## XDVP

ontology eXtension for Dynamic Vehicle Properties


BMW
GROUP THE NEXT
100 YEARS

## EXTENDING VSSO TO HANDLE DATA STREAMS.

## - owl:Thing

## PositionInVehicle

Vehicle$\nabla$
VehicleComponent
$\nabla$
VehiclePropertyDynamicVehicleProperty ActuatableVehicleProperty ObservableVehicleProperty StaticVehicleProperty
$\checkmark$ owl:topObjectProperty

- belongsToVehicleComponent
- hasDynamicVehicleProperty
- hasStaticVehicleProperty
- partOfVehicle
- partOfVehicleComponent
- postionedAt

V owl:topDataProperty
positionName

- propertyValueUpdatedAt
- vehiclePropertyValue

Define the core structural concepts of VSS (e.g. Branch, Attributes, Sensors, etc.)

Use VSSo as domain ontology for other, widely adopted standards (SSN/SOSA)

Generate the data definitions from VSS based on the core ontology.

## DESIGNING THE ONTOLOGY EXTENSION.



Dynamic Vehicle Properties $\rightarrow$ Data in motion (i.e., time-series data, or more generically data streams)

- What event occurred the most in journey $J$ ?
- How many driving journeys does vehicle $V$ have in
- ..total,
- ..the last month,
- ..the last 10 days, etc?
- What methods and parameters are applied to analyze the stream $\boldsymbol{S}$ ? What is the feature $F(e . g \cdot$, average, max, min, etc.) of a given
What is the quantity type associated to the stream S?
What is the unit of the observation of the stream $S$ ?
What is the topic of the stream $S$ ?
When did the value of the stream $S$ changed from $V 1$ to V2?
Where does the stream $S$ derive from?
During a given event $E$,
What is the feat_A of $D V P_{-A}$ when another $D V P_{-} B$ has a value_B?
- VSSo-core
- Specially vsso-core:DynamicVehicleProperty
- Semantic Sensor Network (SSN)
- Vehicle as a sensing platform that implements procedures
- Sensors, Observations, Samples, and Actuators (SOSA)
- Vehicle properties can be observed and (some of them) acted on
- Low-level representation of the data streams (i.e., individual observations and actuations)
- lot-Stream
- Data streams are described by the sequential occurrence of events and stream observations
- High-level representation of the data streams (i.e., aggregated meaning of the sequences)
- Quantities, Units, Dimensions and dataTypes (QUDT)
- Value(s) of data streams as either numerical (with a unit) or categorical (unitless)



## Exploration of diagram and ontology



VSSo + SOSA


VSSo + lotStream

## OPEN MODELING TRADE-OFFS.

- How strict one should be?
- rdfs domain and range (i.e., inferencing), or
- schema.org domainlncludes and rangelncludes
- What would be the preferred vocabulary for working with units and quantity kinds?
- QUDT
- OM
- Other?
- Deal with event values as literals vs. a hierarchy of individuals?
- Other aspects..
- More details would be socialized once the ongoing VSSo main modeling decisions are made

