ASAM OpenLABEL V1.0.0 Release

Multi-Sensor Data Labeling and Scenario Tagging

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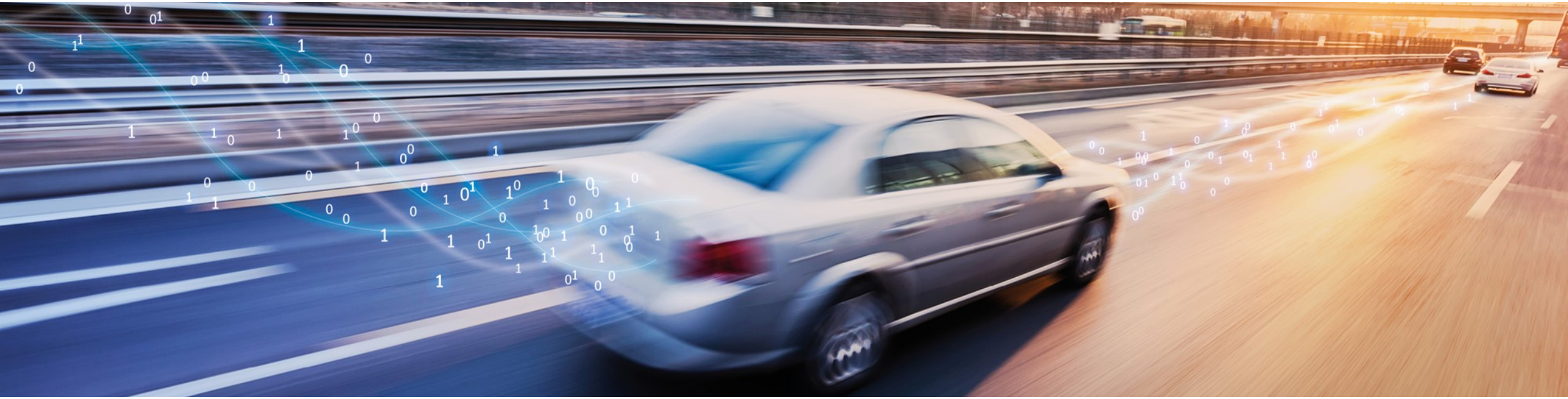


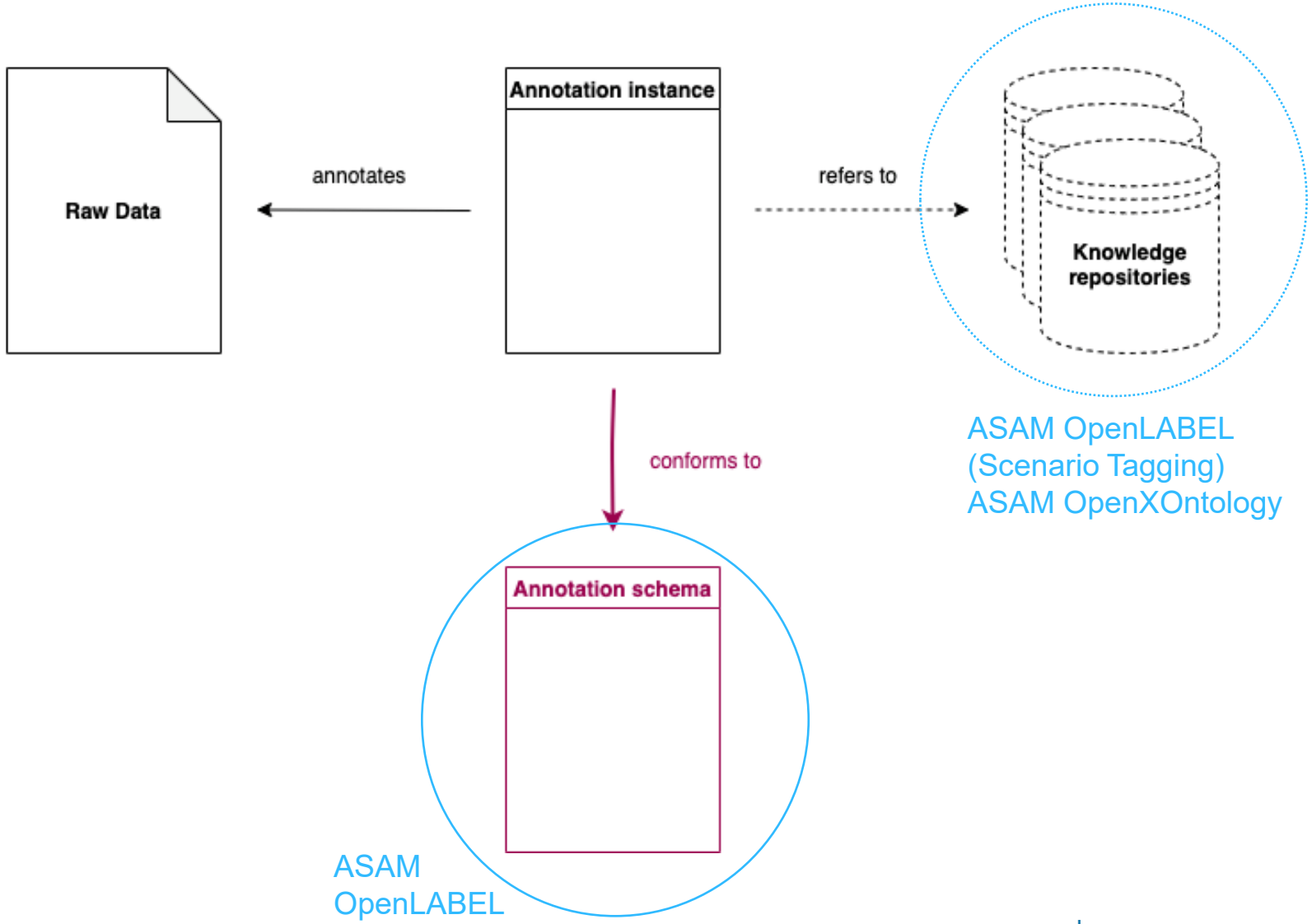
ASAM Association for Standardization of Automation and Measuring Systems

Agenda

OpenLABEL V1.0.0 Release Notes

1	About OpenLABEL 1.0.0. and Deliverables
2	Motivation, Goals and Personas
3	Multi-Sensor Data Labeling
4	Scenario Tagging
5	JSON Schema structure
6	Reference to other Standards

About OpenLABEL



Data annotation is the process of enriching raw data, for example, data streams from multiple sensors, such as cameras, LiDAR, radar, or test scenario artifacts with additional metadata. These metadata are related to the content of the raw data, for example, static or dynamic objects populating a video, actions they are performing, or environmental conditions. Additional information regarding the data may also be included.

Scope: The 2 Facets of OpenLABEL V1.0.0.

ASAM OpenLABEL establishes the basic principles and methods for annotating multi-sensor data streams and for tagging test scenarios for automated driving development, validation, and verification.

Multi-Sensor Data Labeling

- Defines and organizes the annotation data structures, including geometries, coordinate systems and transforms, and other concepts relevant to spatiotemporal annotations for multi-sensor data labeling.
- Does not provide a taxonomy/ontology of physical/abstract entities relevant to the road traffic domain. Instead, it specifies mechanisms to include external knowledge repositories/ontologies and recommends the use of ASAM OpenXOntology as the ontology of reference.
- Does not provide rules, specifications, or guidelines on how to annotate entities for multi-sensor data labeling. Nor does it provide any recommendations as to what elements of a physical entity should be included or not included in a geometry.

Scenario Tagging

- Defines and organizes the annotation data structure for test scenario tagging.
- Defines the set of ASAM OpenLABEL tags, their relationships, and the mechanisms to include the ASAM OpenLABEL set of scenario tags in valid annotation instances of test scenarios.
- Does not define a language or format to describe test scenarios.

Scenery

- Broken line
- Divided road
- Drive on right
- Lane dimensions [Width (m): 3.4 to 3.7]
- Level plane

Environmental Conditions

- Cloudiness [Cloud cover (okta): 0 to 1]
- Day
- Sun elevation [Angle (degree): 10 to 30]

Agents

- Stop

Deliverables OpenLABEL V1.0.0.

What Is Being Released

Multi-Sensor Data Labeling

- Documentation
- Data Labeling JSON Schema
- Examples

Scenario Tagging

- Documentation
- Scenario Tagging JSON Schema
- Examples
- Standardized set of Tags and their hierarchy
  - RDF Turtle Syntax
  - Excel tables

Scenery

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OpenLABEL V1.0.0 Multi-Sensor Data Labeling

Intro & Motivation

Motivation	Goals	Personas
• limited reuse of annotated datasets. • Challenges regarding maintenance and update of the annotations. • Limited sharing of datasets across the industry and between industry and academia. • Negative impact on the quality of annotations.	• Enable efficient sharing of annotated perception datasets and object lists. • Increase the overall quality of annotations by providing a common data structure for annotations. • Improve maintainability and reuse of annotated datasets.	• Perception/computer-vision engineers • Machine-learning engineers • Perception/computer-vision research scientists • Machine-learning research scientists • Data-annotation engineers • Data-annotation analysts • Test engineers

OpenLABEL V1.0.0 Scenario Tagging

Intro & Motivation

Motivation

- Scenario databases storing multi-sensor data, annotated multi-sensor data, simulation scenarios, and test scenarios can be very extensive
- Challenges regarding storing, retrieval and filtering of scenarios according to semantic classes/characteristics.

Goals

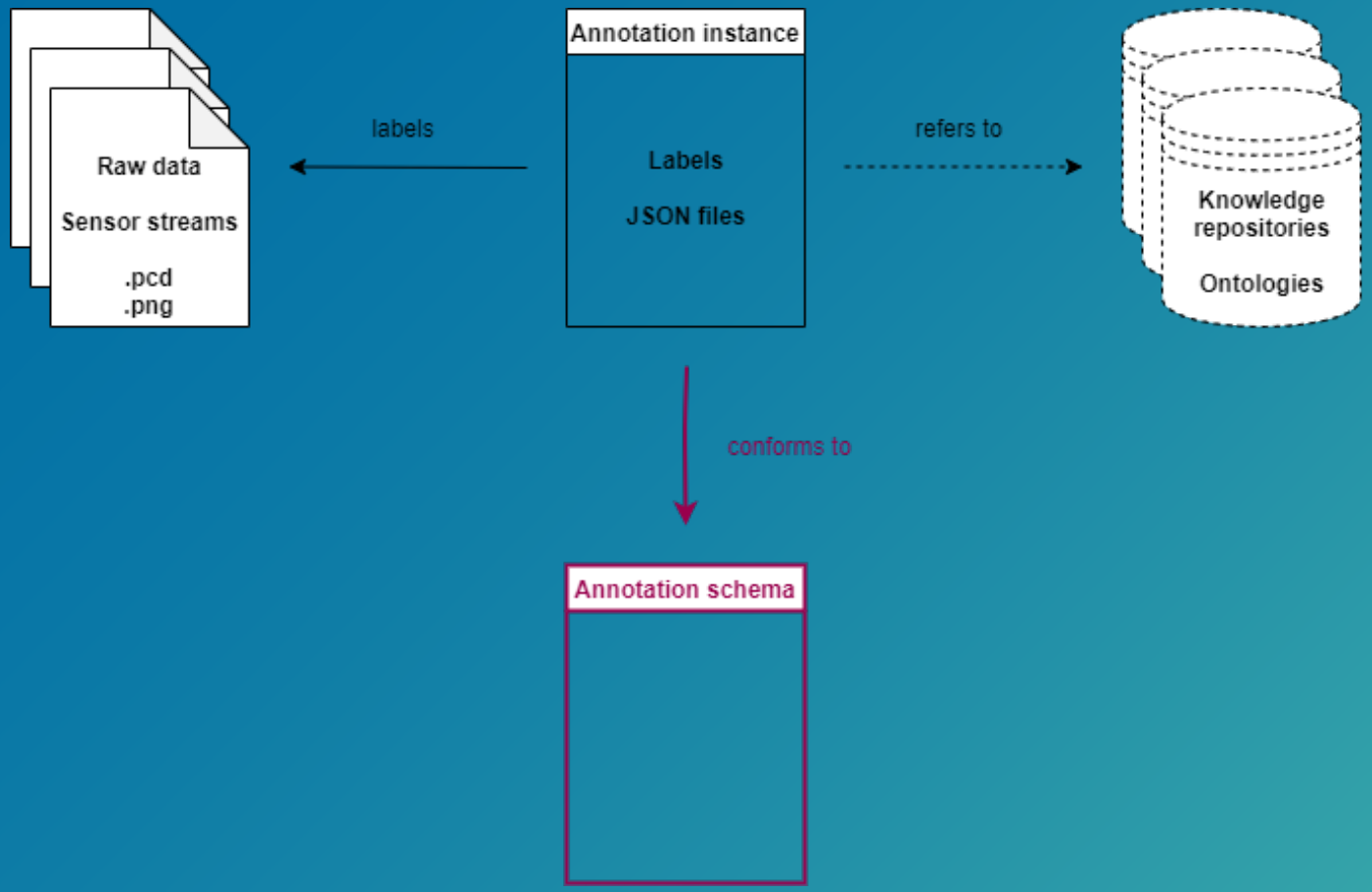
- Enable standardized clustering of test scenarios in scenario databases.
- Facilitate scenario storage systems, which are independent of scenario definition representation.
- Enable efficient search and filtering of test scenarios in scenario databases.
- Enable sharing of information on test scenario categories and clusters between different databases or owners.
- Facilitate the sharing of scenarios between systems that may not have the ability to inspect the scenario definition or underlying scenario data.
- Improve maintainability and reuse of test scenarios and scenario data.
- Enable and enhance machine-learning datasets with additional information to organize the datasets.

Personas

- Systems engineers
- Validation and verification engineers
- Functional-safety engineers
- Simulation specialists

Multi-Sensor Data Labeling

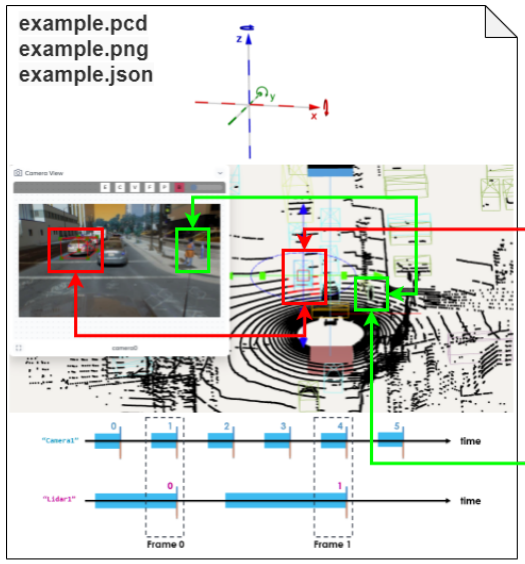
OpenLABEL V1.0.0



Documentation:

- Lists the raw data considered relevant for the multi-sensor data labeling use case.
- Introduces and describe in detail the annotation schema, its structure, elements, and the different ways of expressing labeling geometries, coordinate systems, transforms, and other information relevant for multi-sensor data labeling.
- Describes the mechanisms that govern the reference to external knowledge repositories, such as ontologies, that organize and define the semantics of the labels.
- Supported data types and their representation.
- Provide examples that show how to utilize the schema to produce valid annotation instances in relevant specific cases.

OpenLABEL V1.0.0 Multi-Sensor Data Labeling



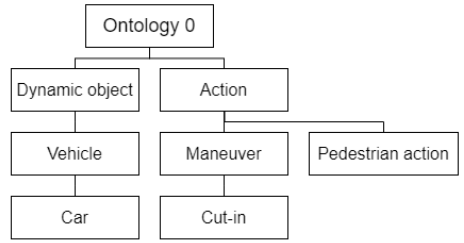
labels

example.json

```
{
   "openlabel" : {
      "metadata" : {
         "schema_version" : "1.0.0"
      },
      "ontologies": {
         "0": "https://www.example.org/example.owl",
      },
      "objects" : {
         "0" : {
            "name" : "object1",
            "type" : "car",
            "ontology_uid": 0
         },
         "1" : {
            "name" : "object2",
            "type" : "pedestrian",
            "ontology_uid": 0
         }
      }
   }
}
```

refers to

example.owl



conforms to

openlabel_json_schema.json

```
{
   "openlabel" : {
      "properties": {
         "actions": {...},
         "contexts": {...},
         "coordinate_systems": {...},
         "events": {...},
         "frame_intervals": {...},
         "frames": {...},
         "metadata": {...},
         "objects": {...},
         "ontologies": {...},
         "relations": {...},
         "resources": {...},
         "streams": {...}
      }
   }
}
```

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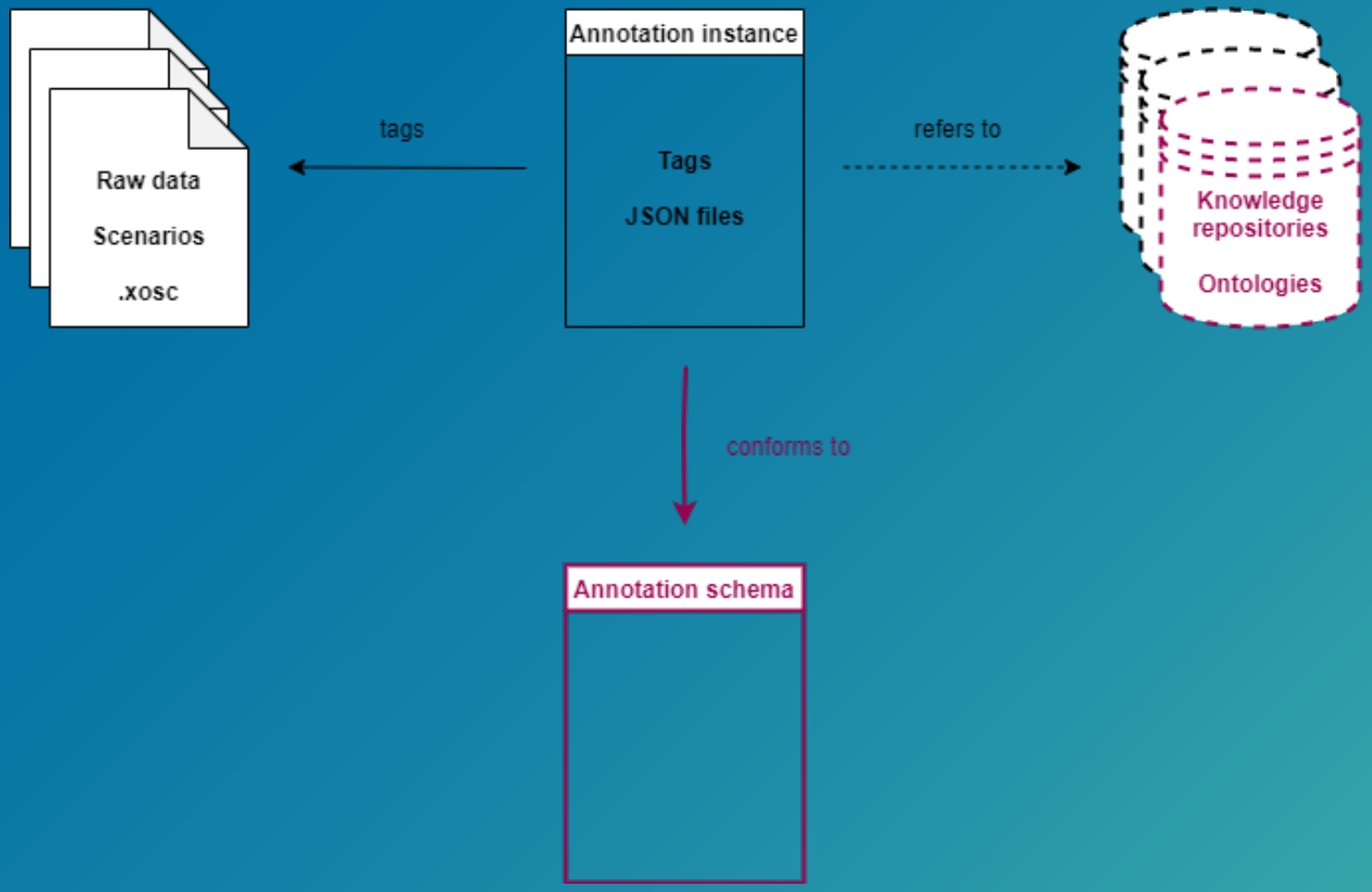
Scenario Tagging

OpenLABEL V1.0.0



Documentation:

- Presents the ontology providing the set of standardized ASAM OpenLABEL scenario tags.
- Explains the semantics and the logic governing the semantics of the ASAM OpenLABEL scenario tags.
- Documents the annotation schema to which valid ASAM OpenLABEL scenario tagging annotation instances should conform to.
- Explains the mechanisms that govern the reference to external knowledge repositories, such as ontologies, that organize and define the semantics of the labels.

ASAM

OpenLABEL V1.0.0 Scenario Tagging

example.xosc

```
<?xml version="1.0" encoding="utf-8"?>
<OpenSCENARIO>
 <FileHeader revMajor="1"
             revMinor="0"
             date="2020-06-16T10:00:00"
             description="Example Scenario"
             author="John Doe">
 </fileHeader>
 </ManeuverGroup>
   <StartTrigger>
    <ConditionGroup>
      <Condition name="ExampleCondition"
                 delay="0" conditionEdge="rising">
        <ByValueCondition>
          <SimulationTimeCondition value="0"
                                   rule="greaterThan" />
        </ByValueCondition>
      </Condition>
    </ConditionGroup>
   </StartTrigger>
   </Act>
   </Story>
   <Story name="CutInStory">
     <Act name="CutInAct">
      <ManeuverGroup maximumExecutionCount="1"
                     name="CutInSequence">
       <Actors selectTriggeringEntities="false">
         <EntityRef entityRef="CutInVehicle" />
       </Actors>
```

tags

example.json

```
{
   "openlabel": {
      "metadata": {
         "schema_version": "1.0.0",
         "tagged_file": "../resources/scenarios/example.xosc"
      },
      "ontologies": {
         "0": {
            "uri": "https://openlabel.asam.net/V1-0-0/
ontologies/openlabel_ontology_scenario_tags.ttl"
         }
      },
      "tags": {
         "0": {
            "type": "RoadTypeMinor",
            "ontology_uid": "0"
         },
         "1": {
            "type": "MotionCutIn",
            "ontology_uid": "0"
         },
         "2": {
            "type": "scenarioVersion",
            "ontology_uid": "0",
            "tag_data": {
               "text": [{
                  "type": "value",
                  "val": "1.0"
               }]
            }
         }
      }
   }
}
```

refers to

openlabel_ontology_scenario_tags.ttl

```
@base <https://openlabel.asam.net/V1-0-0/ontologies/> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .

<RoadTypeMinor> a rdfs:Class ;
rdfs:subClassOf <DrivableAreaType> .

<MotionCutIn> a rdfs:Class ;
rdfs:subClassOf <BehaviourMotion> .

<scenarioVersion> a rdfs:Property ;
   rdfs:label "Scenario version"@en ;
   rdfs:domain <Scenario> ;
   rdfs:range rdfs:Literal .
```

conforms to

openlabel_json_schema.json

```
{
   "openlabel" : {
      "properties": {
         "metadata": {...},
         "ontologies": {...},
         "tags": {...}
      }
   }
}
```

ASAM Association for Standardization of Automation and Measuring Systems

JSON Schema Structure

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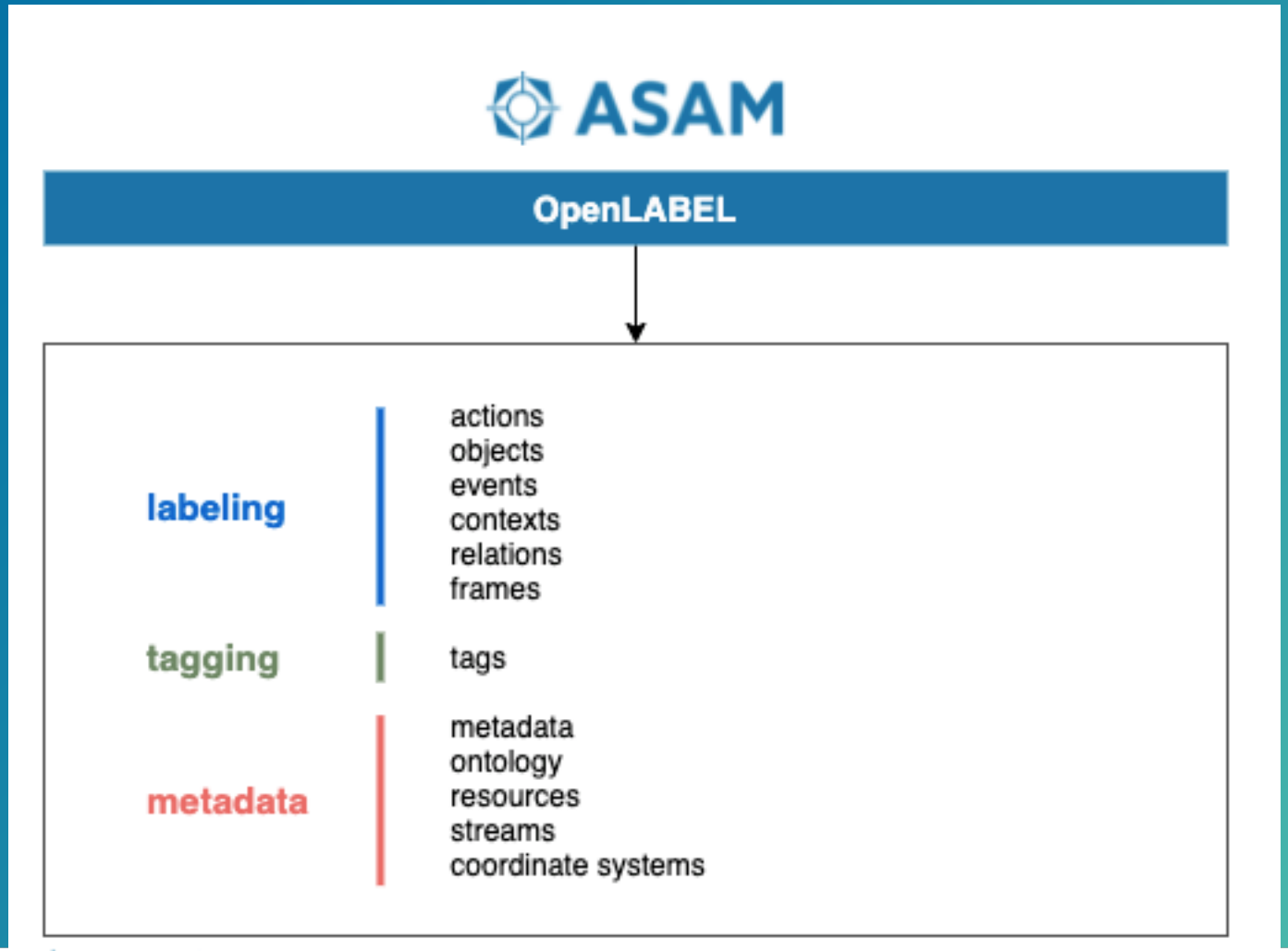
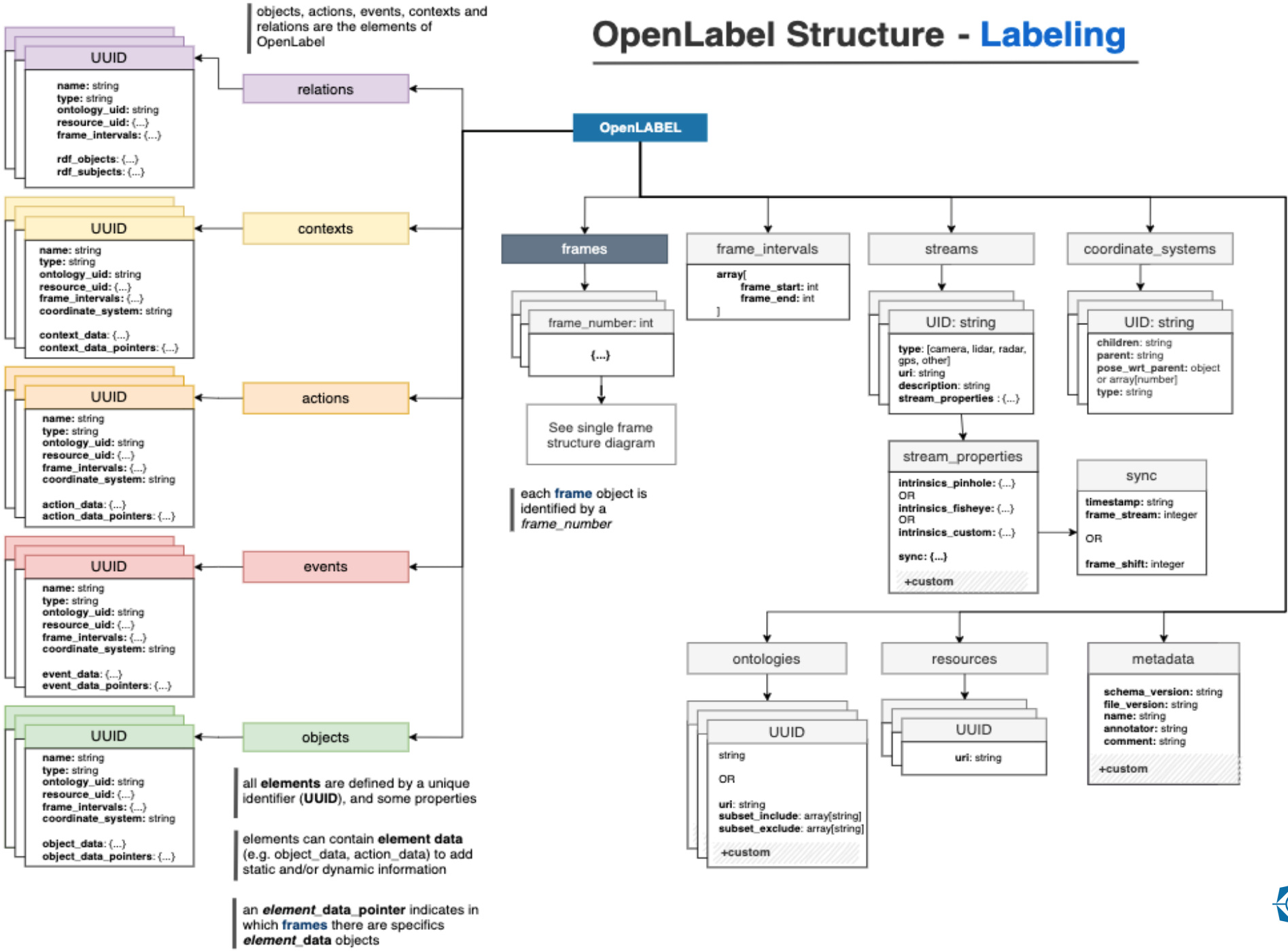
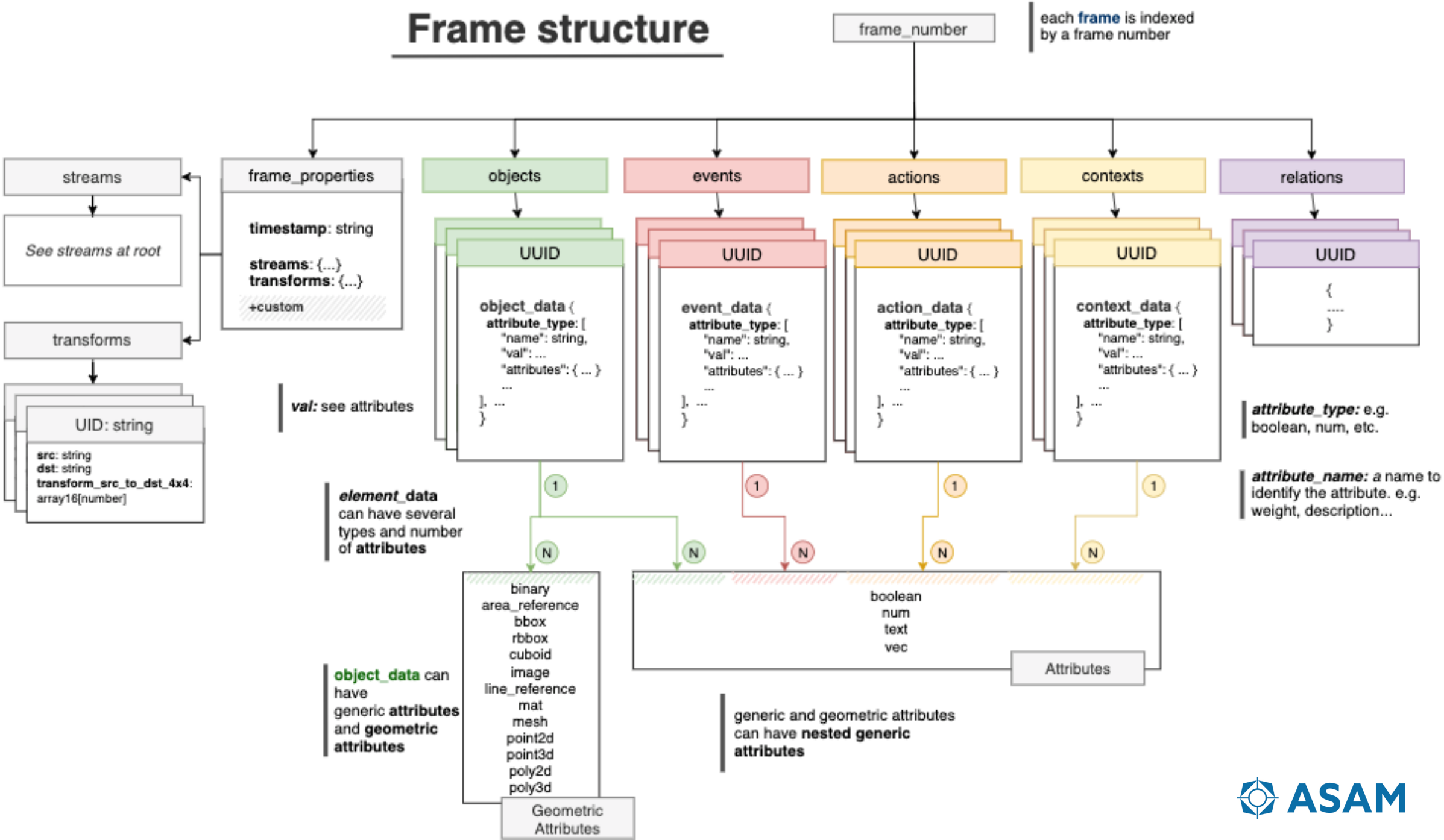


OpenLabel Structure - Labeling



ASAM

Frame structure



ASAM

JSON Schema Scenario Tagging Structure

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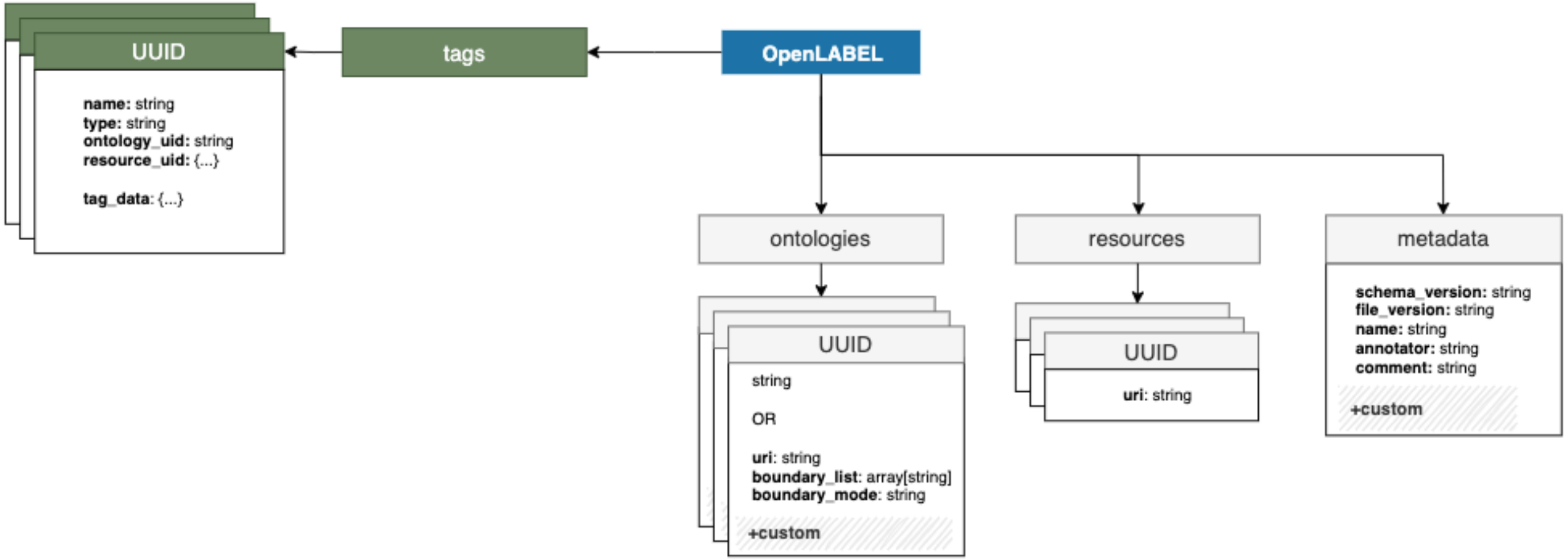

Figure 64. ASAM OpenLABEL labeling structure

Scenario Tagging Standardized Tags

Tags are delivered as a file expressed in RDF Turtle Syntax

ODD Tags	Behaviour Tags	Admin Tags
Operational Domain Design (ODD) tags: ODD tags describe the environmental conditions and road features present in a scenario, such as rainfall and junction. The ASAM OpenLABEL ODD tags are aligned with and share their definitions with the BSI PAS 1883 ODD Taxonomy,	**Behavior tags**: Behavior tags describe the types of road users and the behaviors exhibited by them in a scenario, such as a pedestrian who is walking	**Administration tags**: Administration tags describe things about a scenario which cannot or may not easily be derived from a scenario, such as the creation date of a scenario

Reference to Other Standards

OpenLABEL interfaces or refer to the following standards

- JSON Schema Draft 7 Specification
- TURTLE
- BSI PAS 1883
- SAE J3016 (2021)
- ASAM OpenXOntology V1.0.0
- ASAM OpenDRIVE 1.7.0
- ASAM OpenSCENARIO 1.1.0
- ASAM OpenSCENARIO 2.0.0
- ISO 8601
- ISO 8855
- ISO/AWI 34504

Thank you for your attention!

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