

## GeoGraph

# Modelling and building a graph database of multi-source landmarks to help emergency mountain rescuers

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# Examples of localization clues

I took the **trail** in direction of Oursière **cascade**

*j'ai pris le sentier en direction de la cascade de l'Oursière*

**municipality**

I left from **[Bourg d'Oisans]** on foot, on the **route** to a **ski resort**

*je suis parti de Bourg d'Oisans, à pied, sur chemin, en direction d'une station*

I can see part of a **water body**

*je vois une partie de plan d'eau,*

I'm under a 3-strand **power line**

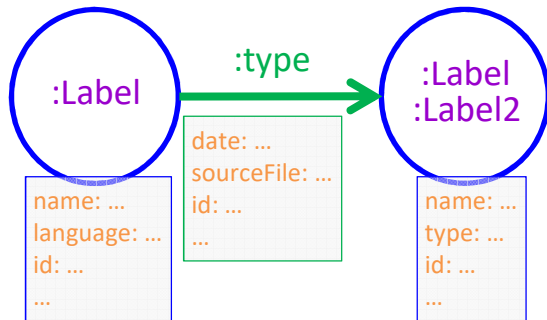
*je suis sous une ligne électrique 3 brins*

-> categories imported data according to  
Landmark Objects Ontology (LOO)

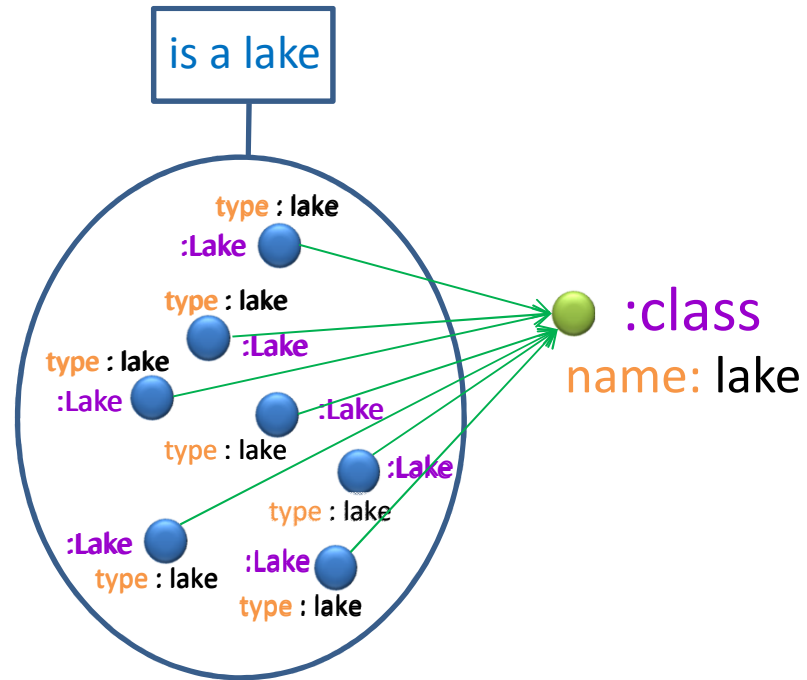
# Label Property Graph data base

## LPG DB elements

nodes  
label



property  
name : value



property  
type: lake

label  
:Lake

relationship to a  
node with Label :class

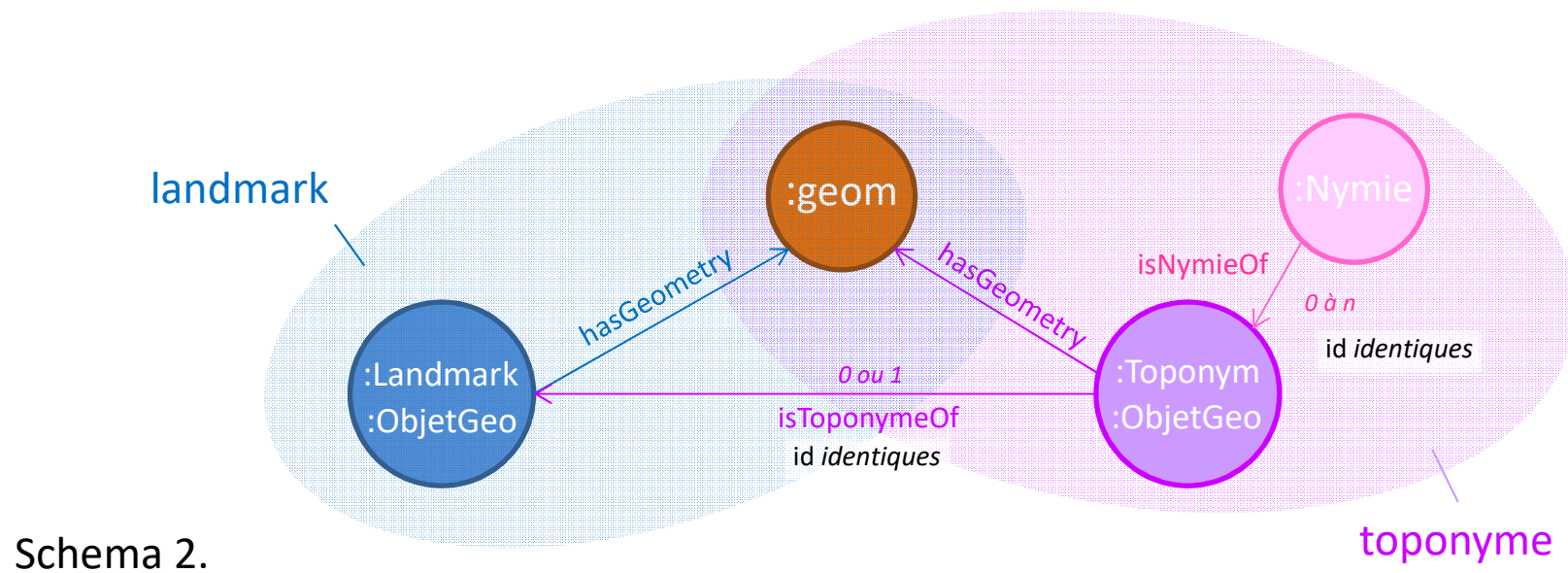
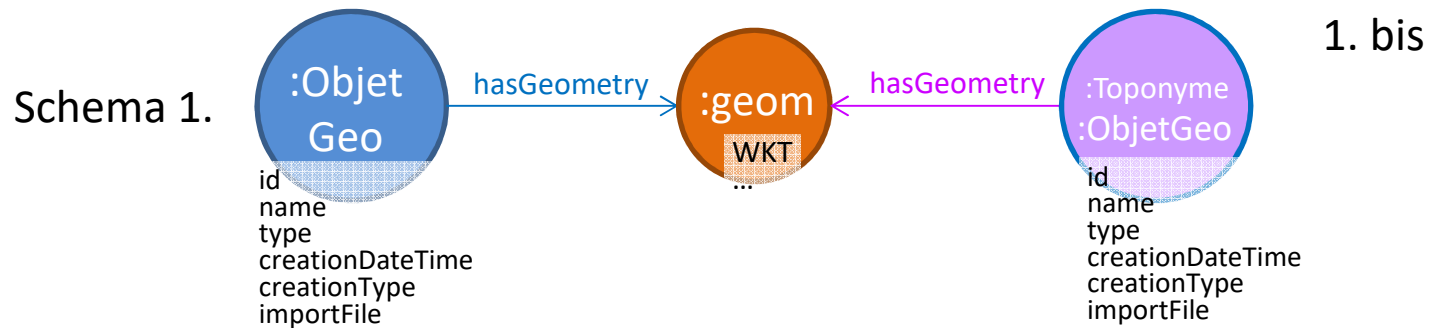
identical *property* values,  
a set-theoretic representation by *label*,  
*links* to class,  
**= formally equivalent ways of categorizing**

# DB modeled by categorization

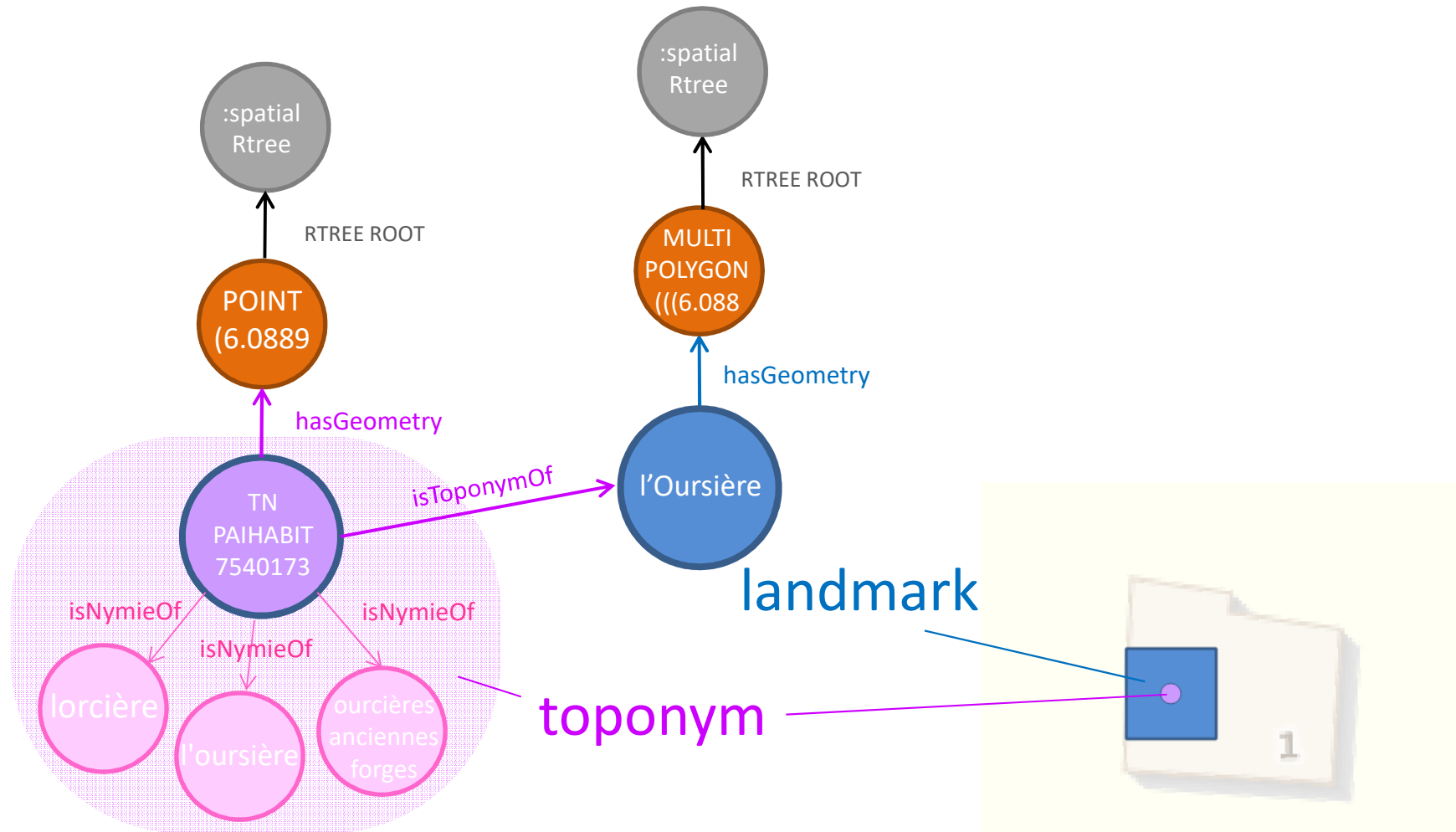
Different categorization needs :

- by sources (IGN BDTPOPO, camp2camp, ENEDIS...)
- extraction date of a data set
- technical classification of nodes (object, geometry, Rtree element)
- geographical object types (landmark, toponym,...)
- according to the Landmark Objects Ontology (LOO)

# DB modeling by iteration



# Landmark and toponym instance

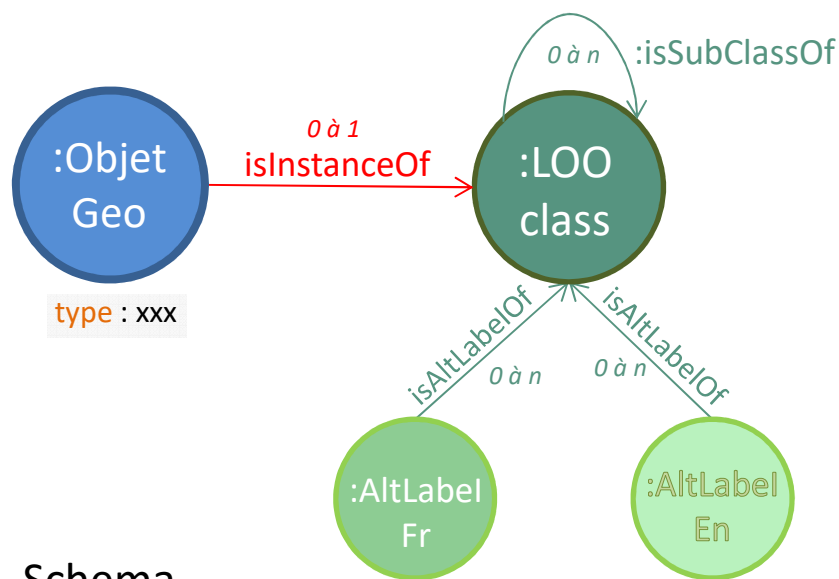


# Landmark Objects Ontology : modeling in DB and instantiation

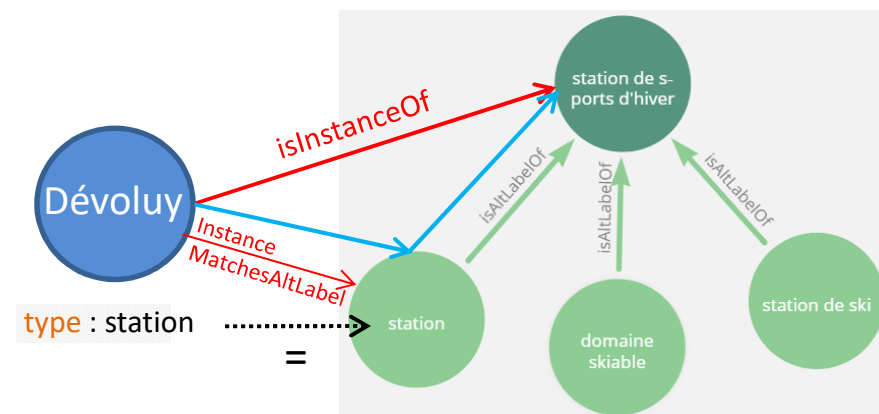
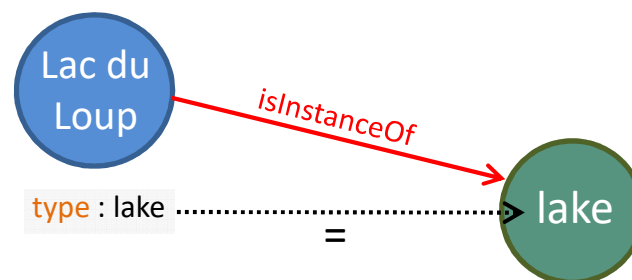
Properties of nodes  
with label :LOOclass

id  
prefLabelFr  
prefLabelEn  
commentFr  
commentEn  
isDefinedBy  
importFile  
creationDateTime  
creationType

*instanciation*

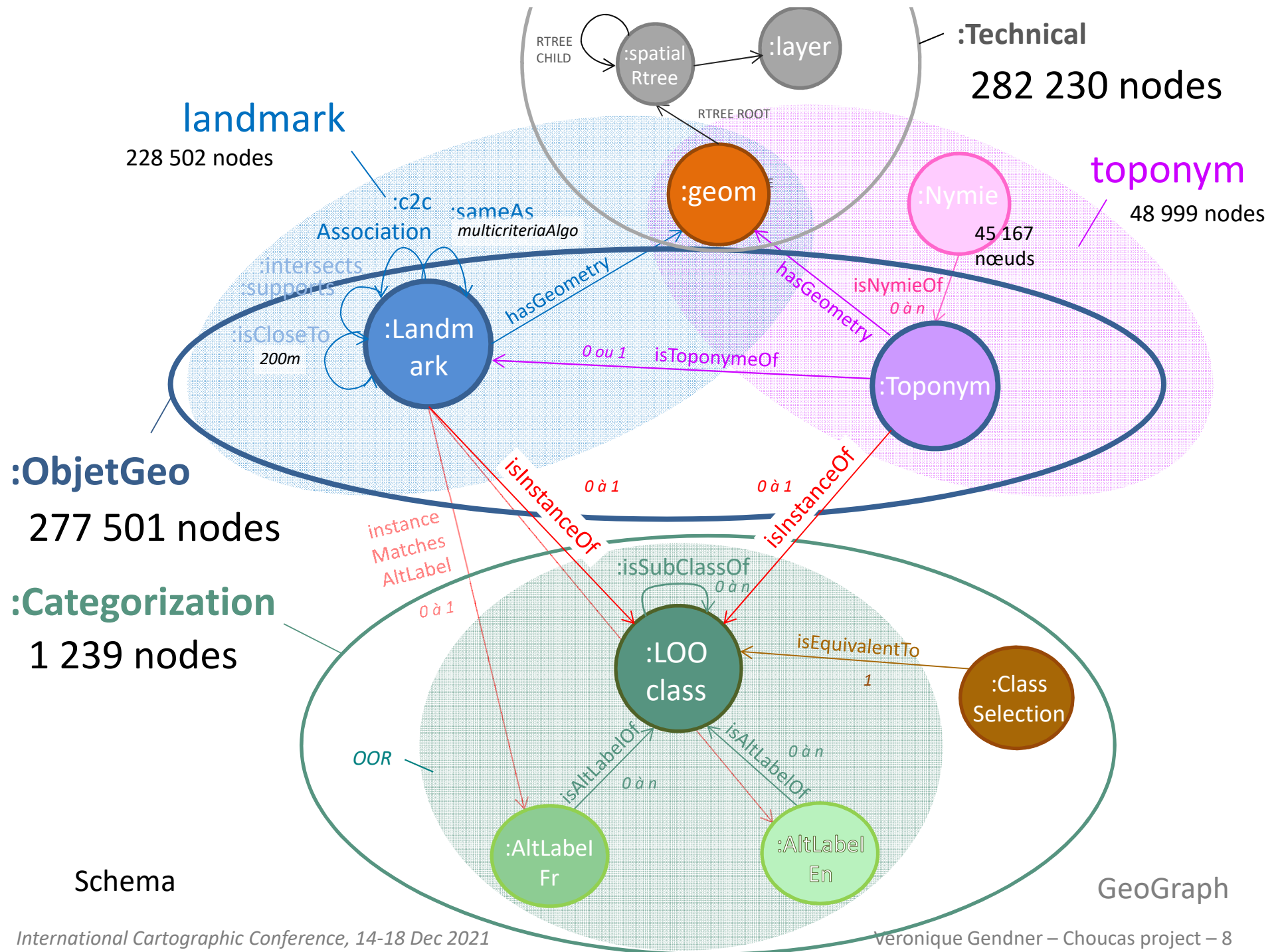


Schema



*Use of relation transitivity  
to normalize categorization*

Example





# Labels : object type, version, source, ...

Toponym

IGN BDTOPO layers  
hydro  
bati  
...

Landmark

IGN BDTOPO layers

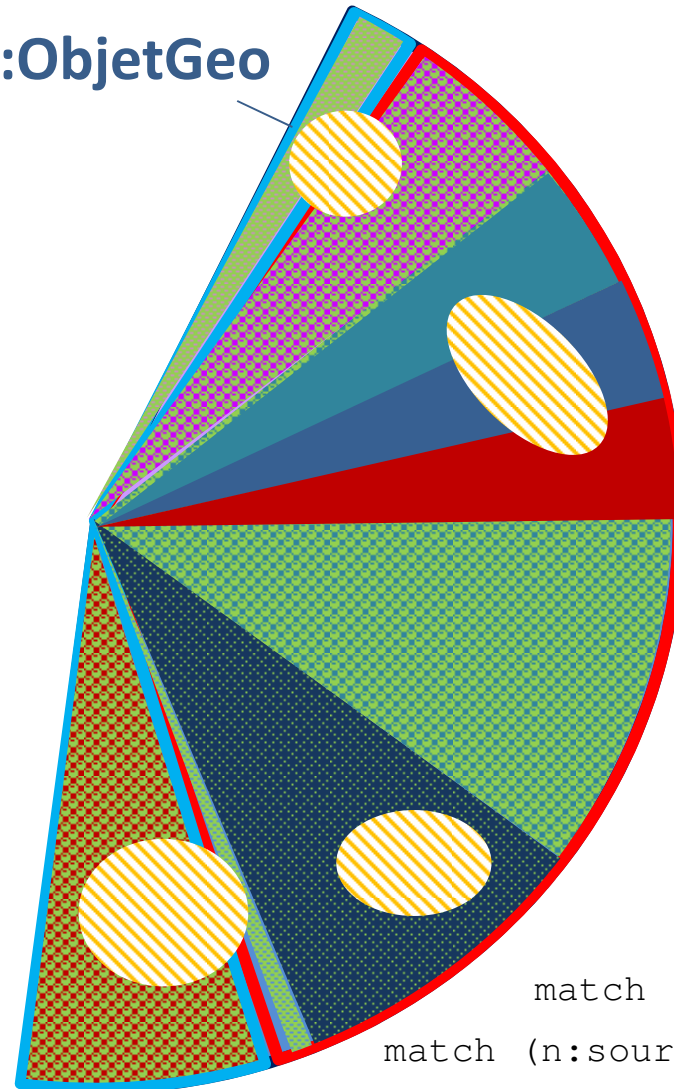
water course

building

electric line

...

:ObjetGeo



Version 2018

Version 2021

sourceBDTOPO

sourceENEDIS

sourceC2c

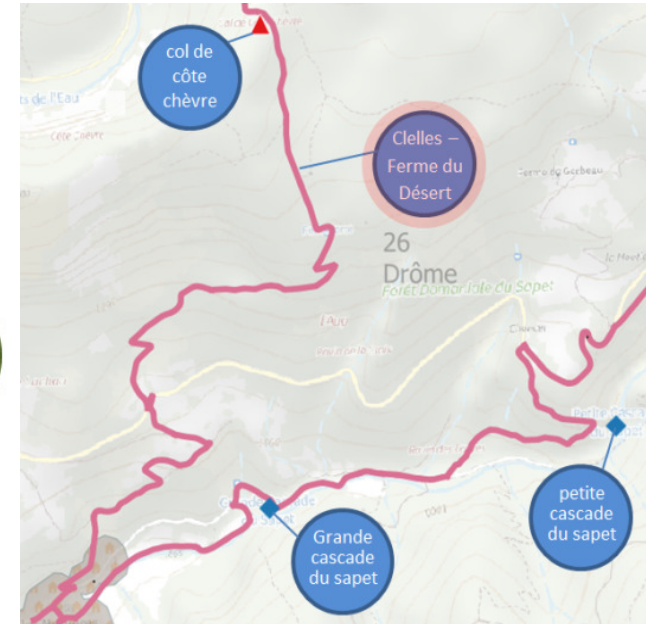
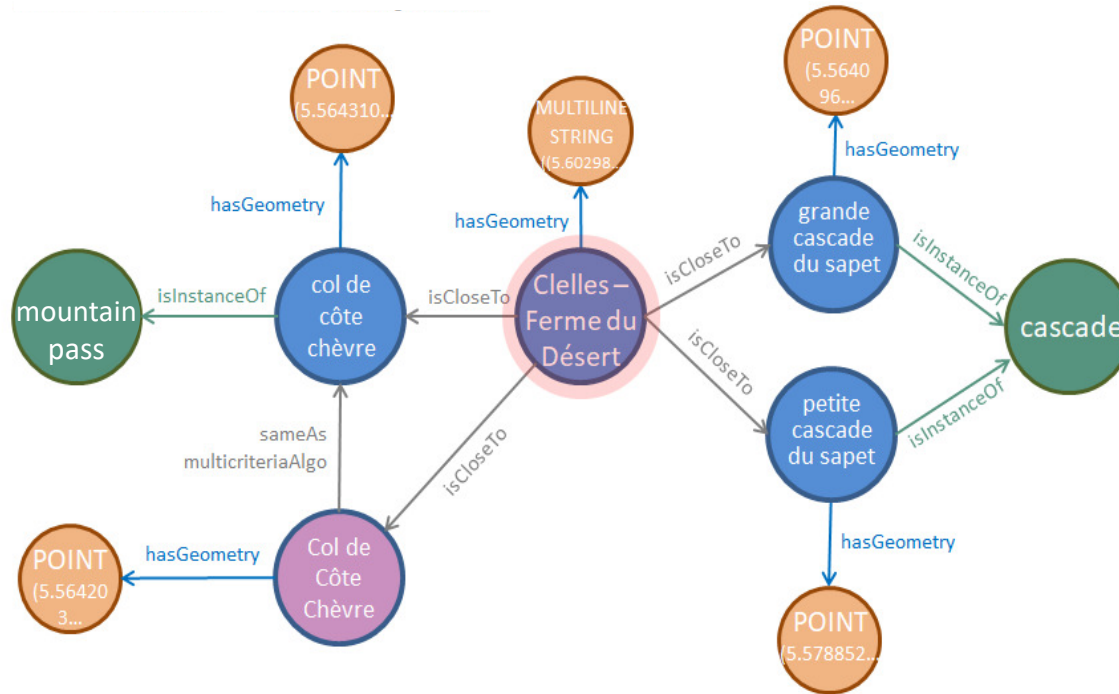
InZoneFilRouge

= restricted study area

```
match (n:v2018) detach delete n  
match (n:sourceC2c:v2021:InZoneFilRouge)
```

# Graph pattern query

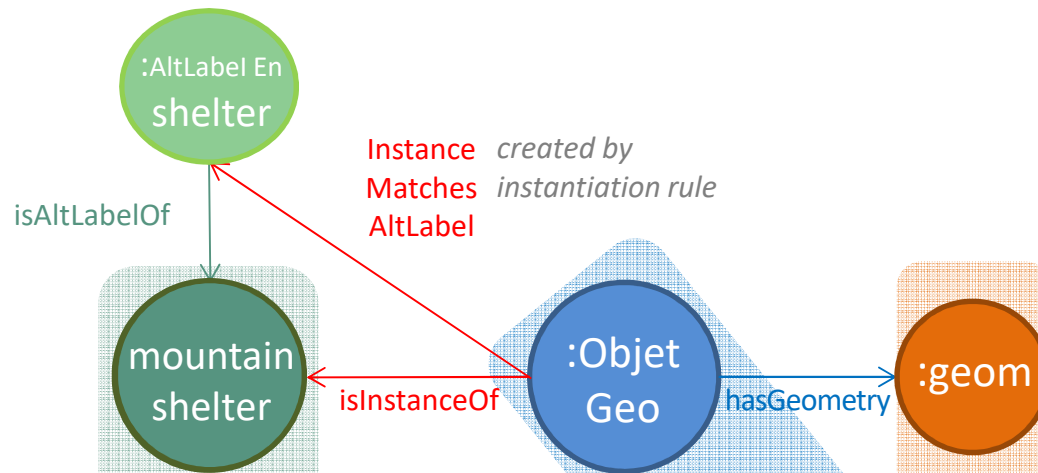
« I'm on a route to Sapet cascade and I passed a mountain pass »



# Using the graph structure of the DB (1)

- Relation between landmarks
  - initial idea, still to further implement with more relationships
- Not one table projection privileged by construction & the schema can easily be adjusted :
  - you can start importing with a modelling hypothesis based on one of the main source and adjust as you import more data (= modelling by iteration)
- Data analysis
  - Extraction of any desired table to analyse data from different angles
  - Search by pattern
  - Granularity (whole table or a few objects) of selection is easily adaptable

# Table extraction for data analysis



```

match (c:L00class) -[:isInstanceOf]- (o:ObjetGeo) -- (g:geom)
optional match (o) -[:instanceMatchesAltLabel]- (aEn:AltLabelEn)
return distinct c.prefLabelEn, count(o),
collect(DISTINCT split(g.WKT, ' ')[0]) as geomTypes,
collect (DISTINCT [lab in labels(o) where lab starts with 'source' | lab][0]) as Source,
collect(DISTINCT aEn.name) as UsedAltLabelsEn

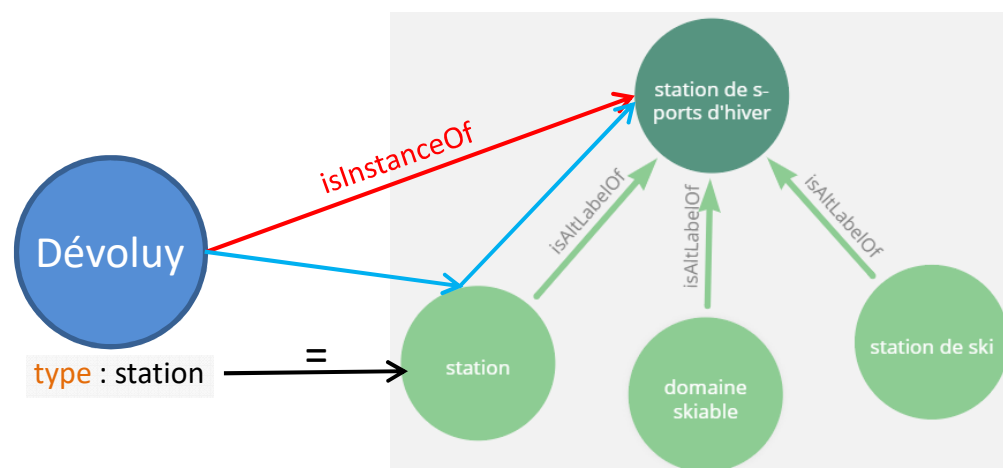
```

<b>c.prefLabelEn</b>	<b>count(o)</b>	<b>geomTypes</b>	<b>Source</b>	<b>UsedAltLabelsEn</b>
mountain shelter	397	[POINT, MULTIPOLYGON]	[sourceC2c, sourceRandoVercors, sourceBDTOPO]	[shelter]
antenna	839	[POINT]	[sourceBDTOPO]	[]
cabana	113	[POINT]	[sourceC2c]	[hut]
dam	559	[MULTIPOLYGON, MULTILINESTRING, POINT]	[sourceBDTOPO]	[]


...

# Using the graph structure of the DB (2)

- In LOO instantiation rules (= connecting data to normalized categories)
  - Relations transitivity used to normalize categorization through different alternative labels



- Context specific rules : applied only on a subdomain
- Checking the manually build Ontology against real world data
  - Some inconsistency detected

-  Choucas Project <http://choucas.ign.fr/>
- Landmark Objects Ontology  
<http://choucas.ign.fr/doc/ontologies/index-fr.html>
- The GeoGraph Data Base
  - uses Neo4j spatial plugin (Craig Taverner)  
<https://neo4j-contrib.github.io/spatial/>
  - is used by GAsPAR (Matthieu Viry, Univ. Grenoble)  
a user interface that helps geolocalize victims
- More about GeoGraph Data Base (QGIS script for test display,...) :

<http://www.e-tissage.net/ICC2021>



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*Thank you for your attention !*