INSPIRE action on Alternative Encodings

Brief introduction

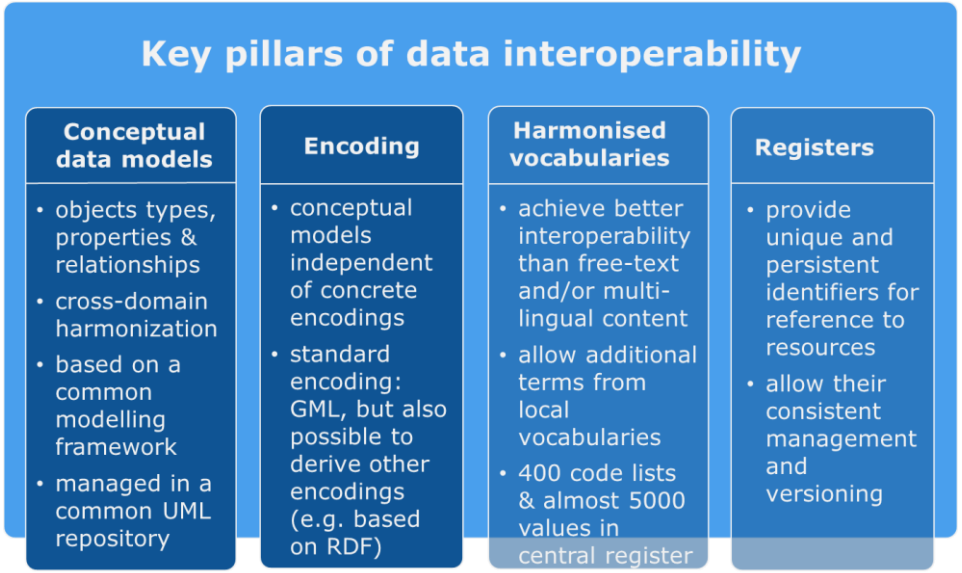
Joint Research Centre
The European Commission's science and knowledge service

European Commission

Context

- The consumption of INSPIRE data is not easy
  - TG define complex data structures
  - Existing applications (libraries, web, desktop, mobile) have difficulties to consume the content
  - Rapid evolution of mainstream ICT

- On-going action under the INSPIRE maintenance and implementation work programme to define **alternative encodings**



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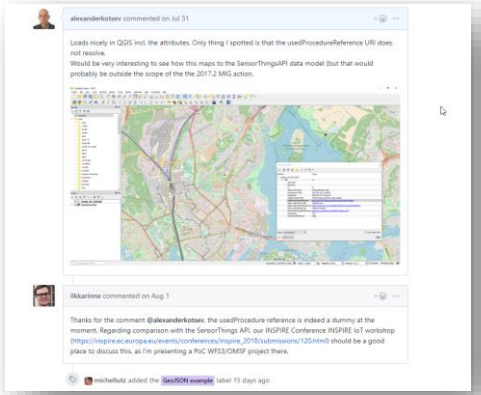
2017.2: Alternative (to GML) encodings

Tasks

1. **Encoding rule for GeoJSON** (as a first example) → Good Practice document 1
2. Generic rules / approaches for **simplifying INSPIRE data models** (useful for a number of alternative encodings) → Good Practice document 2
3. Specific **GeoJSON encodings** (combining (1) and (2)) for **Addresses, Environmental Monitoring Facilities & observations** (as initial examples)



Github working space: https://github.com/INSPIRE-MIF/2017.2

Other alternative encodings (e.g. GeoJSON for other themes, RDF, Geopackage, …) can be proposed in the future following the **INSPIRE Good Practice procedure**

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INSPIRE Good practices - procedure

Step 1. Initiation using a "good practice fiche"

- evidence that the solution has been put into practice, and
- has received broader support

Step 2. Outreach through a webinar

Step 3. Submission for inclusion in a good practices section in the INSPIRE Knowledge Base

- ideally with support from one or several INSPIRE MS representatives

https://inspire.ec.europa.eu/portfolio/good-practice-library

Step 4. Opinion of the MIG to endorse, ask for clarification or reject the good practice

Step 5. Feedback from users through the good practice repository

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UML– Linked Data

Dutch best practice for transforming UML Application Schema to Linked Data Ontologies

The approach centred around developing transformation rules for mapping from the source UML geo metamodel to the target metamodel(s) for SKOS/RDF/SHACL/OWL implementations. The rules were developed on the basis of the existing metamodels but also on a use case about a test case domain model: the Golf Course Domain Model and a related dataset

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NEN 3610 Linked Data Profiel

Geonovum Standaard
Werkversie 26 februari 2019

The Team

Deze versie:
https://geonovum.github.io/NEN3610-Linkeddata/

Laatst gepubliceerde versie:
geen

Laatste werkversie:
https://geonovum.github.io/NEN3610-Linkeddata/

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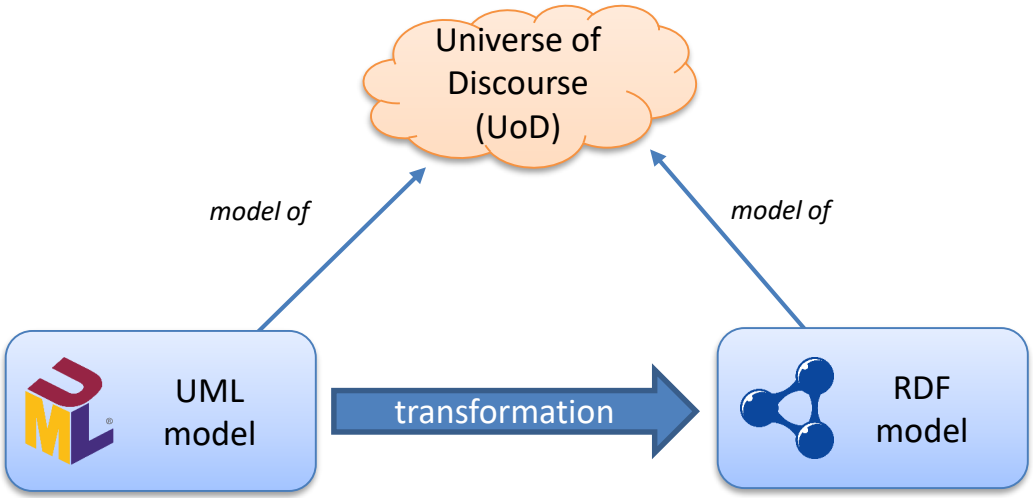
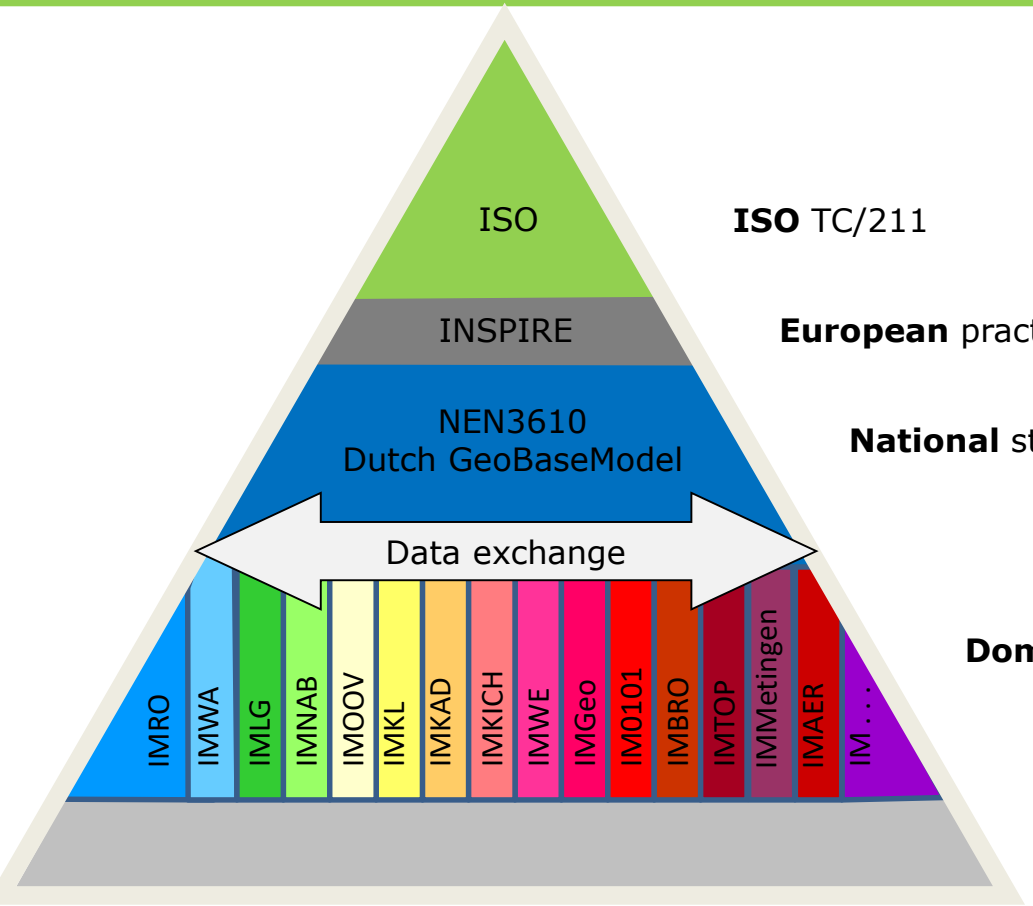
Principal goal



UML legacy



ISO TC/211

European practice

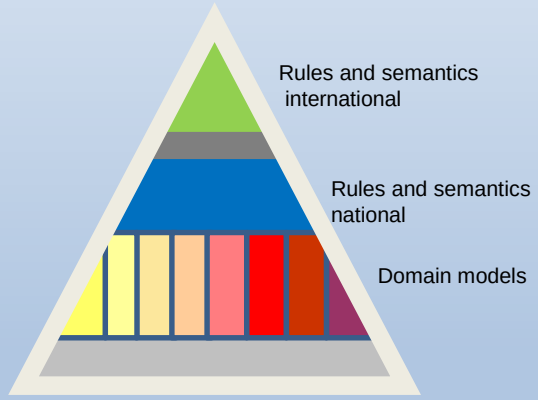
National standards

Domain standards

NEN 3610, the GeoBaseModel. The information standard for the exchange of geo-information. It prescribes UML as the formal language to specify semantics and advocates GML as technical implementation format. NEN 3610 is therefore not equiped to realize data – and semantics sharing through linked data.

UML-OO GeoBaseModel
(NEN 3610)
Pyramid of specialzation

Silos extending common rules
Stack of profiles and extensions



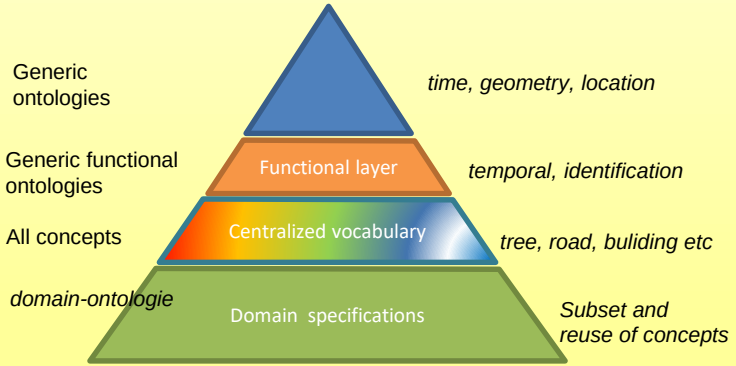
Use case defines universe of discourse

Domain defines vocabulary – domain standard

Linked data

Pyramid of reuse and reference

reuse and references of ontologies



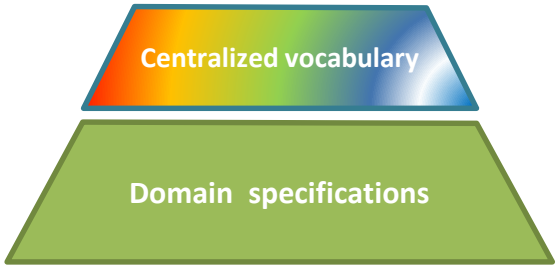
The Universe is the Universe of discourse

Anybody can say anything about anything

GEONOVUM

Linked data revelation

Opening up the data Silos

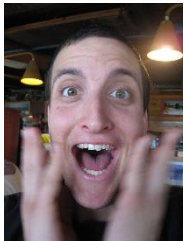


- NOT IN COMPETITION -
Fundamental differences relate to different use cases
UML and LD are complementary

UML model use case: data exchange, harmonized, controlled (environment), handled by applications, (data quality centred). **No surprises!**

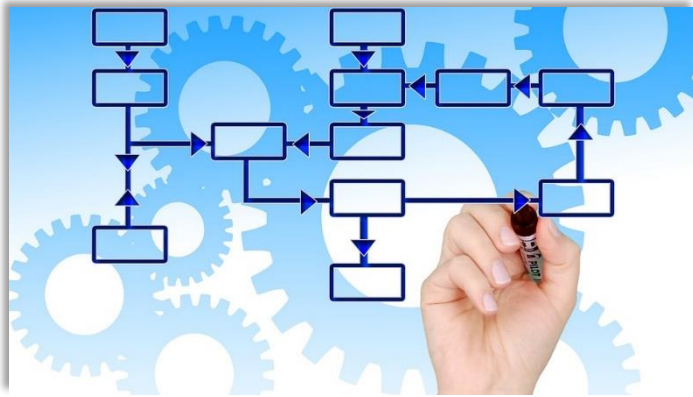
LD use case: data publication, open environment, 'handled by the web' (data access centred).

Be surprised!?



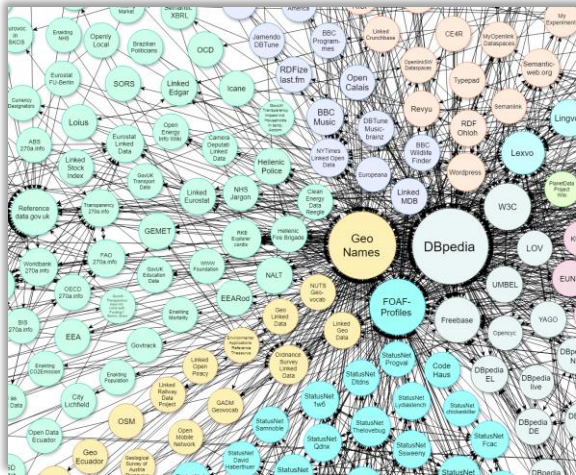
Typical UML domainmodel use cases/concepts

1 vocabularies of classes – taxonomy
2 Codelists
3 datastructure/application oriented
4 data publishing – exchange - application oriented
5 data validation
6 vocabularies related, harmonisation



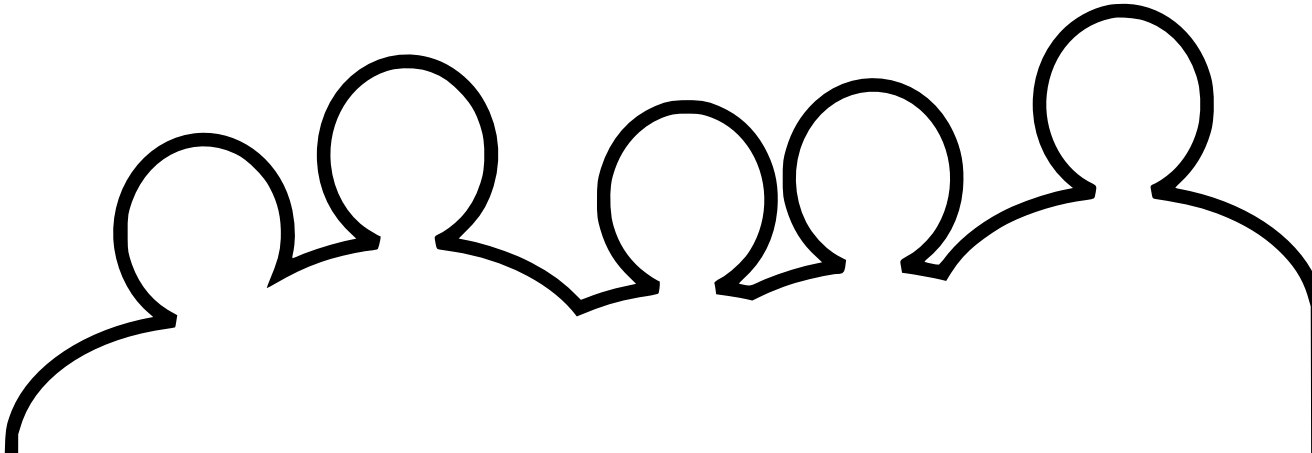
Typical LD model use cases/concepts

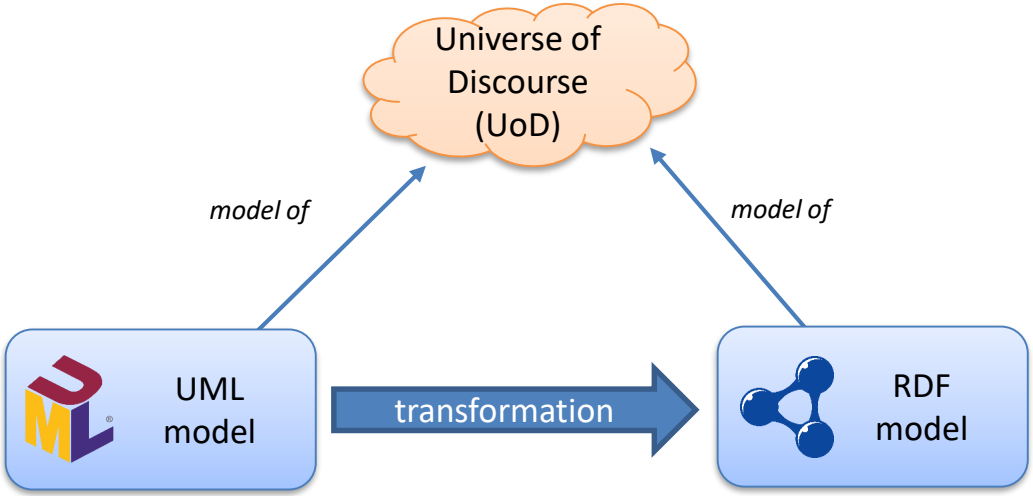
1	vocabulary, thesaurus
2a	Knowledge model (ontology) simple
2b	Knowledge model (ontology) complex
3	web of data (publishing, sharing), semantic web
4	Knowledge deduction, reasoning
5	artificial intelligence



UML – LD combination
UML – LD derivation

Let’s make UML and LD interoperable

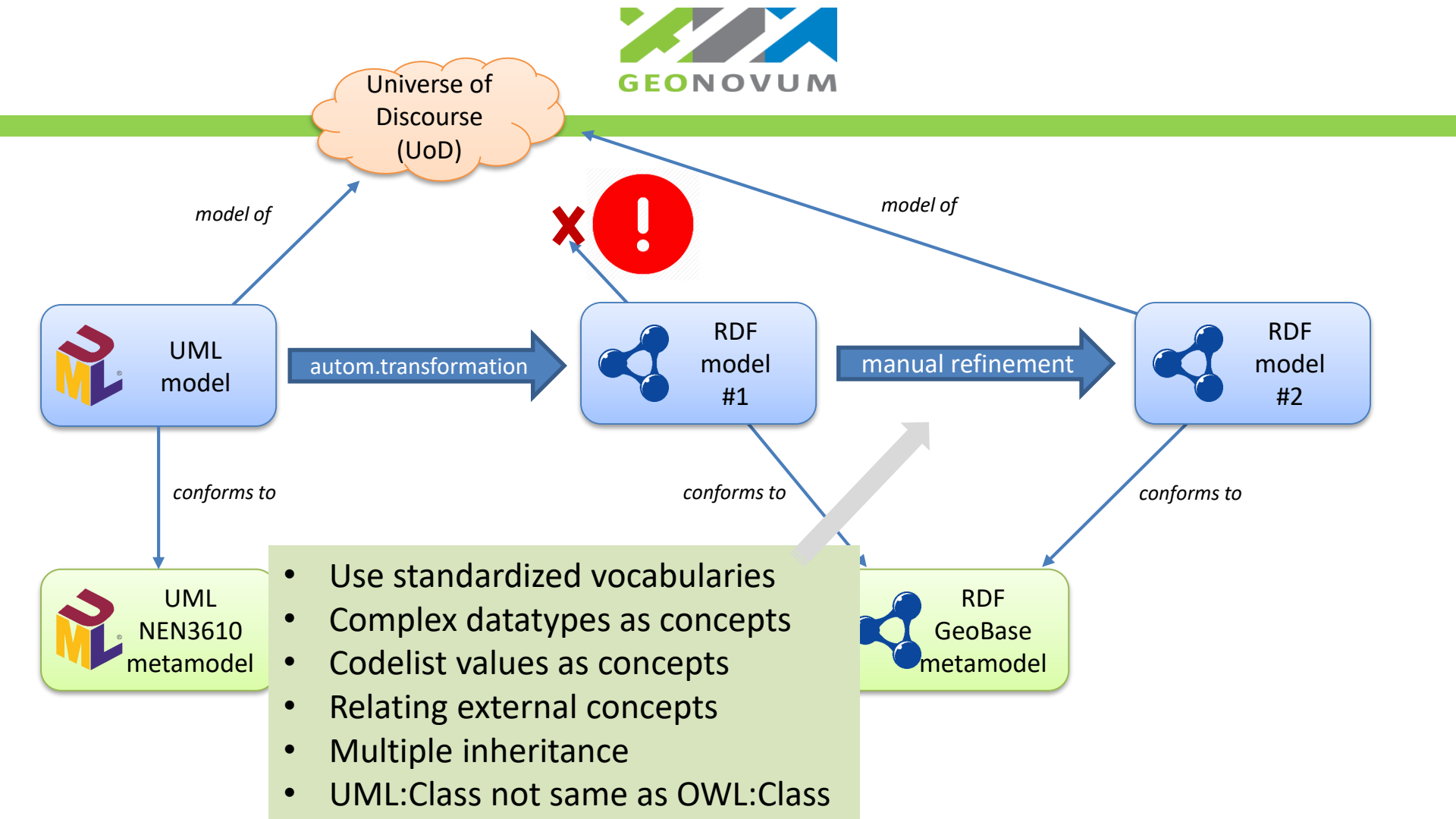


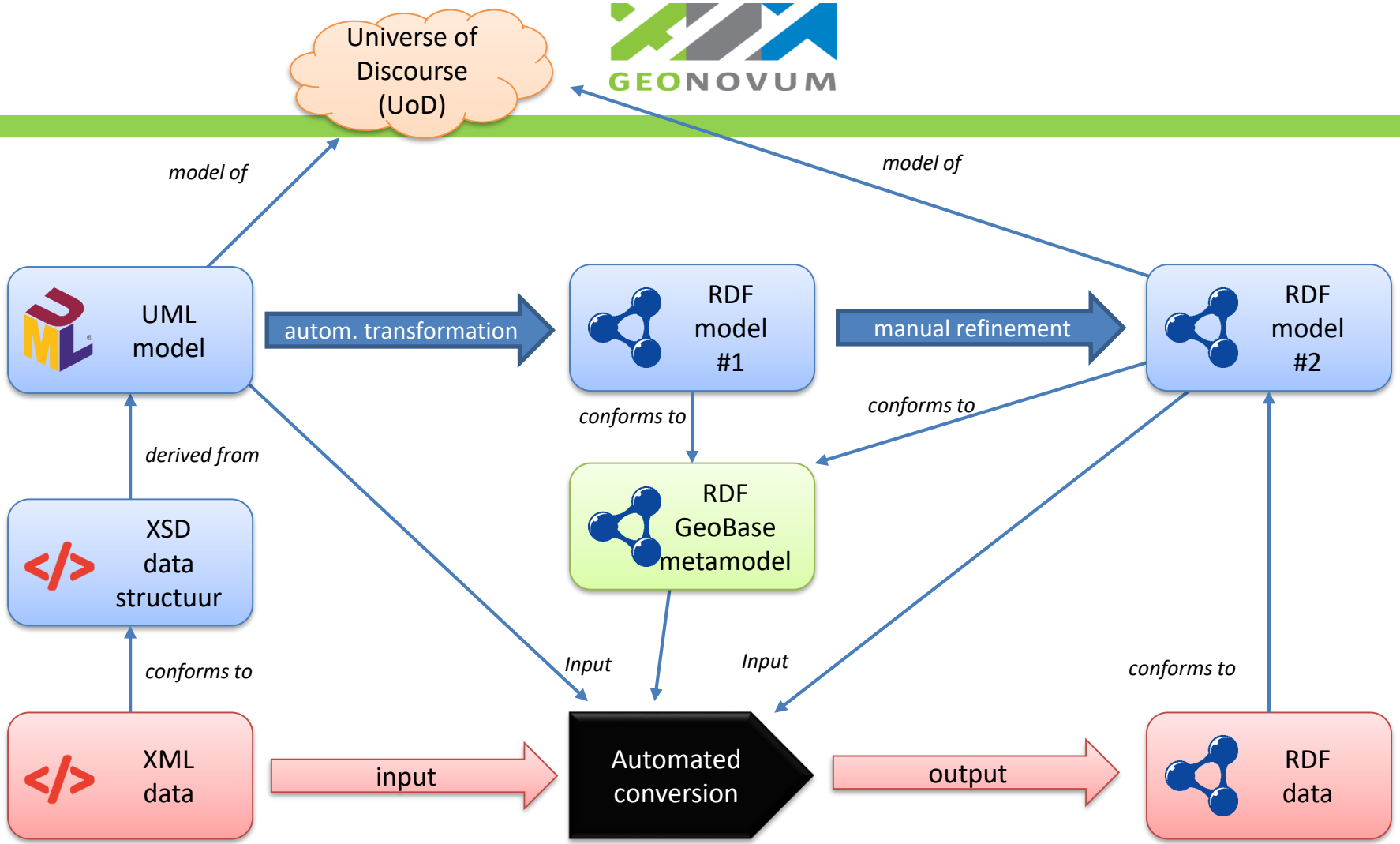


Building on existing knowledge:

ISO 19150-2: 2015 - Geographic information -- Ontology -- Part 2: Rules for developing ontologies in the Web Ontology Language (OWL)

INSPIRE - Guidelines for the RDF encoding of spatial data (ARE3NA)


GEONOVUM
Universe of Discourse (UoD)
model of
model of
UML model
autom.transformation
RDF model #1
manual refinement
RDF model #2
conforms to
conforms to
conforms to
UML NEN3610 metamodel
RDF GeoBase metamodel
• Use standardized vocabularies
• Complex datatypes as concepts
• Codelist values as concepts
• Relating external concepts
• Multiple inheritance
• UML:Class not same as OWL:Class


Universe of Discourse (UoD)
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model of
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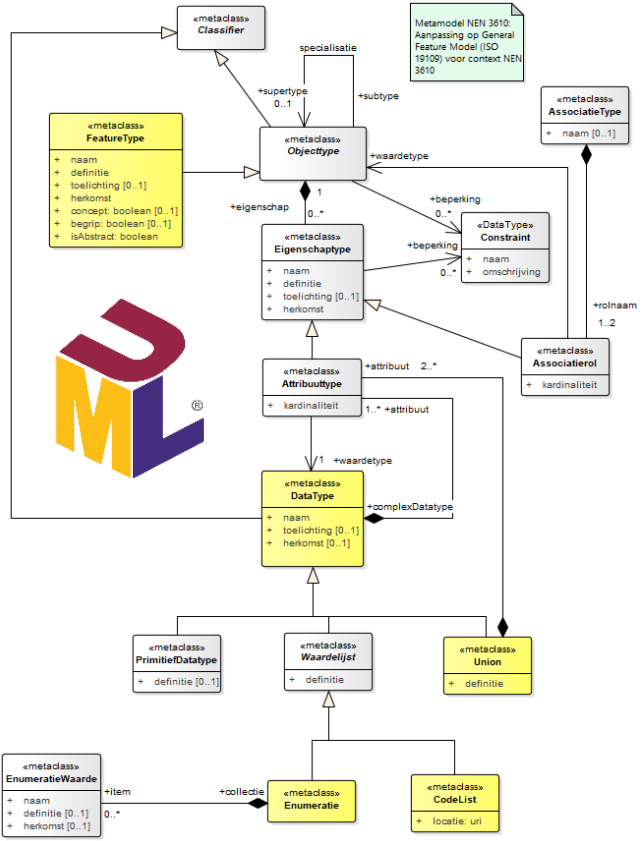
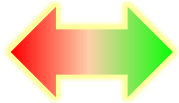
RDF model #2
conforms to
conforms to
derived from
RDF GeoBase metamodel
XSD data structuur
conforms to
Input
Input
conforms to
XML data
input
Automated conversion
output
RDF data

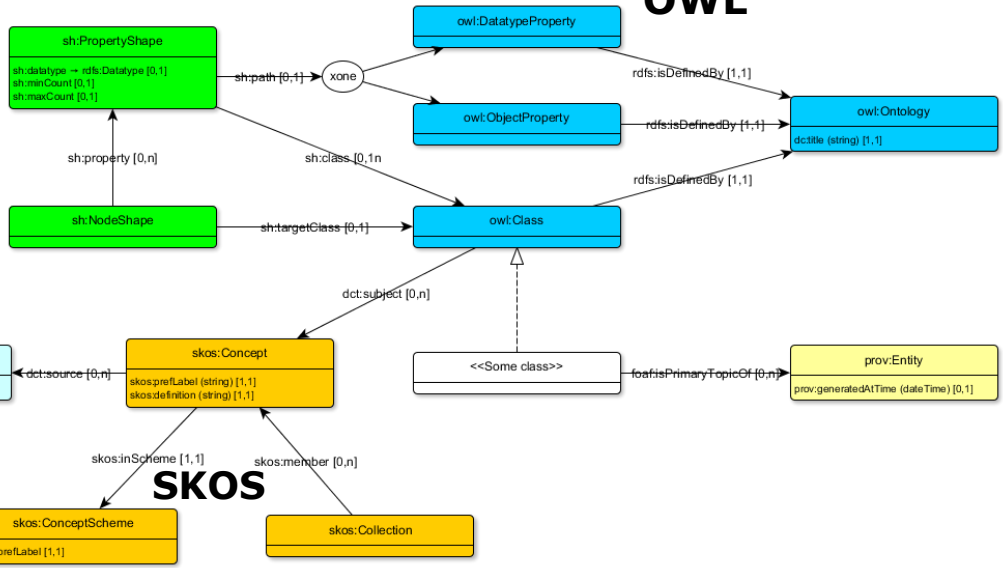
Metamodels compared and mapped
UML profile – RDF/SKOS/OWL/SHACL





SHACL

OWL



SKOS

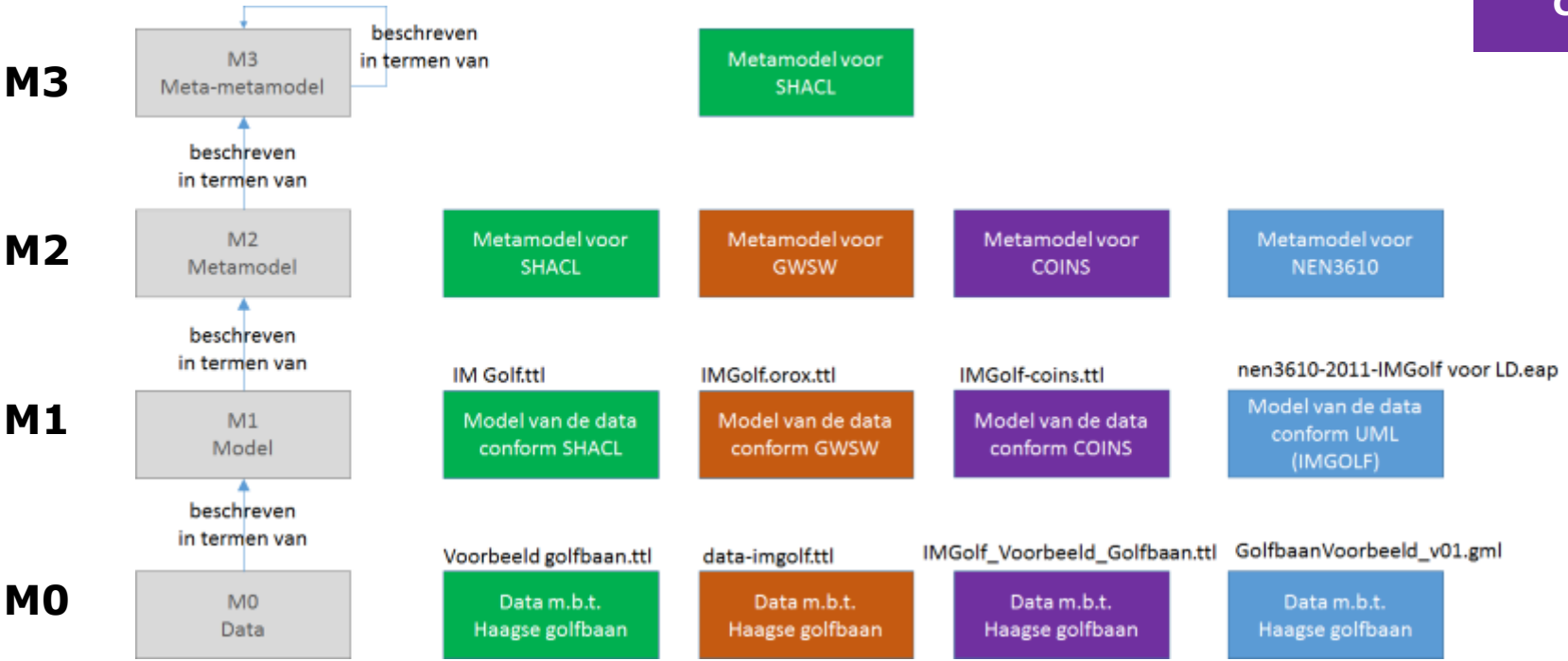
Relating three Metamodels

DSO/SHACL

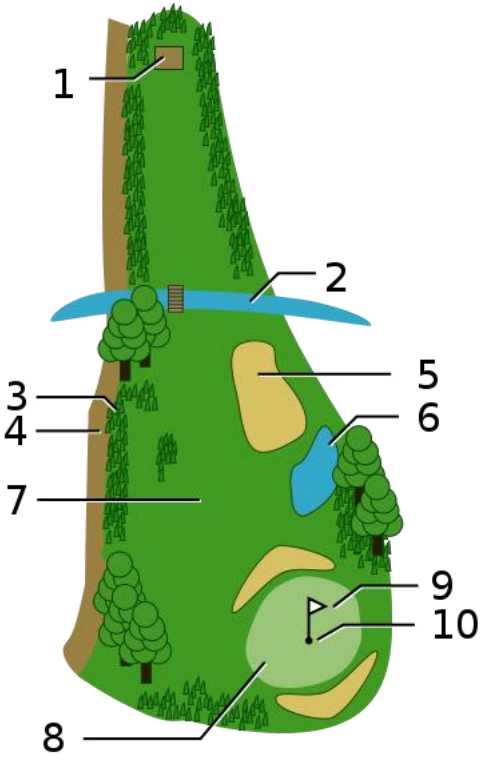
OroX

COINS

OMG – 4 layer metamodel



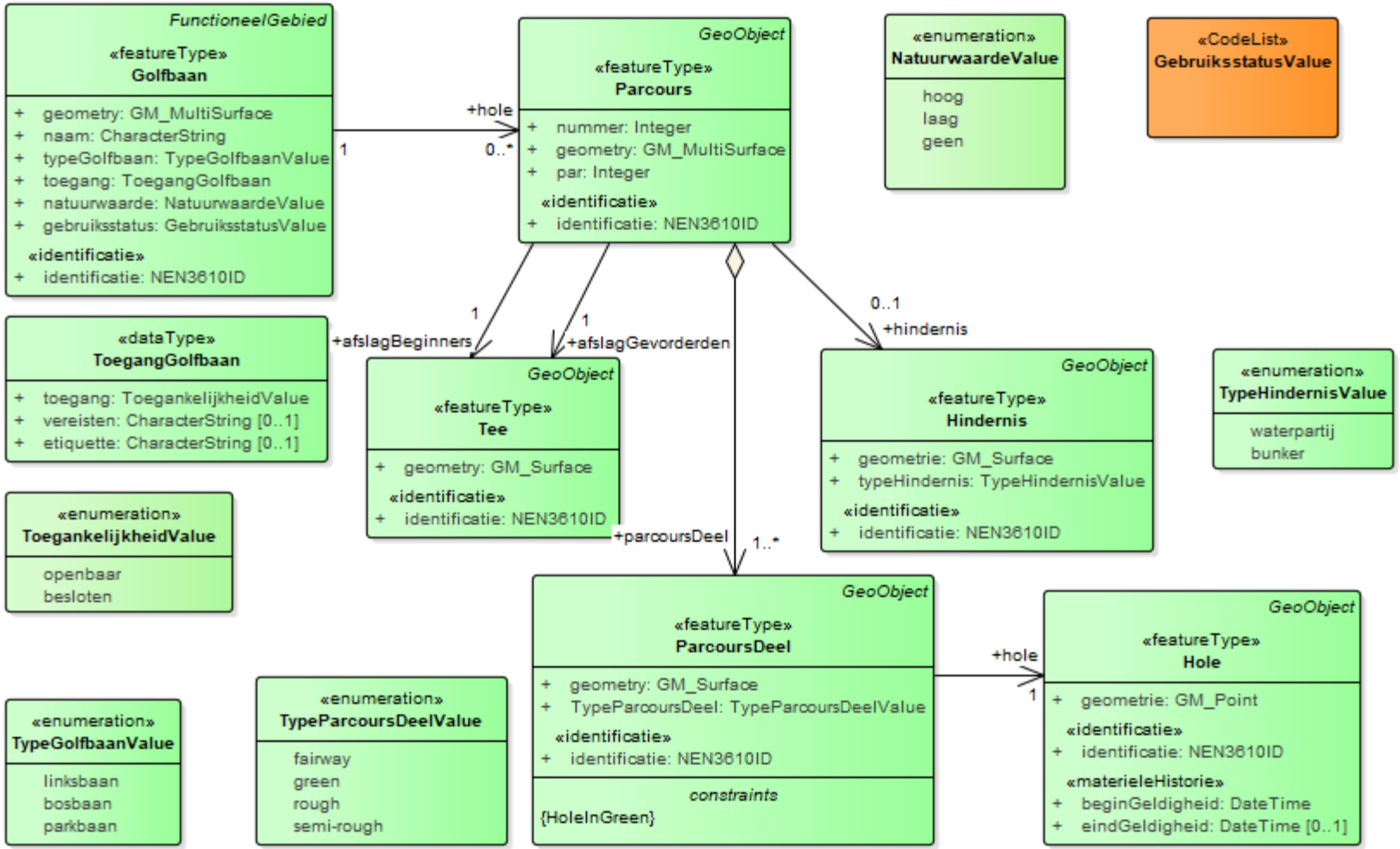
Testing on the golfcourse



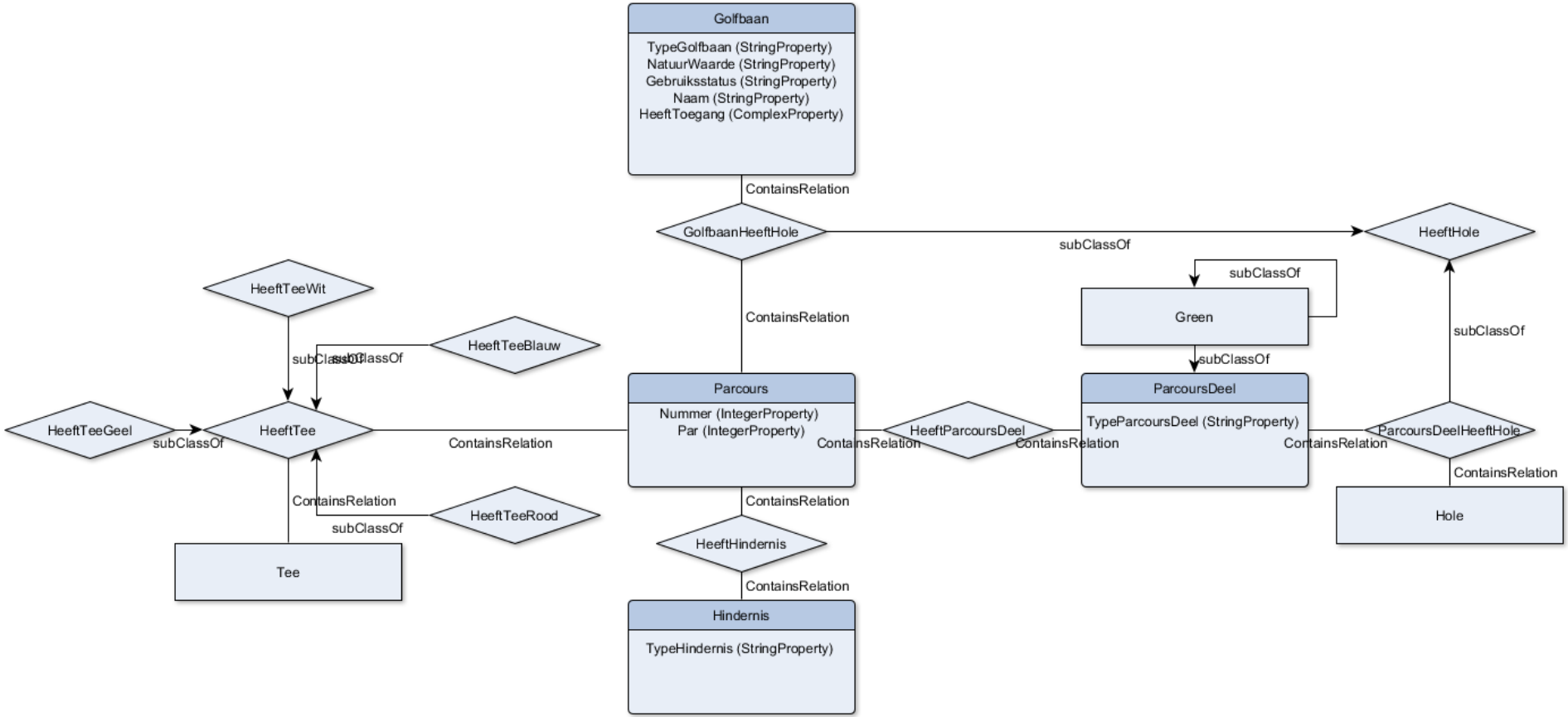
http://commons.wikimedia.org/wiki/File:Golf_field.svg

1 teeing ground
2 water hazard
3 Rough
4 out of bounds
5 sand bunker
6 water hazard
7 fairway
8 green
9 Flagstick
10 hole

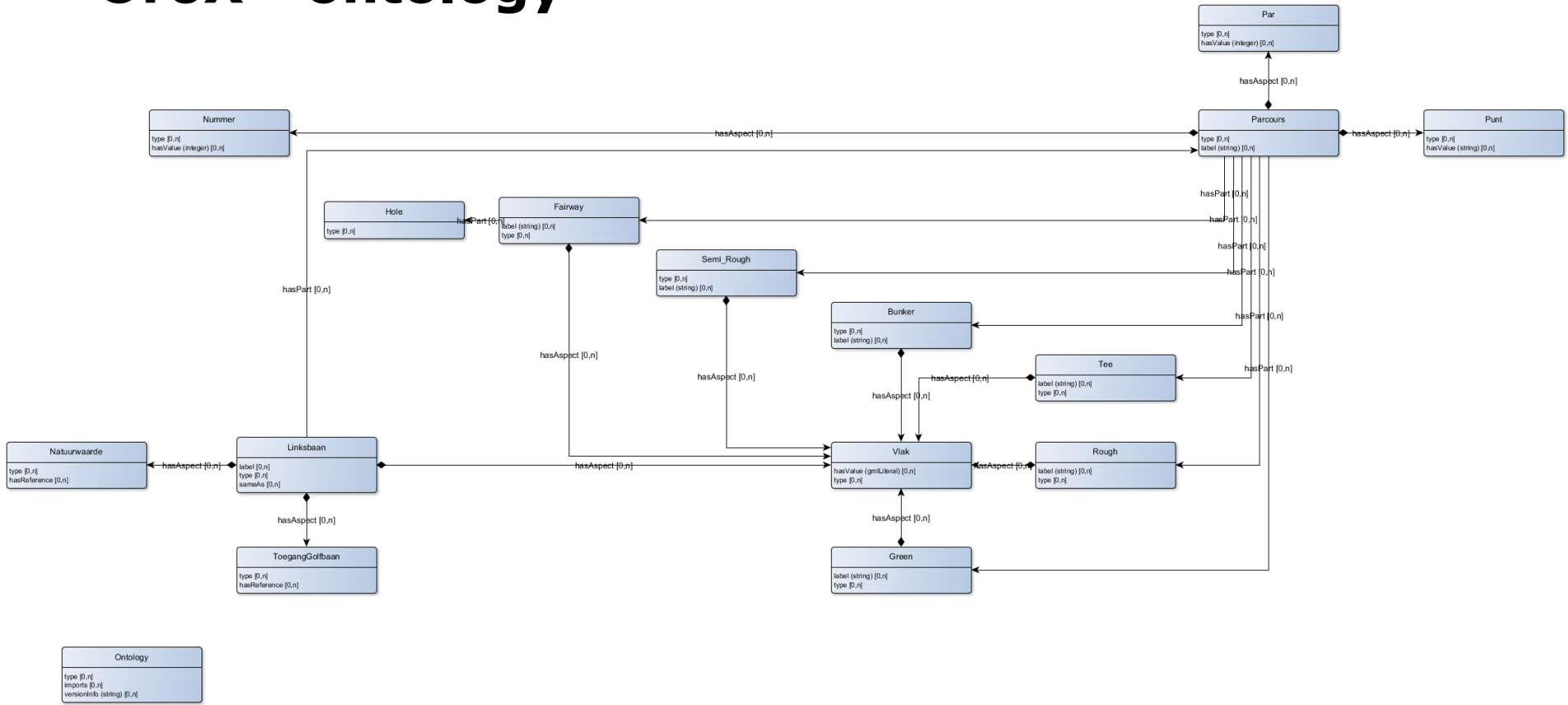
Koninklijke Haagse Golf en Country Club


FunctioneelGebied
«featureType»
Golfbaan
+ geometry: GM_MultiSurface
+ naam: CharacterString
+ typeGolfbaan: TypeGolfbaanValue
+ toegang: ToegangGolfbaan
+ natuurwaarde: NatuurwaardeValue
+ gebruiksstatus: GebruiksstatusValue
«identificatie»
+ identificatie: NEN3610ID
1
+hole
0..*
GeoObject
«featureType»
Parcours
+ nummer: Integer
+ geometry: GM_MultiSurface
+ par: Integer
«identificatie»
+ identificatie: NEN3610ID
«enumeration»
NatuurwaardeValue
hoog
laag
geen
«CodeList»
GebruiksstatusValue
«dataType»
ToegangGolfbaan
+ toegang: ToegankelijkheidValue
+ vereisten: CharacterString [0..1]
+ etiquette: CharacterString [0..1]
1
+afslagBeginners
1
+afslagGevorderden
GeoObject
«featureType»
Tee
+ geometry: GM_Surface
«identificatie»
+ identificatie: NEN3610ID
0..1
+hindernis
GeoObject
«featureType»
Hindernis
+ geometrie: GM_Surface
+ typeHindernis: TypeHindernisValue
«identificatie»
+ identificatie: NEN3610ID
«enumeration»
TypeHindernisValue
waterpartij
bunker
«enumeration»
ToegankelijkheidValue
openbaar
besloten
+parcoursDeel
1..*
GeoObject
«featureType»
ParcoursDeel
+ geometry: GM_Surface
+ TypeParcoursDeel: TypeParcoursDeelValue
«identificatie»
+ identificatie: NEN3610ID
constraints
{HoleInGreen}
+hole
1
GeoObject
«featureType»
Hole
+ geometrie: GM_Point
«identificatie»
+ identificatie: NEN3610ID
«materieleHistorie»
+ beginGeldigheid: DateTime
+ eindGeldigheid: DateTime [0..1]
«enumeration»
TypeGolfbaanValue
linksbaan
bosbaan
parkbaan
«enumeration»
TypeParcoursDeelValue
fairway
green
rough
semi-rough

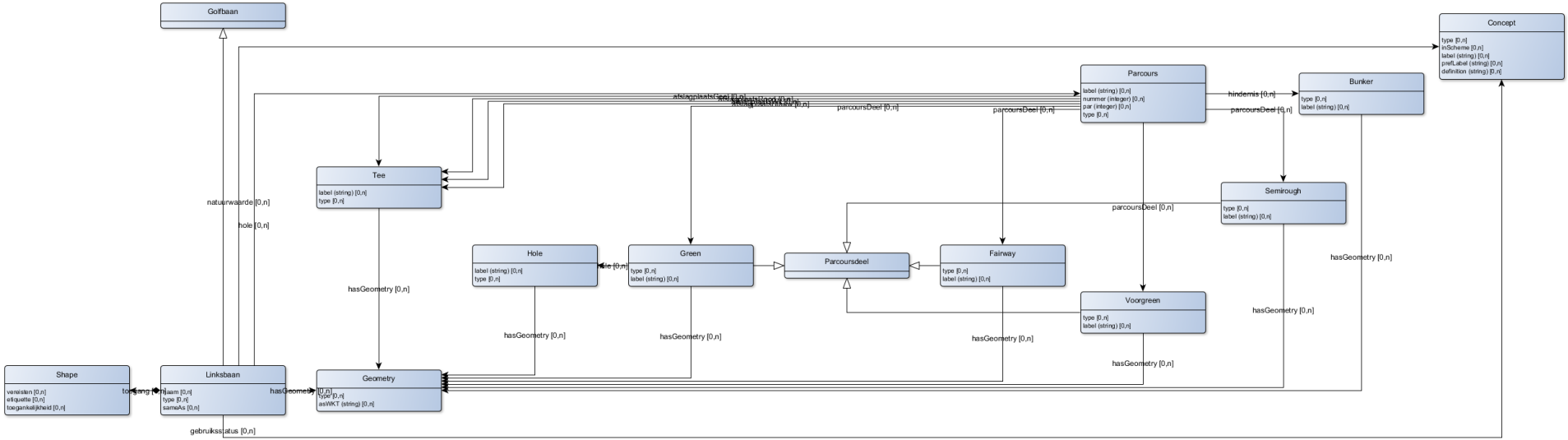
COINS - ontology



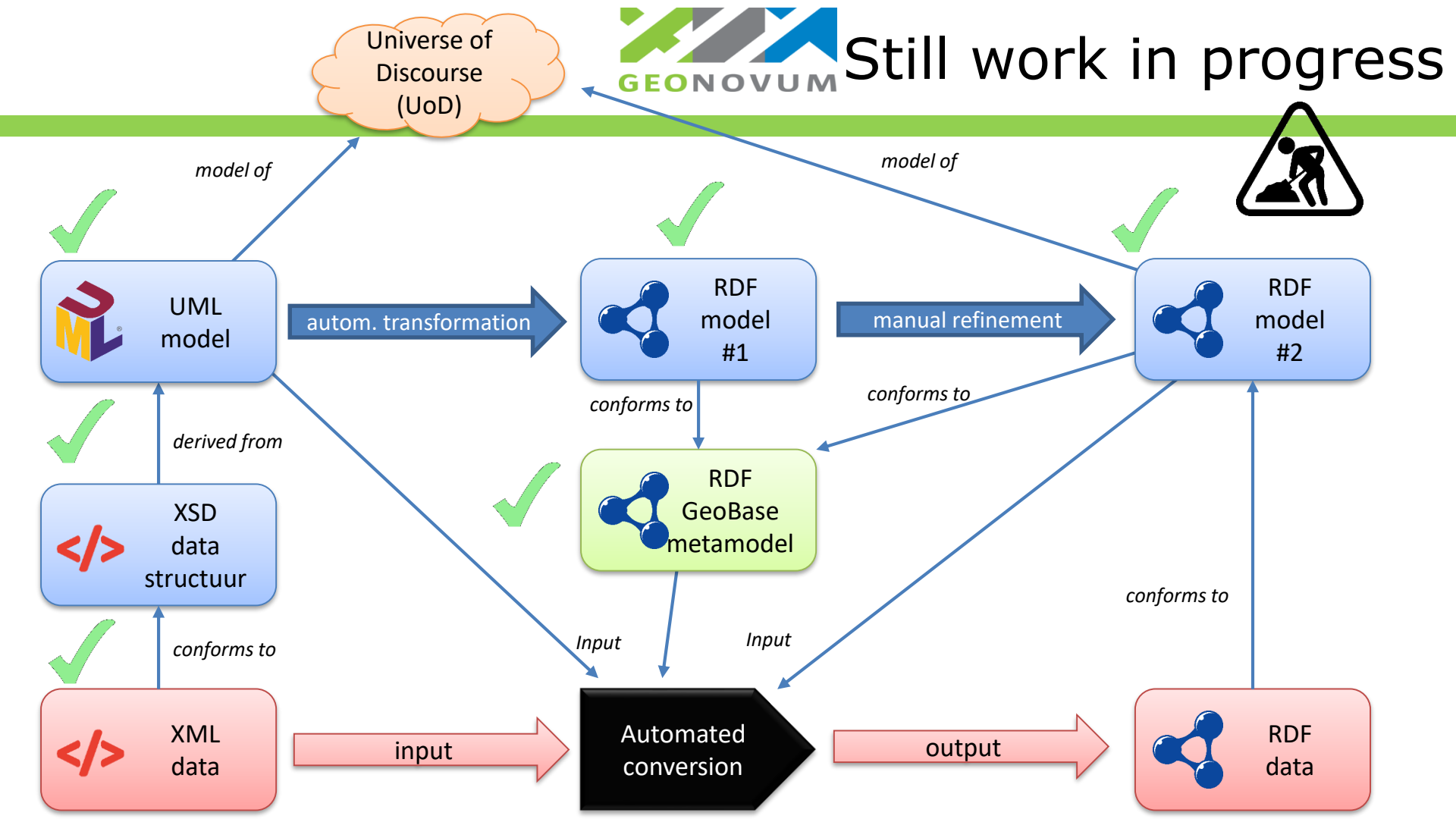
OroX - ontology



DSO/SHACL ontology



Still work in progress

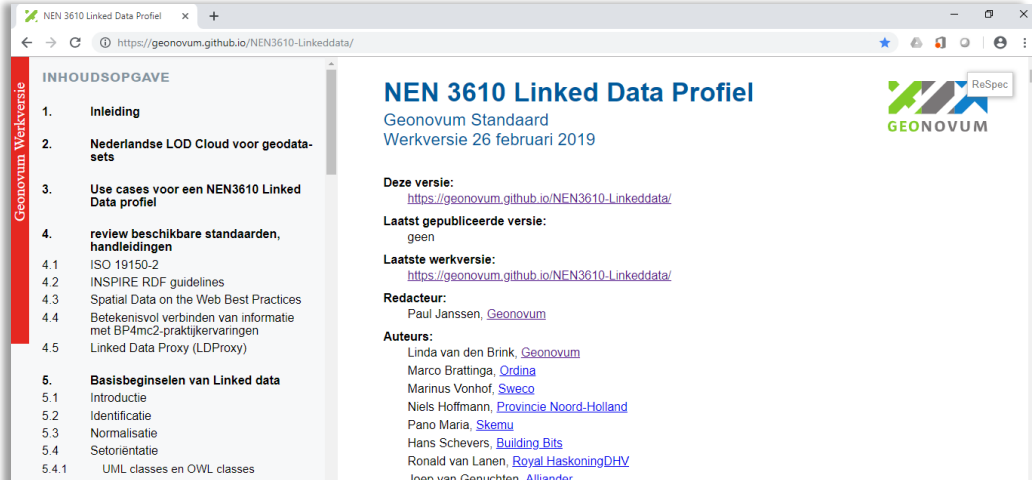


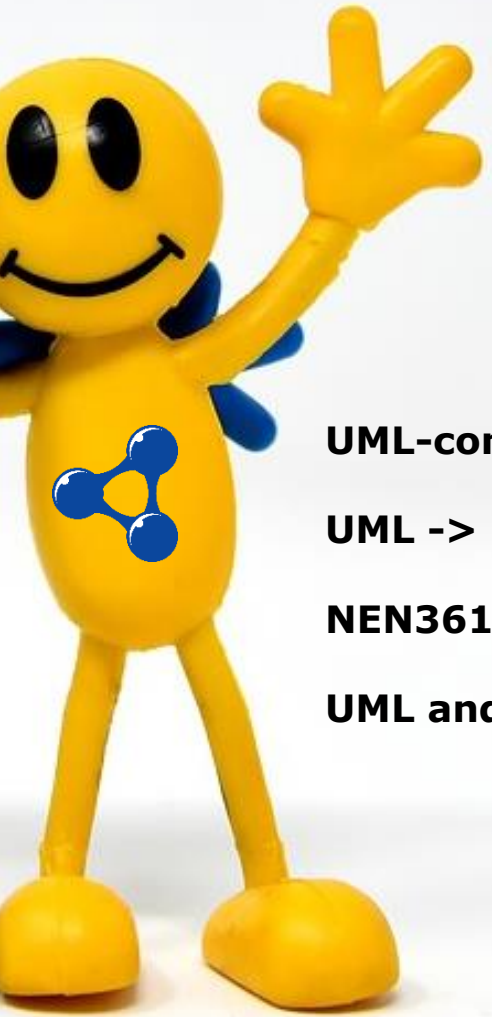
NEN 3610 Ontology is published

https://definities.geostandaarden.nl/def/nen3610#

```
@prefix n3: <http://definities.geostandaarden.nl/def/nen3610#>.
@prefix n4: <http://definities.geostandaarden.nl/def/>.
n3:Kunstwerk rdf:type <http://www.w3.org/2002/07/owl#Class>;
    rdfs:label "Kunstwerk"@nl;
    rdfs:isDefinedBy n4:nen3610;
    rdfs:subClassOf n3:GeoObject;
    ns2:subject <http://definities.geostandaarden.nl/nen3610/id/concept/Kunstwerk>
.
n2:Place rdf:type <http://www.w3.org/2002/07/owl#Class>;
    rdfs:label "Place"@en;
    rdfs:comment "Entities that have a somewhat fixed, physical extension."@en
.
n1:Feature rdf:type <http://www.w3.org/2002/07/owl#Class>;
    rdfs:label "Feature"@en;
    rdfs:comment "This class represents the top-level feature type. This class is equivale
.
n3:FunctioneelGebied rdf:type <http://www.w3.org/2002/07/owl#Class>;
    rdfs:label "Functioneel gebied"@nl;
    rdfs:isDefinedBy n4:nen3610;
    rdfs:subClassOf n3:GeoObject;
    ns2:subject <http://definities.geostandaarden.nl/nen3610/id/concept/FunctioneelGebied>
```

https://geonovum.github.io/NEN3610-Linkeddata/





Conclusions

UML-community and Linked data community are sharing views

UML -> LD conversions are being developed and understood

NEN3610 Ontology is published

UML and LD are becoming interoperable