerousGoodsEmergencyActionCode

Is a: owl:DatatypeProperty

Range: xsd:string

Physical signage placard at the vehicle that carries information on how an emergency service should deal with an incident.

6.3.7.1.3 Property s4auto:hasDangerousGoodsPhone

Is a: owl:ObjectProperty

Contact phone number of assistance service in case of incident or accident.
This component should be represented as a IRI with the tel: schema, following IETF RFC 3966 [i.22].

6.3.7.1.4 Property s4auto:hasDangerousGoodsUnNumber

Is a: owl:DatatypeProperty

Range: xsd:integer

The substance of the dangerous goods. An individual with identifier as specified in United Nations Recommendations on the Transport of Dangerous Goods - Model Regulations [i.14].

6.3.7.1.5 Property s4auto:ElevatedTemperature

In category: s4auto:BooleanProperty

Is property of: s4auto:DangerousGoods

TRUE if the carried dangerous goods are transported at high temperature.

6.3.7.1.6 Property s4auto:TunnelsRestricted

In category: s4auto:BooleanProperty

Is property of: s4auto:DangerousGoods

Whether the heavy vehicle carrying dangerous goods is restricted to enter tunnels.
If yes, the value shall be set to TRUE.

6.3.7.1.7 Property s4auto:LimitedQuantity

In category: s4auto:BooleanProperty

Is property of: s4auto:DangerousGoods

Whether the carried dangerous goods are packed with limited quantity.
If yes, the value shall be set to TRUE.

6.3.7.1.8 Feature kind s4auto:DangerousGoods_corrosiveSubstances

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type corrosiveSubstances.

6.3.7.1.9 Feature kind s4auto:DangerousGoods_explosives1

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type explosives1.

6.3.7.1.10 Feature kind s4auto:DangerousGoods_explosives2

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type explosives2.

6.3.7.1.11 Feature kind s4auto:DangerousGoods_explosives3

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type explosives3.

6.3.7.1.12 Feature kind s4auto:DangerousGoods_explosives4

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type explosives4.

6.3.7.1.13 Feature kind s4auto:DangerousGoods_explosives5

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type explosives5.

6.3.7.1.14 Feature kind s4auto:DangerousGoods_explosives6

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type explosives6.

6.3.7.1.15 Feature kind s4auto:DangerousGoods_flammableGases

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type flammableGases.

6.3.7.1.16 Feature kind s4auto:DangerousGoods_flammableLiquids

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type flammableLiquids.

6.3.7.1.17 Feature kind s4auto:DangerousGoods_flammableSolids

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type flammableSolids.

6.3.7.1.18 Feature kind s4auto:DangerousGoods_infectiousSubstances

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type infectiousSubstances.

6.3.7.1.19 Feature kind s4auto:DangerousGoods_miscellaneousDangerousSubstances

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type miscellaneousDangerousSubstances.

6.3.7.1.20 Feature kind s4auto:DangerousGoods_nonFlammableGases

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type nonFlammableGases.

6.3.7.1.21 Feature kind s4auto:DangerousGoods_organicPeroxides

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type organicPeroxides.

6.3.7.1.22 Feature kind s4auto:DangerousGoods_oxidizingSubstances

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type oxidizingSubstances.

6.3.7.1.23 Feature kind s4auto:DangerousGoods_radioactiveMaterial

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type radioactiveMaterial.

6.3.7.1.24 Feature kind s4auto:DangerousGoods_substancesEmittingFlammableGasesUponContactWithWater

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type substancesEmittingFlammableGasesUponContactWithWater.

6.3.7.1.25 Feature kind s4auto:DangerousGoods_substancesLiableToSpontaneousCombustion

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type substancesLiableToSpontaneousCombustion.

6.3.7.1.26 Feature kind s4auto:DangerousGoods_toxicGases

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type toxicGases.

6.3.7.1.27 Feature kind s4auto:DangerousGoods_toxicSubstances

Broader feature kind: s4auto:DangerousGoods

Kind of dangerous goods of type toxicSubstances.

6.3.8 Platoon

6.3.8.0 Overview

Figure 63 describes how platoon consist of vehicles. Platoons have a set of properties. Vehicles also have properties related to platoons.

One may describe when a vehicle joins or leaves a platoon, and when the platoon leader breaks-up the platoon.

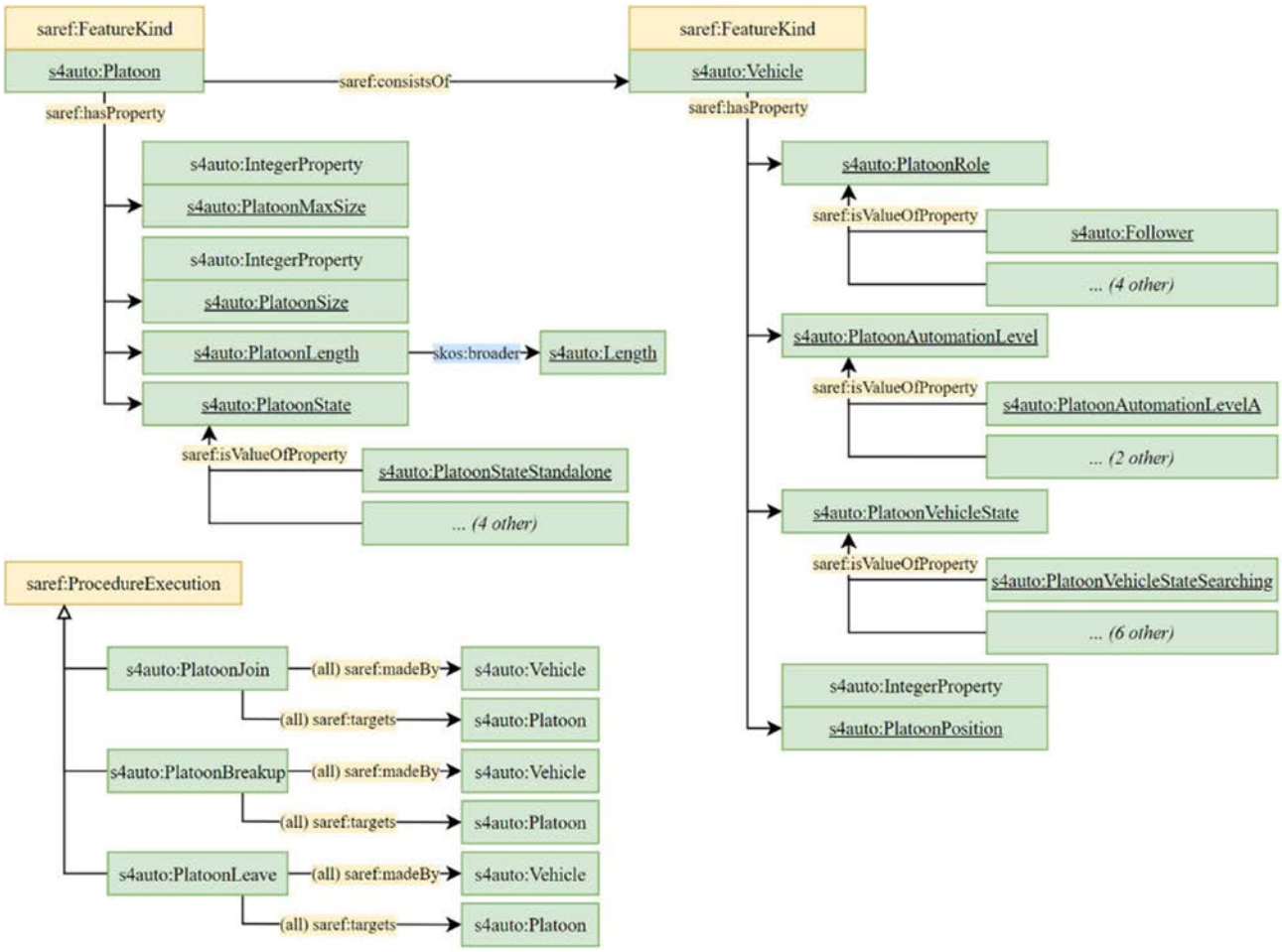

Figure 63: Platoon

Figure 64, Figure 65, and Figure 66, provide practical examples.

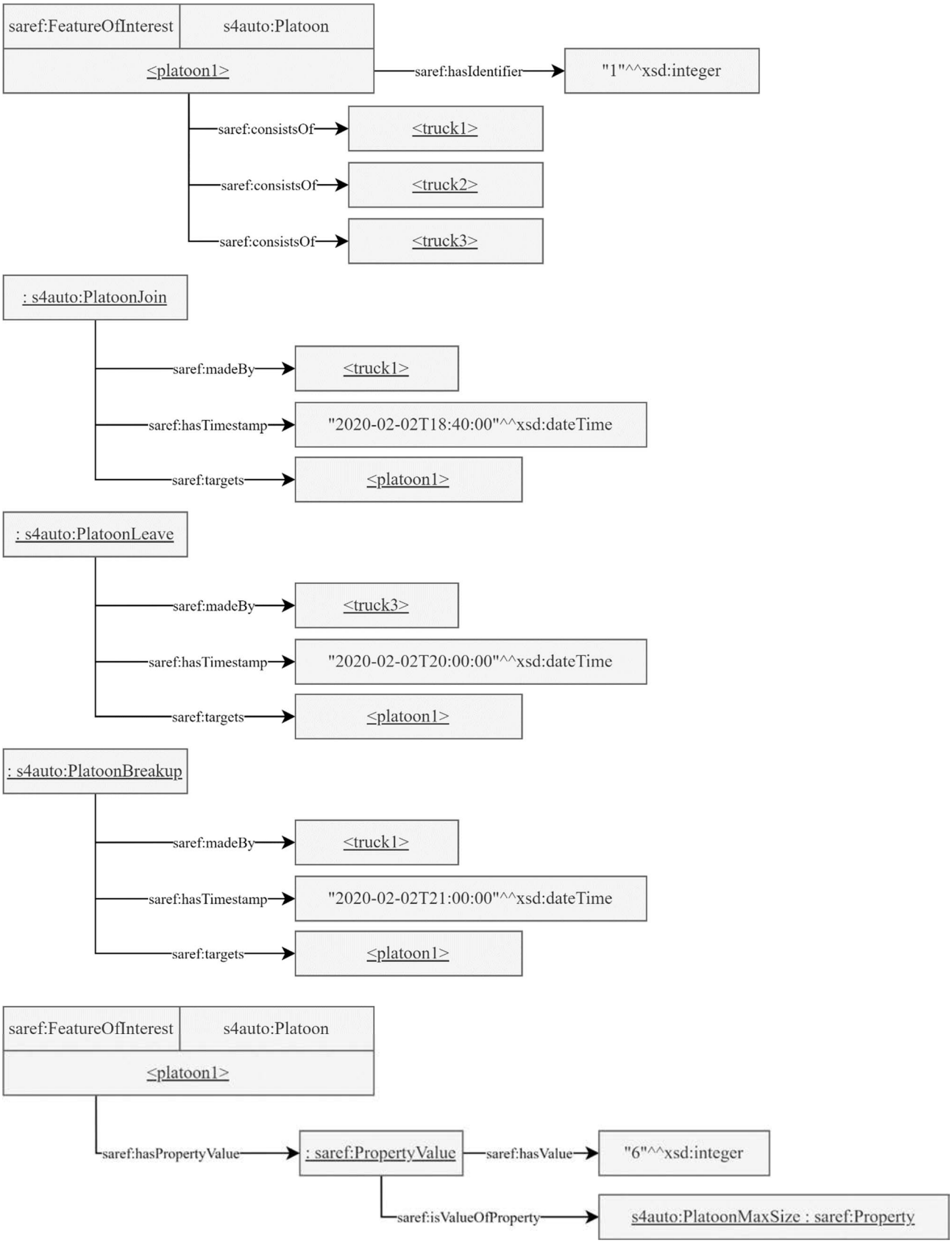

Figure 64: Example for Platoon (1/3)

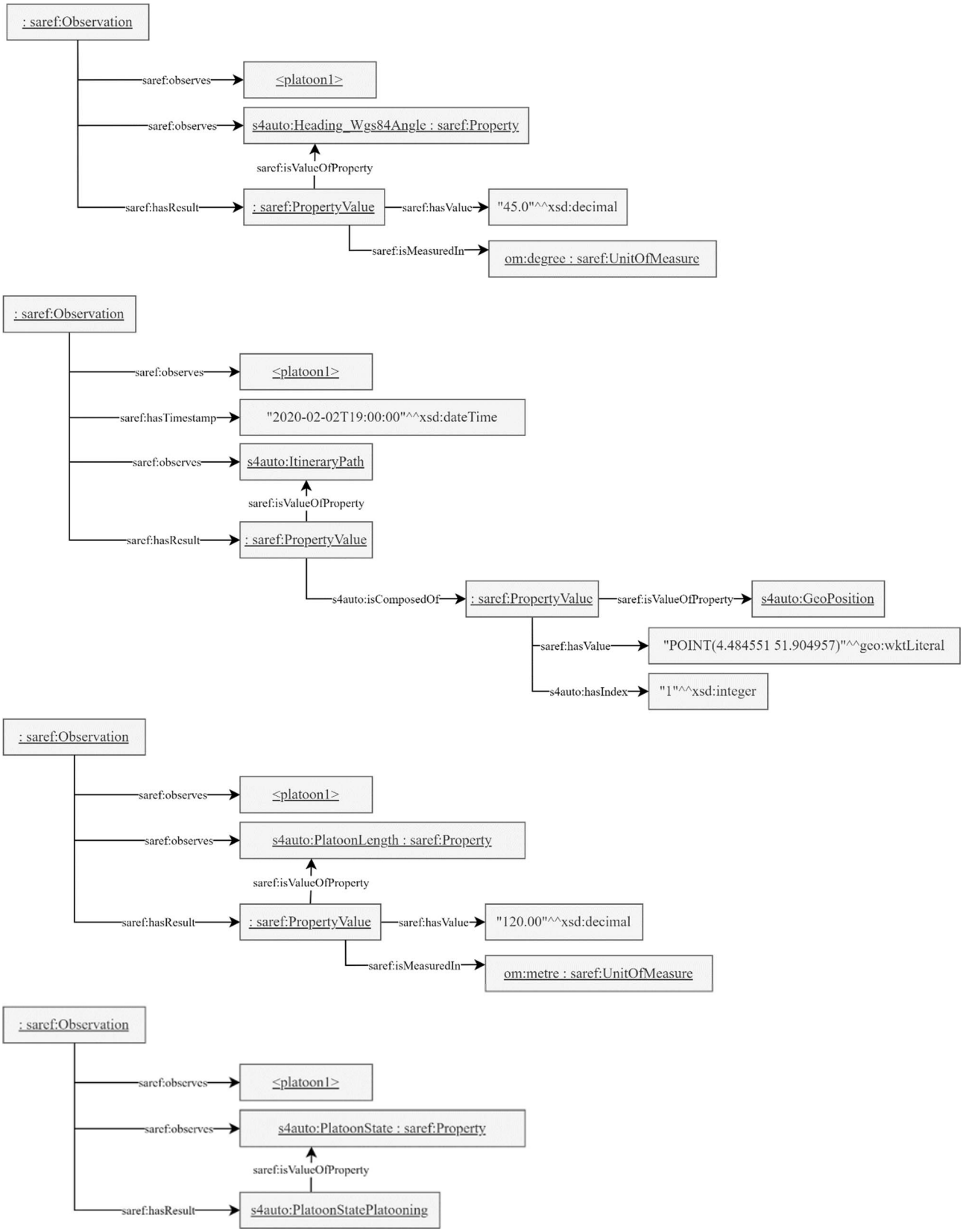

Figure 65: Example for Platoon (2/3)

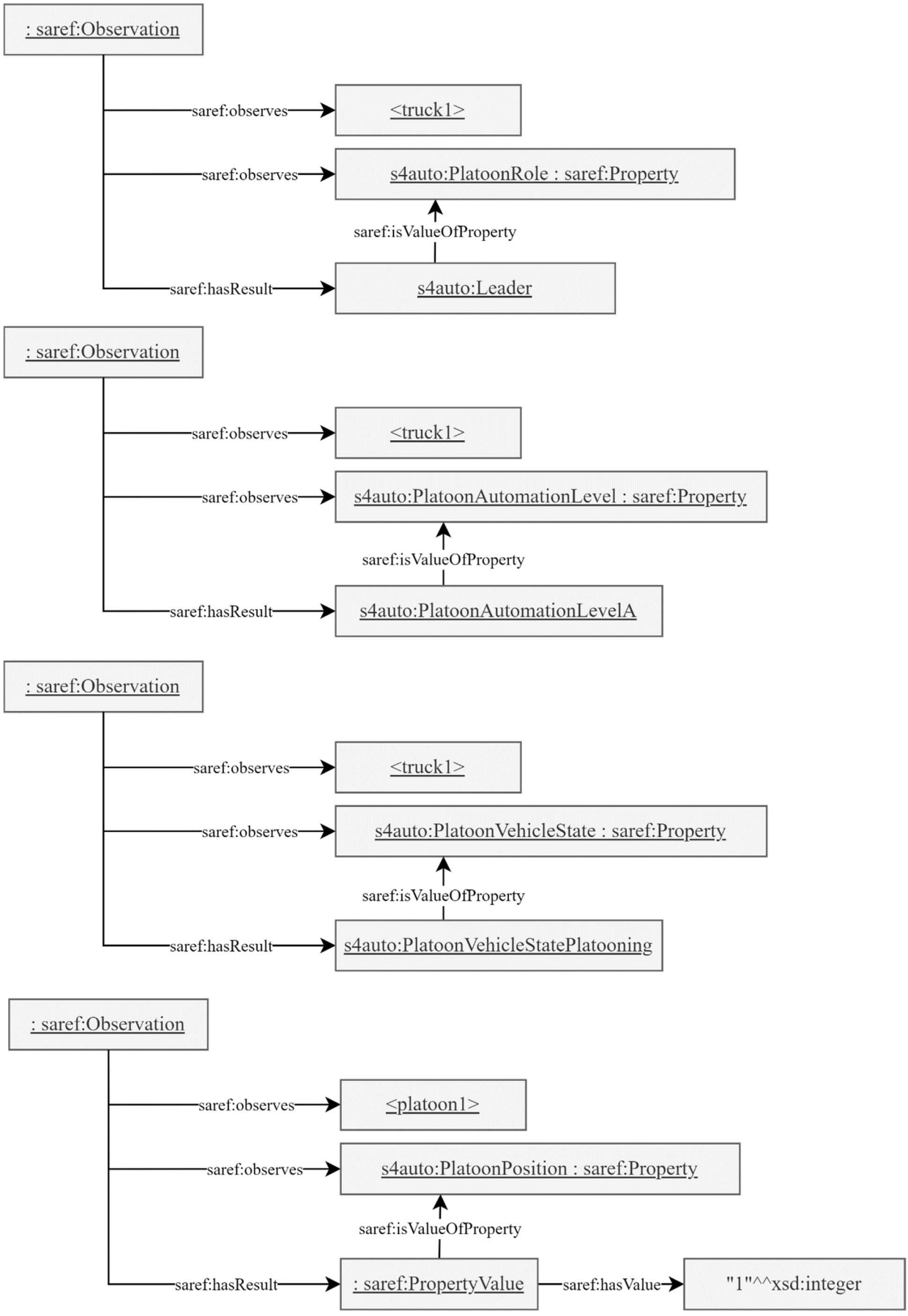

Figure 66: Example for Platoon (3/3)

6.3.8.1 Feature kind s4auto:Platoon

6.3.8.1.0 Definition

Broader feature kind: s4auto:TrafficParticipant

A platoon is a group of vehicles automatically following each other at a relatively close distance.

s4auto:Platoon belongs to the eponym class s4auto:Platoon. This class groups s4auto:Platoon, narrower feature kinds, and features of interest of this kind.

6.3.8.1.1 Property s4auto:PlatoonMaxSize

In category: s4auto:IntegerProperty

Is property of: s4auto:Platoon

The max size of a platoon. This is expected to be a fixed/static value of the platoon that does not change over time, and can therefore be described with saref:PropertyValue directly attached to the platoon instance (a feature of interest). In contrast, the current size of the platoon may change over time and is therefore defined with property (see s4auto:PlatoonSize).

6.3.8.1.2 Property s4auto:PlatoonLength

Broader property: s4auto:Length

Is property of: s4auto:Platoon

Sum of all vehicles' length + inter-vehicle distances.

6.3.8.1.3 Property s4auto:PlatoonSize

In category: s4auto:IntegerProperty

Is property of: s4auto:Platoon

The total number of vehicles currently in the platoon.

6.3.8.1.4 Property s4auto:PlatoonState

6.3.8.1.4.0 Definition

Is property of: s4auto:Platoon

The state of platoons. Examples of states for a platoon are: unknown, standalone, assembling, platooning, disengaging, etc.

6.3.8.1.4.1 Property value s4auto:PlatoonStateAssembling

Is value of property: s4auto:PlatoonState

A type of state for Platoon.

6.3.8.1.4.2 Property value s4auto:PlatoonStateDisengaging

Is value of property: s4auto:PlatoonState

A type of state for a Platoon.

6.3.8.1.4.3 Property value `s4auto:PlatoonStatePlatooning`

Is value of property: `s4auto:PlatoonState`

A type of state for a Platoon.

6.3.8.1.4.4 Property value `s4auto:PlatoonStateStandalone`

Is value of property: `s4auto:PlatoonState`

A type of state for a Platoon.

6.3.8.1.4.5 Property value `s4auto:PlatoonStateUnknown`

Is value of property: `s4auto:PlatoonState`

A type of state for a Platoon.

6.3.8.2 Property `s4auto:PlatoonAutomationLevel`

6.3.8.2.0 Definition

Is property of: `s4auto:Vehicle`

A level of automation is defined for a vehicle that it is platooning. For example, in the ENSEMBLE project there are three levels of platoon automation defined: Level A, Level B, Level C. Level C represents the highest level of automation for platooning in terms of longitudinal and lateral control, shortest time gap supported, wider range of situations handled and support for merging of entire platoons.

6.3.8.2.1 Property value `s4auto:PlatoonAutomationLevelA`

Is value of property: `s4auto:PlatoonAutomationLevel`

Platoon Automation Level A [Source: ENSEMBLE project [i.23]].

6.3.8.2.2 Property value `s4auto:PlatoonAutomationLevelB`

Is value of property: `s4auto:PlatoonAutomationLevel`

Platoon Automation Level B [Source: ENSEMBLE project [i.23]].

6.3.8.2.3 Property value `s4auto:PlatoonAutomationLevelC`

Is value of property: `s4auto:PlatoonAutomationLevel`

Platoon Automation Level C [Source: ENSEMBLE project [i.23]].

6.3.8.3 Property `s4auto:PlatoonPosition`

In category: `s4auto:IntegerProperty`

Broader property: `s4auto:Position`

Is property of: `s4auto:Vehicle`

A position defined as the index of the vehicle in the platoon starting from zero (leader) up to N (trailing vehicle).

6.3.8.4 Property s4auto:PlatoonRole

6.3.8.4.0 Definition

Is property of: s4auto:Vehicle

In platoon a vehicle can assume roles such as: unknown, leader, follower, ready-for-leading, trailing, etc.

6.3.8.4.1 Property value s4auto:Follower

Is value of property: s4auto:PlatoonRole

A type of platoon role.

6.3.8.4.2 Property value s4auto:Leader

Is value of property: s4auto:PlatoonRole

A type of platoon role.

6.3.8.4.3 Property value s4auto:ReadyForLeading

Is value of property: s4auto:PlatoonRole

A type of platoon role.

6.3.8.4.4 Property value s4auto:Trailing

Is value of property: s4auto:PlatoonRole

A type of platoon role.

6.3.8.4.5 Property value s4auto:UnknownPlatoonRole

Is value of property: s4auto:PlatoonRole

A type of platoon role.

6.3.8.5 Property s4auto:PlatoonVehicleState

6.3.8.5.0 Definition

Is property of: s4auto:Vehicle

The state of platoon vehicles. Examples of states are: standalone, engaging, platooning, disengaging, searching, forming.

6.3.8.5.1 Property value s4auto:PlatoonVehicleStateDisengaging

Is value of property: s4auto:PlatoonVehicleState

A type of state for a Vehicle in a Platoon.

6.3.8.5.2 Property value s4auto:PlatoonVehicleStateEngaging

Is value of property: s4auto:PlatoonVehicleState

A type of state for a Vehicle in a Platoon.

6.3.8.5.3 Property value s4auto:PlatoonVehicleStateForming

Is value of property: s4auto:PlatoonVehicleState

A type of state for a Vehicle in a Platoon.

6.3.8.5.4 Property value s4auto:PlatoonVehicleStatePlatooning

Is value of property: s4auto:PlatoonVehicleState

A type of state for a Platoon.

6.3.8.5.5 Property value s4auto:PlatoonVehicleStateSearching

Is value of property: s4auto:PlatoonVehicleState

A type of state for a Vehicle in a Platoon.

6.3.8.5.6 Property value s4auto:PlatoonVehicleStateStandalone

Is value of property: s4auto:PlatoonVehicleState

A type of state for a Vehicle in a Platoon.

6.3.8.5.7 Property value s4auto:PlatoonVehicleStateUnknown

Is value of property: s4auto:PlatoonVehicleState

A type of state for a Vehicle in a Platoon.

6.3.8.6 Procedure Execution s4auto:PlatoonBreakup

Describes the act of a platoon leader carrying out a procedure to breakup a platoon. It is linked to the platoon using OP saref:targets. DP saref:resultTime indicates the time of breakup.

6.3.8.7 Procedure Execution s4auto:PlatoonJoin

Describes the act of a vehicle carrying out a procedure to join a platoon. It is linked to the vehicle that joins the platoon using OP s4auto:madeBy, and to the platoon using OP saref:targets. DP saref:resultTime indicates the time of joining. OP saref:resultPosition indicates the position where the vehicle member joins the platoon. Typically, a s4auto:PlatoonJoin has no saref:hasResult.

6.3.8.8 Procedure Execution s4auto:PlatoonLeave

Describes the act of a platoon participant carrying out a procedure to leave a platoon. It is linked to the platoon using OP saref:targets. DP saref:resultTime indicates the time of leaving.

6.3.9 Vulnerable Road Users

6.3.9.0 Overview

Figure 67 illustrates the kind of vulnerable road users, its narrower kinds, and its different properties.

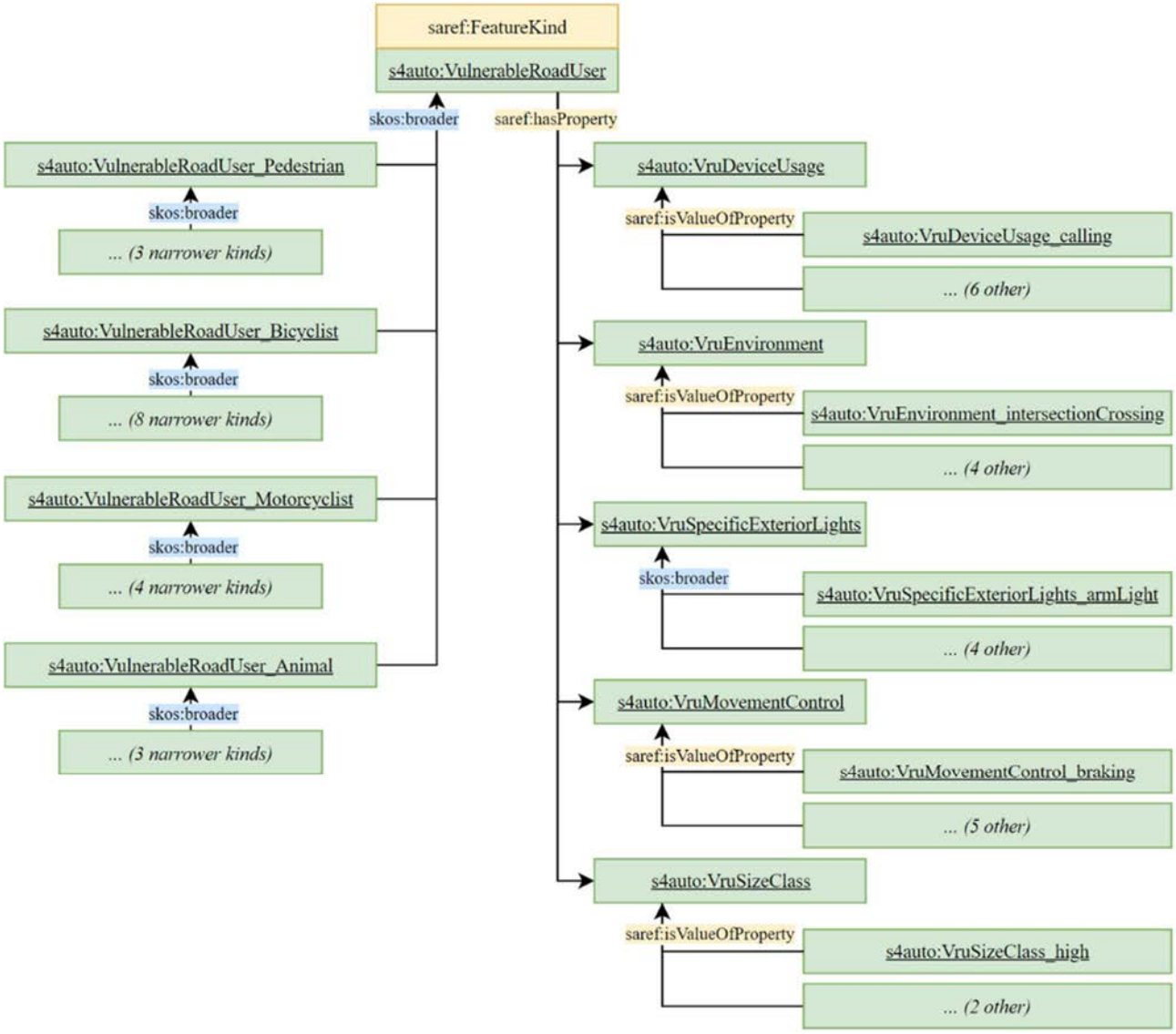

Figure 67: Vulnerable Road Users

6.3.9.1 Feature kind `s4auto:VulnerableRoadUser`

6.3.9.1.0 Definition

Broader feature kind: `s4auto:TrafficParticipant`

Archetype of vulnerable road users, which are non-motorized road users as well as users of VRU vehicles (L class of vehicles, for example mopeds or motorcycles, etc.) participating to the road traffic.

`s4auto:VulnerableRoadUser` belongs to the eponym class `s4auto:VulnerableRoadUser`. This class groups `s4auto:VulnerableRoadUser`, narrower feature kinds, and features of interest of this kind.

6.3.9.1.1 Property `s4auto:VruDeviceUsage`

6.3.9.1.1.0 Definition

Is property of: `s4auto:VulnerableRoadUser`

This property represents the possible usage conditions of the VRU device.

The following property values are defined:

- 2 `idle` - to indicate that the human is currently not interacting with the device;
- 3 `listeningToAudio` - to indicate that any audio source other than calling is in use;
- 4 `typing` - to indicate that the human is texting or performing any other manual input activity;
- 5 `calling` - to indicate that the VRU device is currently receiving a call;
- 6 `playingGames` - to indicate that the human is playing games;
- 7 `reading` - to indicate that the human is reading on the VRU device;
- 8 `viewing` - to indicate that the human is watching dynamic content, including following navigation prompts, viewing videos or other visual contents that are not static.

6.3.9.1.1.1 Property value `s4auto:VruDeviceUsage_idle`

Is value of property: `s4auto:VruDeviceUsage`

Value: 2

2 `idle` - to indicate that the human is currently not interacting with the device.

6.3.9.1.1.2 Property value `s4auto:VruDeviceUsage_listeningToAudio`

Is value of property: `s4auto:VruDeviceUsage`

Value: 3

3 `listeningToAudio` - to indicate that any audio source other than calling is in use.

6.3.9.1.1.3 Property value `s4auto:VruDeviceUsage_typing`

Is value of property: `s4auto:VruDeviceUsage`

Value: 4

4 `typing` - to indicate that the human is texting or performing any other manual input activity.

6.3.9.1.1.4 Property value `s4auto:VruDeviceUsage_calling`

Is value of property: `s4auto:VruDeviceUsage`

Value: 5

5 `calling` - to indicate that the VRU device is currently receiving a call.

6.3.9.1.1.5 Property value `s4auto:VruDeviceUsage_playingGames`

Is value of property: `s4auto:VruDeviceUsage`

Value: 6

6 `playingGames` - to indicate that the human is playing games.

6.3.9.1.1.6 Property value `s4auto:VruDeviceUsage_reading`

Is value of property: `s4auto:VruDeviceUsage`

Value: 7

7 `reading` - to indicate that the human is reading on the VRU device.

6.3.9.1.1.7 Property value s4auto:VruDeviceUsage_viewing

Is value of property: s4auto:VruDeviceUsage

Value: 8

8 viewing - to indicate that the human is watching dynamic content, including following navigation prompts, viewing videos or other visual contents that are not static.

6.3.9.1.2 Property s4auto:VruEnvironment

6.3.9.1.2.0 Definition

Is property of: s4auto:VulnerableRoadUser

This property represents the possible VRU environment conditions.

The following property values are defined:

- 1 intersectionCrossing - to indicate that the VRU is on an intersection or crossing;
- 2 zebraCrossing - to indicate that the VRU is on a zebra crossing (crosswalk);
- 3 sidewalk - to indicate that the VRU is on a sidewalk;
- 4 onVehicleRoad - to indicate that the VRU is on a traffic lane;
- 5 protectedGeographicArea - to indicate that the VRU is in a protected area.

6.3.9.1.2.1 Property value s4auto:VruEnvironment_intersectionCrossing

Is value of property: s4auto:VruEnvironment

Value: 1

1 intersectionCrossing - to indicate that the VRU is on an intersection or crossing.

6.3.9.1.2.2 Property value s4auto:VruEnvironment_zebraCrossing

Is value of property: s4auto:VruEnvironment

Value: 2

2 zebraCrossing - to indicate that the VRU is on a zebra crossing (crosswalk).

6.3.9.1.2.3 Property value s4auto:VruEnvironment_sidewalk

Is value of property: s4auto:VruEnvironment

Value: 3

3 sidewalk - to indicate that the VRU is on a sidewalk.

6.3.9.1.2.4 Property value s4auto:VruEnvironment_onVehicleRoad

Is value of property: s4auto:VruEnvironment

Value: 4

4 onVehicleRoad - to indicate that the VRU is on a traffic lane.

6.3.9.1.2.5 Property value s4auto:VruEnvironment_protectedGeographicArea

Is value of property: s4auto:VruEnvironment

Value: 5

5 protectedGeographicArea- to indicate that the VRU is in a protected area.

6.3.9.1.3 Property s4auto:VruSpecificExteriorLights

Is property of: s4auto:VulnerableRoadUser

This property represents the status of some exterior light switch of a VRU.

Narrower properties indicate the type of exterior light switch of interest:

- s4auto:VruSpecificExteriorLights_backFlashLight - indicates the status of the back flash light;
- s4auto:VruSpecificExteriorLights_helmetLight - indicates the status of the helmet light;
- s4auto:VruSpecificExteriorLights_armLight - indicates the status of the arm light;
- s4auto:VruSpecificExteriorLights_legLight - indicates the status of the leg light;
- s4auto:VruSpecificExteriorLights_wheelLight - indicates the status of the wheel light.

6.3.9.1.4 Property s4auto:VruSpecificExteriorLights_armLight

In category: s4auto:BooleanProperty

Broader property: s4auto:VruSpecificExteriorLights

TRUE when the arm light switch is on.

6.3.9.1.5 Property s4auto:VruSpecificExteriorLights_backFlashLight

In category: s4auto:BooleanProperty

Broader property: s4auto:VruSpecificExteriorLights

TRUE when the back flash light switch is on.

6.3.9.1.6 Property s4auto:VruSpecificExteriorLights_helmetLight

In category: s4auto:BooleanProperty

Broader property: s4auto:VruSpecificExteriorLights

TRUE when the helmet light switch is on.

6.3.9.1.7 Property s4auto:VruSpecificExteriorLights_legLight

In category: s4auto:BooleanProperty

Broader property: s4auto:VruSpecificExteriorLights

TRUE when the leg light switch is on.

6.3.9.1.8 Property s4auto:VruSpecificExteriorLights_wheelLight

In category: s4auto:BooleanProperty

Broader property: s4auto:VruSpecificExteriorLights

TRUE when the wheel light switch is on.

6.3.9.1.9 Property s4auto:VruMovementControl

6.3.9.1.9.0 Definition

Is property of: s4auto:VulnerableRoadUser

This property indicates the status of the possible human control over a VRU vehicle.

The following property values are defined:

- 1 braking - to indicate that the VRU is braking;
- 2 hardBraking - to indicate that the VRU is braking hard;
- 3 stopPedalling - to indicate that the VRU stopped pedalling;
- 4 brakingAndStopPedalling - to indicate that the VRU stopped pedalling an is braking;
- 5 hardBrakingAndStopPedalling - to indicate that the VRU stopped pedalling an is braking hard;
- 6 noReaction - to indicate that the VRU is not changing its behaviour.

6.3.9.1.9.1 Property value s4auto:VruMovementControl_braking

Is value of property: s4auto:VruMovementControl

Value: 1

1 braking - to indicate that the VRU is braking.

6.3.9.1.9.2 Property value s4auto:VruMovementControl_hardBraking

Is value of property: s4auto:VruMovementControl

Value: 2

2 hardBraking - to indicate that the VRU is braking hard.

6.3.9.1.9.3 Property value s4auto:VruMovementControl_stopPedaling

Is value of property: s4auto:VruMovementControl

Value: 3

3 stopPedalling - to indicate that the VRU stopped pedalling.

6.3.9.1.9.4 Property value s4auto:VruMovementControl_brakingAndStopPedaling

Is value of property: s4auto:VruMovementControl

Value: 4

4 brakingAndStopPedalling - to indicate that the VRU stopped pedalling and is braking.

6.3.9.1.9.5 Property value s4auto:VruMovementControl_hardBrakingAndStopPedaling

Is value of property: s4auto:VruMovementControl

Value: 5

5 hardBrakingAndStopPedalling - to indicate that the VRU stopped pedalling and is braking hard.

6.3.9.1.9.6 Property value s4auto:VruMovementControl_noReaction

Is value of property: s4auto:VruMovementControl

Value: 6

6 noReaction - to indicate that the VRU is not changing its behaviour.

6.3.9.1.10 Property s4auto:VruSizeClass

6.3.9.1.10.0 Definition

Is property of: s4auto:VulnerableRoadUser

This property indicates the approximate size of a VRU including the VRU vehicle used.

The following property values are defined:

- 1 low - to indicate that the VRU size class is low depending on the VRU profile;
- 2 medium - to indicate that the VRU size class is medium depending on the VRU profile;
- 3 high - to indicate that the VRU size class is high depending on the VRU profile.

6.3.9.1.10.1 Property value s4auto:VruSizeClass_low

Is value of property: s4auto:VruSizeClass

Value: 1

1 low - to indicate that the VRU size class is low depending on the VRU profile.

6.3.9.1.10.2 Property value s4auto:VruSizeClass_medium

Is value of property: s4auto:VruSizeClass

Value: 2

2 medium - to indicate that the VRU size class is medium depending on the VRU profile.

6.3.9.1.10.3 Property value s4auto:VruSizeClass_high

Is value of property: s4auto:VruSizeClass

Value: 3

3 high - to indicate that the VRU size class is high depending on the VRU profile.

6.3.9.1.11 Feature kind s4auto:VulnerableRoadUser_Animal

6.3.9.1.11.0 Definition

Broader feature kind: s4auto:VulnerableRoadUser

VRU Profile 4 - Animal. For example: dogs, wild animals, horses, cows, sheep, kangaroos, etc.

6.3.9.1.11.1 Feature kind s4auto:VulnerableRoadUser_Animal_farm-animal

Broader feature kind: s4auto:VulnerableRoadUser_Animal

An animal belonging to a farm.

6.3.9.1.11.2 Feature kind s4auto:VulnerableRoadUser_Animal_service-animal

Broader feature kind: s4auto:VulnerableRoadUser_Animal

An animal that supports a human being.

6.3.9.1.11.3 Feature kind s4auto:VulnerableRoadUser_Animal_wild-animal

Broader feature kind: s4auto:VulnerableRoadUser_Animal

An animal living in the wildness.

6.3.9.1.12 Feature kind s4auto:VulnerableRoadUser_Bicyclist

6.3.9.1.12.0 Definition

Broader feature kind: s4auto:VulnerableRoadUser

VRU Profile 2 - Bicyclist. For example: user of bicycle, wheelchair, rollerskater, e-scooter, pedelec, or a mounted horse rider.

6.3.9.1.12.1 Feature kind s4auto:VulnerableRoadUser_Bicyclist_bicyclist

Broader feature kind: s4auto:VulnerableRoadUser_Bicyclist

A cycle and bicyclist.

6.3.9.1.12.2 Feature kind s4auto:VulnerableRoadUser_Bicyclist_e-scooter

Broader feature kind: s4auto:VulnerableRoadUser_Bicyclist

An e-scooter and rider.

6.3.9.1.12.3 Feature kind s4auto:VulnerableRoadUser_Bicyclist_horse-and-rider

Broader feature kind: s4auto:VulnerableRoadUser_Bicyclist

A horse and rider.

6.3.9.1.12.4 Feature kind s4auto:VulnerableRoadUser_Bicyclist_pedelec

Broader feature kind: s4auto:VulnerableRoadUser_Bicyclist

A pedelec and rider.

6.3.9.1.12.5 Feature kind s4auto:VulnerableRoadUser_Bicyclist_personal-transporter

Broader feature kind: s4auto:VulnerableRoadUser_Bicyclist

A personal-transporter and rider.

6.3.9.1.12.6 Feature kind s4auto:VulnerableRoadUser_Bicyclist_rollerskater

Broader feature kind: s4auto:VulnerableRoadUser_Bicyclist

A rollerkater and skater.

6.3.9.1.12.7 Feature kind s4auto:VulnerableRoadUser_Bicyclist_speed-pedelec

Broader feature kind: s4auto:VulnerableRoadUser_Bicyclist

A speed-pedelec and rider.

6.3.9.1.12.8 Feature kind s4auto:VulnerableRoadUser_Bicyclist_wheelchair-user

Broader feature kind: s4auto:VulnerableRoadUser_Bicyclist

A wheelchair and its user.

6.3.9.1.13 Feature kind s4auto:VulnerableRoadUser_Motorcyclist

6.3.9.1.13.0 Definition

Broader feature kind: s4auto:VulnerableRoadUser

VRU Profile 3 - Motorcyclist, which are equipped with engines that allow them to move on the road. It includes users (driver and passengers, e.g. children and animals) of Powered Two Wheelers (PTW) such as mopeds (motorized scooters), motorcycles or side-cars.

6.3.9.1.13.1 Feature kind s4auto:VulnerableRoadUser_Motorcyclist_moped

Broader feature kind: s4auto:VulnerableRoadUser_Motorcyclist

A moped and rider.

6.3.9.1.13.2 Feature kind s4auto:VulnerableRoadUser_Motorcyclist_motorcycle

Broader feature kind: s4auto:VulnerableRoadUser_Motorcyclist

A motorcycle and rider.

6.3.9.1.13.3 Feature kind s4auto:VulnerableRoadUser_Motorcyclist_motorcycle-and-sidecar-left

Broader feature kind: s4auto:VulnerableRoadUser_Motorcyclist

A motorcycle with sidecar on the left and rider.

6.3.9.1.13.4 Feature kind s4auto:VulnerableRoadUser_Motorcyclist_motorcycle-and-sidecar-right

Broader feature kind: s4auto:VulnerableRoadUser_Motorcyclist

A motorcycle with sidecar on the right and rider.

6.3.9.1.14 Feature kind s4auto:VulnerableRoadUser_Pedestrian

6.3.9.1.14.0 Definition

Broader feature kind: s4auto:VulnerableRoadUser

VRU Profile 1 - Pedestrian. For example: adult, child, elderly person, pram, animal, blind person guided by a dog, rider off its bike.

6.3.9.1.14.1 Feature kind s4auto:VulnerableRoadUser_Pedestrian_first-responder

Broader feature kind: s4auto:VulnerableRoadUser_Pedestrian

A pedestrian with the role of a first responder.

6.3.9.1.14.2 Feature kind s4auto:VulnerableRoadUser_Pedestrian_ordinary-pedestrian

Broader feature kind: s4auto:VulnerableRoadUser_Pedestrian

A pedestrian to which no more-specific profile applies.

6.3.9.1.14.3 Feature kind `s4auto:VulnerableRoadUser_Pedestrian_road-worker`

Broader feature kind: `s4auto:VulnerableRoadUser_Pedestrian`

A pedestrian with the role of a road worker.

6.3.10 Vulnerable Road User Clusters

6.3.10.0 Overview

Figure 68 describes vulnerable road user clusters, that consist of vulnerable road users.

One may describe when and for what reason a vulnerable road user joins or leaves a cluster, and when the cluster leader breaks-up the cluster.

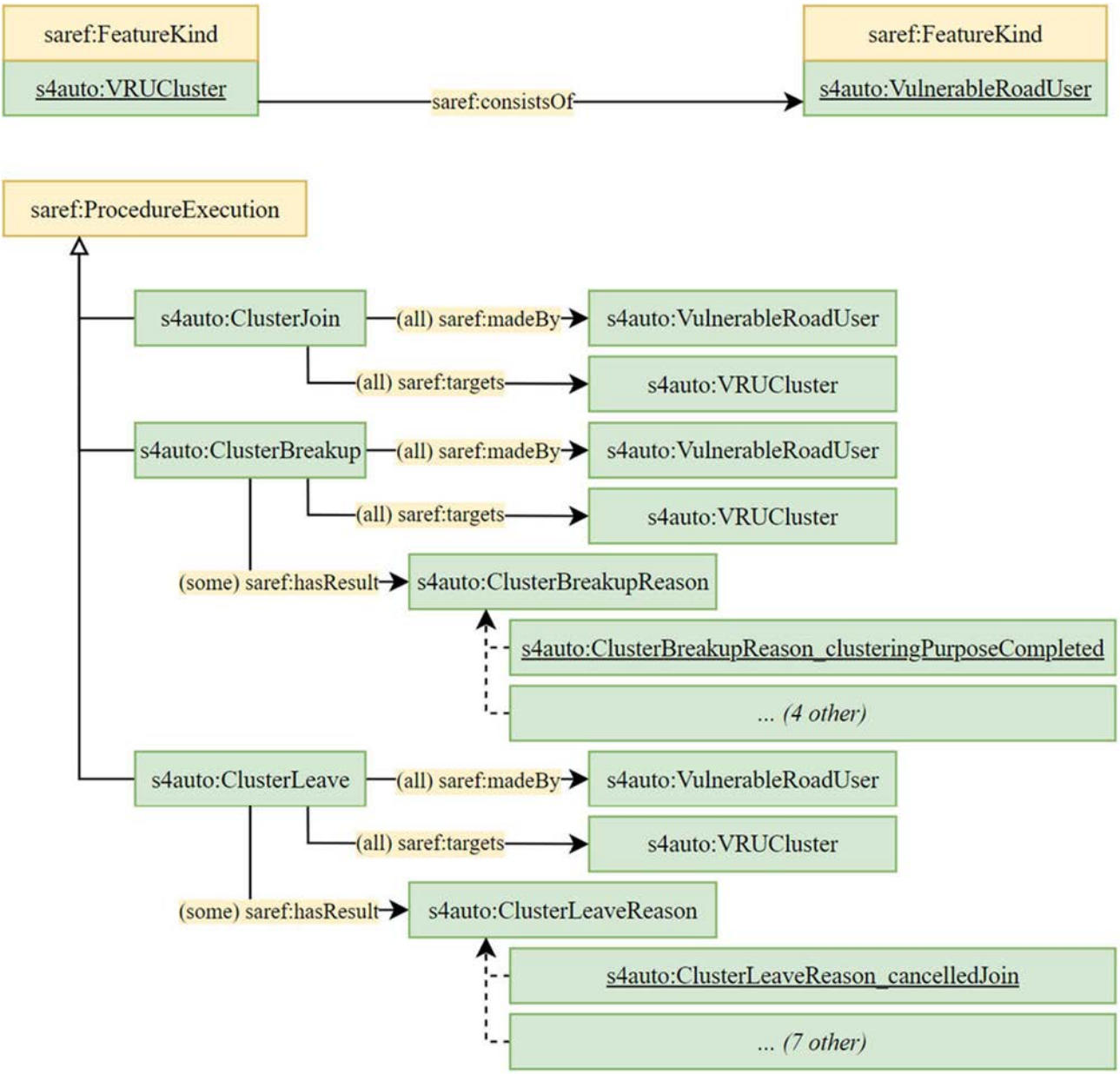

Figure 68: Vulnerable Road User Clusters

Figure 69 provides practical examples.

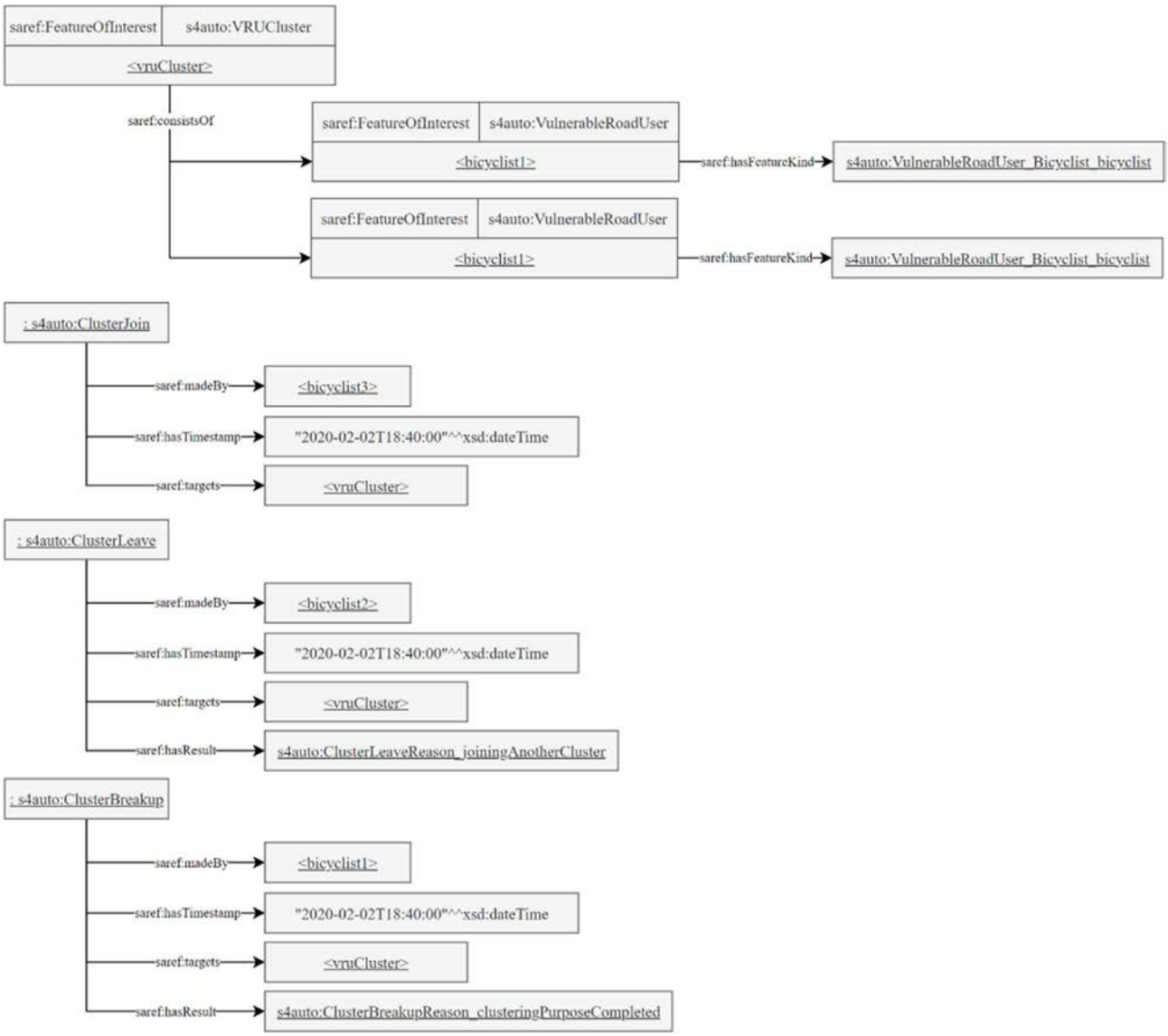

Figure 69: Example for Vulnerable Road User Clusters

6.3.10.1 Feature kind `s4auto:VRUCluster`

Broader feature kind: `s4auto:TrafficParticipant`

A Vulnerable Road User (VRU) cluster is a group of VRUs with a homogeneous behaviour (see ETSI TS 103 300-2 [i.18]), where VRU Awareness Messages (VAM) related to the VRU cluster provide information about the entire cluster. Within a VRU cluster, VRU devices take the role of either leader (one per cluster) or member.

A VRU Cluster may have a geometry as a bounding box.

A cluster may contain VRU devices of multiple profiles. A cluster is referred to as "homogeneous" if it contains devices of only one profile, and "heterogeneous" if it contains VRU devices of more than one profile (e.g. a mixed group of pedestrians and bicyclists).

`s4auto:VRUCluster` belongs to the eponym class `s4auto:VRUCluster`. This class groups `s4auto:VRUCluster`, narrower feature kinds, and features of interest of this kind.

6.3.10.2 Procedure Execution `s4auto:ClusterBreakup`

Describes the act of a VRU leader carrying out a procedure to breakup a VRU cluster. It is linked to the VRU cluster using OP `saref:targets`. DP `saref:resultTime` indicates the time of breakup. OP `saref:hasResult`, if present, indicates the reason for breakup.

6.3.10.3 Class s4auto:ClusterBreakupReason

6.3.10.3.0 Definition

This class indicates the reasons why a cluster leader intends to break up a VRU cluster.

The following instances are defined:

- s4auto:ClusterBreakupReason_clusteringPurposeCompleted - the cluster purpose has been completed;
- s4auto:ClusterBreakupReason_leaderMovedOutOfClusterBoundingBox - the leader moved out of the cluster's bounding box;
- s4auto:ClusterBreakupReason_joiningAnotherCluster - the cluster leader is about to join another cluster;
- s4auto:ClusterBreakupReason_enteringLowRiskAreaBasedOnMaps - the cluster is entering an area identified as low risk based on the use of maps;
- s4auto:ClusterBreakupReason_receptionOfCpmContainingCluster - the leader received a Collective Perception Message containing information about the same cluster.

6.3.10.3.1 s4auto:ClusterBreakupReason_clusteringPurposeCompleted

The cluster purpose has been completed.

6.3.10.3.2 s4auto:ClusterBreakupReason_enteringLowRiskAreaBasedOnMaps

The cluster is entering an area identified as low risk based on the use of maps.

6.3.10.3.3 s4auto:ClusterBreakupReason_joiningAnotherCluster

The cluster leader is about to join another cluster.

6.3.10.3.4 s4auto:ClusterBreakupReason_leaderMovedOutOfClusterBoundingBox

The leader moved out of the cluster's bounding box.

6.3.10.3.5 s4auto:ClusterBreakupReason_receptionOfCpmContainingCluster

The leader received a Collective Perception Message containing information about the same cluster.

6.3.10.4 Procedure Execution s4auto:ClusterJoin

Describes the act of a VRU carrying out a procedure to join a VRU cluster. It is linked to the VRU that joins the cluster using OP s4auto:madeBy, and to the VRU cluster using OP saref:targets. DP saref:resultTime indicates the time of joining. Typically, a s4auto:ClusterJoin has no saref:hasResult.

6.3.10.5 Procedure Execution s4auto:ClusterLeave

Describes the act of a VRU cluster participant carrying out a procedure to leave a VRU cluster. It is linked to the VRU cluster using OP saref:targets. DP saref:resultTime indicates the time of leaving. OP saref:hasResult, if present, indicates the reason why a cluster participant is leaving the cluster.

6.3.10.6 Class s4auto:ClusterLeaveReason

6.3.10.6.0 Definition

This property indicates the reason why a cluster participant is leaving the cluster.

The following instances values are defined:

- `s4auto:ClusterLeaveReason_clusterLeaderLost` - if the cluster leader cannot be found anymore;
- `s4auto:ClusterLeaveReason_clusterDisbandedByLeader` - if the cluster has been disbanded by the leader;
- `s4auto:ClusterLeaveReason_outOfClusterBoundingBox` - if the participants moved out of the cluster's bounding box;
- `s4auto:ClusterLeaveReason_outOfClusterSpeedRange` - if the cluster speed moved out of a defined range;
- `s4auto:ClusterLeaveReason_joiningAnotherCluster` - if the participant is joining another cluster;
- `s4auto:ClusterLeaveReason_cancelledJoin` - if the participant is cancelling a joining procedure;
- `s4auto:ClusterLeaveReason_failedJoin` - if the participant failed to join the cluster;
- `s4auto:ClusterLeaveReason_safetyCondition` - if a safety condition applies.

6.3.10.6.1 `s4auto:ClusterLeaveReason_cancelledJoin`

The participant is cancelling a joining procedure.

6.3.10.6.2 `s4auto:ClusterLeaveReason_clusterDisbandedByLeader`

The cluster has been disbanded by the leader.

6.3.10.6.3 `s4auto:ClusterLeaveReason_clusterLeaderLost`

The cluster leader cannot be found anymore.

6.3.10.6.4 `s4auto:ClusterLeaveReason_failedJoin`

The participant failed to join the cluster.

6.3.10.6.5 `s4auto:ClusterLeaveReason_joiningAnotherCluster`

The participant is joining another cluster.

6.3.10.6.6 `s4auto:ClusterLeaveReason_outOfClusterBoundingBox`

The participants moved out of the cluster's bounding box.

6.3.10.6.7 `s4auto:ClusterLeaveReason_outOfClusterSpeedRange`

The cluster speed moved out of a defined range.

6.3.10.6.8 `s4auto:ClusterLeaveReason_safetyCondition`

A safety condition applies.

6.3.11 Parking Spots

6.3.11.0 Overview

Figure 70 illustrates the kind of parking spots, its different narrower kinds, and the properties that can be used to describe it. Vehicles have a state related to a parking spot.

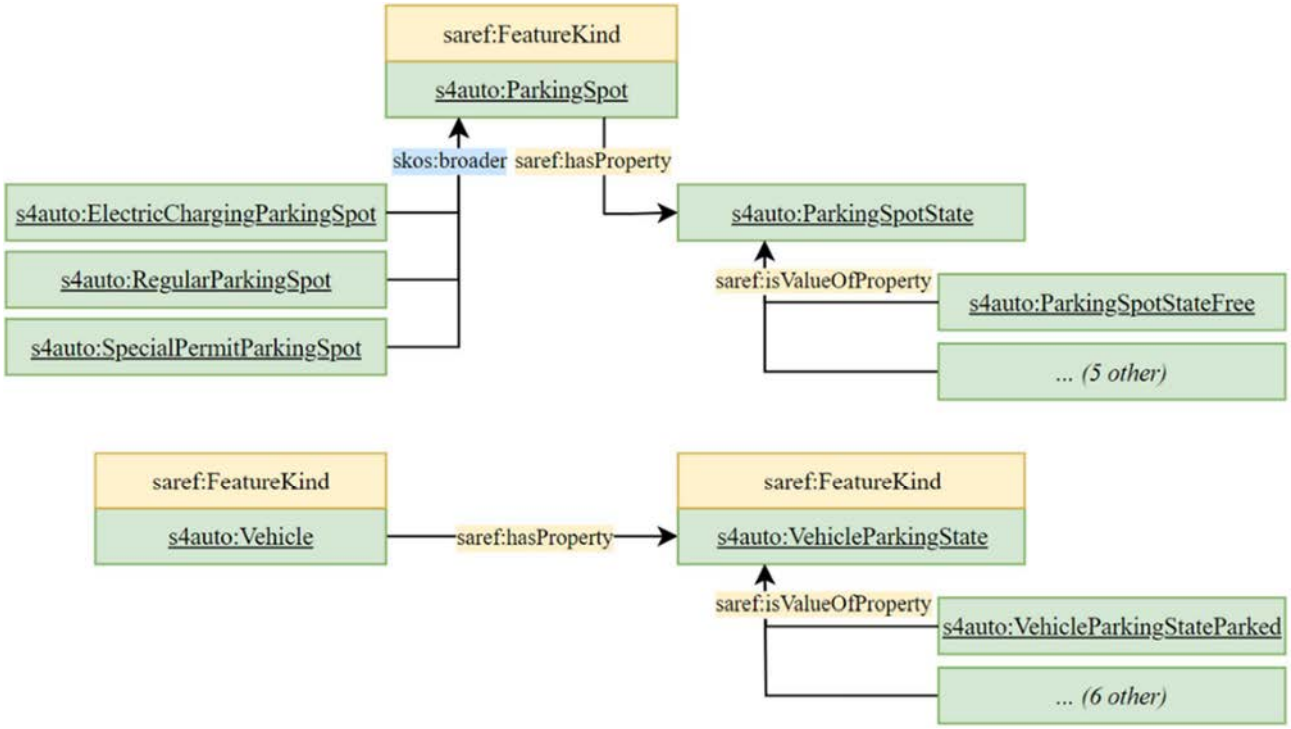

Figure 70: Parking Spots

Figure 71 and Figure 72 provide practical examples.

Figure 71: Example for Parking Spots (1/2)

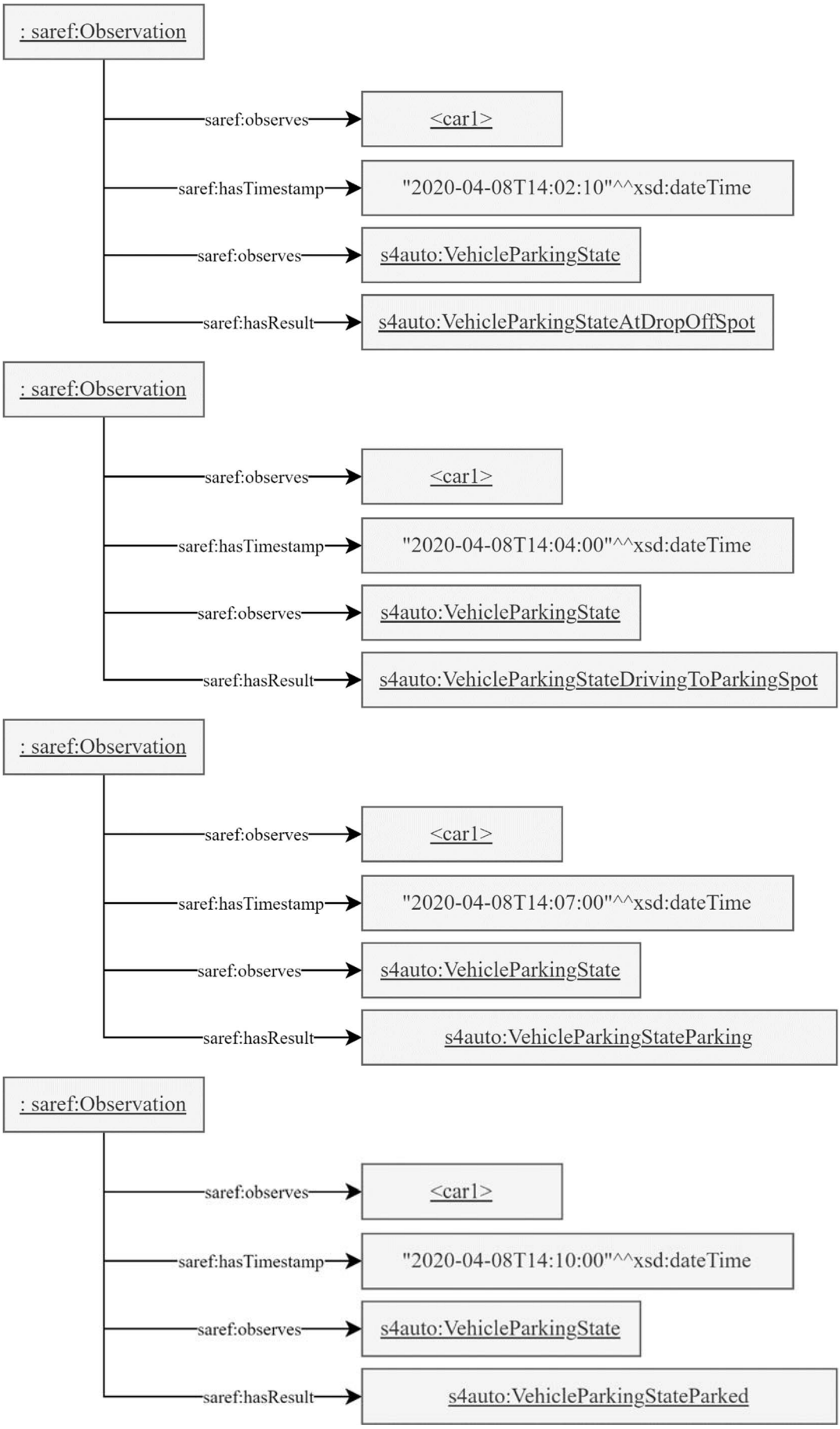

Figure 72: Example for Parking Spots (2/2)

6.3.11.1 Feature kind s4auto:ParkingSpot

6.3.11.1.0 Definition

Broader feature kind: s4auto:AutomotiveEntity

A location that is designated for parking. A parking spot is a geo:Feature and can thus have a geometry.

s4auto:ParkingSpot belongs to the eponym class s4auto:ParkingSpot. This class groups s4auto:ParkingSpot, narrower feature kinds, and features of interest of this kind.

6.3.11.1.1 Property s4auto:ParkingSpotState

6.3.11.1.1.0 Definition

Is property of: s4auto:ParkingSpot

The state related to parking spots. Possible values for parking spot state are Free, occupied, reserved, closed, charging.

6.3.11.1.1.1 Property value s4auto:ParkingSpotStateCharging

Is value of property: s4auto:ParkingSpotState

A type of state for Parking Spot.

6.3.11.1.1.2 Property value s4auto:ParkingSpotStateClosed

Is value of property: s4auto:ParkingSpotState

A type of state for Parking Spot.

6.3.11.1.1.3 Property value s4auto:ParkingSpotStateFree

Is value of property: s4auto:ParkingSpotState

A type of state for Parking Spot.

6.3.11.1.1.4 Property value s4auto:ParkingSpotStateOccupied

Is value of property: s4auto:ParkingSpotState

A type of state for Parking Spot.

6.3.11.1.1.5 Property value s4auto:ParkingSpotStateOpen

Is value of property: s4auto:ParkingSpotState

A type of state for Parking Spot.

6.3.11.1.1.6 Property value s4auto:ParkingSpotStateReserved

Is value of property: s4auto:ParkingSpotState

A type of state for Parking Spot.

6.3.11.1.2 Feature kind s4auto:ElectricChargingParkingSpot

Broader feature kind: s4auto:ParkingSpot

A type of parking spot.

6.3.11.1.3 Feature kind s4auto:RegularParkingSpot

Broader feature kind: s4auto:ParkingSpot

A type of parking spot.

6.3.11.1.4 Feature kind s4auto:SpecialPermitParkingSpot

Broader feature kind: s4auto:ParkingSpot

A type of parking spot. Parking spot reserved for special permits (authorities, disabled, blue Zone, resident, etc.).

6.3.11.2 Property s4auto:VehicleParkingState

6.3.11.2.0 Definition

Is property of: s4auto:Vehicle

The state related to the parking phases of a vehicle.

6.3.11.2.1 Property value s4auto:VehicleParkingStateAtDropOffSpot

Is value of property: s4auto:VehicleParkingState

A type of state for Parking Vehicle.

6.3.11.2.2 Property value s4auto:VehicleParkingStateAtPickUpSpot

Is value of property: s4auto:VehicleParkingState

A type of state for Parking Vehicle.

6.3.11.2.3 Property value s4auto:VehicleParkingStateCharging

Is value of property: s4auto:VehicleParkingState

A type of state for Parking Vehicle.

6.3.11.2.4 Property value s4auto:VehicleParkingStateDrivingToParkingSpot

Is value of property: s4auto:VehicleParkingState

A type of state for Parking Vehicle.

6.3.11.2.5 Property value s4auto:VehicleParkingStateDrivingToPickUpSpot

Is value of property: s4auto:VehicleParkingState

A type of state for Parking Vehicle.

6.3.11.2.6 Property value s4auto:VehicleParkingStateParked

Is value of property: s4auto:VehicleParkingState

A type of state for Parking Vehicle.

6.3.11.2.7 Property value s4auto:VehicleParkingStateParking

Is value of property: s4auto:VehicleParkingState

A type of state for Parking Vehicle.

6.3.12 Automotive Devices

6.3.12.0 Overview

Figure 73 illustrates the narrower kinds of automotive device, and the different categories of automotive devices.

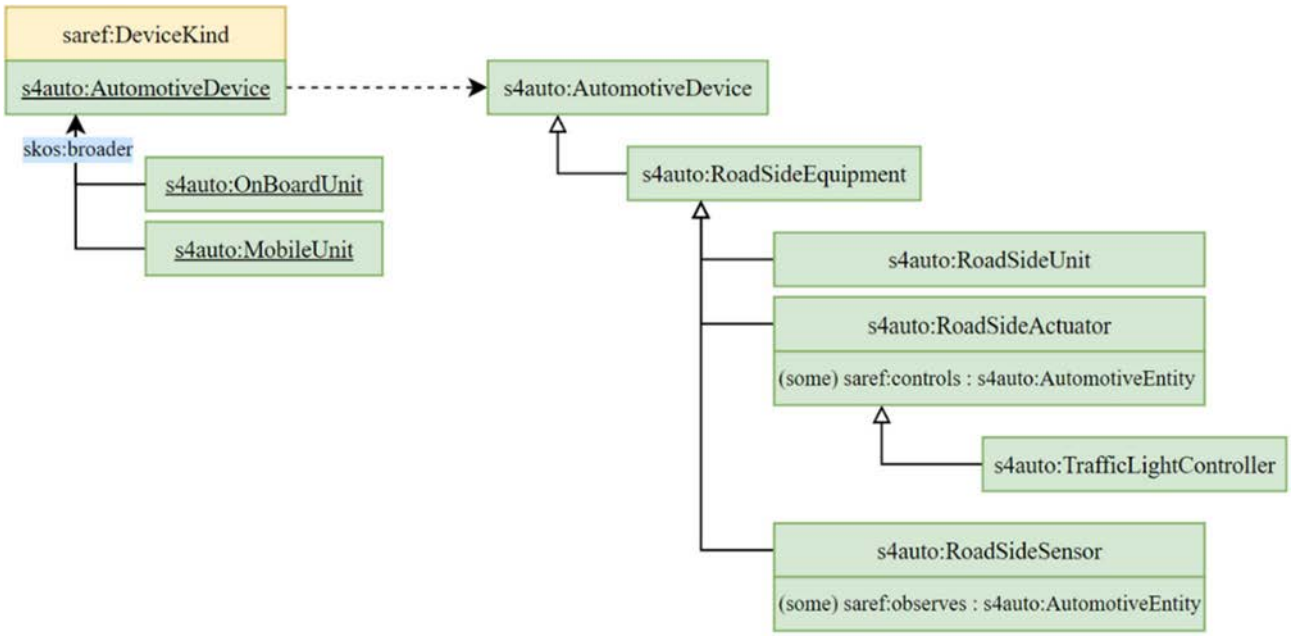

Figure 73: Automotive Devices

Figure 74 provide practical examples.

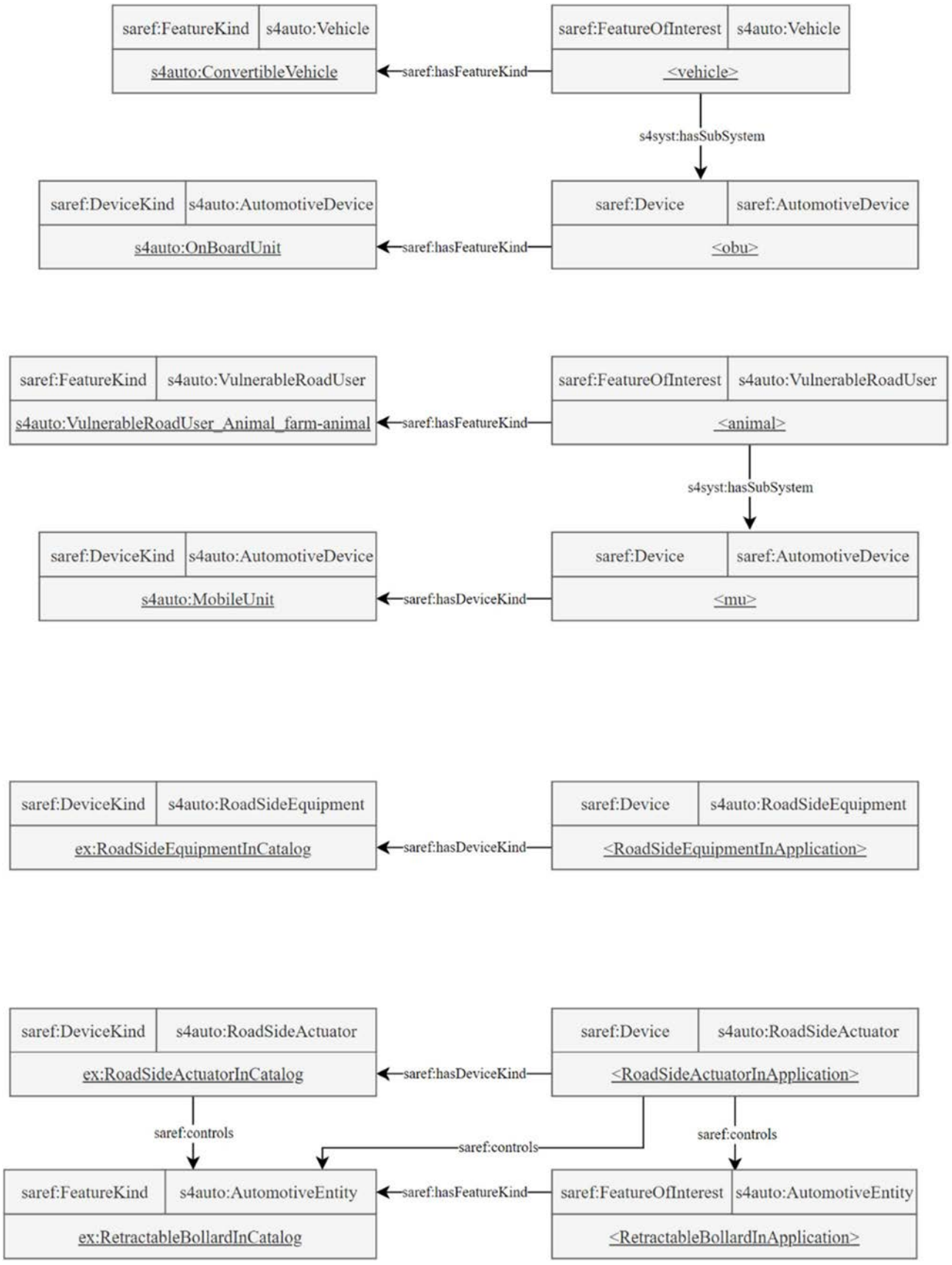

Figure 74: Example for Automotive Devices

6.3.12.1 Device kind s4auto:AutomotiveDevice

Broader device kind: s4auto:AutomotiveEntity

A device used to wirelessly communicate with other devices for safety and mobility purposes.

s4auto:AutomotiveDevice belongs to the eponym class s4auto:AutomotiveDevice. This class groups s4auto:AutomotiveDevice, narrower device kinds, and devices of this kind.

6.3.12.2 Device kind s4auto:MobileUnit

Broader device kind: s4auto:AutomotiveDevice

A device used to wirelessly communicate with other devices for safety and mobility purposes carried by a pedestrian, bicyclist, work zone worker, or other traveller.

6.3.12.3 Device kind s4auto:OnBoardUnit

Broader device kind: s4auto:AutomotiveDevice

A device used to wirelessly communicate with other devices for safety and mobility purposes installed in a vehicle as original equipment or as aftermarket equipment (sometimes referred to as an "aftermarket safety device (ASD)".

6.3.12.4 Device class s4auto:RoadSideEquipment

Super class: s4auto:AutomotiveDevice

A road side equipment can be either a simple data relay between vehicles and infrastructure or between the vehicles themselves, or it can run applications. It is usually high mounted in existing equipment, such as a street light, city traffic light, VMS or highway sign, or has its own pole.

Includes the ITS-C road side units and other ITS field equipment (includes traffic signal controllers).

6.3.12.5 Device class s4auto:RoadSideActuator

Super class: s4auto:RoadSideEquipment

Devices deployed along the road that produce signals based on road side sensor data measurements. Types of road side actuators that are relevant are devices such as traffic light controllers changing from red to green based on detected vehicles.

6.3.12.6 Device class s4auto:TrafficLightController

Super class: s4auto:RoadSideActuator

A device that automatically operates coloured lights, typically red, amber, and green, for controlling traffic at road junctions, pedestrian crossings, and roundabouts.

6.3.12.7 Device class s4auto:RoadSideSensor

Super class: s4auto:RoadSideEquipment

Sensors such as cameras, radars that are deployed along the road (e.g. at intersections and at poles along a highway). Road side sensors perform measurements, such as speed, position (relative or absolute), dimension, direction, etc. of road objects.

6.3.12.8 Device class s4auto:RoadSideUnit

Super class: s4auto:RoadSideEquipment

A transportation infrastructure communications device located on the roadside that provides V2X connectivity between On Board Units/Mobile Units and other parts of the transportation infrastructure including traffic control devices, traffic management systems, and back-office systems.

NOTE: Devices that are not part of the transportation infrastructure, such as cellular base stations or satellites, are not Road Side Units.

6.3.12.9 Sensors

6.3.12.9.1 Sensor category s4auto:AcousticSensor

The class of acoustic sensors.

6.3.12.9.2 Sensor category s4auto:InductionLoopSensor

The class of induction loop sensors.

6.3.12.9.3 Sensor category s4auto:ItsAggregationSensor

The class of systems that aggregate information from other received ITS messages.

6.3.12.9.4 Sensor category s4auto:LidarSensor

The class of lidar sensors.

6.3.12.9.5 Sensor category s4auto:LocalAggregationSensor

The class of systems that aggregate information from different local sensors. Aggregation may include fusion.

6.3.12.9.6 Sensor category s4auto:MonovideoSensor

The class of mono video sensors.

6.3.12.9.7 Sensor category s4auto:NightvisionSensor

The class of night vision sensors.

6.3.12.9.8 Sensor category s4auto:PmdSensor

The class of photonic mixing device sensors.

6.3.12.9.9 Sensor category s4auto:RadarSensor

The class of radar sensors.

6.3.12.9.10 Sensor category s4auto:SphericalCameraSensor

The class of spherical camera sensors.

6.3.12.9.11 Sensor category s4auto:StereovisionSensor

The class of stereo vision sensors.

6.3.12.9.12 Sensor category `s4auto:UltrasonicSensor`

The class of ultrasonic sensors.

6.3.12.9.13 Sensor category `s4auto:UwbSensor`

The class of ultra wide band sensors.

6.3.13 Traffic Event Observations

6.3.13.0 Overview

Figure 75 describes the specialization of `saref:Observation` for observing traffic events.

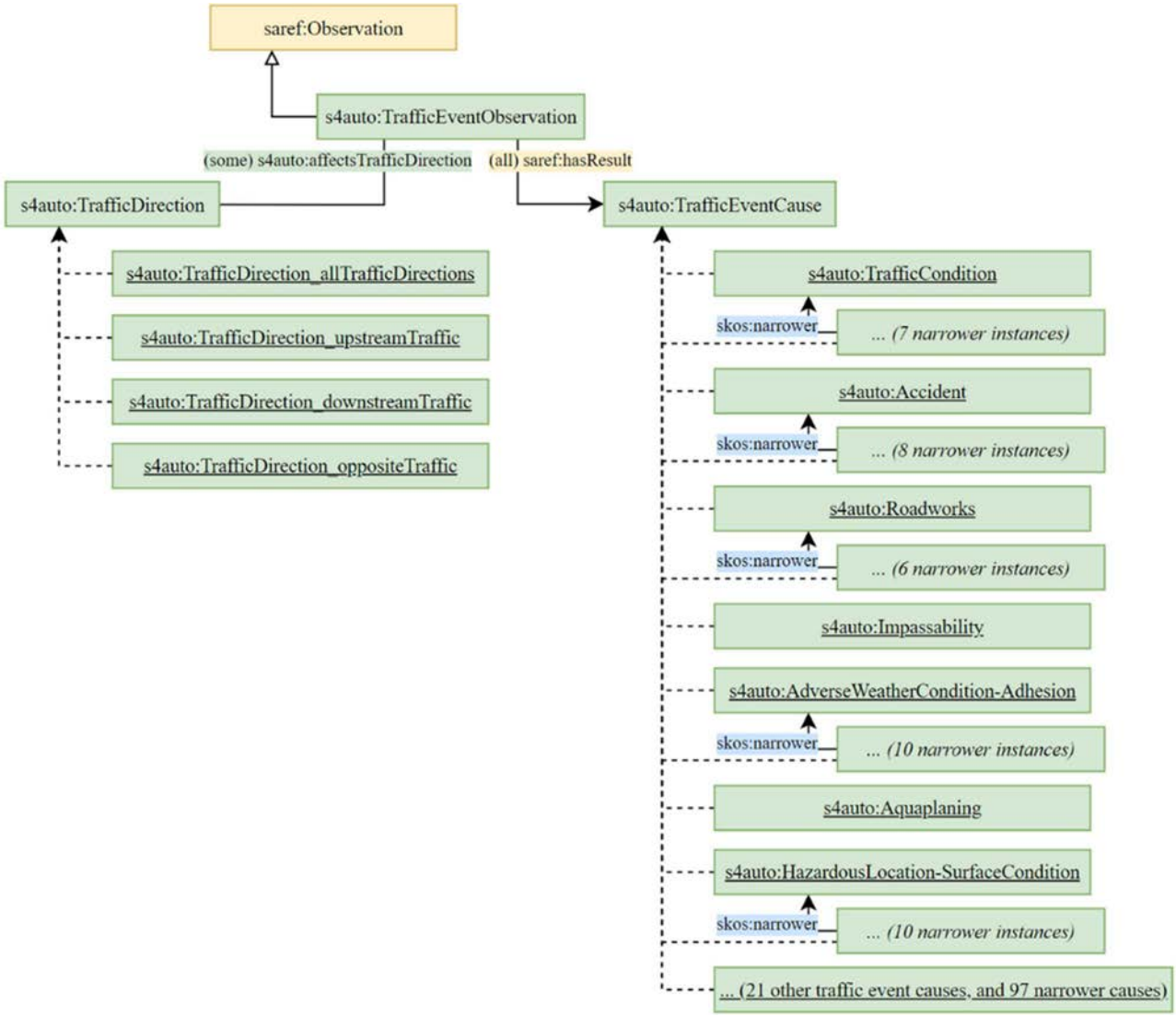

Figure 75: Traffic Event Observation

Figure 76 provides practical examples.

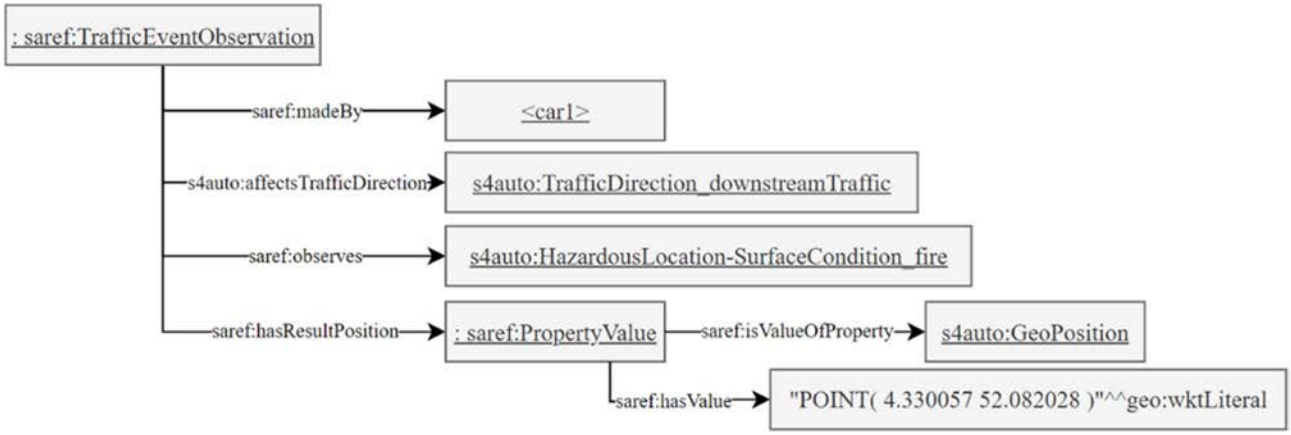

Figure 76: Example for Traffic Event Observation

6.3.13.1 s4auto:TrafficEventObservation

6.3.13.1.0 Definition

Act of carrying an observation resulting in a traffic event description. OP `saref:hasResult` links to the cause of the traffic event. OP `saref:observes` links to the direction and traffic direction where the event occurred.

6.3.13.1.1 Property s4auto:affectsTrafficDirection

Is a: owl:ObjectProperty

Range: `s4auto:TrafficDirection`

Links a traffic event observation to which traffic direction the observed event affects.

6.3.13.1.2 Class s4auto:TrafficDirection

6.3.13.1.2.0 Definition

The class of traffic direction in which observed traffic events are detected.

The following instances are defined:

- `s4auto:TrafficDirection_allTrafficDirections` - for all traffic directions;
- `s4auto:TrafficDirection_upstreamTraffic` - for upstream traffic;
- `s4auto:TrafficDirection_downstreamTraffic` - for downstream traffic;
- `s4auto:TrafficDirection_oppositeTraffic` - for traffic in the opposite direction.

The terms `upstream`, `downstream` and `oppositeTraffic` are relative to the event position.

6.3.13.1.2.1 s4auto:TrafficDirection_allTrafficDirections

All traffic directions.

6.3.13.1.2.2 s4auto:TrafficDirection_downstreamTraffic

Downstream traffic.

6.3.13.1.2.3 s4auto:TrafficDirection_oppositeTraffic

Traffic in the opposite direction.

6.3.13.1.2.4 s4auto:TrafficDirection_upstreamTraffic

Upstream traffic.

6.3.13.1.3 Property saref:hasResult

6.3.13.1.4 Class s4auto:TrafficEventCause

6.3.13.1.4.0 Definition

Class of concepts that describe traffic event causes.

The traffic event cause is completely defined by the top-level concepts. Narrower concepts may provide additional information that is not strictly necessary.

6.3.13.1.4.1 s4auto:Accident

6.3.13.1.4.1.0 Definition

In case the type of event is a road accident.

The following narrower traffic event causes are defined:

- s4auto:Accident_multiVehicleAccident - in case more than two vehicles are involved in accident;
- s4auto:Accident_heavyAccident - in case the airbag of the vehicle involved in the accident is triggered, the accident requires important rescue and/or recovery work;
- s4auto:Accident_accidentInvolvingLorry - in case the accident involves a lorry;
- s4auto:Accident_accidentInvolvingBus - in case the accident involves a bus;
- s4auto:Accident_accidentInvolvingHazardousMaterials - in case the accident involves hazardous material;
- s4auto:Accident_accidentOnOppositeLane - in case the accident happens on opposite lanes;
- s4auto:Accident_unsecuredAccident - in case the accident is not secured;
- s4auto:Accident_assistanceRequested - in case rescue and assistance are requested.

6.3.13.1.4.1.1 s4auto:Accident_accidentInvolvingBus

In case the accident involves a bus.

6.3.13.1.4.1.2 s4auto:Accident_accidentInvolvingHazardousMaterials

In case the accident involves hazardous material.

6.3.13.1.4.1.3 s4auto:Accident_accidentInvolvingLorry

In case the accident involves a lorry.

6.3.13.1.4.1.4 s4auto:Accident_accidentOnOppositeLane

In case the accident happens on opposite lanes.

6.3.13.1.4.1.5 s4auto:Accident_assistanceRequested

In case rescue and assistance are requested.

6.3.13.1.4.1.6 s4auto:Accident_heavyAccident

In case the airbag of the vehicle involved in the accident is triggered, the accident requires important rescue and/or recovery work.

6.3.13.1.4.1.7 s4auto:Accident_multiVehicleAccident

In case more than two vehicles are involved in accident.

6.3.13.1.4.1.8 s4auto:Accident_unsecuredAccident

In case the accident is not secured.

6.3.13.1.4.2 s4auto:AdverseWeatherCondition-Adhesion

6.3.13.1.4.2.0 Definition

In case the type of event is low adhesion.

The following narrower traffic event causes are defined:

- s4auto:AdverseWeatherCondition-Adhesion_heavyFrostOnRoad - in case the low road adhesion is due to heavy frost on the road;
- s4auto:AdverseWeatherCondition-Adhesion_fuelOnRoad - in case the low road adhesion is due to fuel on the road;
- s4auto:AdverseWeatherCondition-Adhesion_mudOnRoad - in case the low road adhesion is due to mud on the road;
- s4auto:AdverseWeatherCondition-Adhesion_snowOnRoad - in case the low road adhesion is due to snow on the road;
- s4auto:AdverseWeatherCondition-Adhesion_iceOnRoad - in case the low road adhesion is due to ice on the road;
- s4auto:AdverseWeatherCondition-Adhesion_blackIceOnRoad - in case the low road adhesion is due to black ice on the road;
- s4auto:AdverseWeatherCondition-Adhesion_oilOnRoad - in case the low road adhesion is due to oil on the road;
- s4auto:AdverseWeatherCondition-Adhesion_looseChippings - in case the low road adhesion is due to loose gravel or stone fragments detached from a road surface or from a hazard;
- s4auto:AdverseWeatherCondition-Adhesion_instantBlackIce - in case the low road adhesion is due to instant black ice on the road surface;
- s4auto:AdverseWeatherCondition-Adhesion_roadsSalted - when the low road adhesion is due to salted road.

6.3.13.1.4.2.1 s4auto:AdverseWeatherCondition-Adhesion_blackIceOnRoad

In case the low road adhesion is due to black ice on the road.

6.3.13.1.4.2.2 s4auto:AdverseWeatherCondition-Adhesion_fuelOnRoad

In case the low road adhesion is due to fuel on the road.

6.3.13.1.4.2.3 s4auto:AdverseWeatherCondition-Adhesion_heavyFrostOnRoad

In case the low road adhesion is due to heavy frost on the road.

6.3.13.1.4.2.4 s4auto:AdverseWeatherCondition-Adhesion_iceOnRoad

In case the low road adhesion is due to ice on the road.

6.3.13.1.4.2.5 s4auto:AdverseWeatherCondition-Adhesion_instantBlackIce

In case the low road adhesion is due to instant black ice on the road surface.

6.3.13.1.4.2.6 s4auto:AdverseWeatherCondition-Adhesion_looseChippings

In case the low road adhesion is due to lose gravel or stone fragments detached from a road surface or from a hazard.

6.3.13.1.4.2.7 s4auto:AdverseWeatherCondition-Adhesion_mudOnRoad

In case the low road adhesion is due to mud on the road.

6.3.13.1.4.2.8 s4auto:AdverseWeatherCondition-Adhesion_oilOnRoad

In case the low road adhesion is due to oil on the road.

6.3.13.1.4.2.9 s4auto:AdverseWeatherCondition-Adhesion_roadsSalted

In case the low road adhesion is due to salted road.

6.3.13.1.4.2.10 s4auto:AdverseWeatherCondition-Adhesion_snowOnRoad

In case the low road adhesion is due to snow on the road.

6.3.13.1.4.3 s4auto:AdverseWeatherCondition-ExtremeWeatherCondition

6.3.13.1.4.3.0 Definition

In case the type of event is extreme weather condition.

The following narrower traffic event causes are defined:

- s4auto:AdverseWeatherCondition-ExtremeWeatherCondition_strongWinds - in case the type of extreme weather condition is strong wind;
- s4auto:AdverseWeatherCondition-ExtremeWeatherCondition_damagingHail - in case the type of extreme weather condition is damaging hail;
- s4auto:AdverseWeatherCondition-ExtremeWeatherCondition_hurricane - in case the type of extreme weather condition is hurricane;
- s4auto:AdverseWeatherCondition-ExtremeWeatherCondition_thunderstorm - in case the type of extreme weather condition is thunderstorm;
- s4auto:AdverseWeatherCondition-ExtremeWeatherCondition_tornado - in case the type of extreme weather condition is tornado;
- s4auto:AdverseWeatherCondition-ExtremeWeatherCondition_blizzard - in case the type of extreme weather condition is blizzard.

6.3.13.1.4.3.1 s4auto:AdverseWeatherCondition-ExtremeWeatherCondition_blizzard

In case the type of extreme weather condition is blizzard.

6.3.13.1.4.3.2 s4auto:AdverseWeatherCondition-ExtremeWeatherCondition_damagingHail

In case the type of extreme weather condition is damaging hail.

6.3.13.1.4.3.3 s4auto:AdverseWeatherCondition-ExtremeWeatherCondition_hurricane

In case the type of extreme weather condition is hurricane.

6.3.13.1.4.3.4 s4auto:AdverseWeatherCondition-ExtremeWeatherCondition_strongWinds

In case the type of extreme weather condition is strong wind.

6.3.13.1.4.3.5 s4auto:AdverseWeatherCondition-ExtremeWeatherCondition_thunderstorm

In case the type of extreme weather condition is thunderstorm.

6.3.13.1.4.3.6 s4auto:AdverseWeatherCondition-ExtremeWeatherCondition_tornado

In case the type of extreme weather condition is tornado.

6.3.13.1.4.4 s4auto:AdverseWeatherCondition-Precipitation

6.3.13.1.4.4.0 Definition

In case the type of event is precipitation.

The following narrower traffic event causes are defined:

- s4auto:AdverseWeatherCondition-Precipitation_heavyRain - in case the type of precipitation is heavy rain;
- s4auto:AdverseWeatherCondition-Precipitation_heavySnowfall - in case the type of precipitation is heavy snow fall;
- s4auto:AdverseWeatherCondition-Precipitation_softHail - in case the type of precipitation is soft hail.

6.3.13.1.4.4.1 s4auto:AdverseWeatherCondition-Precipitation_heavyRain

In case the type of precipitation is heavy rain.

6.3.13.1.4.4.2 s4auto:AdverseWeatherCondition-Precipitation_heavySnowfall

In case the type of precipitation is heavy snow fall.

6.3.13.1.4.4.3 s4auto:AdverseWeatherCondition-Precipitation_softHail

In case the type of precipitation is soft hail.

6.3.13.1.4.5 s4auto:AdverseWeatherCondition-Visibility

6.3.13.1.4.5.0 Definition

In case the type of event is low visibility.

The following narrower traffic event causes are defined:

- s4auto:AdverseWeatherCondition-Visibility_fog - in case the cause of low visibility is fog;
- s4auto:AdverseWeatherCondition-Visibility_smoke - in case the cause of low visibility is smoke;
- s4auto:AdverseWeatherCondition-Visibility_heavySnowfall - in case the cause of low visibility is heavy snow fall;
- s4auto:AdverseWeatherCondition-Visibility_heavyRain - in case the cause of low visibility is heavy rain;

- s4auto:AdverseWeatherCondition-Visibility_heavyHail - in case the cause of low visibility is heavy hail;
- s4auto:AdverseWeatherCondition-Visibility_lowSunGlare - in case the cause of low visibility is sun glare;
- s4auto:AdverseWeatherCondition-Visibility_sandstorms - in case the cause of low visibility is sand storm;
- s4auto:AdverseWeatherCondition-Visibility_swarmsOfInsects - in case the cause of low visibility is swarm of insects.

6.3.13.1.4.5.1 s4auto:AdverseWeatherCondition-Visibility_fog

In case the cause of low visibility is fog.

6.3.13.1.4.5.2 s4auto:AdverseWeatherCondition-Visibility_heavyHail

In case the cause of low visibility is heavy hail.

6.3.13.1.4.5.3 s4auto:AdverseWeatherCondition-Visibility_heavyRain

In case the cause of low visibility is heavy rain.

6.3.13.1.4.5.4 s4auto:AdverseWeatherCondition-Visibility_heavySnowfall

In case the cause of low visibility is heavy snow fall.

6.3.13.1.4.5.5 s4auto:AdverseWeatherCondition-Visibility_lowSunGlare

In case the cause of low visibility is sun glare.

6.3.13.1.4.5.6 s4auto:AdverseWeatherCondition-Visibility_sandstorms

In case the cause of low visibility is sandstorm.

6.3.13.1.4.5.7 s4auto:AdverseWeatherCondition-Visibility_smoke

In case the cause of low visibility is smoke.

6.3.13.1.4.5.8 s4auto:AdverseWeatherCondition-Visibility_swarmsOfInsects

In case the cause of low visibility is swarm of insects.

6.3.13.1.4.6 s4auto:Aquaplaning

Danger of aquaplaning on the road.

6.3.13.1.4.7 s4auto:CollisionRisk

6.3.13.1.4.7.0 Definition

In case the type of event is a collision risk.

The following narrower traffic event causes are defined:

- s4auto:CollisionRisk_longitudinalCollisionRisk - in case the type of detected collision risk is longitudinal collision risk, e.g. forward collision or face to face collision;
- s4auto:CollisionRisk_crossingCollisionRisk - in case the type of detected collision risk is crossing collision risk;

- s4auto:CollisionRisk_lateralCollisionRisk - in case the type of detected collision risk is lateral collision risk;
- s4auto:CollisionRisk_vulnerableRoadUser - in case the type of detected collision risk involves vulnerable road users, e.g. pedestrians or bicycles.

6.3.13.1.4.7.1 s4auto:CollisionRisk_crossingCollisionRisk

In case the type of detected collision risk is crossing collision risk.

6.3.13.1.4.7.2 s4auto:CollisionRisk_lateralCollisionRisk

In case the type of detected collision risk is lateral collision risk.

6.3.13.1.4.7.3 s4auto:CollisionRisk_longitudinalCollisionRisk

In case the type of detected collision risk is longitudinal collision risk, e.g. forward collision or face to face collision.

6.3.13.1.4.7.4 s4auto:CollisionRisk_vulnerableRoadUser

In case the type of detected collision risk involves vulnerable road users e.g. pedestrians or bicycles.

6.3.13.1.4.8 s4auto:DangerousEndOfQueue

6.3.13.1.4.8.0 Definition

In case the type of event is dangerous end of vehicle queue.

The following narrower traffic event causes are defined:

- s4auto:DangerousEndOfQueue_suddenEndOfQueue - in case a sudden end of queue is detected, e.g. due to accident or obstacle;
- s4auto:DangerousEndOfQueue_queueOverHill - in case the dangerous end of queue is detected on the road hill;
- s4auto:DangerousEndOfQueue_queueAroundBend - in case the dangerous end of queue is detected around the road bend;
- s4auto:DangerousEndOfQueue_queueInTunnel - in case queue is detected in tunnel.

6.3.13.1.4.8.1 s4auto:DangerousEndOfQueue_queueAroundBend

In case the dangerous end of queue is detected around the road bend.

6.3.13.1.4.8.2 s4auto:DangerousEndOfQueue_queueInTunnel

In case queue is detected in tunnel.

6.3.13.1.4.8.3 s4auto:DangerousEndOfQueue_queueOverHill

In case the dangerous end of queue is detected on the road hill.

6.3.13.1.4.8.4 s4auto:DangerousEndOfQueue_suddenEndOfQueue

In case a sudden end of queue is detected, e.g. due to accident or obstacle.

6.3.13.1.4.9 s4auto:DangerousSituation

6.3.13.1.4.9.0 Definition

In case the type of event is dangerous situation in which autonomous safety system in vehicle is activated.

The following narrower traffic event causes are defined:

- `s4auto:DangerousSituation_emergencyElectronicBrakeEngaged` - in case emergency electronic brake is engaged;
- `s4auto:DangerousSituation_preCrashSystemEngaged` - in case pre-crash system is engaged;
- `s4auto:DangerousSituation_espEngaged` - in case Electronic Stability Program (ESP) system is engaged;
- `s4auto:DangerousSituation_absEngaged` - in case Anti-lock Braking System (ABS) is engaged;
- `s4auto:DangerousSituation_aebEngaged` - in case Autonomous Emergency Braking (AEB) system is engaged;
- `s4auto:DangerousSituation_brakeWarningEngaged` - in case brake warning is engaged;
- `s4auto:DangerousSituation_collisionRiskWarningEngaged` - in case collision risk warning is engaged.

6.3.13.1.4.9.1 s4auto:DangerousSituation_absEngaged

In case Anti-lock Braking System (ABS) is engaged.

6.3.13.1.4.9.2 s4auto:DangerousSituation_brakeWarningEngaged

In case brake warning is engaged.

6.3.13.1.4.9.3 s4auto:DangerousSituation_collisionRiskWarningEngaged

In case collision risk warning is engaged.

6.3.13.1.4.9.4 s4auto:DangerousSituation_ebEngaged

In case Autonomous Emergency Braking (AEB) system is engaged.

6.3.13.1.4.9.5 s4auto:DangerousSituation_emergencyElectronicBrakeEngaged

In case emergency electronic brake is engaged.

6.3.13.1.4.9.6 s4auto:DangerousSituation_espEngaged

In case Electronic Stability Program (ESP) system is engaged.

6.3.13.1.4.9.7 s4auto:DangerousSituation_preCrashSystemEngaged

In case pre-crash system is engaged.

6.3.13.1.4.10 s4auto:EmergencyVehicleApproaching

6.3.13.1.4.10.0 Definition

In case the type of event is approaching vehicle operating emergency mission.

The following narrower traffic event causes are defined:

- s4auto:EmergencyVehicleApproaching_emergencyVehicleApproaching - in case an operating emergency vehicle is approaching;
- s4auto:EmergencyVehicleApproaching_prioritizedVehicleApproaching - in case a prioritized vehicle is approaching.

6.3.13.1.4.10.1 s4auto:EmergencyVehicleApproaching_emergencyVehicleApproaching

In case an operating emergency vehicle is approaching.

6.3.13.1.4.10.2 s4auto:EmergencyVehicleApproaching_prioritizedVehicleApproaching

In case a prioritized vehicle is approaching.

6.3.13.1.4.11 s4auto:HazardousLocation-AnimalOnTheRoad

6.3.13.1.4.11.0 Definition

In case the type of event is animal on the road.

The following narrower traffic event causes are defined:

- s4auto:HazardousLocation-AnimalOnTheRoad_wildAnimals - in case wild animals are detected on the road;
- s4auto:HazardousLocation-AnimalOnTheRoad_herdOfAnimals - in case herd of animals are detected on the road;
- s4auto:HazardousLocation-AnimalOnTheRoad_smallAnimals - in case small size animals are detected on the road;
- s4auto:HazardousLocation-AnimalOnTheRoad_largeAnimals - in case large size animals are detected on the road.

6.3.13.1.4.11.1 s4auto:HazardousLocation-AnimalOnTheRoad_herdOfAnimals

In case herd of animals are detected on the road.

6.3.13.1.4.11.2 s4auto:HazardousLocation-AnimalOnTheRoad_largeAnimals

In case large size animals are detected on the road.

6.3.13.1.4.11.3 s4auto:HazardousLocation-AnimalOnTheRoad_smallAnimals

In case small size animals are detected on the road.

6.3.13.1.4.11.4 s4auto:HazardousLocation-AnimalOnTheRoad_wildAnimals

In case wild animals are detected on the road.

6.3.13.1.4.12 s4auto:HazardousLocation-DangerousCurve

6.3.13.1.4.12.0 Definition

In case the type of event is dangerous curve.

The following narrower traffic event causes are defined:

- s4auto:HazardousLocation-DangerousCurve_dangerousLeftTurnCurve - in case the dangerous curve is a left turn curve;

- s4auto:HazardousLocation-DangerousCurve_dangerousRightTurnCurve - in case the dangerous curve is a right turn curve;
- s4auto:HazardousLocation-DangerousCurve_multipleCurvesStartingWithUnknownTurningDirection - in case of multiple curves for which the starting curve turning direction is not known;
- s4auto:HazardousLocation-DangerousCurve_multipleCurvesStartingWithLeftTurn - in case of multiple curves starting with a left turn curve;
- s4auto:HazardousLocation-DangerousCurve_multipleCurvesStartingWithRightTurn - in case of multiple curves starting with a right turn curve.

The definition of whether a curve is dangerous may vary according to region and according to vehicle types/mass and vehicle speed driving on the curve. This definition is out of scope of the present document.

6.3.13.1.4.12.1 s4auto:HazardousLocation-DangerousCurve_dangerousLeftTurnCurve

In case the dangerous curve is a left turn curve.

6.3.13.1.4.12.2 s4auto:HazardousLocation-DangerousCurve_dangerousRightTurnCurve

In case the dangerous curve is a right turn curve.

6.3.13.1.4.12.3 s4auto:HazardousLocation-DangerousCurve_multipleCurvesStartingWithLeftTurn

In case of multiple curves starting with a left turn curve.

6.3.13.1.4.12.4 s4auto:HazardousLocation-DangerousCurve_multipleCurvesStartingWithRightTurn

In case of multiple curves starting with a right turn curve.

6.3.13.1.4.12.5 s4auto:HazardousLocation-DangerousCurve_multipleCurvesStartingWithUnknownTurningDirection

In case of multiple curves for which the starting curve turning direction is not known.

6.3.13.1.4.13 s4auto:HazardousLocation-ObstacleOnTheRoad

6.3.13.1.4.13.0 Definition

In case the type of event is obstacle on the road.

The following narrower traffic event causes are defined:

- s4auto:HazardousLocation-ObstacleOnTheRoad_shedLoad - in case detected obstacle is large amount of obstacles (shedload);
- s4auto:HazardousLocation-ObstacleOnTheRoad_partsOfVehicles - in case detected obstacles are parts of vehicles;
- s4auto:HazardousLocation-ObstacleOnTheRoad_partsOfTyres - in case the detected obstacles are parts of tyres;
- s4auto:HazardousLocation-ObstacleOnTheRoad_bigObjects - in case the detected obstacles are big objects;
- s4auto:HazardousLocation-ObstacleOnTheRoad_fallenTrees - in case the detected obstacles are fallen trees;
- s4auto:HazardousLocation-ObstacleOnTheRoad_hubCaps - in case the detected obstacles are hub caps;

- s4auto:HazardousLocation-ObstacleOnTheRoad_waitingVehicles - in case the detected obstacles are waiting vehicles.

6.3.13.1.4.13.1 s4auto:HazardousLocation-ObstacleOnTheRoad_bigObjects

In case the detected obstacles are big objects.

6.3.13.1.4.13.2 s4auto:HazardousLocation-ObstacleOnTheRoad_fallenTrees

In case the detected obstacles are fallen trees.

6.3.13.1.4.13.3 s4auto:HazardousLocation-ObstacleOnTheRoad_hubCaps

In case the detected obstacles are hub caps.

6.3.13.1.4.13.4 s4auto:HazardousLocation-ObstacleOnTheRoad_partsOfTyres

In case the detected obstacles are parts of tyres.

6.3.13.1.4.13.5 s4auto:HazardousLocation-ObstacleOnTheRoad_partsOfVehicles

In case detected obstacles are parts of vehicles.

6.3.13.1.4.13.6 s4auto:HazardousLocation-ObstacleOnTheRoad_shedLoad

In case detected obstacle is large amount of obstacles (shedload).

6.3.13.1.4.13.7 s4auto:HazardousLocation-ObstacleOnTheRoad_waitingVehicles

In case the detected obstacles are waiting vehicles.

6.3.13.1.4.14 s4auto:HazardousLocation-SurfaceCondition

6.3.13.1.4.14.0 Definition

In case the type of event is abnormal road surface condition.

The following narrower traffic event causes are defined:

- s4auto:HazardousLocation-SurfaceCondition_rockfalls - in case rock falls are detected on the road surface;
- s4auto:HazardousLocation-SurfaceCondition_earthquakeDamage - in case the road surface is damaged by earthquake;
- s4auto:HazardousLocation-SurfaceCondition_sewerCollapse - in case of sewer collapse on the road surface;
- s4auto:HazardousLocation-SurfaceCondition_subsidence - in case road surface is damaged by subsidence;
- s4auto:HazardousLocation-SurfaceCondition_snowDrifts - in case road surface is damaged due to snow drift;
- s4auto:HazardousLocation-SurfaceCondition_stormDamage - in case road surface is damaged by strong storm;
- s4auto:HazardousLocation-SurfaceCondition_burstPipe - in case road surface is damaged due to pipe burst;
- s4auto:HazardousLocation-SurfaceCondition_volcanoEruption - in case road surface is damaged due to volcano eruption;

- s4auto:HazardousLocation-SurfaceCondition_fallingIce - in case road surface damage is due to falling ice;
- s4auto:HazardousLocation-SurfaceCondition_fire - in case there is fire on or near to the road surface.

6.3.13.1.4.14.1 s4auto:HazardousLocation-SurfaceCondition_burstPipe

In case road surface is damaged due to pipe burst.

6.3.13.1.4.14.2 s4auto:HazardousLocation-SurfaceCondition_earthquakeDamage

In case the road surface is damaged by earthquake.

6.3.13.1.4.14.3 s4auto:HazardousLocation-SurfaceCondition_fallingIce

In case road surface damage is due to falling ice.

6.3.13.1.4.14.4 s4auto:HazardousLocation-SurfaceCondition_fire

In case there is fire on or near to the road surface.

6.3.13.1.4.14.5 s4auto:HazardousLocation-SurfaceCondition_rockfalls

In case rock falls are detected on the road surface.

6.3.13.1.4.14.6 s4auto:HazardousLocation-SurfaceCondition_sewerCollapse

In case of sewer collapse on the road surface.

6.3.13.1.4.14.7 s4auto:HazardousLocation-SurfaceCondition_snowDrifts

In case road surface is damaged due to snow drift.

6.3.13.1.4.14.8 s4auto:HazardousLocation-SurfaceCondition_stormDamage

In case road surface is damaged by strong storm.

6.3.13.1.4.14.9 s4auto:HazardousLocation-SurfaceCondition_subsidence

In case road surface is damaged by subsidence.

6.3.13.1.4.14.10 s4auto:HazardousLocation-SurfaceCondition_volcanoEruption

In case road surface is damaged due to volcano eruption.

6.3.13.1.4.15 s4auto:HumanPresenceOnTheRoad

6.3.13.1.4.15.0 Definition

In case the type of event is human presence on the road.

The following narrower traffic event causes are defined:

- s4auto:HumanPresenceOnTheRoad_childrenOnRoadway - in case children are detected on the road;
- s4auto:HumanPresenceOnTheRoad_cyclistOnRoadway - in case cyclist presence is detected on the road;
- s4auto:HumanPresenceOnTheRoad_motorcyclistOnRoadway - in case motorcyclist presence is detected on the road.

6.3.13.1.4.15.1 s4auto:HumanPresenceOnTheRoad_childrenOnRoadway

In case children are detected on the road.

6.3.13.1.4.15.2 s4auto:HumanPresenceOnTheRoad_cyclistOnRoadway

In case cyclist presence is detected on the road.

6.3.13.1.4.15.3 s4auto:HumanPresenceOnTheRoad_motorcyclistOnRoadway

In case motorcyclist presence is detected on the road.

6.3.13.1.4.16 s4auto:HumanProblem

6.3.13.1.4.16.0 Definition

In case the type of event is human health problem in vehicles involved in traffic.

The following narrower traffic event causes are defined:

- s4auto:HumanProblem_glycemiaProblem - in case human problem is due to glycaemia problem;
- s4auto:HumanProblem_heartProblem - in case human problem is due to heart problem.

6.3.13.1.4.16.1 s4auto:HumanProblem_glycemiaProblem

In case human problem is due to glycaemia problem.

6.3.13.1.4.16.2 s4auto:HumanProblem_heartProblem

In case human problem is due to heart problem.

6.3.13.1.4.17 s4auto:Impassability

in case the type of event is unmanaged road blocking, referring to any blocking of a road, partial or total, which has not been adequately secured and signposted.

6.3.13.1.4.18 s4auto:PostCrash

6.3.13.1.4.18.0 Definition

In case the type of event is a detected crash.

The following narrower traffic event causes are defined:

- s4auto:PostCrash_accidentWithoutECallTriggered - in case no eCall has been triggered for an accident;
- s4auto:PostCrash_accidentWithECallManuallyTriggered - in case eCall has been manually triggered and transmitted to eCall back end;
- s4auto:PostCrash_accidentWithECallAutomaticallyTriggered - in case eCall has been automatically triggered and transmitted to eCall back end;
- s4auto:PostCrash_accidentWithECallTriggeredWithoutAccessToCellularNetwork - in case eCall has been triggered but cellular network is not accessible from triggering vehicle.

6.3.13.1.4.18.1 s4auto:PostCrash_accidentWithECallAutomaticallyTriggered

In case eCall has been automatically triggered and transmitted to eCall back end.

6.3.13.1.4.18.2 s4auto:PostCrash_accidentWithECallManuallyTriggered

In case eCall has been manually triggered and transmitted to eCall back end.

6.3.13.1.4.18.3 s4auto:PostCrash_accidentWithECallTriggeredWithoutAccessToCellularNetwork

In case eCall has been triggered but cellular network is not accessible from triggering vehicle.

6.3.13.1.4.18.4 s4auto:PostCrash_accidentWithoutECallTriggered

In case no eCall has been triggered for an accident.

6.3.13.1.4.19 s4auto:RailwayLevelCrossing

6.3.13.1.4.19.0 Definition

In case the type of event is a railway level crossing.

The following narrower traffic event causes are defined:

- s4auto:RailwayLevelCrossing_doNotCrossAbnormalSituation - in case when something wrong is detected by equation or sensors of the railway level crossing, including level crossing is closed for too long (e.g. more than 10 minutes long ; default value);
- s4auto:RailwayLevelCrossing_closed - in case the crossing is closed (barriers down);
- s4auto:RailwayLevelCrossing_unguarded - in case the level crossing is unguarded (i.e. a Saint Andrew cross level crossing without detection of train);
- s4auto:RailwayLevelCrossing_nominal - in case the barriers are up and lights are off.

6.3.13.1.4.19.1 s4auto:RailwayLevelCrossing_closed

In case the crossing is closed (barriers down).

6.3.13.1.4.19.2 s4auto:RailwayLevelCrossing_doNotCrossAbnormalSituation

In case when something wrong is detected by equation or sensors of the railway level crossing, including level crossing is closed for too long (e.g. more than 10 minutes long; default value).

6.3.13.1.4.19.3 s4auto:RailwayLevelCrossing_nominal

In case the barriers are up and lights are off.

6.3.13.1.4.19.4 s4auto:RailwayLevelCrossing_unguarded

In case the level crossing is unguarded (i.e. a Saint Andrew cross level crossing without detection of train).

6.3.13.1.4.20 s4auto:RescueAndRecoveryWorkInProgress

6.3.13.1.4.20.0 Definition

In case the type of event is rescue and recovery work for accident or for a road hazard in progress.

The following narrower traffic event causes are defined:

- s4auto:RescueAndRecoveryWorkInProgress_emergencyVehicles - in case rescue work is ongoing by emergency vehicles;

- `s4auto:RescueAndRecoveryWorkInProgress_rescueHelicopterLanding` - in case rescue helicopter is landing;
- `s4auto:RescueAndRecoveryWorkInProgress_policeActivityOngoing` - in case police activity is ongoing;
- `s4auto:RescueAndRecoveryWorkInProgress_medicalEmergencyOngoing` - in case medical emergency recovery is ongoing;
- `s4auto:RescueAndRecoveryWorkInProgress_childAbductionInProgress` - in case a child kidnapping alarm is activated and rescue work is ongoing.

6.3.13.1.4.20.1 `s4auto:RescueAndRecoveryWorkInProgress_childAbductionInProgress`

In case a child kidnapping alarm is activated and rescue work is ongoing.

6.3.13.1.4.20.2 `s4auto:RescueAndRecoveryWorkInProgress_emergencyVehicles`

In case rescue work is ongoing by emergency vehicles.

6.3.13.1.4.20.3 `s4auto:RescueAndRecoveryWorkInProgress_medicalEmergencyOngoing`

In case medical emergency recovery is ongoing.

6.3.13.1.4.20.4 `s4auto:RescueAndRecoveryWorkInProgress_policeActivityOngoing`

In case police activity is ongoing.

6.3.13.1.4.20.5 `s4auto:RescueAndRecoveryWorkInProgress_rescueHelicopterLanding`

In case rescue helicopter is landing.

6.3.13.1.4.21 `s4auto:Roadworks`

6.3.13.1.4.21.0 Definition

In case the type of event is roadwork.

The following narrower traffic event causes are defined:

- `s4auto:Roadworks_majorRoadworks` - in case a major roadworks is ongoing;
- `s4auto:Roadworks_roadMarkingWork` - in case a road marking work is ongoing;
- `s4auto:Roadworks_slowMovingRoadMaintenance` - in case slow moving road maintenance work is ongoing;
- `s4auto:Roadworks_shortTermStationaryRoadworks` - in case a short term stationary roadwork is ongoing;
- `s4auto:Roadworks_streetCleaning` - in case a vehicle street cleaning work is ongoing;
- `s4auto:Roadworks_winterService` - in case winter service work is ongoing.

6.3.13.1.4.21.1 `s4auto:Roadworks_majorRoadworks`

In case a major roadworks is ongoing.

6.3.13.1.4.21.2 `s4auto:Roadworks_roadMarkingWork`

In case a road marking work is ongoing.

6.3.13.1.4.21.3 `s4auto:Roadworks_shortTermStationaryRoadworks`

In case a short term stationary roadwork is ongoing.

6.3.13.1.4.21.4 s4auto:Roadworks_slowMovingRoadMaintenance

In case slow moving road maintenance work is ongoing.

6.3.13.1.4.21.5 s4auto:Roadworks_streetCleaning

In case a vehicle street cleaning work is ongoing.

6.3.13.1.4.21.6 s4auto:Roadworks_winterService

In case winter service work is ongoing.

6.3.13.1.4.22 s4auto:SignalViolation

6.3.13.1.4.22.0 Definition

In case the type of event is signal violation.

The following narrower traffic event causes are defined:

- s4auto:SignalViolation_stopSignViolation - in case a stop sign violation is detected;
- s4auto:SignalViolation_trafficLightViolation - in case a traffic light violation is detected;
- s4auto:SignalViolation_turningRegulationViolation - in case a turning regulation violation is detected.

6.3.13.1.4.22.1 s4auto:SignalViolation_stopSignViolation

In case a stop sign violation is detected.

6.3.13.1.4.22.2 s4auto:SignalViolation_trafficLightViolation

In case a traffic light violation is detected.

6.3.13.1.4.22.3 s4auto:SignalViolation_turningRegulationViolation

In case a turning regulation violation is detected.

6.3.13.1.4.23 s4auto:SlowVehicle

6.3.13.1.4.23.0 Definition

In case the type of event is slow vehicle driving on the road.

The following narrower traffic event causes are defined:

- s4auto:SlowVehicle_maintenanceVehicle - in case of a slow driving maintenance vehicle on the road;
- s4auto:SlowVehicle_vehiclesSlowingToLookAtAccident - in case vehicle is temporally slowing down to look at accident, spot, etc.;
- s4auto:SlowVehicle_abnormalLoad - in case an abnormal loaded vehicle is driving slowly on the road;
- s4auto:SlowVehicle_abnormalWideLoad - in case an abnormal wide load vehicle is driving slowly on the road;
- s4auto:SlowVehicle_convoy - in case of slow driving convoy on the road;
- s4auto:SlowVehicle_snowplough - in case of slow driving snow plough on the road;
- s4auto:SlowVehicle_deicing - in case of slow driving de-icing vehicle on the road;

- s4auto:SlowVehicle_saltingVehicles - in case of slow driving salting vehicle on the road.

6.3.13.1.4.23.1 s4auto:SlowVehicle_abnormalLoad

In case an abnormal loaded vehicle is driving slowly on the road.

6.3.13.1.4.23.2 s4auto:SlowVehicle_abnormalWideLoad

In case an abnormal wide load vehicle is driving slowly on the road.

6.3.13.1.4.23.3 s4auto:SlowVehicle_convoy

In case of slow driving convoy on the road.

6.3.13.1.4.23.4 s4auto:SlowVehicle_deicing

In case of slow driving de-icing vehicle on the road.

6.3.13.1.4.23.5 s4auto:SlowVehicle_maintenanceVehicle

In case of a slow driving maintenance vehicle on the road.

6.3.13.1.4.23.6 s4auto:SlowVehicle_saltingVehicles

In case of slow driving salting vehicle on the road.

6.3.13.1.4.23.7 s4auto:SlowVehicle_snowplough

In case of slow driving snow plough on the road.

6.3.13.1.4.23.8 s4auto:SlowVehicle_vehiclesSlowingToLookAtAccident

In case vehicle is temporally slowing down to look at accident, spot, etc.

6.3.13.1.4.24 s4auto:StationaryVehicle

6.3.13.1.4.24.0 Definition

In case the type of event is stationary vehicle.

The following narrower traffic event causes are defined:

- s4auto:StationaryVehicle_humanProblem - in case stationary vehicle is due to health problem of driver or passenger;
- s4auto:StationaryVehicle_vehicleBreakdown - in case stationary vehicle is due to vehicle break down;
- s4auto:StationaryVehicle_postCrash - in case stationary vehicle is caused by collision;
- s4auto:StationaryVehicle_publicTransportStop - in case public transport vehicle is stationary at bus stop;
- s4auto:StationaryVehicle_carryingDangerousGoods - in case the stationary vehicle is carrying dangerous goods;
- s4auto:StationaryVehicle_vehicleOnFire - in case of vehicle on fire.

6.3.13.1.4.24.1 s4auto:StationaryVehicle_carryingDangerousGoods

In case the stationary vehicle is carrying dangerous goods.

6.3.13.1.4.24.2 s4auto:StationaryVehicle_humanProblem

In case stationary vehicle is due to health problem of driver or passenger.

6.3.13.1.4.24.3 s4auto:StationaryVehicle_postCrash

In case stationary vehicle is caused by collision.

6.3.13.1.4.24.4 s4auto:StationaryVehicle_publicTransportStop

In case public transport vehicle is stationary at bus stop.

6.3.13.1.4.24.5 s4auto:StationaryVehicle_vehicleBreakdown

In case stationary vehicle is due to vehicle break down.

6.3.13.1.4.24.6 s4auto:StationaryVehicle_vehicleOnFire

In case of vehicle on fire.

6.3.13.1.4.25 s4auto:TrafficCondition

6.3.13.1.4.25.0 Definition

In case the type of event is an abnormal traffic condition.

The following narrower traffic event causes are defined:

- s4auto:TrafficCondition_increasedVolumeOfTraffic - in case detected jam volume is increased;
- s4auto:TrafficCondition_trafficJamSlowlyIncreasing - in case detected traffic jam volume is increasing slowly;
- s4auto:TrafficCondition_trafficJamIncreasing - in case traffic jam volume is increasing;
- s4auto:TrafficCondition_trafficJamStronglyIncreasing - in case traffic jam volume is strongly increasing;
- s4auto:TrafficCondition_trafficStationary - in case traffic is stationary;
- s4auto:TrafficCondition_trafficJamSlightlyDecreasing - in case traffic jam volume is decreasing slowly;
- s4auto:TrafficCondition_trafficJamDecreasing - in case traffic jam volume is decreasing;
- s4auto:TrafficCondition_trafficJamStronglyDecreasing - in case traffic jam volume is decreasing rapidly.

6.3.13.1.4.25.1 s4auto:TrafficCondition_increasedVolumeOfTraffic

In case detected jam volume is increased.

6.3.13.1.4.25.2 s4auto:TrafficCondition_trafficJamDecreasing

In case traffic jam volume is decreasing.

6.3.13.1.4.25.3 s4auto:TrafficCondition_trafficJamIncreasing

In case traffic jam volume is increasing.

6.3.13.1.4.25.4 s4auto:TrafficCondition_trafficJamSlightlyDecreasing

In case traffic jam volume is decreasing slowly.

6.3.13.1.4.25.5 s4auto:TrafficCondition_trafficJamSlowlyIncreasing

In case detected traffic jam volume is increasing slowly.

6.3.13.1.4.25.6 s4auto:TrafficCondition_trafficJamStronglyDecreasing

In case traffic jam volume is decreasing rapidly.

6.3.13.1.4.25.7 s4auto:TrafficCondition_trafficJamStronglyIncreasing

In case traffic jam volume is strongly increasing.

6.3.13.1.4.25.8 s4auto:TrafficCondition_trafficStationary

In case traffic is stationary.

6.3.13.1.4.26 s4auto:VehicleBreakdown

6.3.13.1.4.26.0 Definition

In case the type of event is break down vehicle on the road.

The following narrower traffic event causes are defined:

- s4auto:VehicleBreakdown_lackOfFuel - in case vehicle break down is due to lack of fuel;
- s4auto:VehicleBreakdown_lackOfBatteryPower - in case vehicle break down is caused by lack of battery power;
- s4auto:VehicleBreakdown_engineProblem - in case vehicle break down is caused by an engine problem;
- s4auto:VehicleBreakdown_transmissionProblem - in case vehicle break down is caused by transmission problem;
- s4auto:VehicleBreakdown_engineCoolingProblem - in case vehicle break down is caused by an engine cooling problem;
- s4auto:VehicleBreakdown_brakingSystemProblem - in case vehicle break down is caused by a braking system problem;
- s4auto:VehicleBreakdown_steeringProblem - in case vehicle break down is caused by a steering problem;
- s4auto:VehicleBreakdown_tyrePuncture - in case vehicle break down is caused by tyre puncture;
- s4auto:VehicleBreakdown_tyrePressureProblem - in case low tyre pressure in detected;
- s4auto:VehicleBreakdown_vehicleOnFire - in case the vehicle is on fire.

6.3.13.1.4.26.1 s4auto:VehicleBreakdown_brakingSystemProblem

In case vehicle break down is caused by a braking system problem.

6.3.13.1.4.26.2 s4auto:VehicleBreakdown_engineCoolingProblem

In case vehicle break down is caused by an engine cooling problem.

6.3.13.1.4.26.3 s4auto:VehicleBreakdown_engineProblem

In case vehicle break down is caused by an engine problem.

6.3.13.1.4.26.4 s4auto:VehicleBreakdown_lackOfBatteryPower

In case vehicle break down is caused by lack of battery power.

6.3.13.1.4.26.5 s4auto:VehicleBreakdown_lackOfFuel

In case vehicle break down is due to lack of fuel.

6.3.13.1.4.26.6 s4auto:VehicleBreakdown_steeringProblem

In case vehicle break down is caused by a steering problem.

6.3.13.1.4.26.7 s4auto:VehicleBreakdown_transmissionProblem

In case vehicle break down is caused by transmission problem.

6.3.13.1.4.26.8 s4auto:VehicleBreakdown_tyrePressureProblem

In case low tyre pressure in detected.

6.3.13.1.4.26.9 s4auto:VehicleBreakdown_tyrePuncture

In case vehicle break down is caused by tyre puncture.

6.3.13.1.4.26.10 s4auto:VehicleBreakdown_vehicleOnFire

In case the vehicle is on fire.

6.3.13.1.4.27 s4auto:Violence

In case the type of event is human violence on or near the road.

6.3.13.1.4.28 s4auto:WrongWayDriving

6.3.13.1.4.28.0 Definition

In case the type of the event is vehicle driving in wrong way.

The following narrower traffic event causes are defined:

- s4auto:WrongWayDriving_wrongLane - in case vehicle is driving on a lane for which it has no authorization to use;
- s4auto:WrongWayDriving_wrongDirection - in case vehicle is driving in a direction that it is not allowed.

6.3.13.1.4.28.1 s4auto:WrongWayDriving_wrongDirection

In case vehicle is driving in a direction that it is not allowed.

6.3.13.1.4.28.2 s4auto:WrongWayDriving_wrongLane

In case vehicle is driving on a lane for which it has no authorization to use.

Annex A (informative): Change history

Date	Version	Information about changes
July 2020	V1.1.1	First publication of the TS.
August 2024	V2.1.1	SAREF4AUTO V2.1.1 is a major change with respect to SAREF4AUTO V1.1.1. Version V2.1.1 of the ontology is heavily adapting ETSI TS 102 894-2 [i.8] - ITS Common Data Dictionary (CDD) V2.1.1 [i.8].

History

Document history		
V1.1.1	July 2020	Publication
V2.1.1	August 2024	Publication