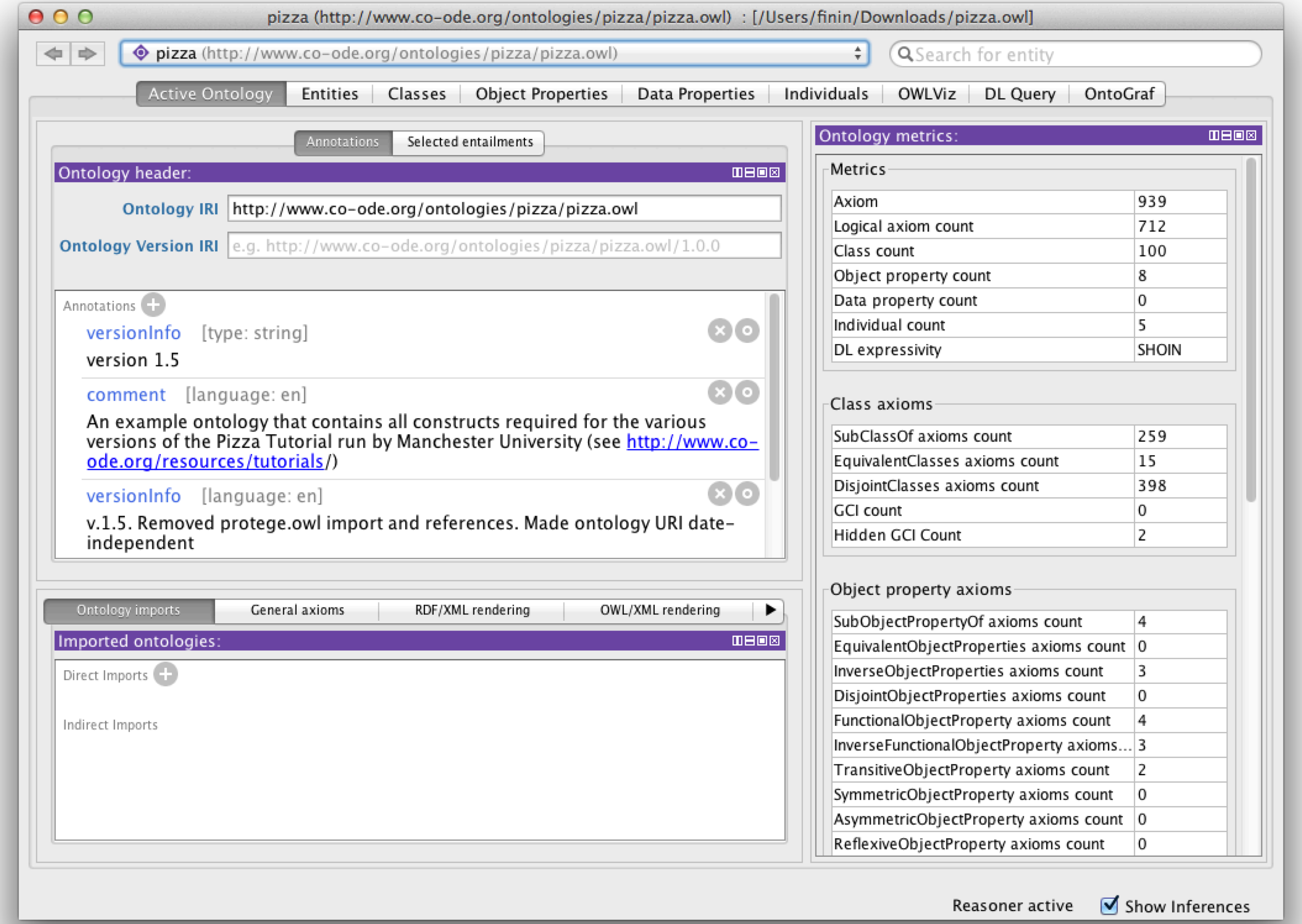
Ontology Editors

IDEs for Ontologies

- **Some people use simple text editors**
  - Doing this with the XML serialization will drive you crazy
  - Using Turtle or an abstract syntax works well
- **Others prefer an IDE**
  - Good IDEs include support for reasoning, visualization, and more
- Protégé is very a very popular IDE
  - From Stanford, free, lots of plugins
- TopQuadrant Composer is also good
  - Feature rich but expensive ($600 for a single academic license)

Protégé 4.3



Ontology IRI: http://www.co-ode.org/ontologies/pizza/pizza.owl

Ontology Version IRI: e.g. http://www.co-ode.org/ontologies/pizza/pizza.owl/1.0.0

Annotations

versionInfo [type: string]
version 1.5

comment [language: en]
An example ontology that contains all constructs required for the various versions of the Pizza Tutorial run by Manchester University (see http://www.co-ode.org/resources/tutorials/)

versionInfo [language: en]
v.1.5. Removed protege.owl import and references. Made ontology URI date-independent

Metrics

Axiom	939
Logical axiom count	712
Class count	100
Object property count	8
Data property count	0
Individual count	5
DL expressivity	SHOIN

Class axioms

SubClassOf axioms count	259
EquivalentClasses axioms count	15
DisjointClasses axioms count	398
GCI count	0
Hidden GCI Count	2

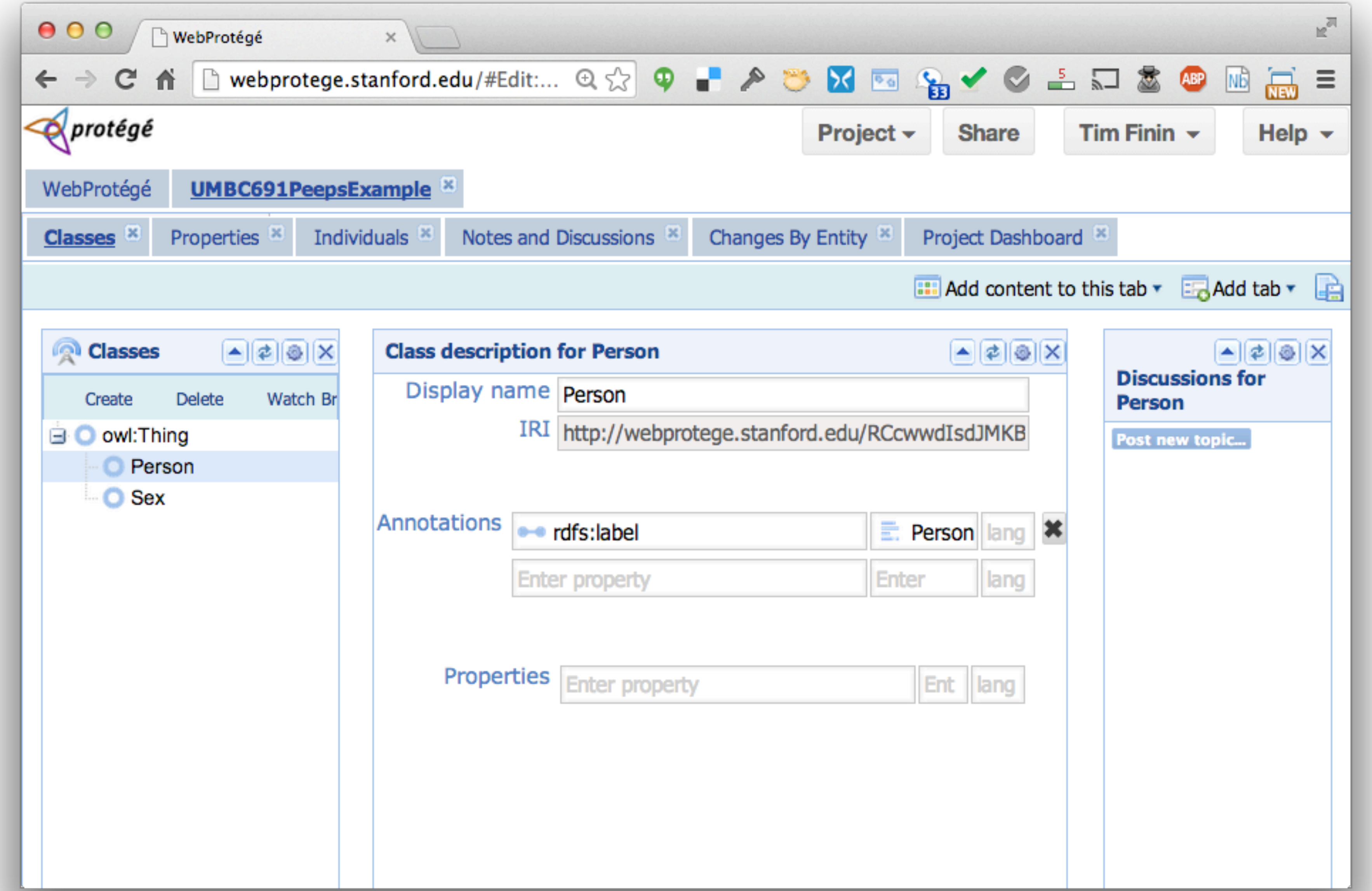
Object property axioms

SubObjectPropertyOf axioms count	4
EquivalentObjectProperties axioms count	0
InverseObjectProperties axioms count	3
DisjointObjectProperties axioms count	0
FunctionalObjectProperty axioms count	4
InverseFunctionalObjectProperty axioms...	3
TransitiveObjectProperty axioms count	2
SymmetricObjectProperty axioms count	0
AsymmetricObjectProperty axioms count	0
ReflexiveObjectProperty axioms count	0

Protégé 4.3

- http://protege.stanford.edu/
- Free, open source ontology editor and KB framework
- Predates OWL, still supports earlier Frames representation
- In Java, extensible, large community of users
- V4.3 supports OWL 2 but missing other features (e.g., SPARQL)
- v3.5 version has missing features, but only supports OWL 1

Web Protege



Display name: Person

IRI: http://webprotege.stanford.edu/RCcwwdIsdJMKB

Annotations: rdfs:label | Person | lang

Enter property | Enter | lang

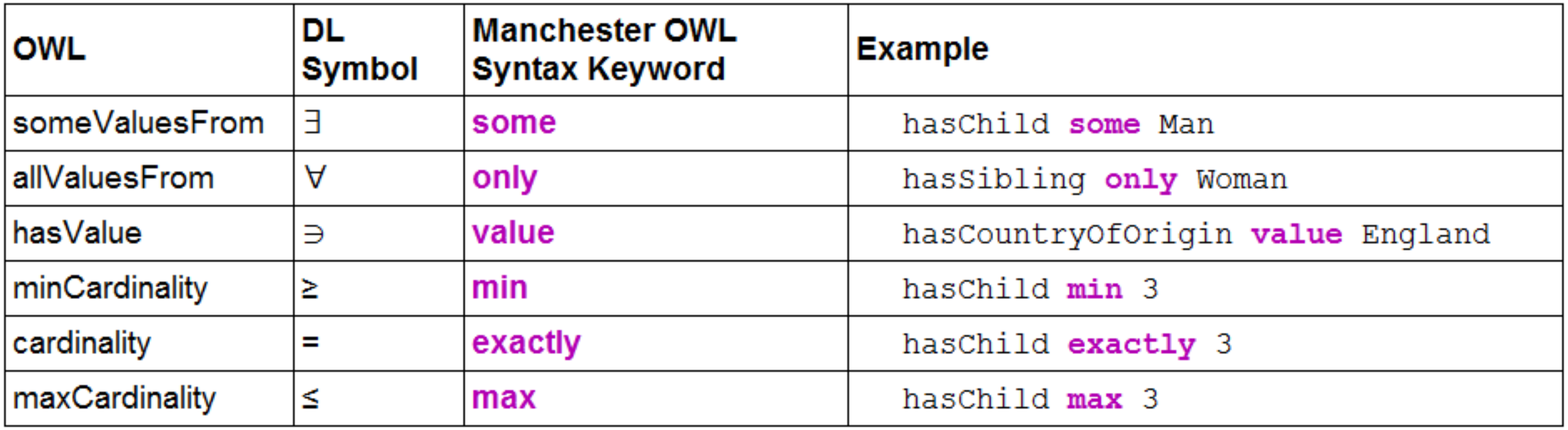
Properties: Enter property | Ent | lang

YAS: Yet Another Syntax

- Neither OWL's official abstract syntax nor XML serialization is easy to read or use
- Protégé uses the Manchester syntax
- Simpler and more compact: “some” and “only”, not “someValuesFrom” and “allValuesFrom”
- A W3C recommendation (http://bit.ly/manSyn), used in the OWL 2 Primer (http://bit.ly/OWL2Pri)

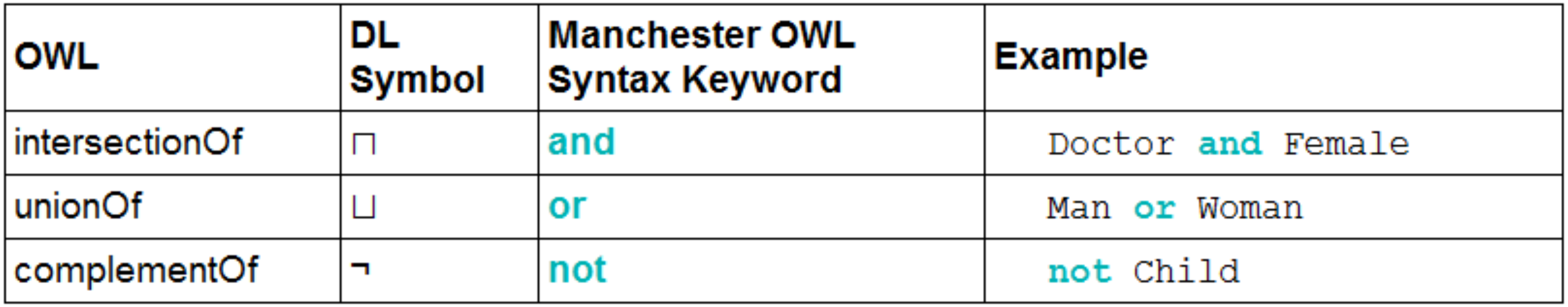
```
Class: man
    Annotations: rdfs:label "man"
    EquivalentTo: adult and male and person
```

Manchester OWL syntax



OWL	DL Symbol	Manchester OWL Syntax Keyword	Example
someValuesFrom	∃	**some**	`hasChild some Man`
allValuesFrom	∀	**only**	`hasSibling only Woman`
hasValue	∋	**value**	`hasCountryOfOrigin value England`
minCardinality	≥	**min**	`hasChild min 3`
cardinality	=	**exactly**	`hasChild exactly 3`
maxCardinality	≤	**max**	`hasChild max 3`

Manchester OWL syntax



OWL	DL Symbol	Manchester OWL Syntax Keyword	Example
intersectionOf	⊓	and	`Doctor and Female`
unionOf	⊔	or	`Man or Woman`
complementOf	¬	not	`not Child`

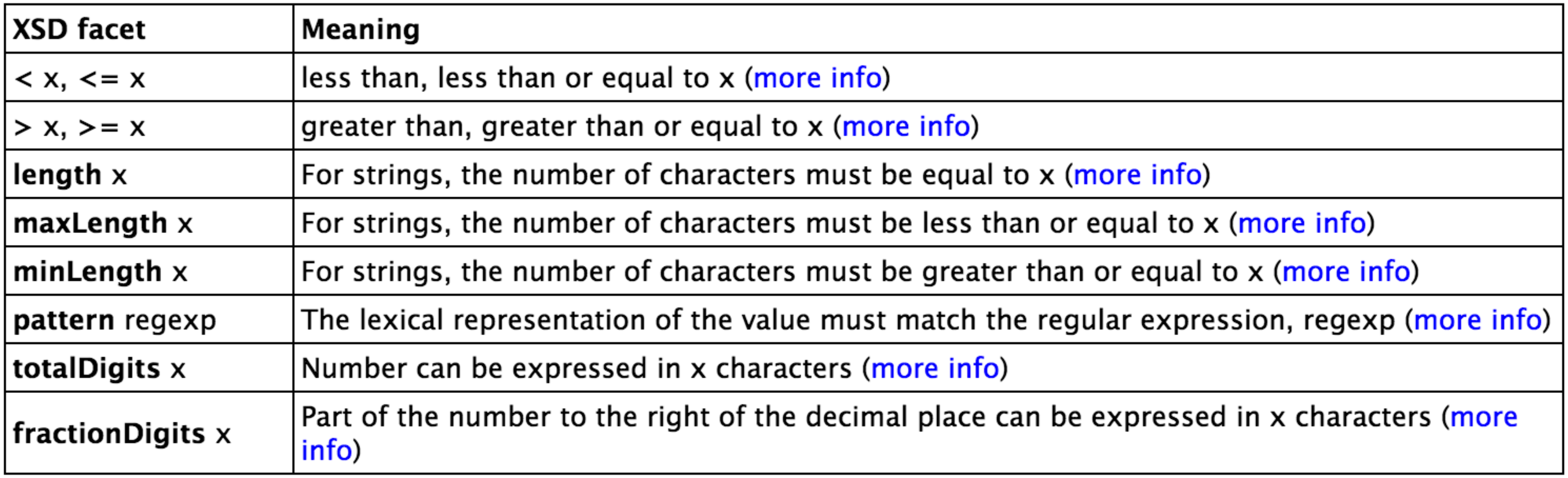
Example

```
Person and
   hasChild some
      (Person and
          (hasChild only Man) and
             (hasChild some Person))
```

The set of people who have at least one child that has some children that are only men (i.e., grandparents that only have grandsons)

Data values and datatypes

- Data values typed or untyped (e.g., int, boolean, float)
- Constants with or w/o type, e.g.: hasAge value "21"^^long
- Use datatype names as classes: hasAge some int
- XSD facets, e.g.: Person and hasAge some int[>= 65]
- Ranges: Person and hasAge some int[>= 18, <= 30].

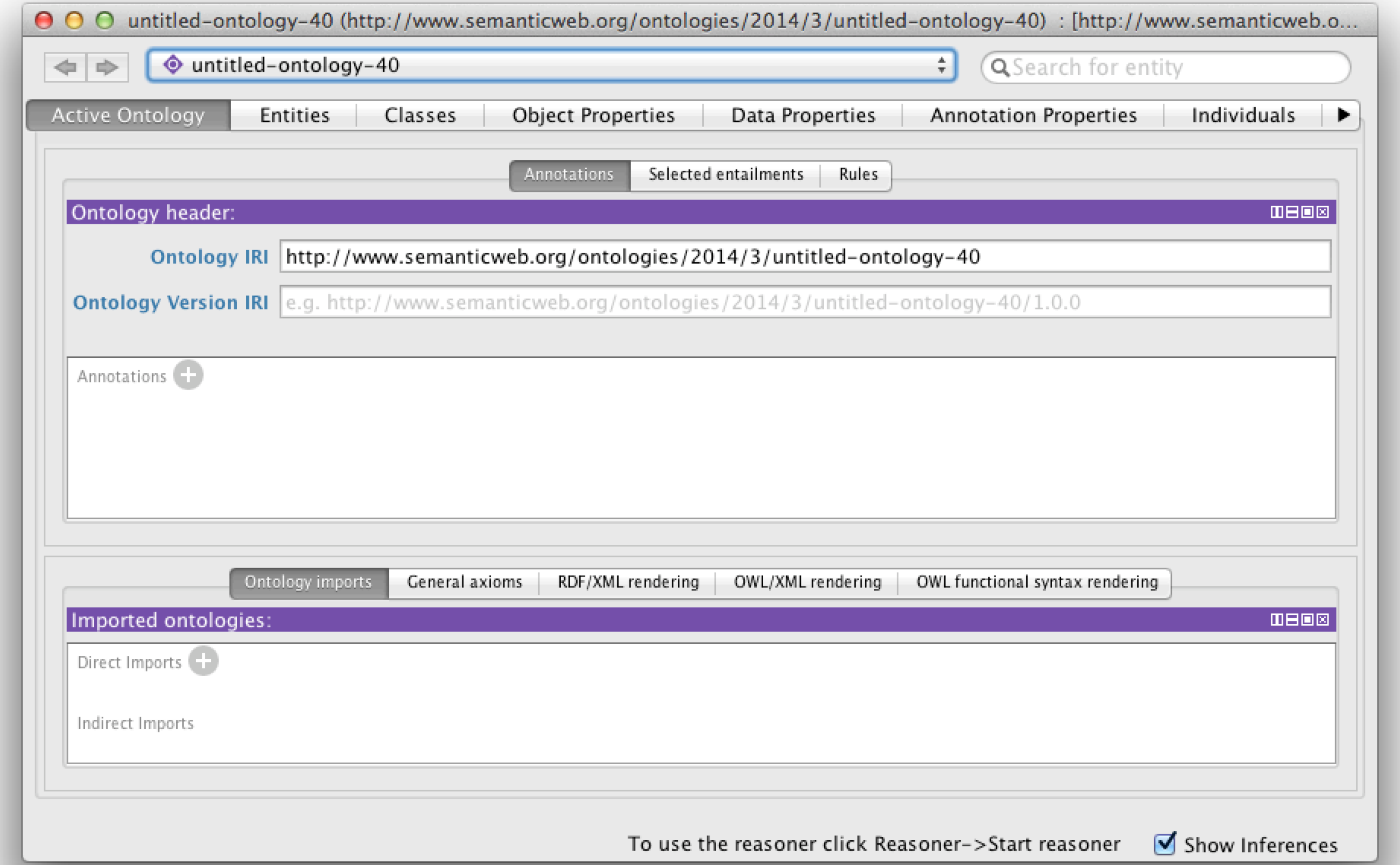


XSD facet	**Meaning**
< x, <= x	less than, less than or equal to x (more info)
> x, >= x	greater than, greater than or equal to x (more info)
length x	For strings, the number of characters must be equal to x (more info)
maxLength x	For strings, the number of characters must be less than or equal to x (more info)
minLength x	For strings, the number of characters must be greater than or equal to x (more info)
pattern regexp	The lexical representation of the value must match the regular expression, regexp (more info)
totalDigits x	Number can be expressed in x characters (more info)
fractionDigits x	Part of the number to the right of the decimal place can be expressed in x characters (more info)

Demonstration

- We’ll use Protégé OWL v4.3 to implement a tiny ontology for people
- Start by downloading and installing Protégé 4.3
  - You will need Java
- You may want to install Graphviz
- Configure Protégé
  - E.g., select a reasoner to use (e.g., HermiT or Pellet)

Protégé OWL v 4.3



untitled-ontology-40 (http://www.semanticweb.org/ontologies/2014/3/untitled-ontology-40) : [http://www.semanticweb.o...

Ontology header:

Ontology IRI: http://www.semanticweb.org/ontologies/2014/3/untitled-ontology-40

Ontology Version IRI: e.g. http://www.semanticweb.org/ontologies/2014/3/untitled-ontology-40/1.0.0

Imported ontologies:

To use the reasoner click Reasoner->Start reasoner

☑ Show Inferences

A basic workflow

- Think about usecases
- Preliminaries
  - Choose namespace URL, import other ontologies used
- Identify and define classes
  - Place in hierarchy, add axioms and run reasoner to check for errors or omissions
- Identify and define properties
  - Place in hierarchy, add axioms, run reasoner
- Add individuals & reasoner to check for problems
- Add comments and labels
- Export in desired formats, maybe upload to Web

More workflow steps

- Use OOPS to find common ontology pitfalls
- Link concepts (and individuals) to common ontologies (e.g., Dbpeia, foaf)
- Generate visualizations
- Produce documentation
- Develop examples with your use case(s)
- Encode data, describe in VoID (Vocabulary of Interlinked Datasets), add to LOD cloud

Demonstration

Use Protégé OWL (v4.3) to build a simple ontology for people based on the following

- People have just one sex that's either *male* or *female*, an integer age, and two parents, one male, one female
- A person's grandparent is the parent of their parent
- Every person is either a man or a woman but not both
- A man is defined as any person whose sex is male and a woman as any person whose sex is female
- A boy is defined as a person whose sex is male and whose age is less than 18, a girl is …
- A person is either an adult or (age >18), minor (age <18)

Test cases

AllDifferent people

Alice F

Bob M

Carol F

Don M

Edith F

Pat ?

Other people

Frank M

Gwen F

Some possible test cases

- Alice parent Bob . Bob parent Carol
  - Alice grandparent Carol
- Alice parent Bob . Alice parent Don.
  - Contradiction
- Alice parent Bob . Pat parent Bob
  - Pat a female
- Alice parent Bob . Gwen parent Bob .
  - Alice owl:sameAs Gwen