Master M2 IAFA 2022-2023
UE « Représentation des connaissances : Logique modale et ontologies » KINIAAE1
Enseignants : Emiliano Lorini, Andreas Herzig, Adrien Barton

Cours AB.1
Le Web Sémantique et ses techniques
Introduction aux ontologies

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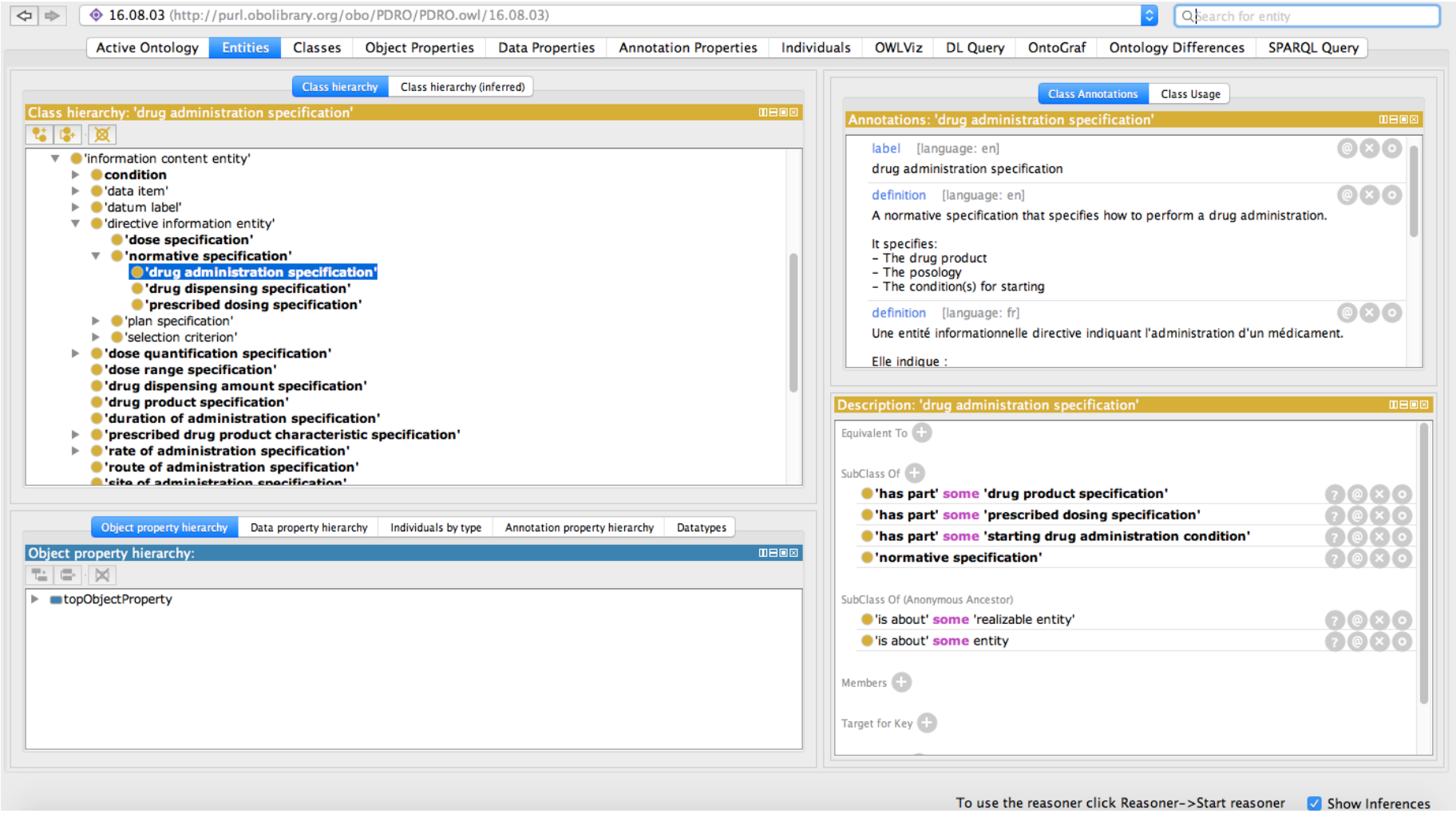
13 Janvier 2023

Protégé : un outil de création d'ontologies



Tutoriel

Adapté de “A Practical Guide To Building OWL Ontologies Using Protégé 4 and CO-ODE Tools, Edition 1.3”, de Matthew Horridge

http://mowl-power.cs.man.ac.uk/protegeowltutorial/resources/ProtegeOWLTutorialP4_v1_3.pdf

Individus et propriétés

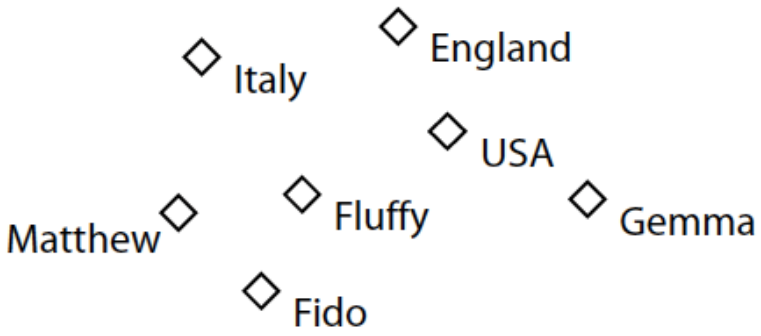


Figure 3.1: Representation Of Individuals

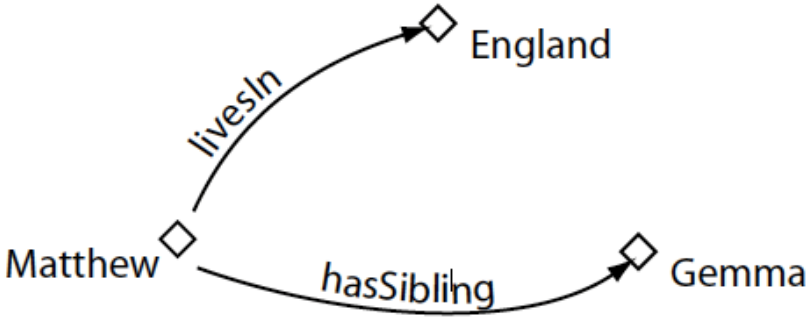


Figure 3.2: Representation Of Properties

Classes

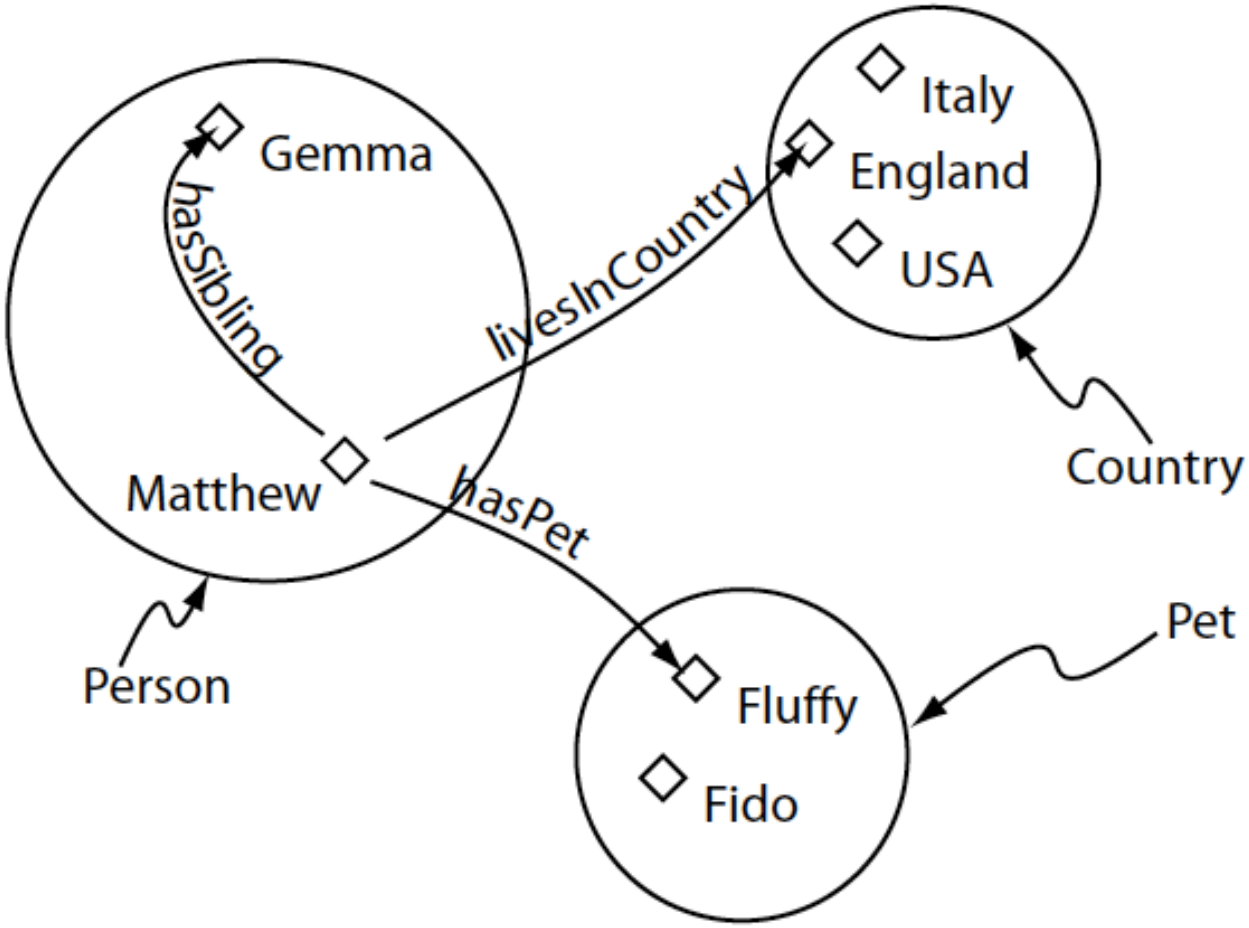
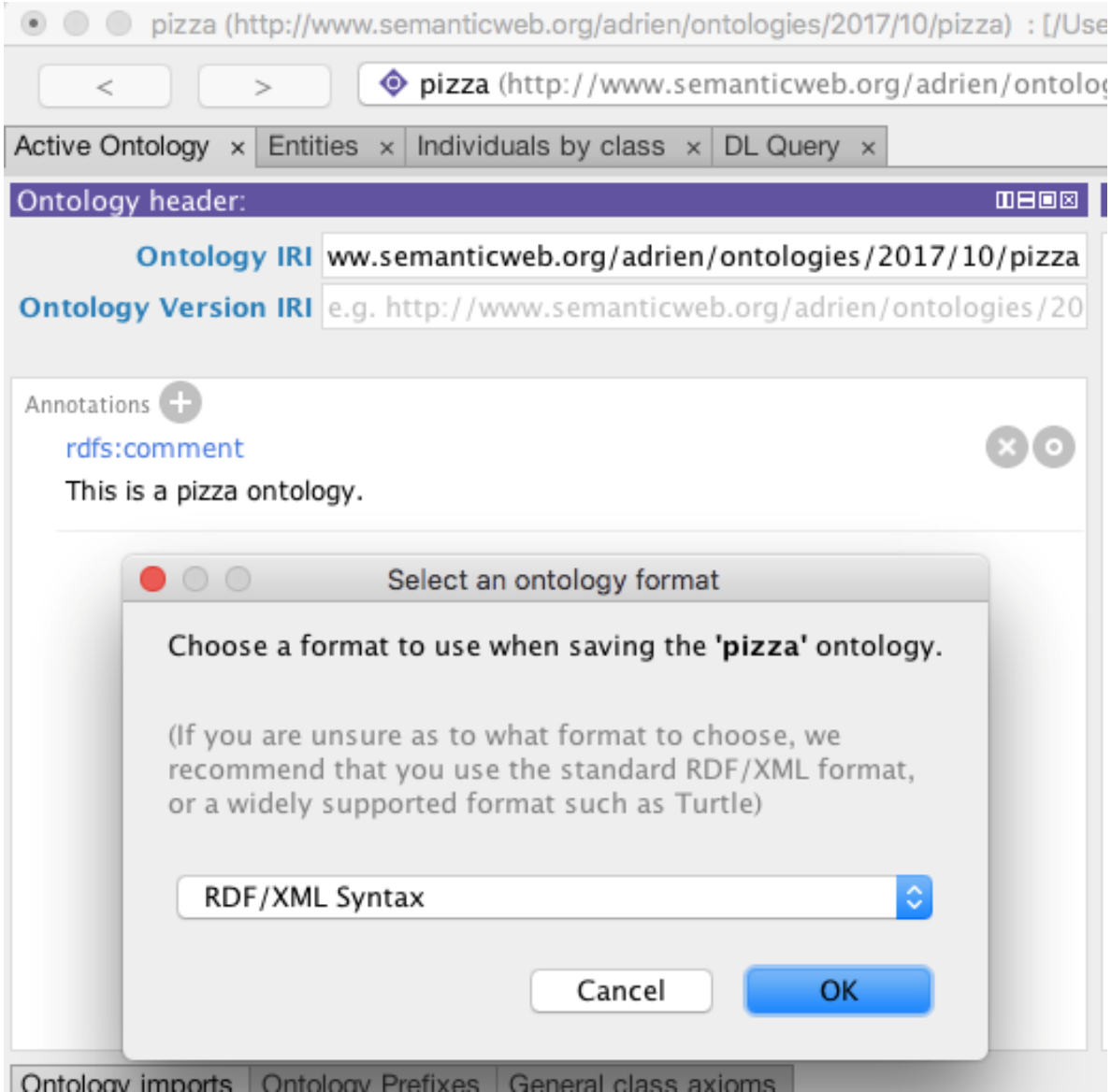
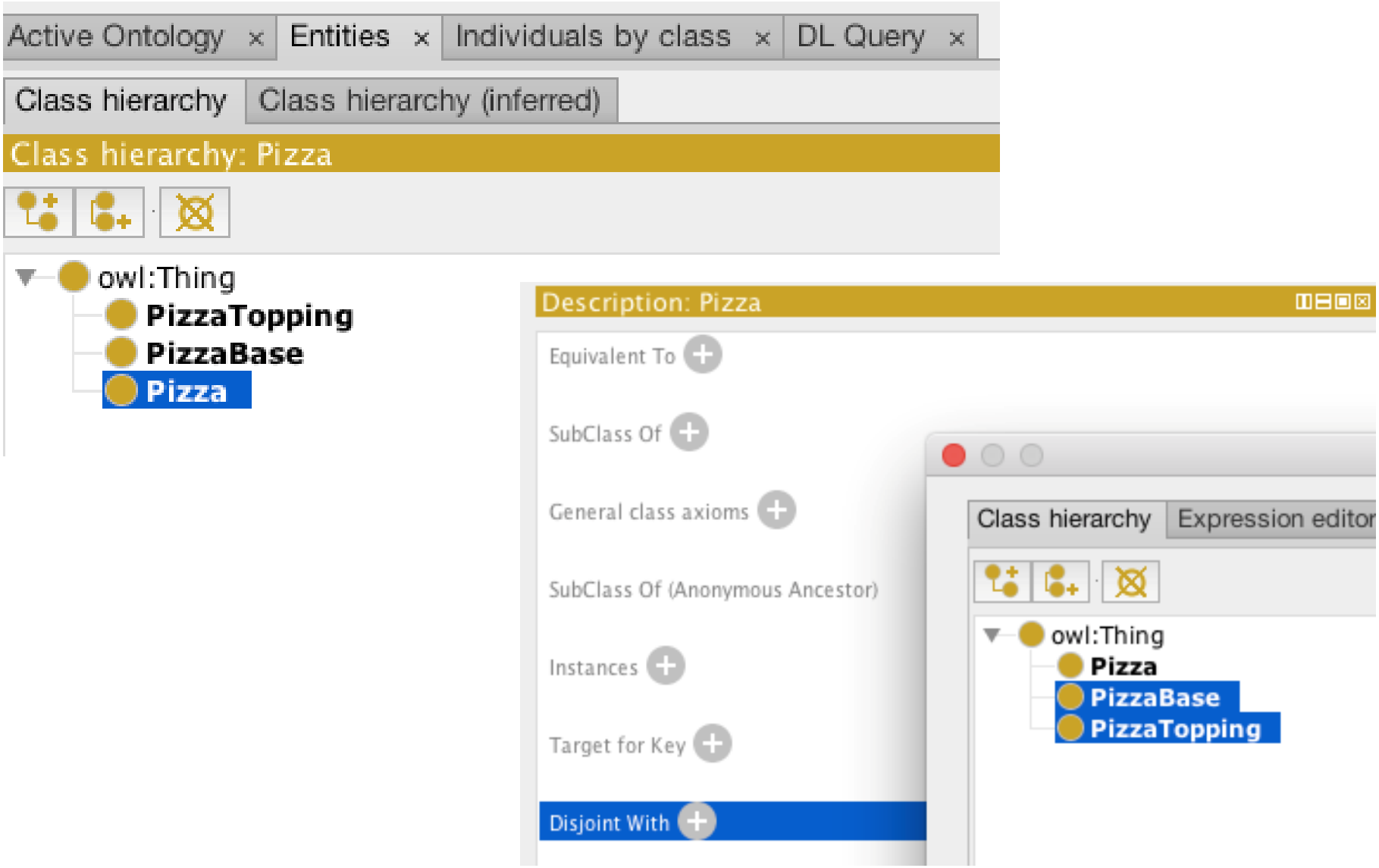


Figure 3.3: Representation Of Classes (Containing Individuals)

Créer une ontologie sous Protégé 5.1

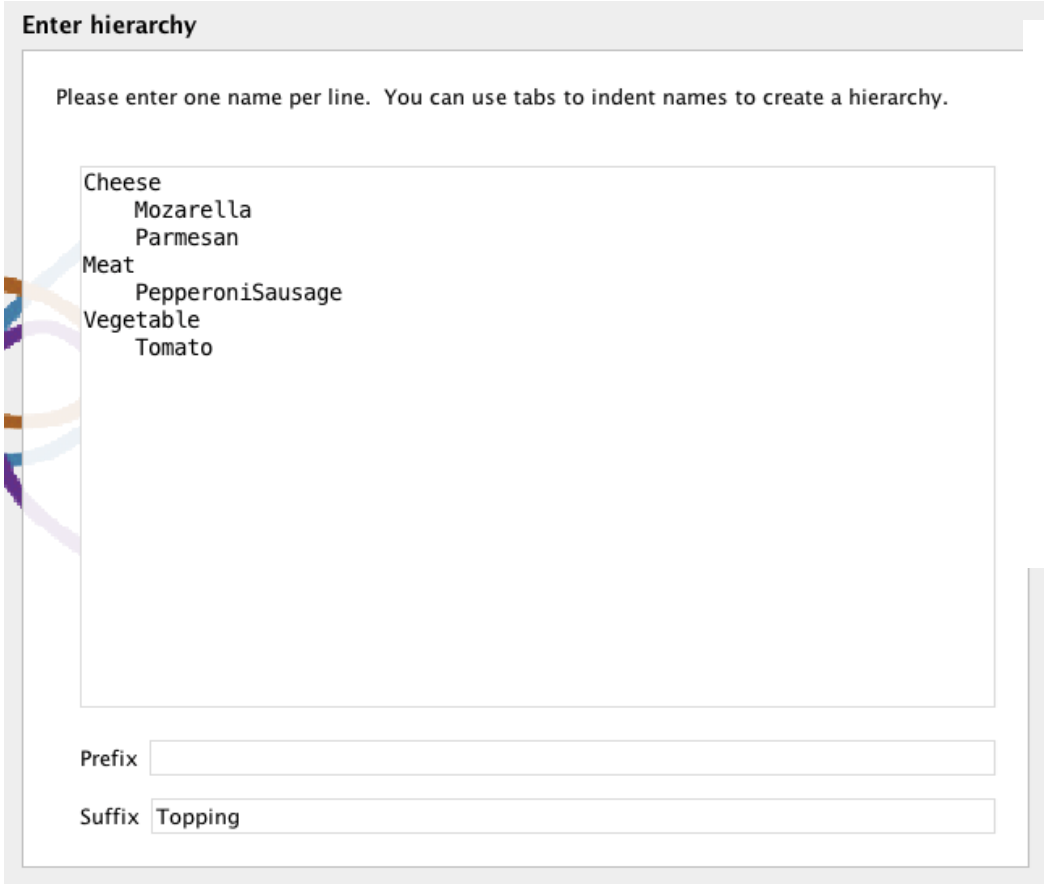


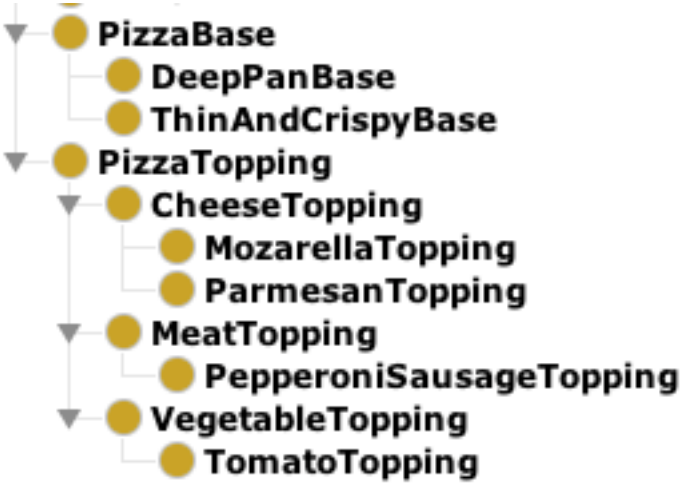
Premières classes

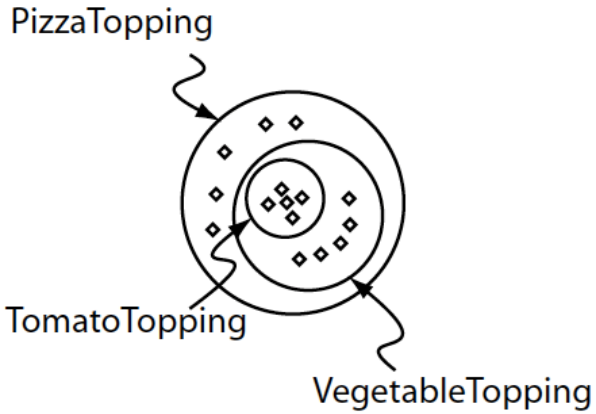


Créer des taxonomies de classes

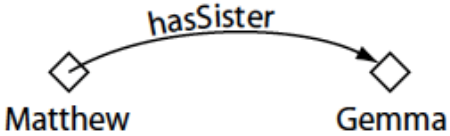
- Sélectionner ‘PizzaTopping’; Tools -> Create class hierarchy:



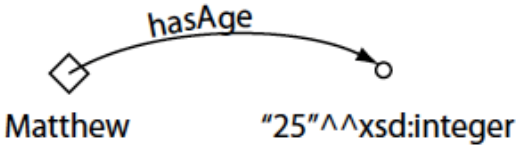




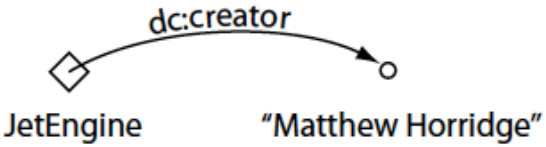
Trois types de propriétés (aka relations)



An object property linking the individual Matthew to the individual Gemma



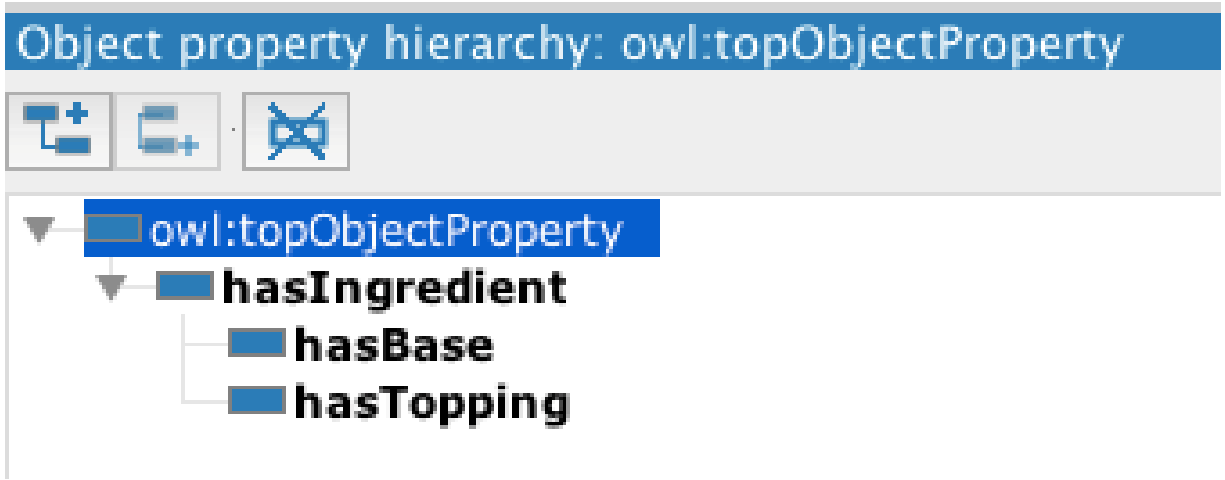
A datatype property linking the individual Matthew to the data literal '25', which has a type of an xsd:integer.



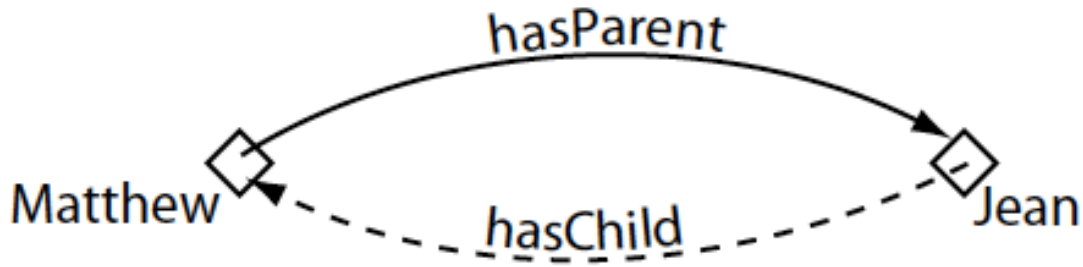
An annotation property, linking the class 'JetEngine' to the data literal (string) "Matthew Horridge".

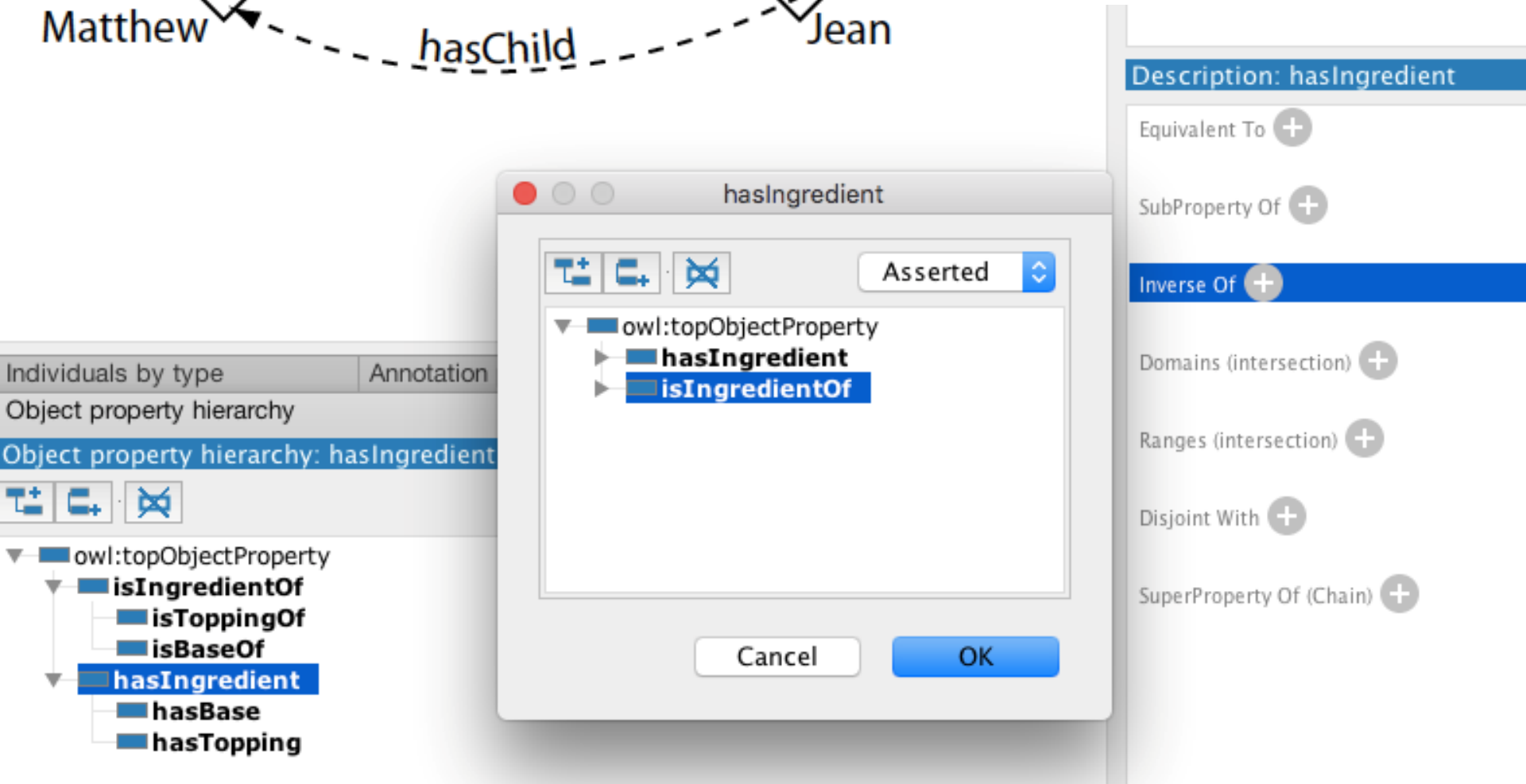
Figure 4.12: The Different types of OWL Properties

Créer des ‘object properties’



Relations inverses





Caractéristique des relations

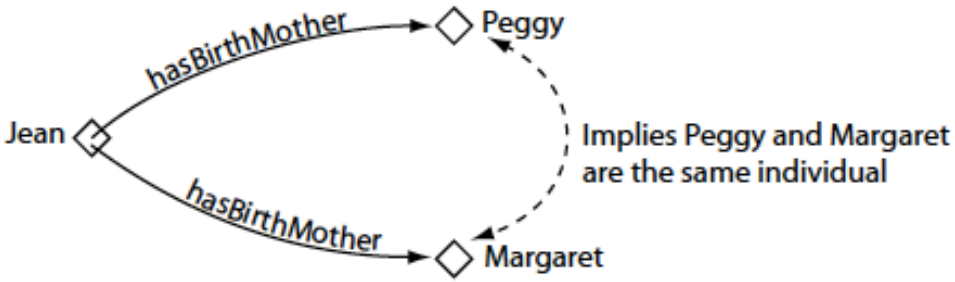


Figure 4.18: An Example Of A Functional Property: hasBirthMother

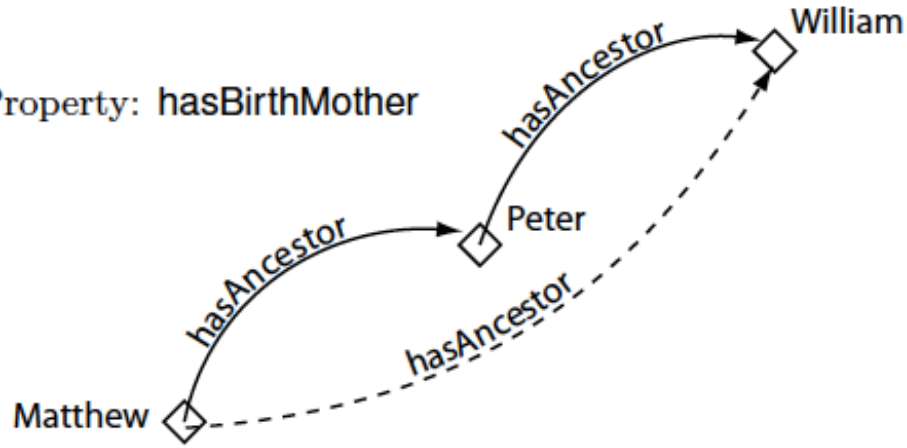


Figure 4.20: An Example Of A Transitive Property: hasAncestor

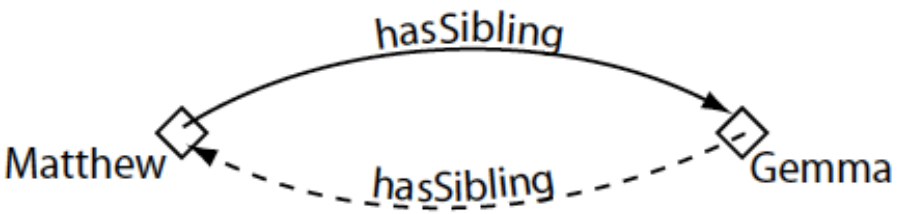
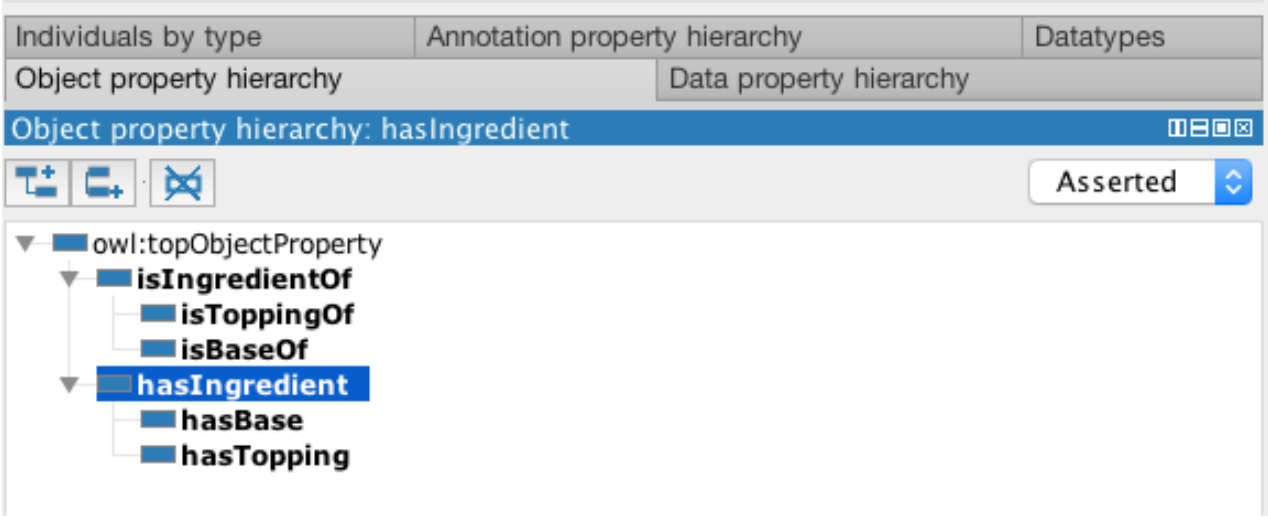
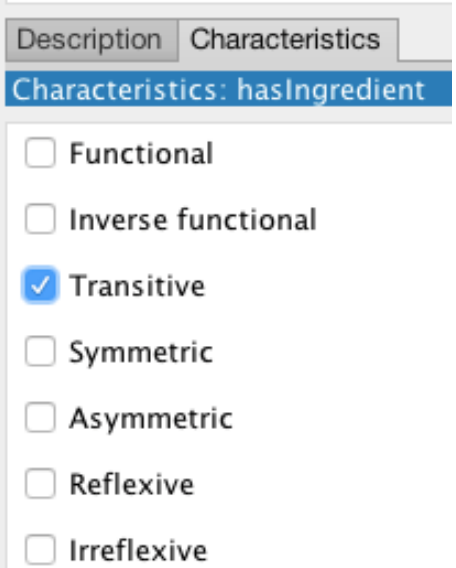


Figure 4.21: An Example Of A Symmetric Property: hasSibling

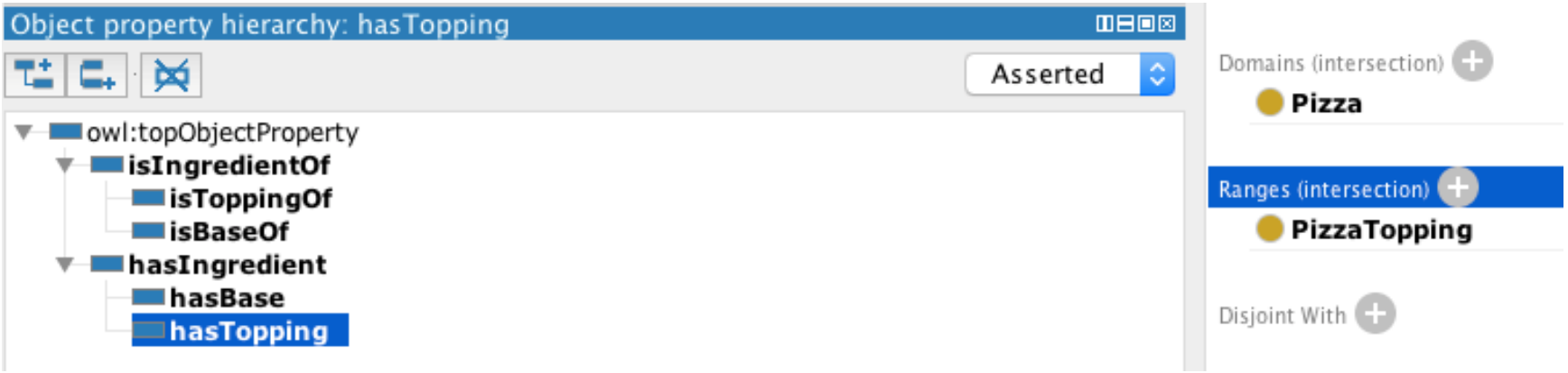
Caractéristiques des relations : application

- Rendre ‘hasIngredient’ et ‘isIngredientOf’ transitives
- Rendre ‘hasBase’ fonctionnelle
- Veut-on ‘hasTopping’ fonctionnelle ou symétrique ?





Domain & Range



hasBase: Domain Pizza, Range PizzaBase (utiliser autocomplete)

Property Domains And Ranges In OWL — It is important to realise that in OWL domains and ranges should *not* be viewed as constraints to be checked. They are used as 'axioms' in reasoning. For example if the property hasTopping has the domain set as Pizza and we then applied the hasTopping property to IceCream (individuals that are members of the class IceCream), this would generally not result in an error. It would be used to infer that the class IceCream must be a subclass of Pizza! [a].

[a] An error will only be generated (by a reasoner) if Pizza is disjoint to IceCream

Axiomes (aka restrictions) : Restrictions existentielles

Créer NamedPizza sous-classe de Pizza

Description: Pizza

Equivalent To

SubClass Of

- hasBase some PizzaBase

Description: AmericanaPizza

Equivalent To

SubClass Of

- hasTopping some MozarellaTopping
- hasTopping some PepperoniSausageTopping
- hasTopping some TomatoTopping
- NamedPizza

General class axioms

SubClass Of (Anonymous Ancestor)

- hasBase some PizzaBase

Description: MargheritaPizza

Equivalent To

SubClass Of

- hasTopping some MozarellaTopping
- hasTopping some TomatoTopping
- NamedPizza

General class axioms

SubClass Of (Anonymous Ancestor)

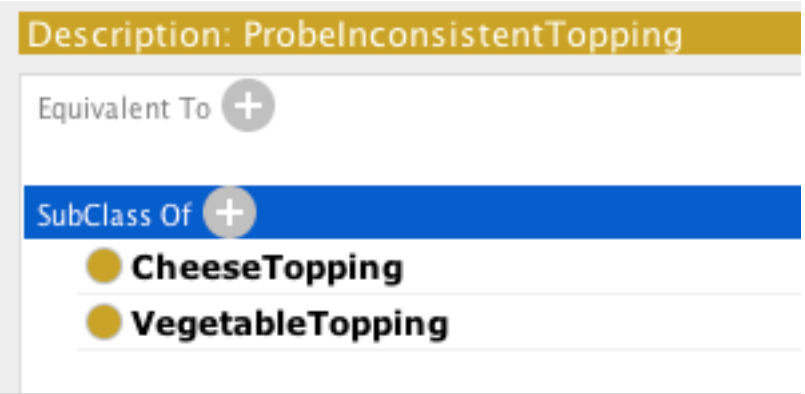
- hasBase some PizzaBase

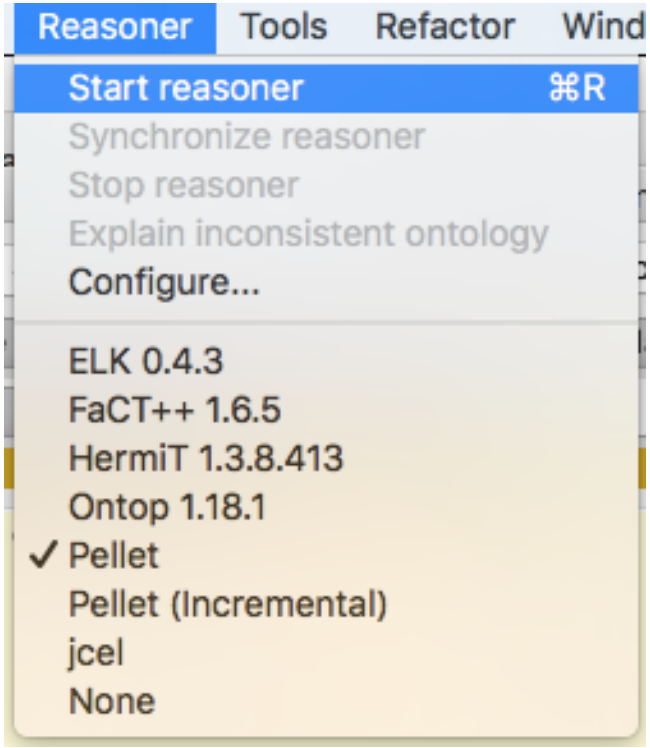
Pour créer AmericanaPizza:
- Selectionner MargheritaPizza
- Edit / Duplicate selected class
- Changer nom pour ‘AmericanaPizza’
- Cliquer OK
- Ajouter axiome ‘hasTopping some PepperoniSausageTopping’

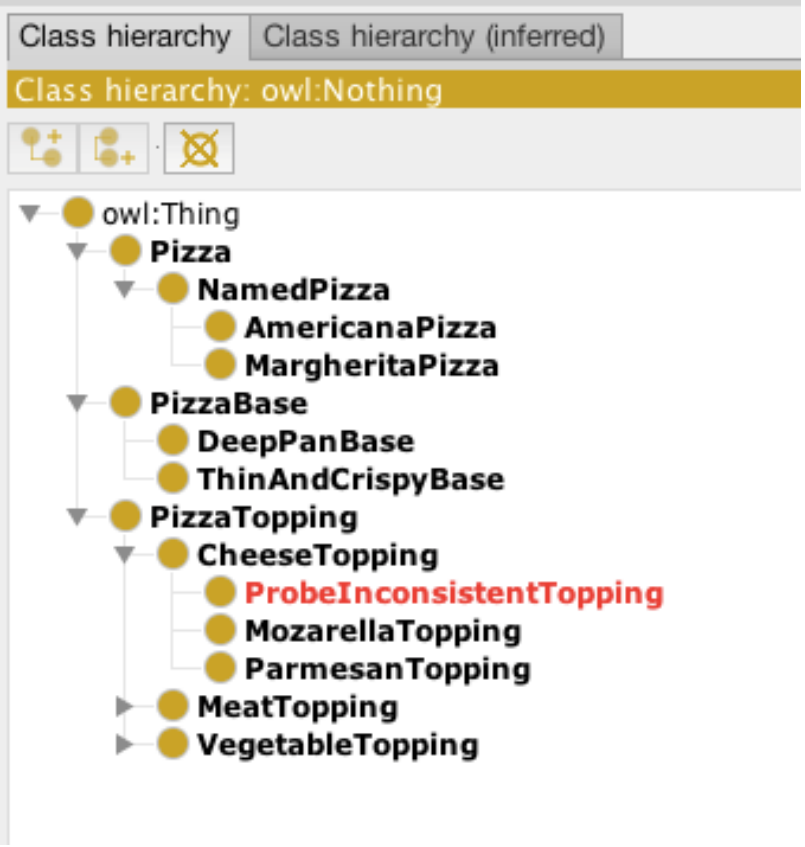
Rendre MargheritaPizza et AmericanaPizza disjointes

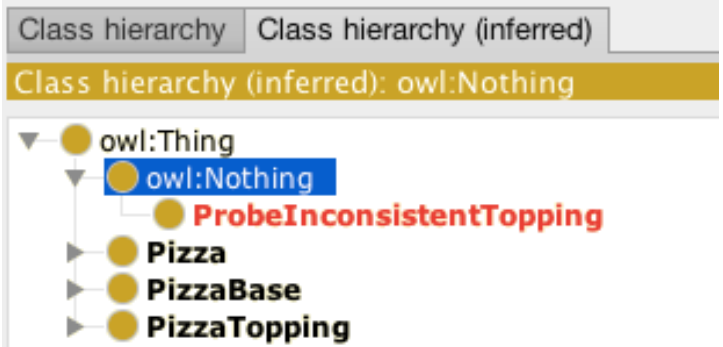
Remarque : Une restriction définit une classe anonyme.

Raisonneur : détecter les incohérences









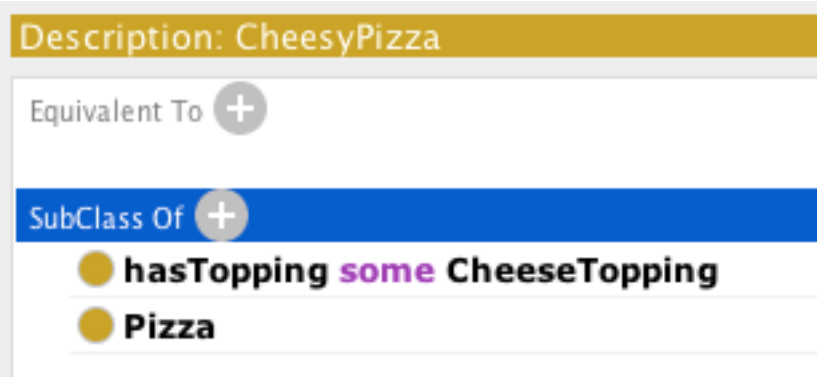
Ne pas oublier d'arrêter le raisonneur.
Réessayer en enlevant l'axiome de disjointure de CheeseTopping et VegetableTopping.

Classes primitive et classes définies (aka classes équivalentes)

Vocabulary

A class that only has *necessary* conditions is known as a **Primitive Class**.

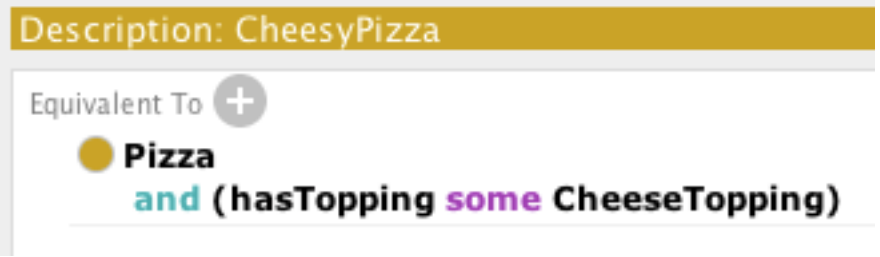
Créer CheesyPizza



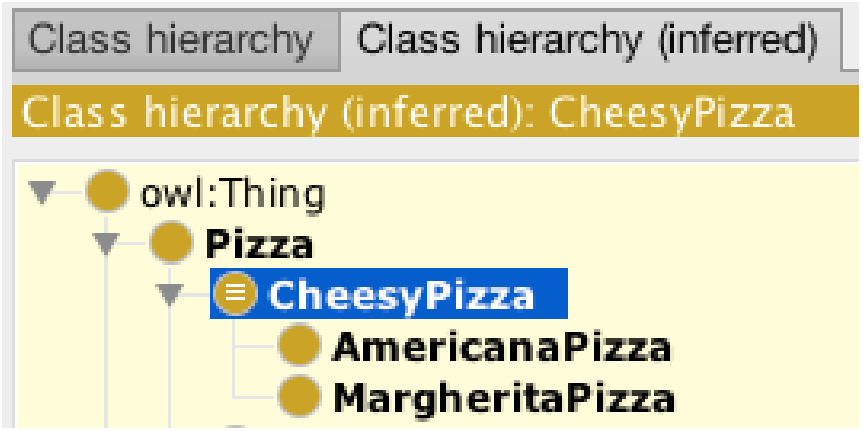
Vocabulary

A class that has at least one set of *necessary and sufficient* conditions is known as a **Defined Class**.

Edit -> Convert to defined class



Raisonneur : classification automatique



- Héritage multiple := Certaines classes ont plusieurs classes parentes.
- Principe méthodologique: Construire une hiérarchie à héritage simple asserté.
- Le raisonneur pourra inférer et maintenir l'héritage multiple.

It is important to realise that, in general, classes will never be placed as sub-classes of *primitive* classes (i.e. classes that only have necessary conditions) by the reasoner[a].

[a] The exception to this is when a property has a domain that is a primitive class. This can *coerce* classes to be reclassified under the primitive class that is the domain of the property — the use of property domains to cause such effects is strongly discouraged.

Restrictions universelles

Description: VegetarianPizza

Equivalent To

SubClass Of

- **hasTopping only (CheeseTopping or VegetableTopping)**
- **Pizza**

Voyez-vous un problème avec cette caractérisation ?

Edit -> Convert to defined class

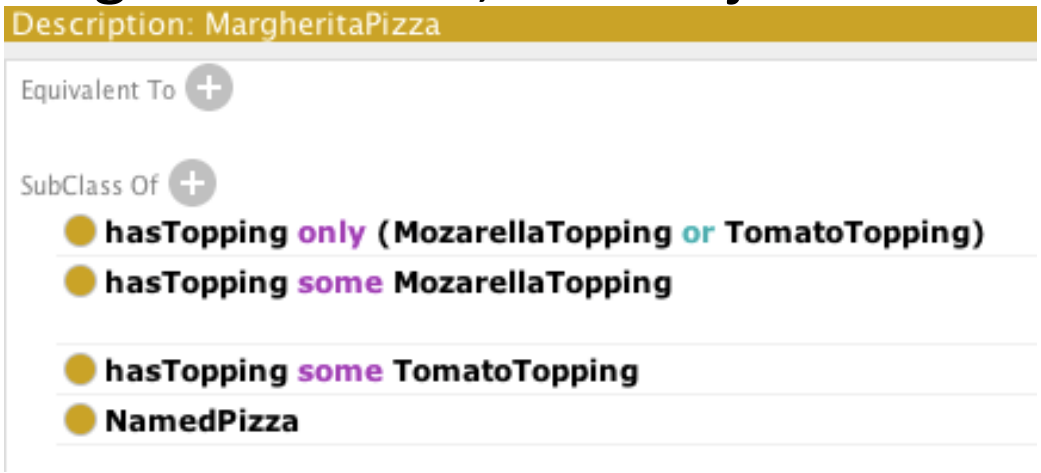
Description: VegetarianPizza

Equivalent To

- **Pizza**
  and (hasTopping only
  (CheeseTopping or VegetableTopping))

Raisonnement en monde ouvert

- MargheritaPizza sera-t-elle classée en sous-classe de VegetarianPizza ?
- Hypothèse de **monde ouvert** : on ne peut pas supposer que quelque chose n'existe pas à moins qu'il ne soit explicitement énoncé qu'il n'existe pas.
- Pour que MargheritaPizza soit classée en sous-classe de VegetarianPizza, il faut ajouter un axiome de fermeture.



Remarque : Les axiomes existentiels sont également importants, pour éviter qu'une pizza sans garniture puisse être considérée comme MargheritaPizza.

Clic droit sur axiome existentiel -> 'Create closure axiom'

Restrictions de cardinalité

Créer InterestingPizza sous-classe de Pizza

Description: InterestingPizza

Equivalent To

Pizza
and (hasTopping min 3 PizzaTopping)

Description: FourCheesePizza

Equivalent To

SubClass Of

hasTopping exactly 4 CheeseTopping
NamedPizza

Class hierarchy | Class hierarchy (inferred)

Class hierarchy (inferred): owl:Thing

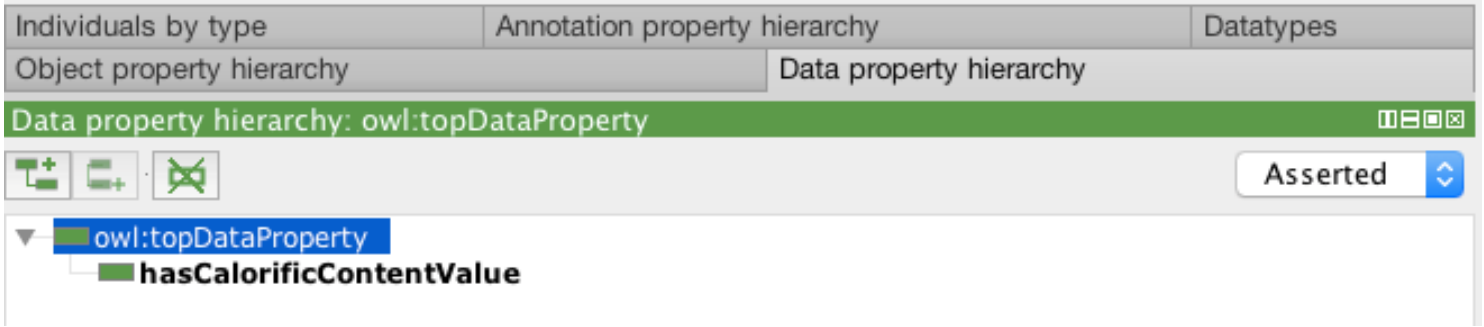
- owl:Thing
  - Pizza
    - CheesyPizza
    - InterestingPizza
      - AmericanaPizza

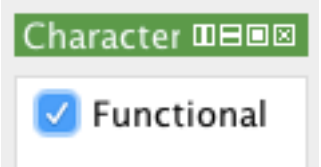
Class hierarchy | Class hierarchy (inferred)

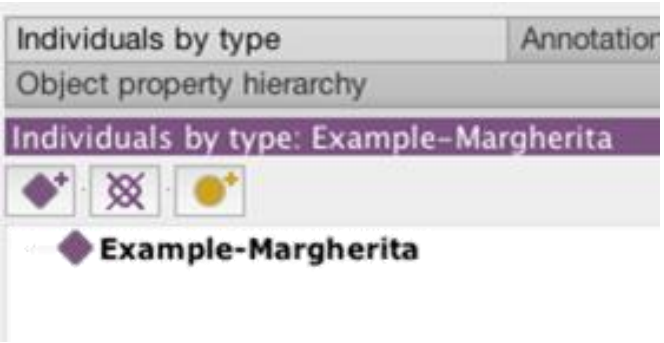
Class hierarchy (inferred): Pizza

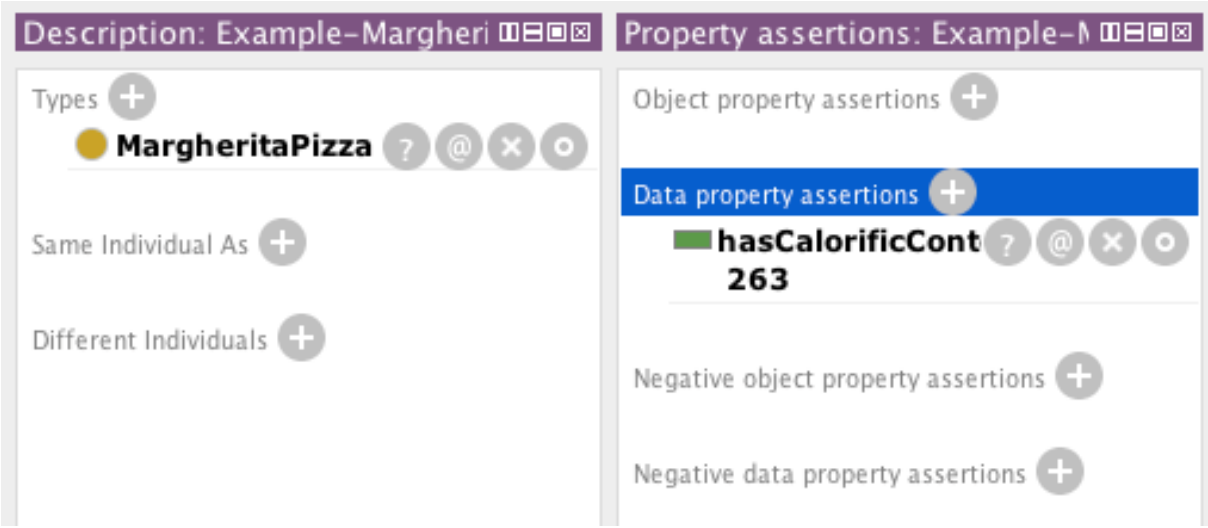
- owl:Thing
  - Pizza
    - CheesyPizza
    - InterestingPizza
      - AmericanaPizza
      - FourCheesePizza

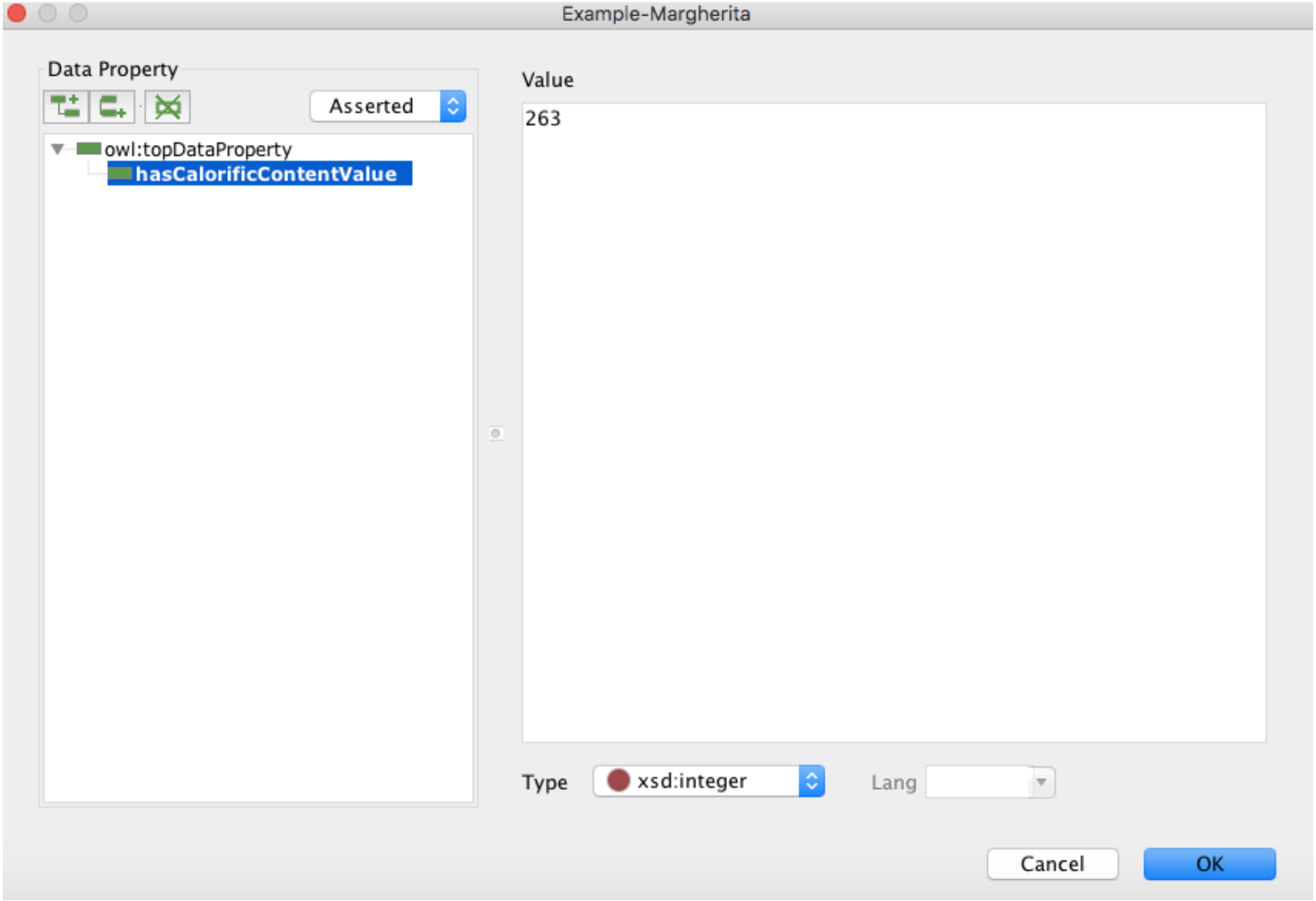
Datatype properties et individus



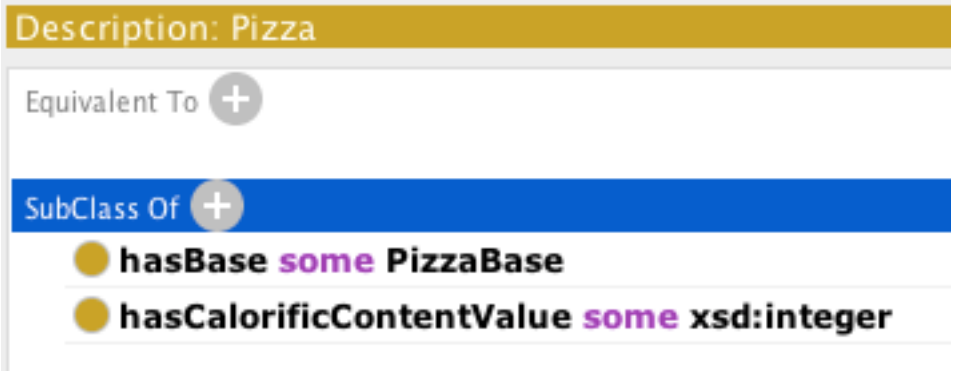


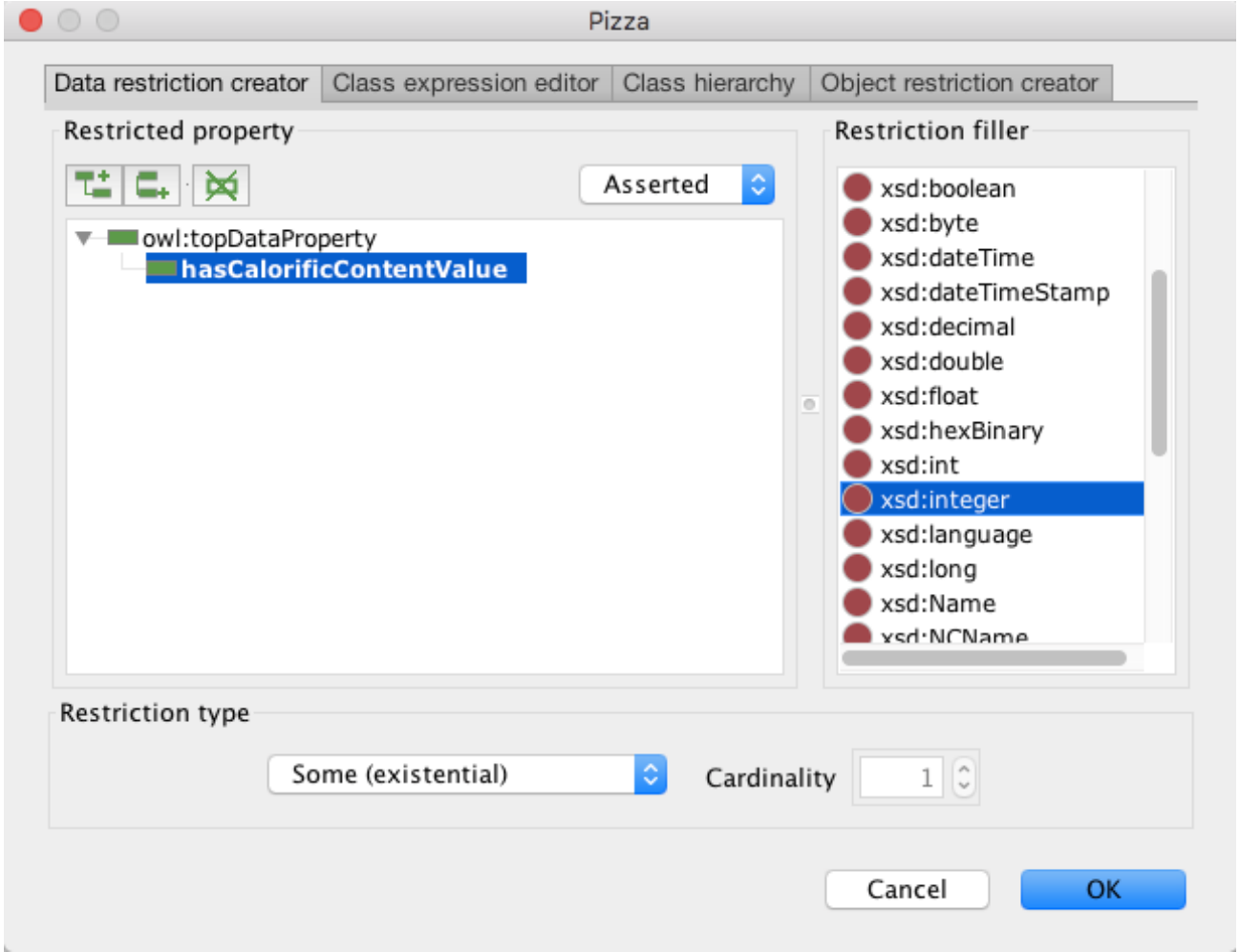




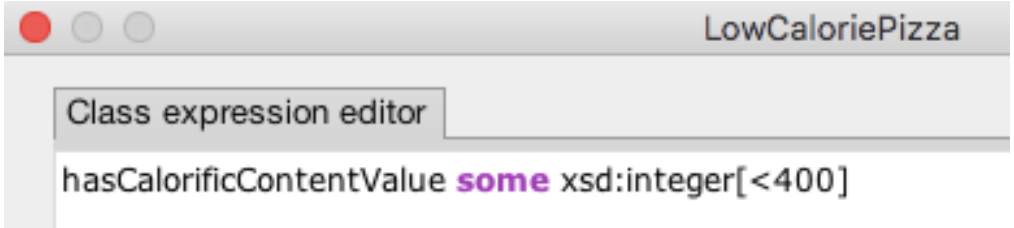

Example-Margherita
Data Property
Asserted
owl:topDataProperty
hasCalorificContentValue
Value
263
Type
xsd:integer
Lang
Cancel
OK

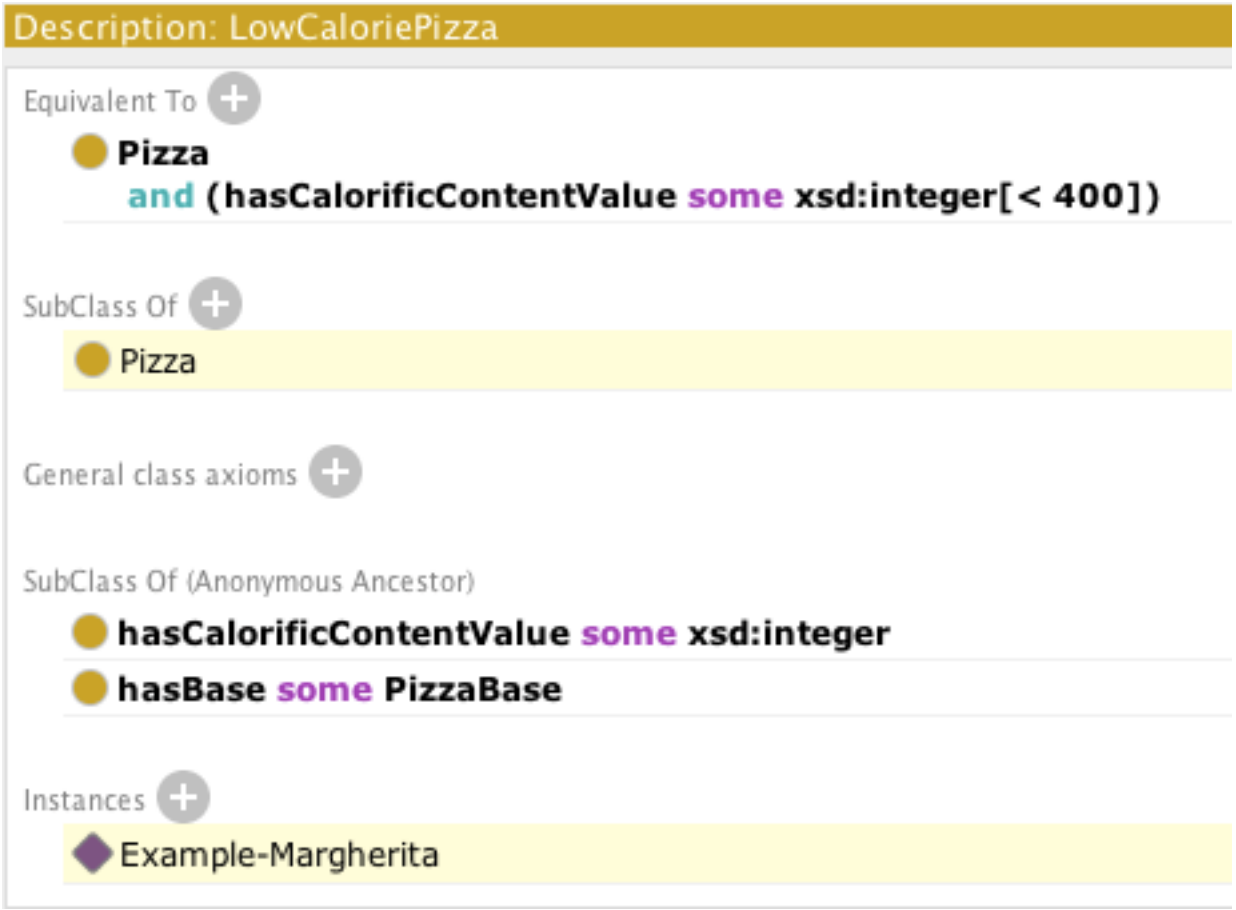
Axiome : Toutes les pizzas ont une valeur calorifique





Raisonner avec des datatype properties





Analyse ontologique des pays

- On voudrait pouvoir dire que la pizza Margharita a comme pays d'origine l'Italie.

- Les pays sont-ils des classes ou des individus?

Relation entre une classe et un individu