Hypercar Information System Ontology

Team 10

Marwan Mohamed Ashraf – 18P2920

Ahmed Gamal Ahmed Mahmoud – 18P1767

Seif Muhammad Abdelwahab – 18P2158

Mohamed Amr Mohamed Ghonaim – 18P2783

Mahmoud Mourad Youssef – 18P6555

Background

Hypercar Information System is used as a registry for hypercars, storing information about hypercars including engine spec, performance spec, transmission, model type and manufacturer. It also helps us find common specs between the various hypercar models.

The reason we register this information using ontology is because there are relations between models.

Hypercar manufacturers (i.e. Bugatti) do not make new models frequently. What they do is, they put out one base model (i.e. Bugatti Chiron) every 10-12 years. And during this gap they produce special editions and variants based on this model.

These variants can be track-only versions of the base model, downforce (track-focused lightweight) model, low drag (top-speed focused), one-off (coach-built, unique) model, or roadster version. These variants share specs with each other and with the base model while differing in other specs.

For example, the models can share the same engine (number of cylinders, layout, capacity, ..) and share the transmission spec (same number of gears, same transmission type) but differ in performance specs.

Description

Manufacturer makes at least 1 Model.

Models are divided into:

- Base Model (from which variants are made),
- Downforce Model (high-downforce track-focused sports model),
- Low Drag Model (top-speed-focused model),
- One-Off Model (unique model of which only 1 car is made)
- Roadster Model (model with removable/convertible roof)
- Track Only Model (track model illegal on road)

Model has exactly 1 Bodystyle (model bodystyle is coupe or roadster).
Model has exactly one Performance Spec (power, torque, drivetrain).
Model has max 1 Retractable Wing (wing width, wing adjustment type, angle of attack).
Model has exactly 1 Transmission Spec.
Model has exactly 1 Engine Spec (cylinders, capacity, layout, aspiration).
Model has exactly 1 Wheel Type (material, spokes, bolting).

Downforce Model, Track Only Model has exactly 1 Fixed Wing.

Roadster Model has exactly one Roadster (bodystyle).

Downforce Model, Low Drag Model, One Off Model, Roadster Model, Track Only Model have exactly 1 Base Model.

Transmission Spec is divided into A/T, Dual Clutch, Manual, Multi Clutch, Single Speed Direct Drive.

Wheel is divided into Carbon Wheel, Alloy Wheel, CenterLockWheel, LugNutWheel.

Carbon Wheel and Alloy Wheel are disjoint.

Center Lock Wheel and Lug Nut Wheel are disjoint.

A Wheel can be of type Carbon Wheel and Center Lock Wheel for example.

Object Properties (Relations)

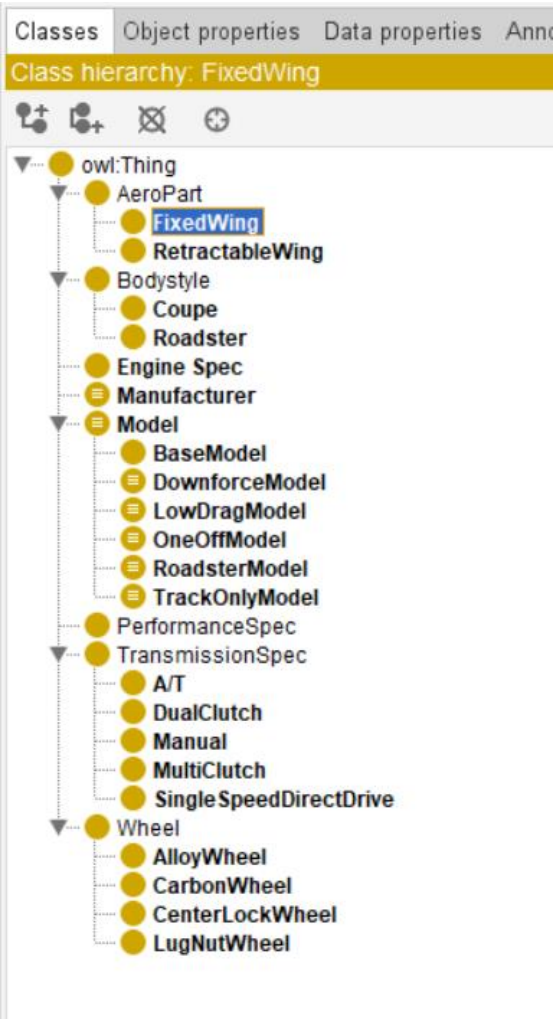
	Domain	Range
hasFixedWing	DownforceModel, RoadsterModel, TrackOnlyModel	FixedWing
hasRetractableWing	Model	RetractableWing
hasBaseModel	DownforceModel, LowDragModel, OneOffModel, RoadsterModel, TrackOnlyModel	BaseModel
hasBodystyle	Model	Bodystyle
hasEngineSpec	Model	EngineSpec
hasPerformanceSpec	Model	PerformanceSpec
hasTransmission	Model	TransmissionSpec
hasWheelType	Model	Wheel
isRoadsterVersionOf	RoadsterModel	BaseModel, DownforceModel, LowDragModel, OneOffModel, TrackOnlyModel
isVariantOf	DownforceModel, LowDragModel, OneOffModel, RoadsterModel, TrackOnlyModel	Model
makesModel	Manufacturer	Model

Data properties (attributes)

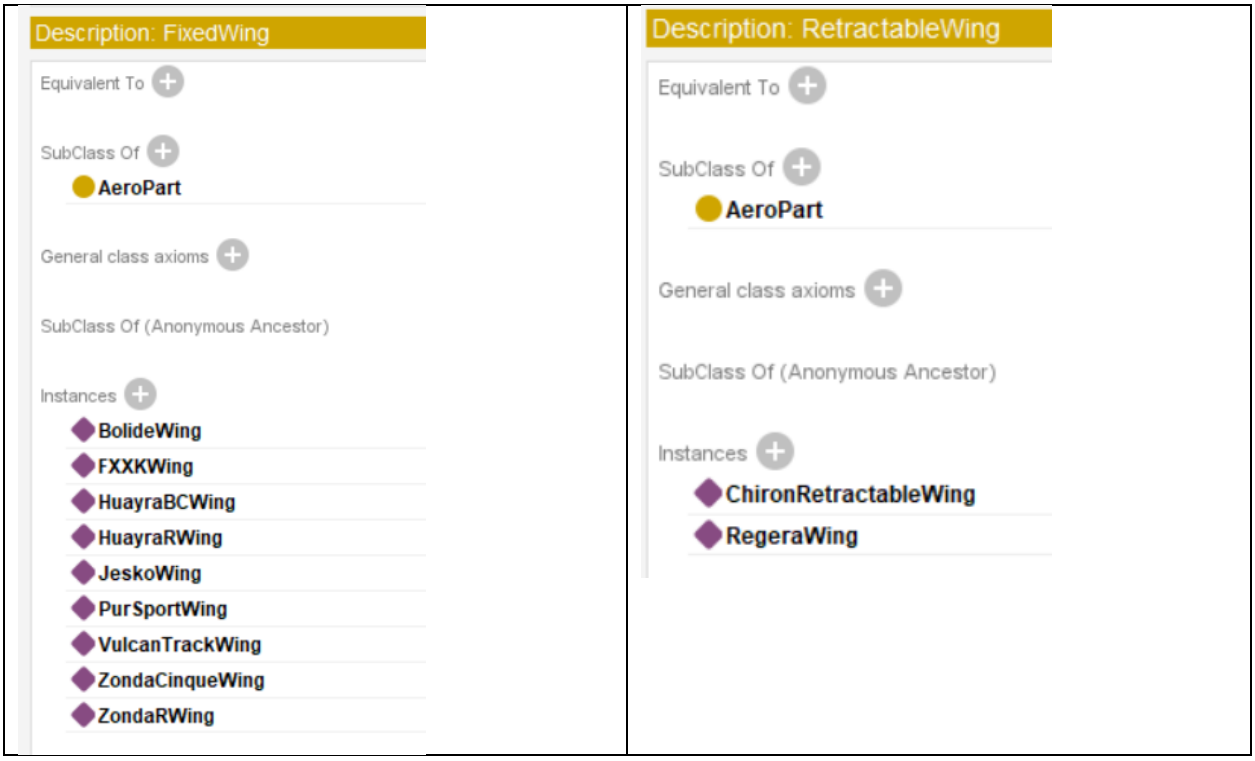
	Domain	Range
drivetrain	Performance Spec	{AWD, FWD, RWD}
	Domains (intersection) PerformanceSpec (drivetrain value "AWD") or (drivetrain value "FWD") or (drivetrain value "RWD")	
engineAspiration	EngineSpec	{Natural, Twin-turbocharged, Quad-turbocharged}
	Domains (intersection) (engineAspiration value "Natural") or (engineAspiration value "Quad-turbocharged") or (engineAspiration value "Twin-turbocharged") EngineSpec	
engineCapacity	EngineSpec	String
engineCylinders	EngineSpec	Some int >5
	Domains (intersection) EngineSpec engineCylinders some xsd:int[> "5"^^xsd:int]	
engineLayout	EngineSpec	{Front-engined, Mid-engined, Rear-engined}
	Domains (intersection) EngineSpec (engineLayout value "Front-engined") or (engineLayout value "Mid-engined") or (engineLayout value "Rear-engined")	
label	AeroPart , Bodystyle , EngineSpec , Manufacturer , Model , PerformanceSpec TransmissionSpec , Wheel	String
manufacturerLocation	Manufacturer	String
Material	AeroPart , Bodystyle , Wheel	{Alloy, Carbon fibre}
	Domains (intersection) AeroPart Wheel (material value "Alloy") or (material value "Carbon fibre") Bodystyle	
numOfGears	TransmissionSpec	Some int >0
	Domains (intersection) numOfGears some xsd:int[> "0"^^xsd:int] TransmissionSpec	

numOfSpokes	Wheel	String
numOfUnits	Model	Some int >0
	Domains (intersection) Model numOfUnits some xsd:int[> "0"^^xsd:int]	
power	PerformanceSpec	String
roadLegality	Model	String
roofMaterial	Roadster	{Hardtop, Vinyl}
	Domains (intersection) (roofMaterial value "Hardtop") or (roofMaterial value "Vinyl") Roadster	
roofMechanism	Roadster	{Convertible, Detachable}
	Domains (intersection) Roadster (roofMechanism value "Convertible") or (roofMechanism value "Detachable")	
torque	PerformanceSpec	String
versionType	Model	String
wheelBolting	Wheel	{center lock, lug nuts}
	Domains (intersection) Wheel (wheelBolting value "center lock") or (wheelBolting value "lug nuts")	
wingAdjustment Type	Wing	{Active Aero, Fixed, Fixed - Active Aero}
	Domains (intersection) (wingAdjustmentType value "Active Aero") or (wingAdjustmentType value "Fixed") or (wingAdjustmentType value "Fixed - Active Aero")	
wingAttackAngle	Wing	String
wingWidth	Wing	String

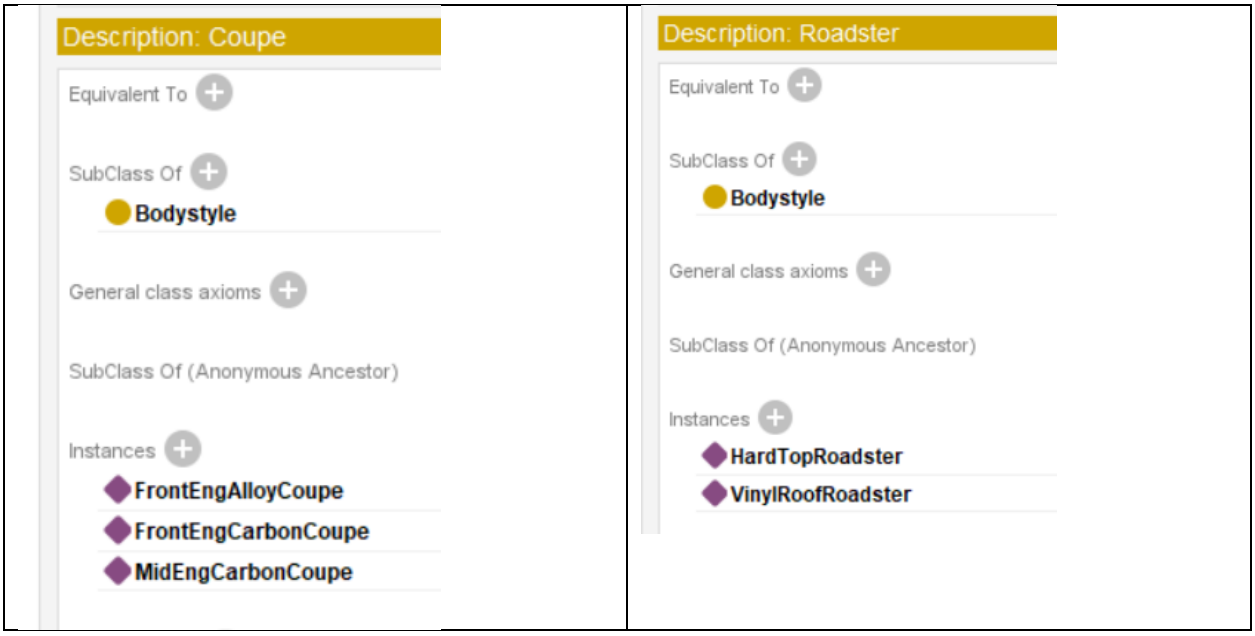
Classes, Subclasses and Restrictions



FixedWing, RetractableWing (Subclasses of AeroPart)

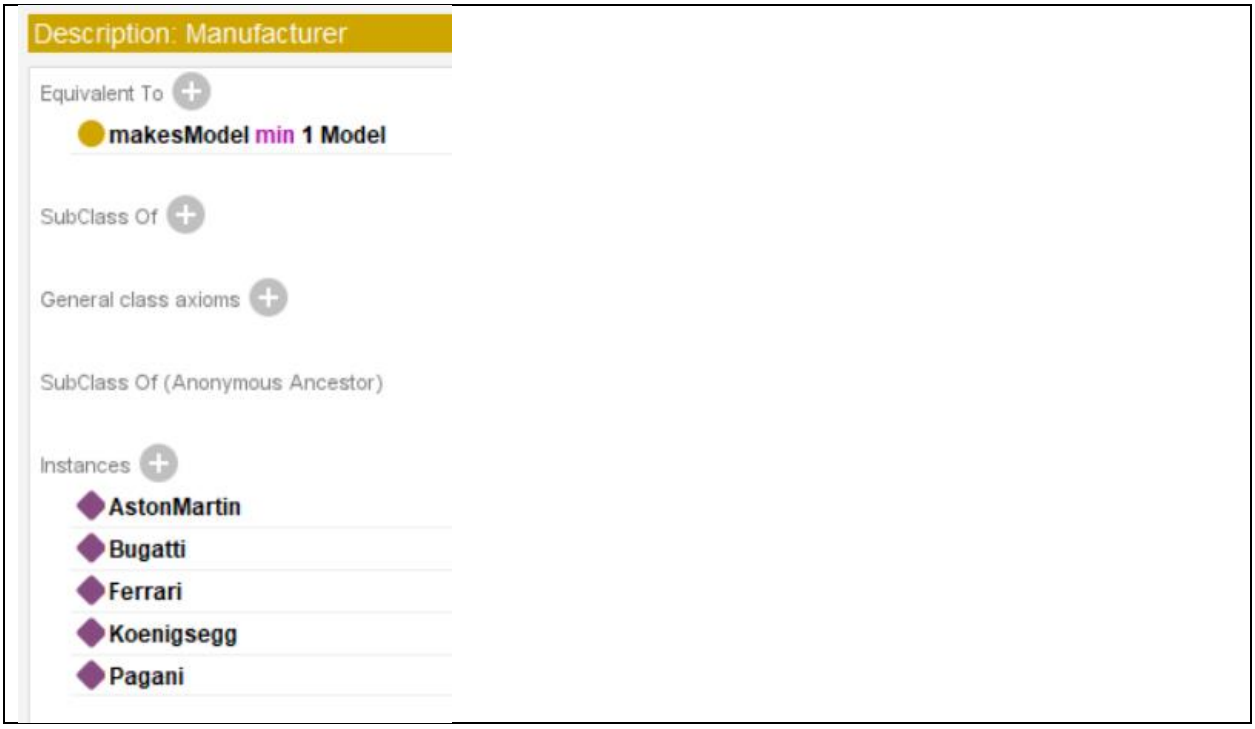


Coupe, Roadster (Subclasses of Bodystyle)



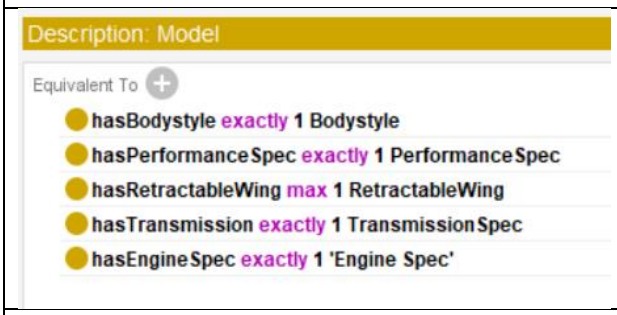
EngineSpec

Manufacturer

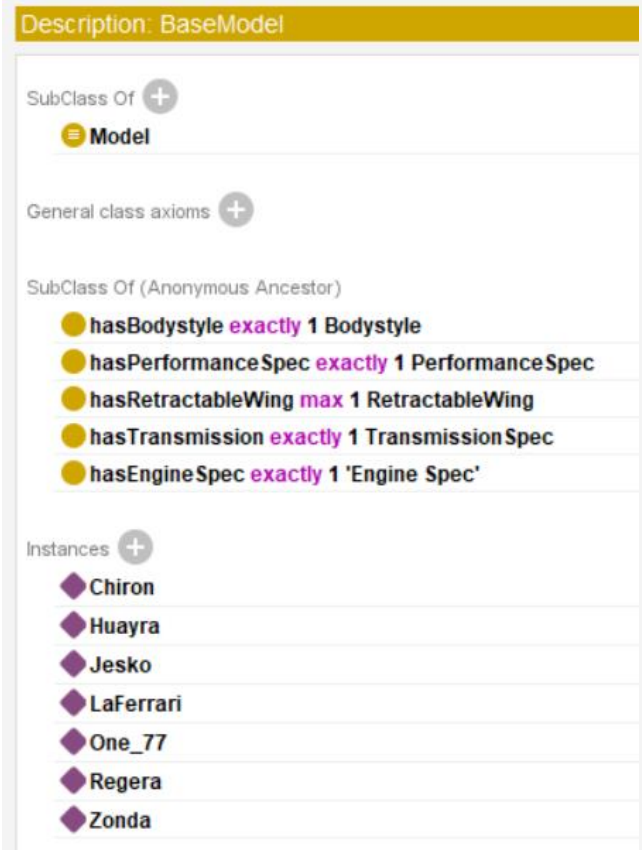


Model, BaseModel, DownforceModel, LowDragModel, OneOffModel, RoadsterModel, TrackOnlyModel

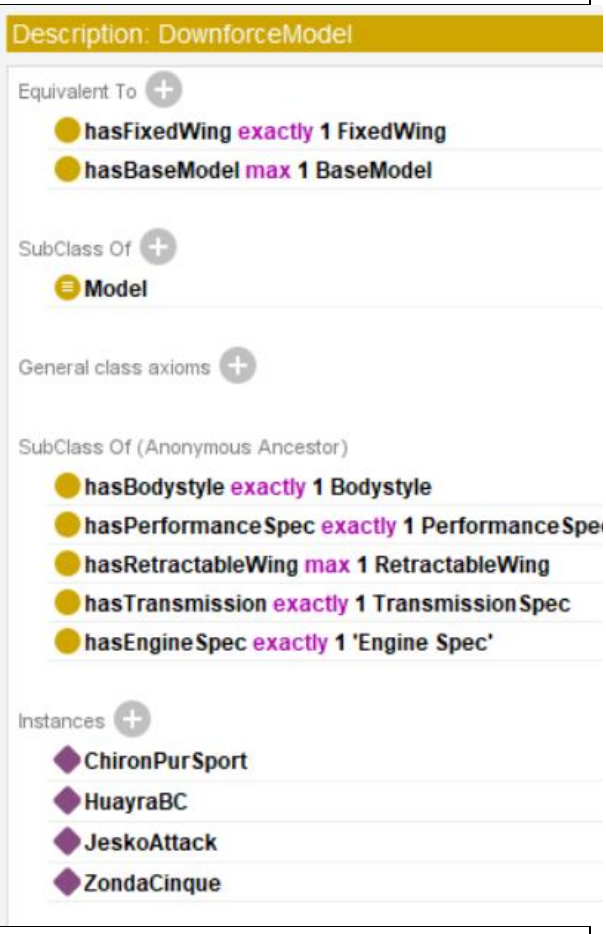
Model



BaseModel

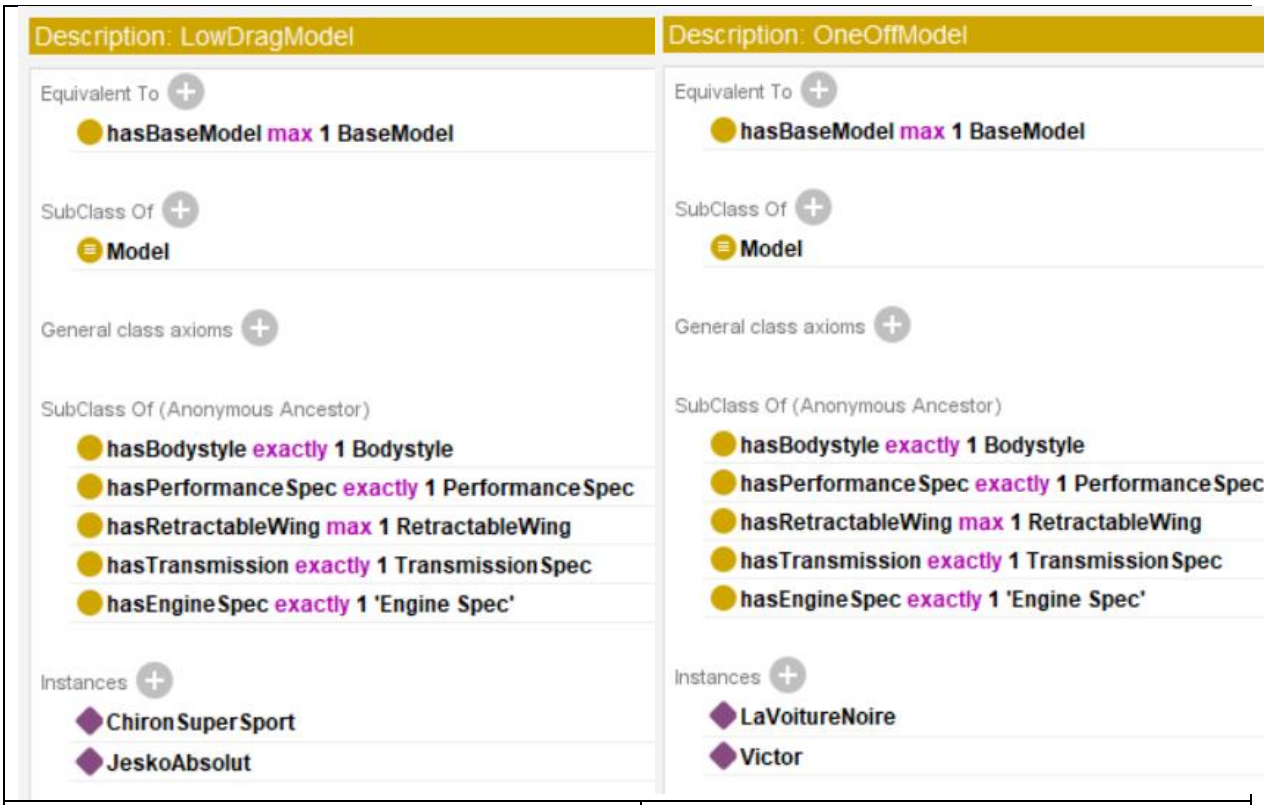


DownforceModel

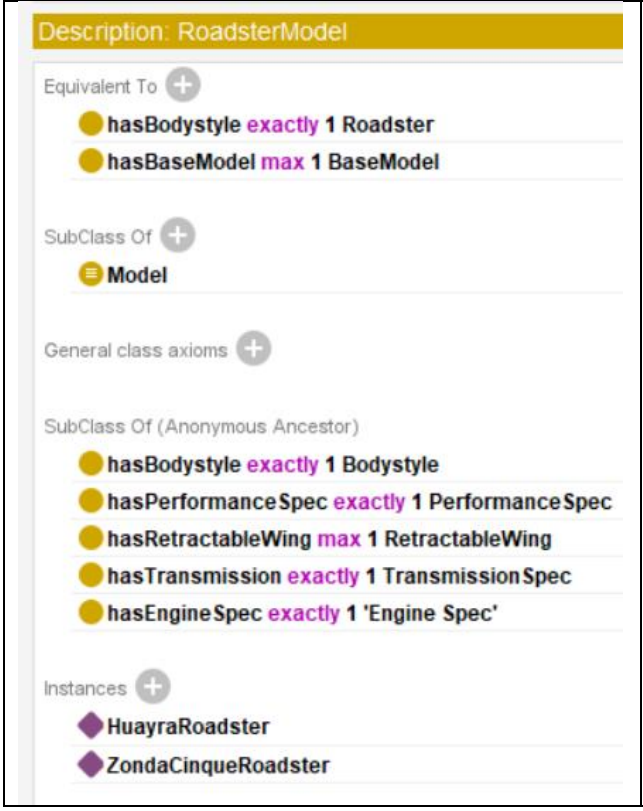


LowDragModel

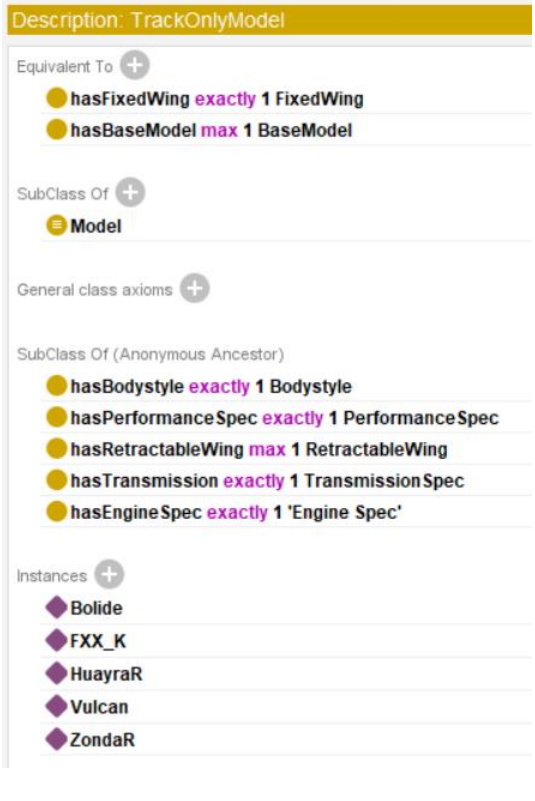
OneOffModel



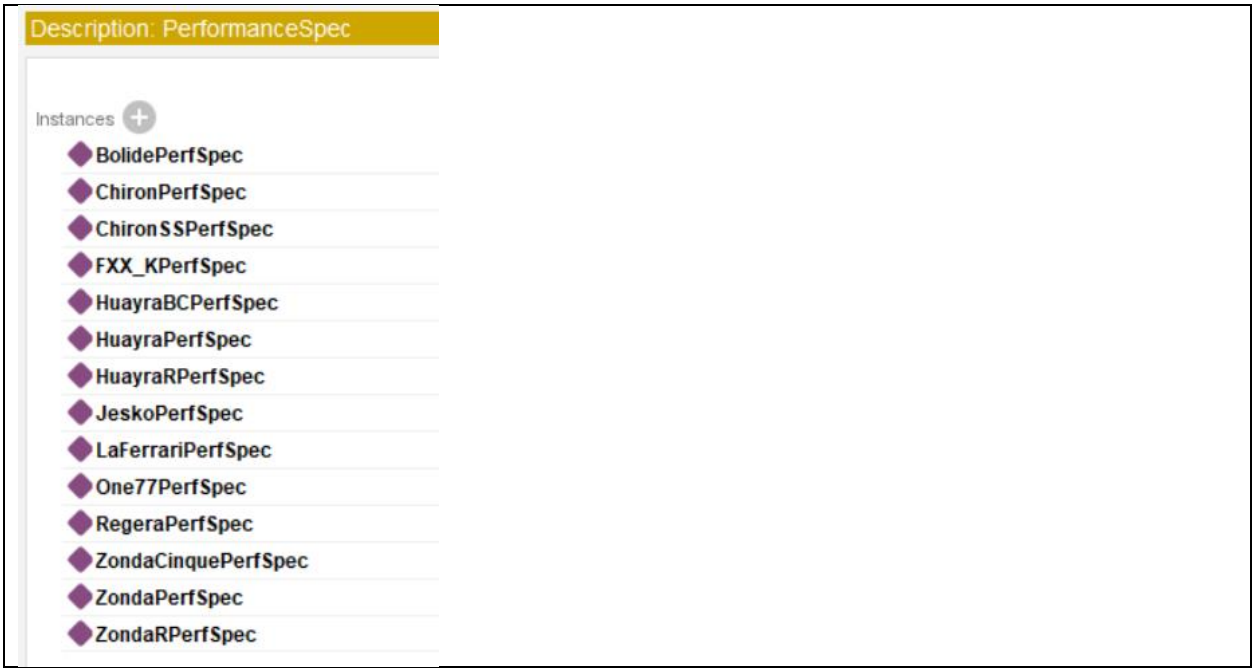
Roadster Model



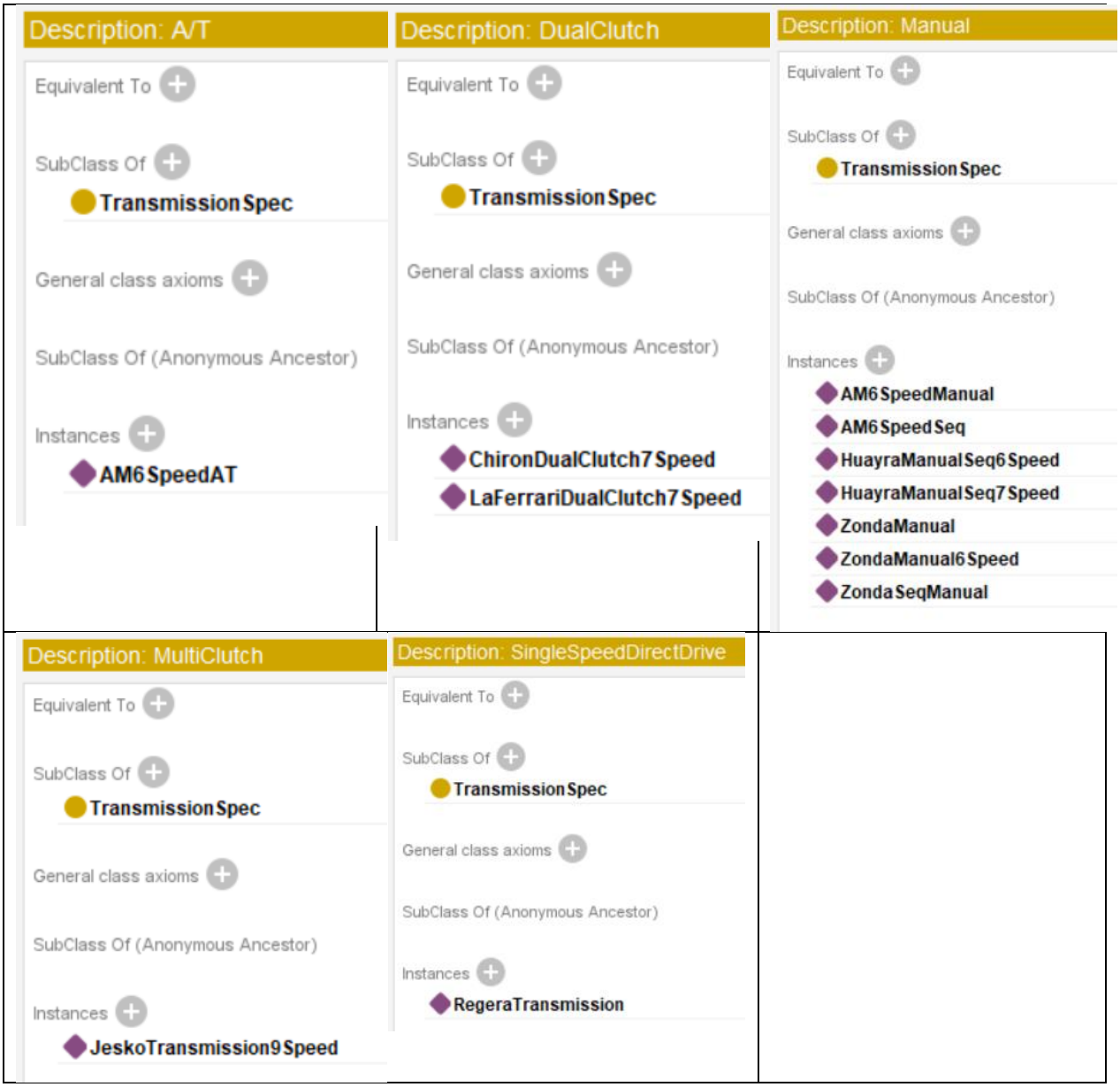
Track Only Model



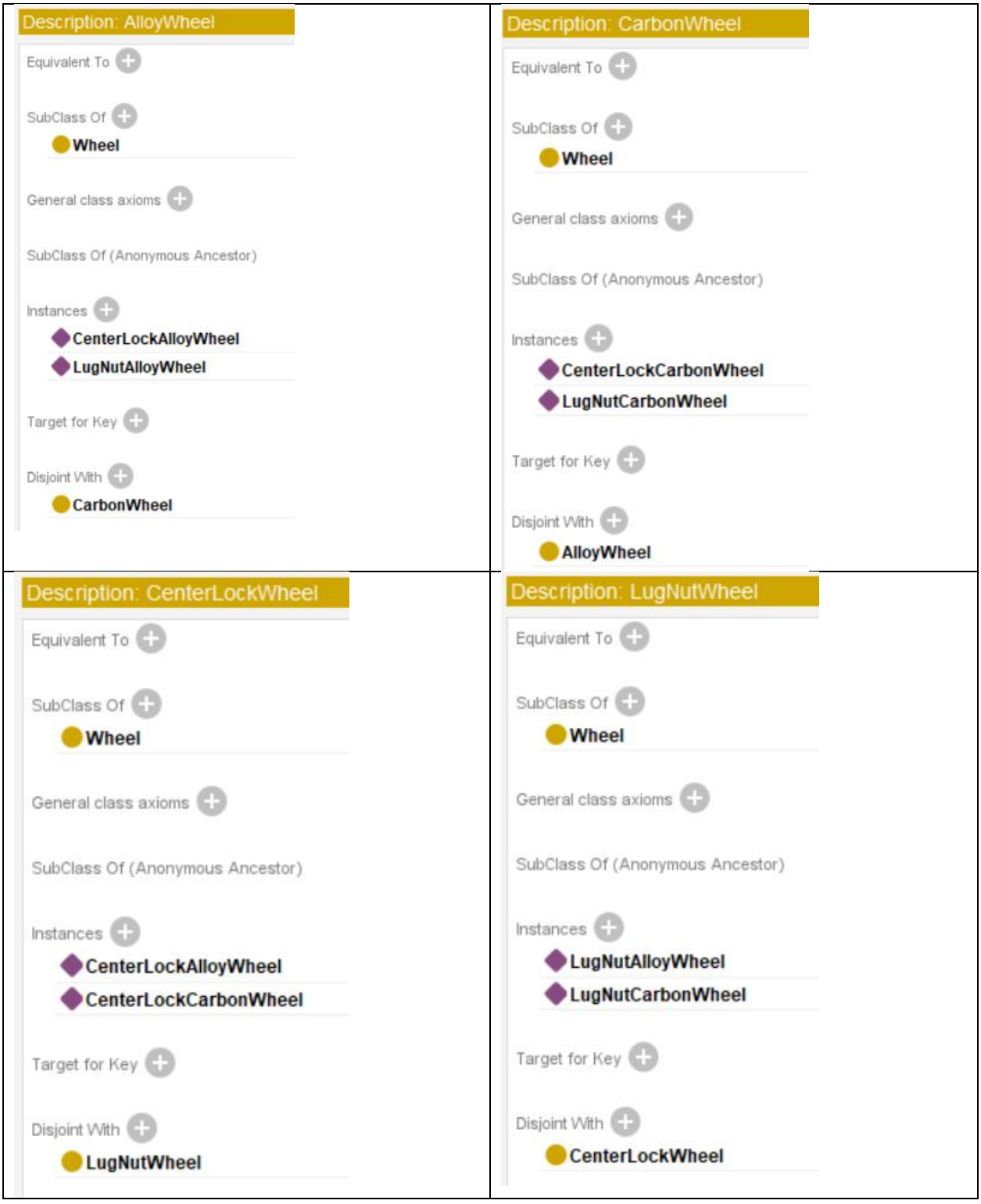
PerformanceSpec



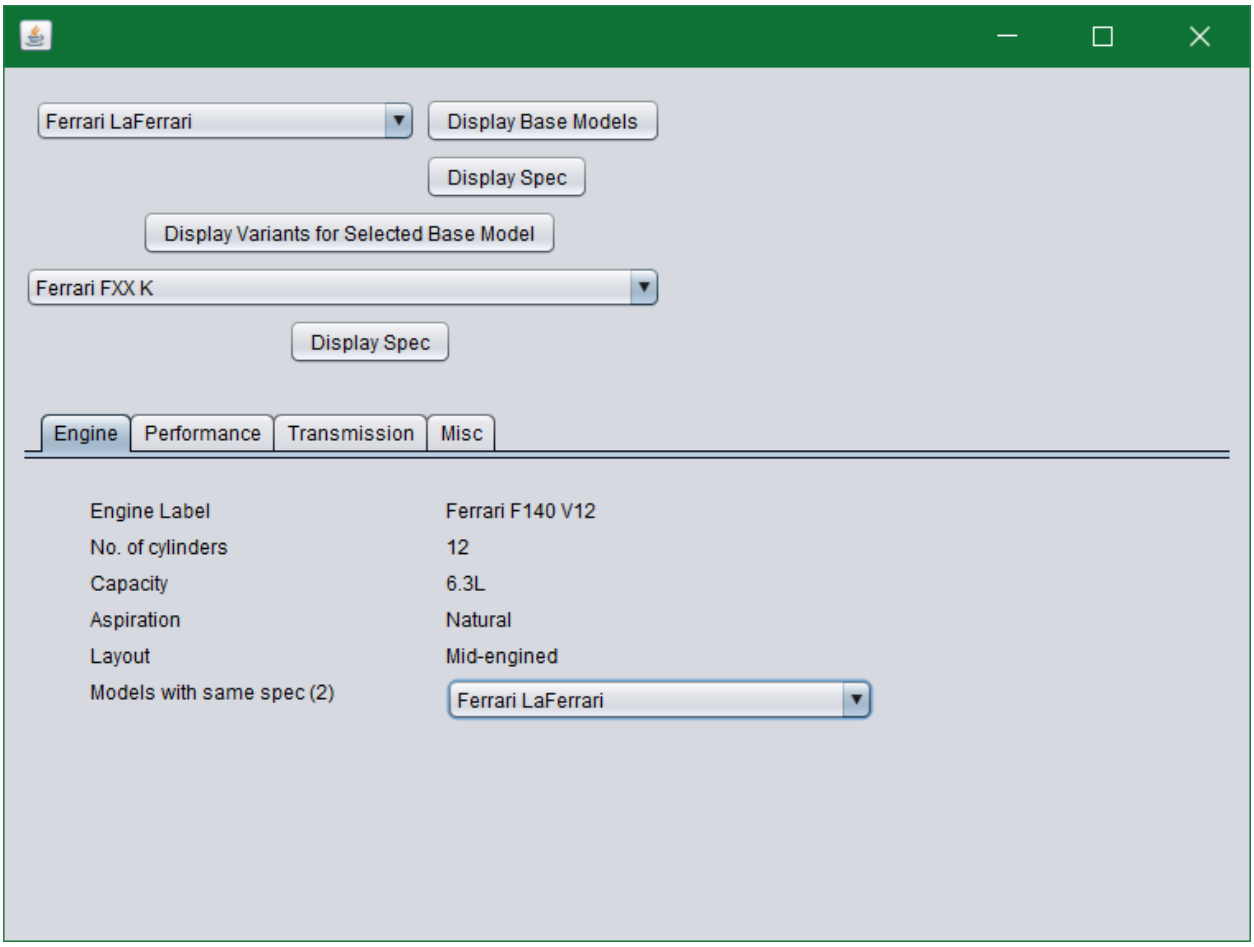
TransmissionSpec subclasses

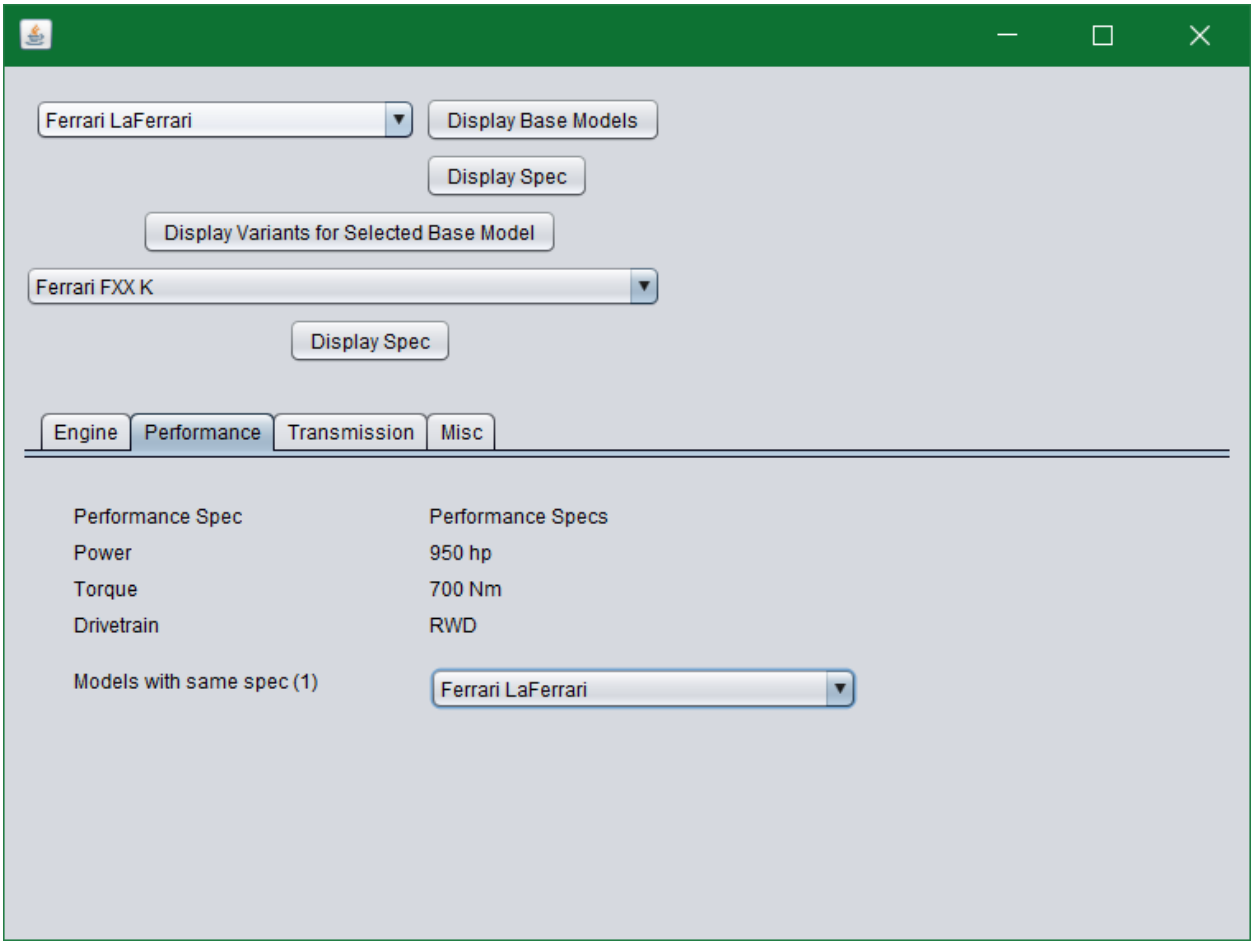


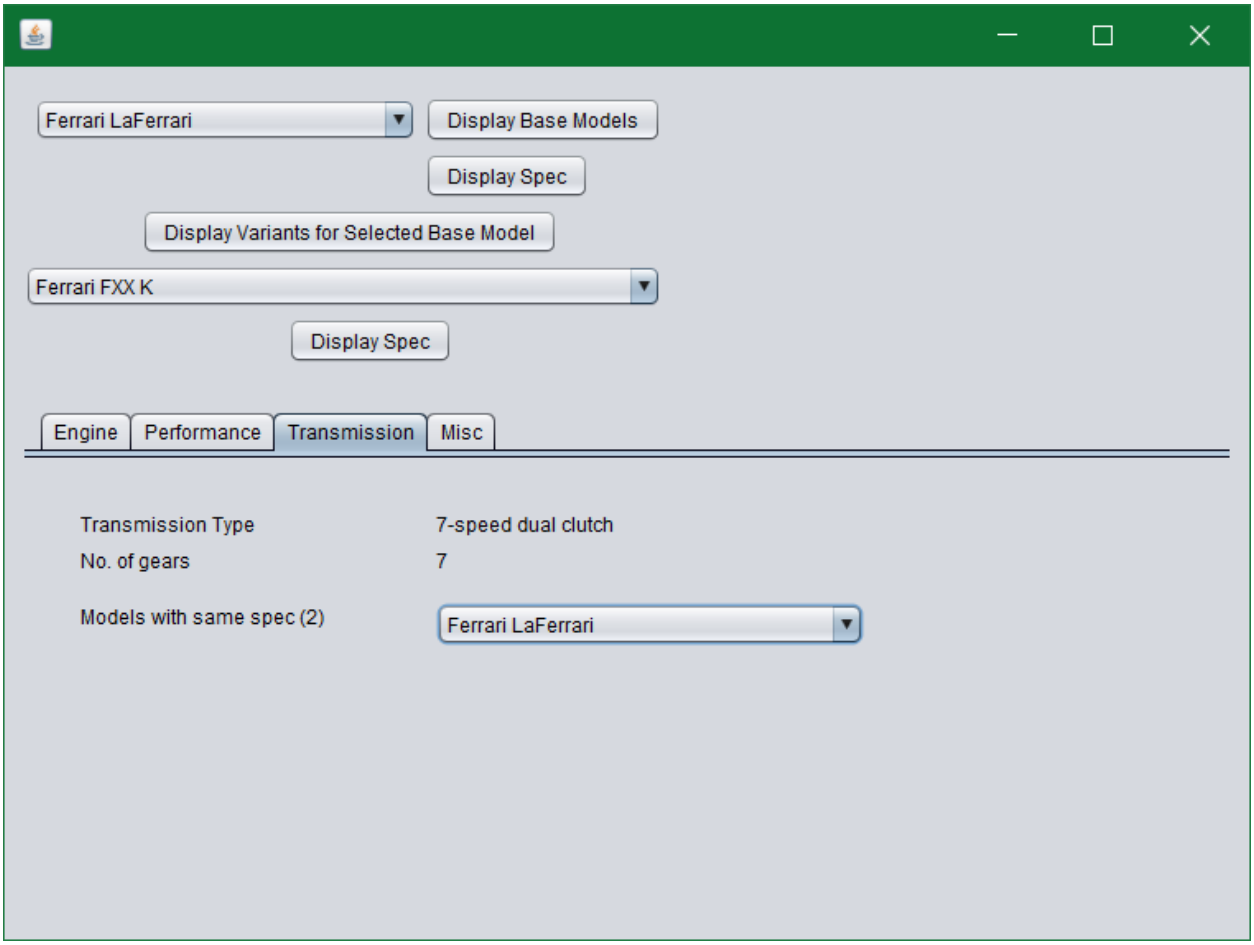
Wheel subclasses

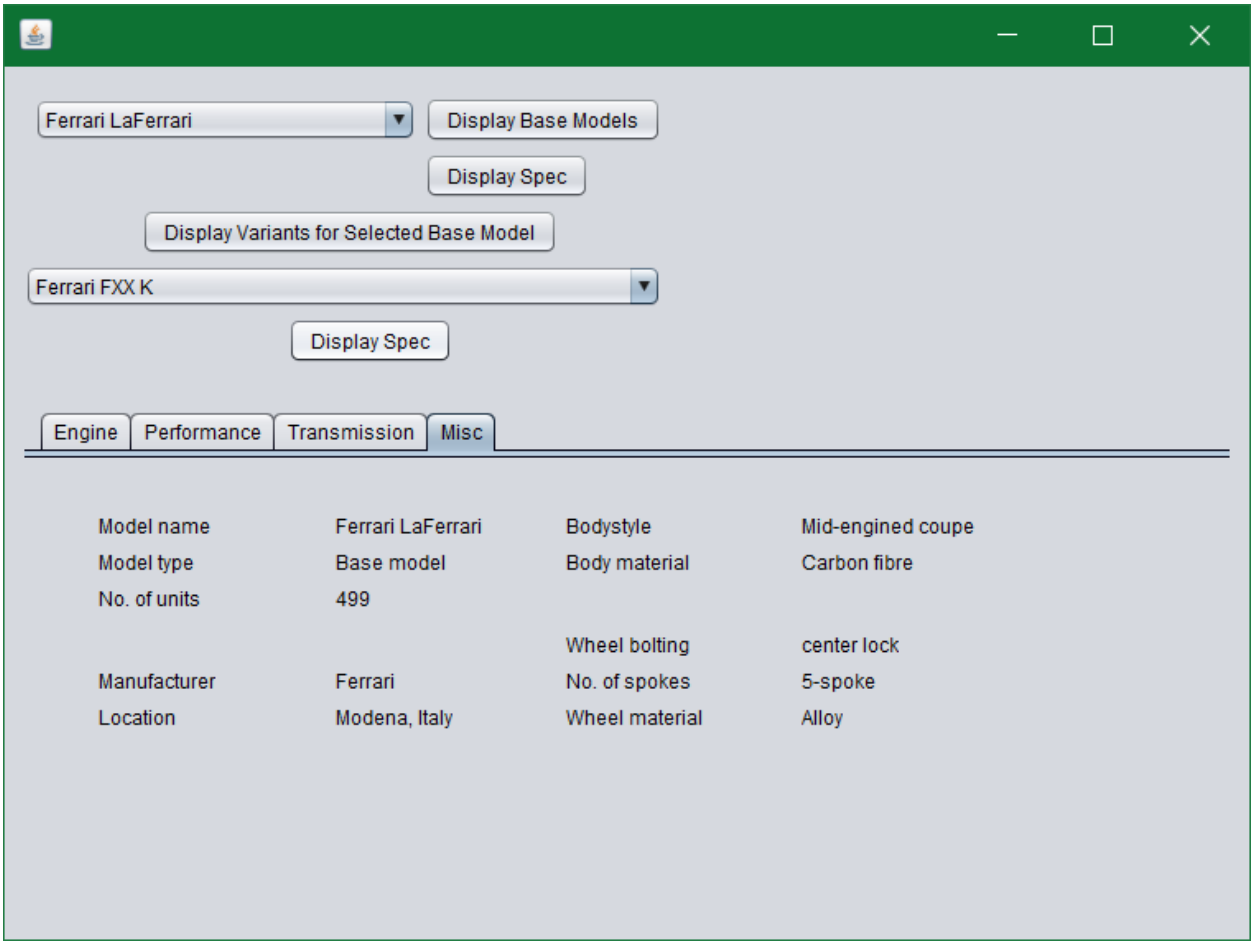


Jena Application (Variants Spec Display) (DisplayFrame.java)

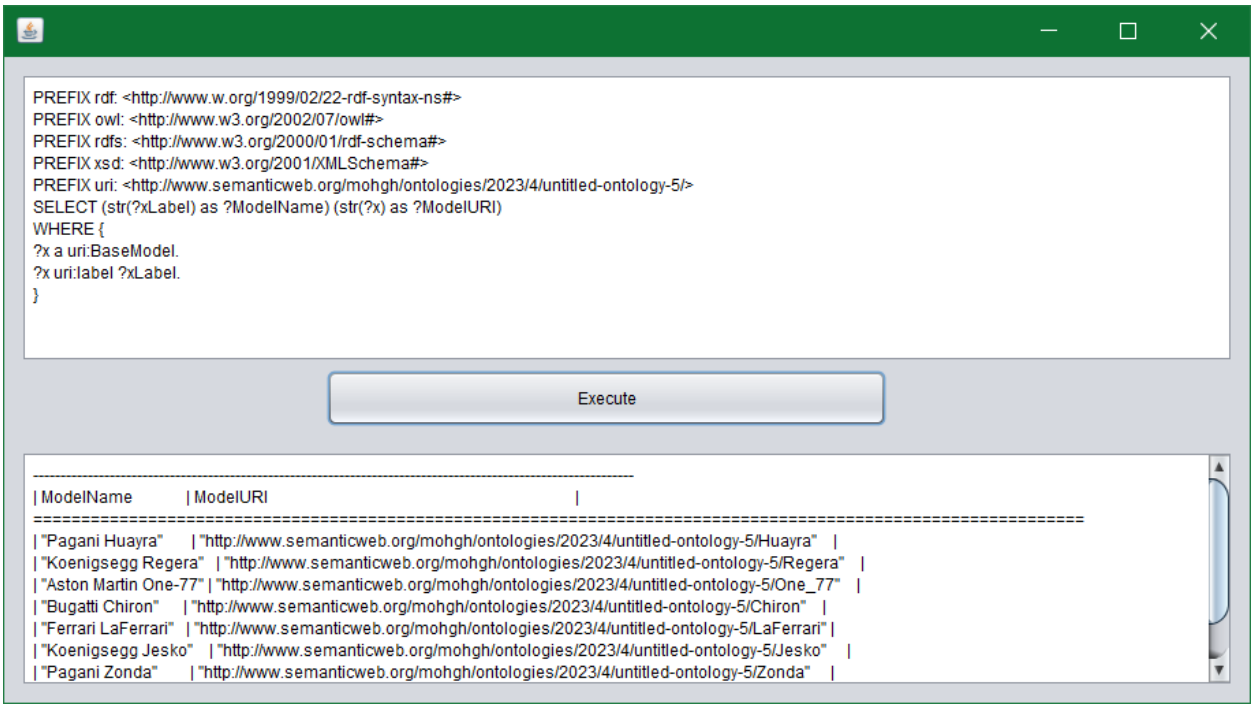


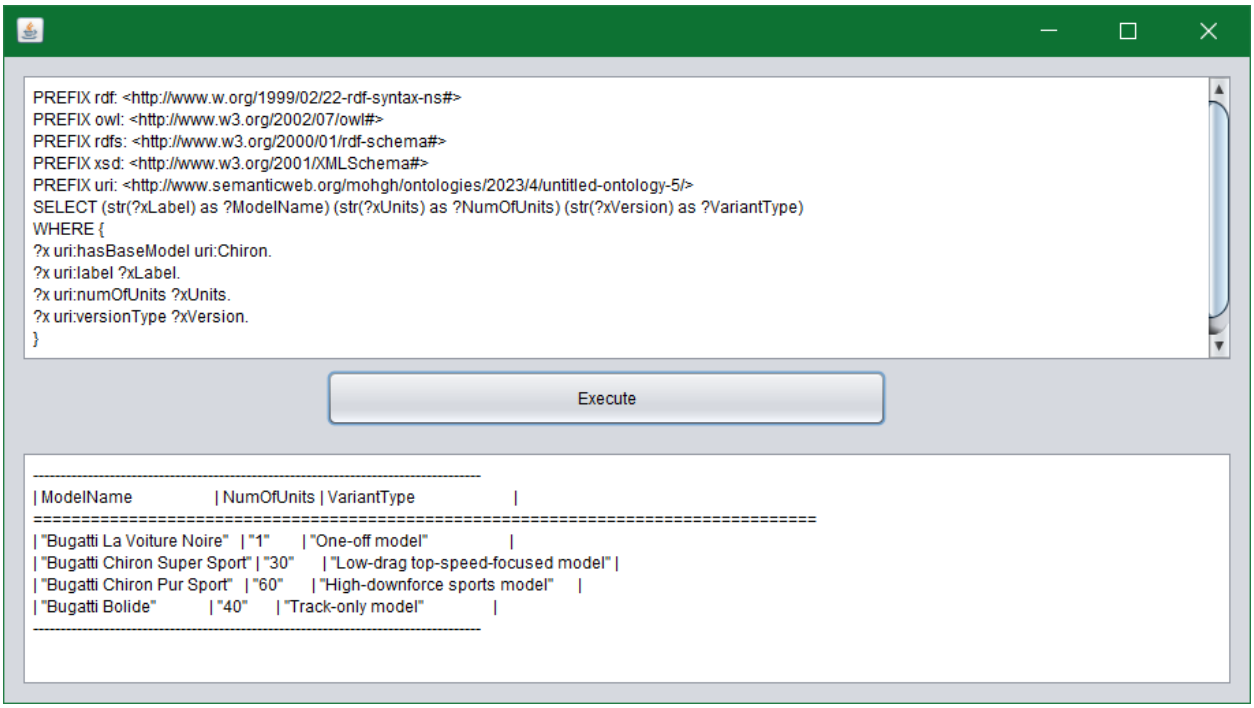

Ferrari LaFerrari
Display Base Models
Display Spec
Display Variants for Selected Base Model
Ferrari FXX K
Display Spec
Engine
Performance
Transmission
Misc
Performance Spec
Performance Specs
Power
950 hp
Torque
700 Nm
Drivetrain
RWD
Models with same spec (1)
Ferrari LaFerrari

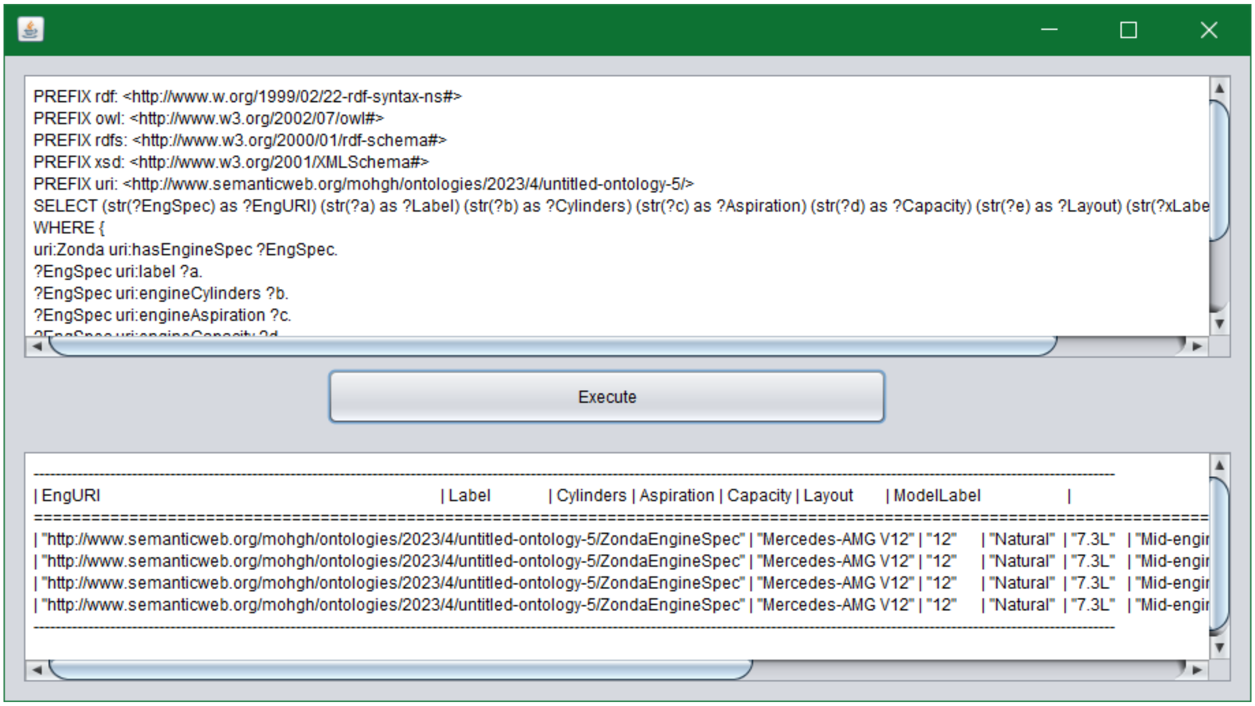

Ferrari LaFerrari
Display Base Models
Display Spec
Display Variants for Selected Base Model
Ferrari FXX K
Display Spec
Engine
Performance
Transmission
Misc
Transmission Type
7-speed dual clutch
No. of gears
7
Models with same spec (2)
Ferrari LaFerrari

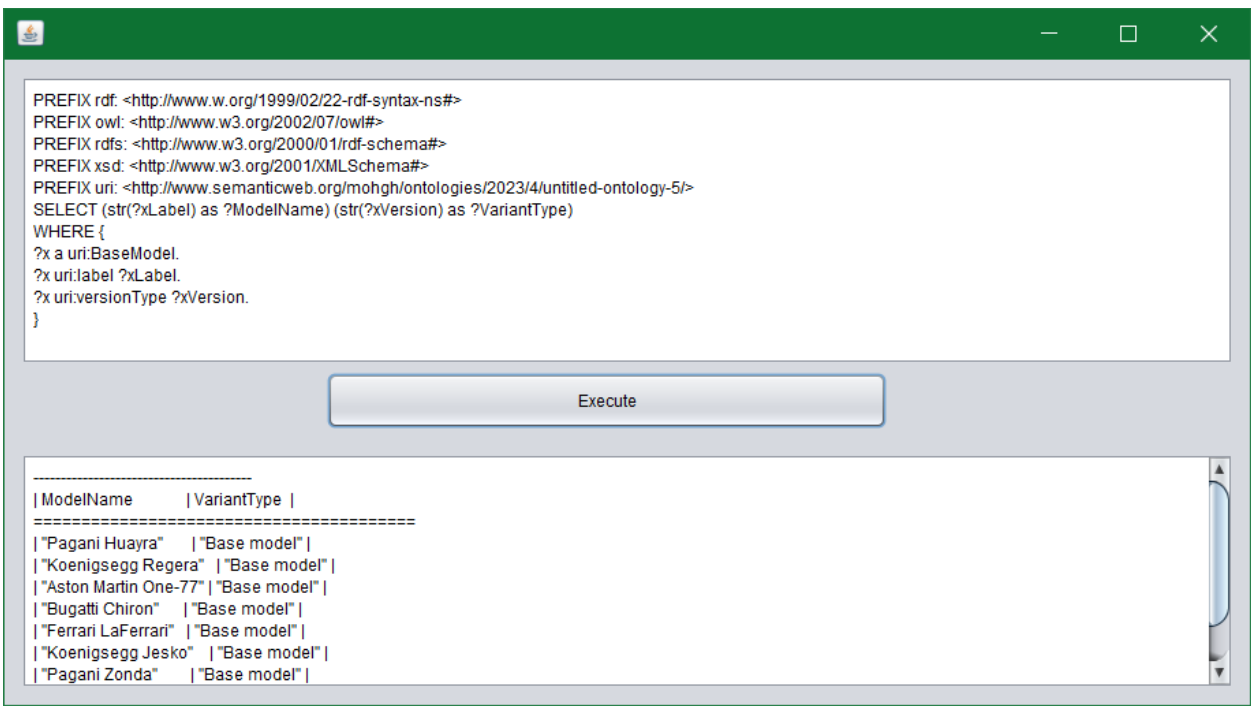

Ferrari LaFerrari
Display Base Models
Display Spec
Display Variants for Selected Base Model
Ferrari FXX K
Display Spec
Engine
Performance
Transmission
Misc
Model name
Ferrari LaFerrari
Bodystyle
Mid-engined coupe
Model type
Base model
Body material
Carbon fibre
No. of units
499
Wheel bolting
center lock
Manufacturer
Ferrari
No. of spokes
5-spoke
Location
Modena, Italy
Wheel material
Alloy

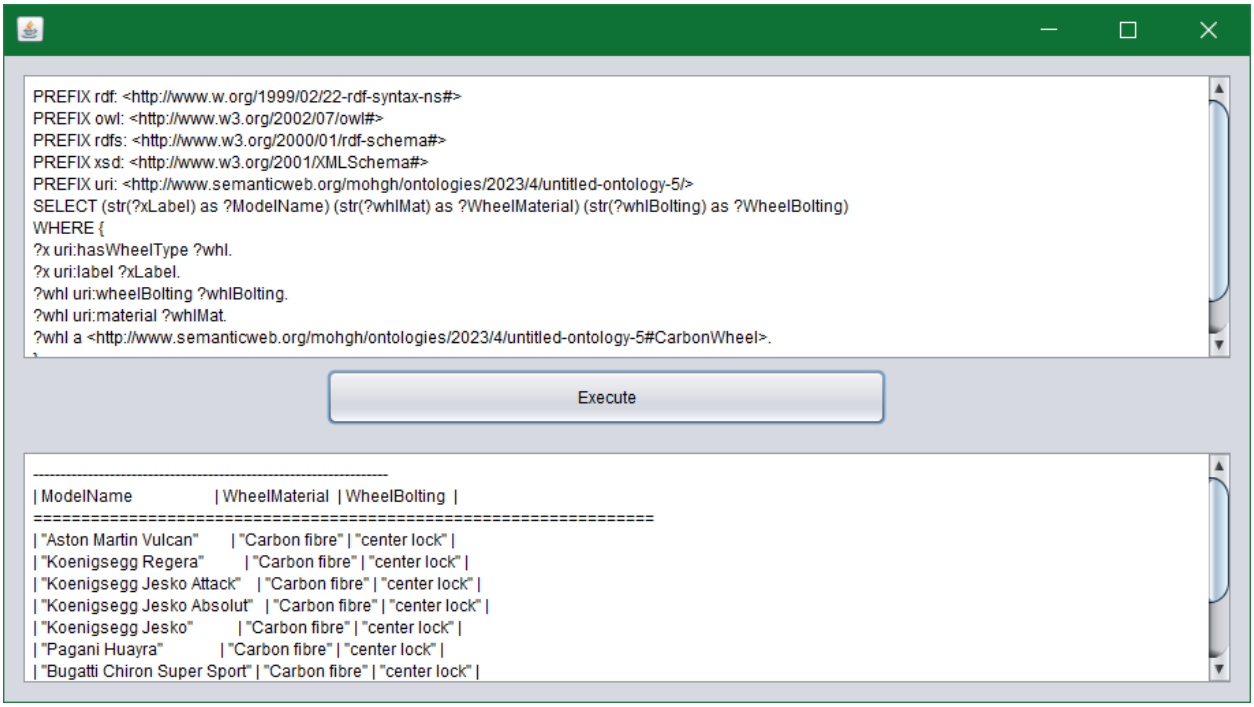
Jena Application (Query Execution) (QueryFrame.java)






PREFIX rdf: <http://www.w.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX uri: <http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5/>
SELECT (str(?EngSpec) as ?EngURI) (str(?a) as ?Label) (str(?b) as ?Cylinders) (str(?c) as ?Aspiration) (str(?d) as ?Capacity) (str(?e) as ?Layout) (str(?xLabe
WHERE {
uri:Zonda uri:hasEngineSpec ?EngSpec.
?EngSpec uri:label ?a.
?EngSpec uri:engineCylinders ?b.
?EngSpec uri:engineAspiration ?c.
Execute
| EngURI | Label | Cylinders | Aspiration | Capacity | Layout | ModelLabel |
| "http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5/ZondaEngineSpec" | "Mercedes-AMG V12" | "12" | "Natural" | "7.3L" | "Mid-engi
| "http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5/ZondaEngineSpec" | "Mercedes-AMG V12" | "12" | "Natural" | "7.3L" | "Mid-engi
| "http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5/ZondaEngineSpec" | "Mercedes-AMG V12" | "12" | "Natural" | "7.3L" | "Mid-engi
| "http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5/ZondaEngineSpec" | "Mercedes-AMG V12" | "12" | "Natural" | "7.3L" | "Mid-engi


PREFIX rdf: <http://www.w.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX uri: <http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5/>
SELECT (str(?xLabel) as ?ModelName) (str(?xVersion) as ?VariantType)
WHERE {
?x a uri:BaseModel.
?x uri:label ?xLabel.
?x uri:versionType ?xVersion.
}
Execute
ModelName	VariantType
"Pagani Huayra"	"Base model"
"Koenigsegg Regera"	"Base model"
"Aston Martin One-77"	"Base model"
"Bugatti Chiron"	"Base model"
"Ferrari LaFerrari"	"Base model"
"Koenigsegg Jesko"	"Base model"
"Pagani Zonda"	"Base model"


PREFIX rdf: <http://www.w.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX uri: <http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5/>
SELECT (str(?xLabel) as ?ModelName) (str(?whlMat) as ?WheelMaterial) (str(?whlBolting) as ?WheelBolting)
WHERE {
?x uri:hasWheelType ?whl.
?x uri:label ?xLabel.
?whl uri:wheelBolting ?whlBolting.
?whl uri:material ?whlMat.
?whl a <http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5#CarbonWheel>.
Execute
ModelName	WheelMaterial	WheelBolting
"Aston Martin Vulcan"	"Carbon fibre"	"center lock"
"Koenigsegg Regera"	"Carbon fibre"	"center lock"
"Koenigsegg Jesko Attack"	"Carbon fibre"	"center lock"
"Koenigsegg Jesko Absolut"	"Carbon fibre"	"center lock"
"Koenigsegg Jesko"	"Carbon fibre"	"center lock"
"Pagani Huayra"	"Carbon fibre"	"center lock"
"Bugatti Chiron Super Sport"	"Carbon fibre"	"center lock"

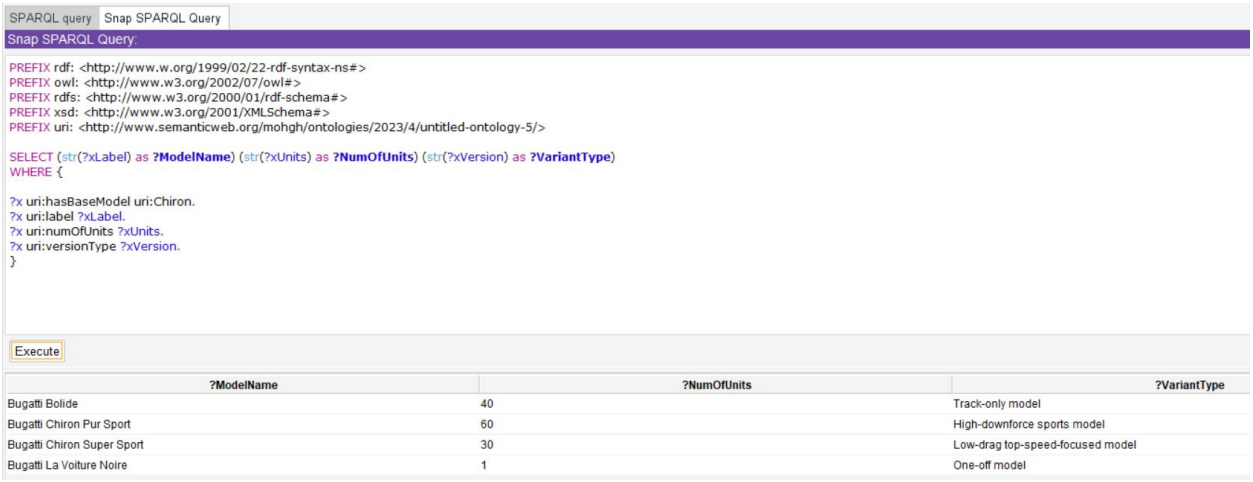
Queries

SPARQL query to get all models based on Bugatti Chiron

```
PREFIX rdf: <http://www.w.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX uri: <http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5/>

SELECT (str(?xLabel) as ?ModelName) (str(?xUnits) as ?NumOfUnits) (str(?xVersion) as ?VariantType)

WHERE {
?x uri:hasBaseModel uri:Chiron.
?x uri:label ?xLabel.
?x uri:numOfUnits ?xUnits.
?x uri:versionType ?xVersion.
}
```


SPARQL query Snap SPARQL Query

Snap SPARQL Query:

```
PREFIX rdf: <http://www.w.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX uri: <http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5/>

SELECT (str(?xLabel) as ?ModelName) (str(?xUnits) as ?NumOfUnits) (str(?xVersion) as ?VariantType)
WHERE {

?x uri:hasBaseModel uri:Chiron.
?x uri:label ?xLabel.
?x uri:numOfUnits ?xUnits.
?x uri:versionType ?xVersion.
}
```

Execute

?ModelName	?NumOfUnits	?VariantType
Bugatti Bolide	40	Track-only model
Bugatti Chiron Pur Sport	60	High-downforce sports model
Bugatti Chiron Super Sport	30	Low-drag top-speed-focused model
Bugatti La Voiture Noire	1	One-off model

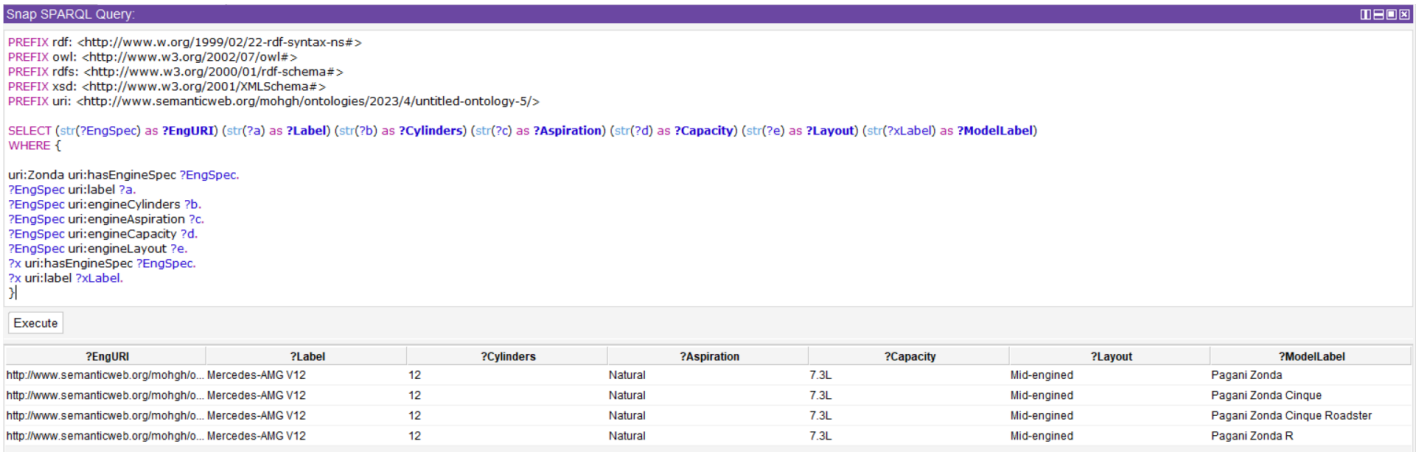
SPARQL query to get all models with same Engine Spec as Pagani Zonda

```
PREFIX rdf: <http://www.w.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX uri: <http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5/>

SELECT (str(?EngSpec) as ?EngURI) (str(?a) as ?Label) (str(?b) as ?Cylinders) (str(?c) as ?Aspiration)
(str(?d) as ?Capacity) (str(?e) as ?Layout) (str(?xLabel) as ?ModelLabel)

WHERE {
uri:Zonda uri:hasEngineSpec ?EngSpec.
?EngSpec uri:label ?a.
?EngSpec uri:engineCylinders ?b.
?EngSpec uri:engineAspiration ?c.
?EngSpec uri:engineCapacity ?d.
```

?EngSpec uri:engineLayout ?e.
?x uri:hasEngineSpec ?EngSpec.
?x uri:label ?xLabel.
}



SPARQL query to get all models and their manufacturers

PREFIX rdf: <http://www.w.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX uri: <http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5/>

SELECT (str(?xLabel) as ?ModelName) (str(?xVersion) as ?VariantType) (str(?yLabel) as ?MakerLabel) (str(?yLoc) as ?MakerLoc)

WHERE {
?x uri:label ?xLabel.
?x uri:versionType ?xVersion.
?y uri:makesModel ?x.
?y uri:label ?yLabel.
?y uri:manufacturerLocation ?yLoc.
}

Snap SPARQL Query:

```
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX uri: <http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5/>

SELECT (str(?xLabel) as ?ModelName) (str(?xVersion) as ?VariantType) (str(?yLabel) as ?MakerLabel) (str(?yLoc) as ?MakerLoc)
WHERE {
?x uri:label ?xLabel.
?x uri:versionType ?xVersion.
?y uri:makesModel ?x.
?y uri:label ?yLabel.
?y uri:manufacturerLocation ?yLoc.
}
```

Execute

?ModelName	?VariantType	?MakerLabel	?MakerLoc
Bugatti Bolide	Track-only model	Bugatti	Molsheim, France
Bugatti Chiron	Base model	Bugatti	Molsheim, France
Bugatti Chiron Pur Sport	High-downforce sports model	Bugatti	Molsheim, France
Bugatti Chiron Super Sport	Low-drag top-speed-focused model	Bugatti	Molsheim, France
Ferrari FXX K	Track-only model	Ferrari	Modena, Italy
Pagani Huayra	Base model	Pagani	Modena, Italy
Pagani Huayra BC	High-downforce sports model	Pagani	Modena, Italy
Pagani Huayra R	Track-only model	Pagani	Modena, Italy
Pagani Huayra Roadster	Roadster edition	Pagani	Modena, Italy
Koenigsegg Jesko	Base model	Koenigsegg	Ängelholm, Sweden
Koenigsegg Jesko Absolut	Low-drag top-speed-focused model	Koenigsegg	Ängelholm, Sweden
Koenigsegg Jesko Attack	High-downforce sports model	Koenigsegg	Ängelholm, Sweden
Ferrari LaFerrari	Base model	Ferrari	Modena, Italy
Bugatti La Voiture Noire	One-off model	Bugatti	Molsheim, France
Aston Martin One-77	Base model	Aston Martin	Gaydon, Warwickshire

22 results

SPARQL query to get all base models

PREFIX rdf: <http://www.w.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX uri: <http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5/>

SELECT (str(?xLabel) as ?ModelName) (str(?xVersion) as ?VariantType)

WHERE {
?x a uri:BaseModel.
?x uri:label ?xLabel.
?x uri:versionType ?xVersion.
}

Snap SPARQL Query:

```
PREFIX rdf: <http://www.w.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX uri: <http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5/>

SELECT (str(?xLabel) as ?ModelName) (str(?xVersion) as ?VariantType)
WHERE {
?x a uri:BaseModel.
?x uri:label ?xLabel.
?x uri:versionType ?xVersion.
}
```

Execute

?ModelName	?VariantType
Koenigsegg Regera	Base model
Aston Martin One-77	Base model
Bugatti Chiron	Base model
Pagani Huayra	Base model
Ferrari LaFerrari	Base model
Koenigsegg Jesko	Base model
Pagani Zonda	Base model

SPARQL query to get all models with carbon wheels

```
PREFIX rdf: <http://www.w.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX uri: <http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5/>

SELECT (str(?xLabel) as ?ModelName) (str(?whlMat) as ?WheelMaterial) (str(?whlBolting) as
?WheelBolting)

WHERE {
?x uri:hasWheelType ?whl.
?x uri:label ?xLabel.
?whl uri:wheelBolting ?whlBolting.
?whl uri:material ?whlMat.
?whl a <http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5#CarbonWheel>.
}
```

Snap SPARQL Query:

```
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX uri: <http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5/>

SELECT (str(?xLabel) as ?ModelName) (str(?whlMat) as ?WheelMaterial) (str(?whlBolting) as ?WheelBolting)
WHERE {
?x uri:hasWheelType ?whl.
?x uri:label ?xLabel.
?whl uri:wheelBolting ?whlBolting.
?whl uri:material ?whlMat.
?whl a <http://www.semanticweb.org/mohgh/ontologies/2023/4/untitled-ontology-5#CarbonWheel>.
}
```

Execute

?ModelName	?WheelMaterial	?WheelBolting
Bugatti Bolide	Carbon fibre	center lock
Bugatti Chiron Pur Sport	Carbon fibre	center lock
Bugatti Chiron Super Sport	Carbon fibre	center lock
Pagani Huayra	Carbon fibre	center lock
Koenigsegg Jesko	Carbon fibre	center lock
Koenigsegg Jesko Absolut	Carbon fibre	center lock
Koenigsegg Jesko Attack	Carbon fibre	center lock
Koenigsegg Regera	Carbon fibre	center lock
Aston Martin Vulcan	Carbon fibre	center lock