RDF Validation - RDF(s)/OWL/SHACL

8th tutorial

Ontologies and Semantic Web

Michal Med

michal.med@fel.cvut.cz

RDF(S) reasoning

- Create new repository in GraphDB with Ruleset OWL-Max

- Insert following snippet:

```
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .

@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

@prefix : <http://onto.fel.cvut.cz/ontologies/__username__/>.

:John :hasWife :Sue .

:John a :Man .

:hasWife rdfs:domain :MarriedMan ;

        rdfs:range :MarriedWoman ;

        rdfs:subPropertyOf :hasRelative .
```

RDF(S) reasoning

- Check if John is a :MarriedMan using ASK statement

```
ASK { :John a :MarriedMan}
```

YES

RDF(S) entailment

Check what new information about John and Sue were inferred. Which were got by RDFS entailment? Check https://cw.fel.cvut.cz/wiki/_media/courses/b4m36osw/lecture-02-rdf-s.pdf

	subject	predicate	object	context
1	:John	:hasRelative	:Sue	http://www.ontotext.com/implicit
2	:John	:hasWife	:Sue	http://www.ontotext.com/explicit
3	:John	rdf:type	:Man	http://www.ontotext.com/explicit
4	:John	rdf:type	:MarriedMan	http://www.ontotext.com/implicit

	subject	predicate	object	context
1	:Sue	rdf:type	:MarriedWoman	http://www.ontotext.com/implicit

Validation problem

- How to ensure that John has ONLY ONE wife?
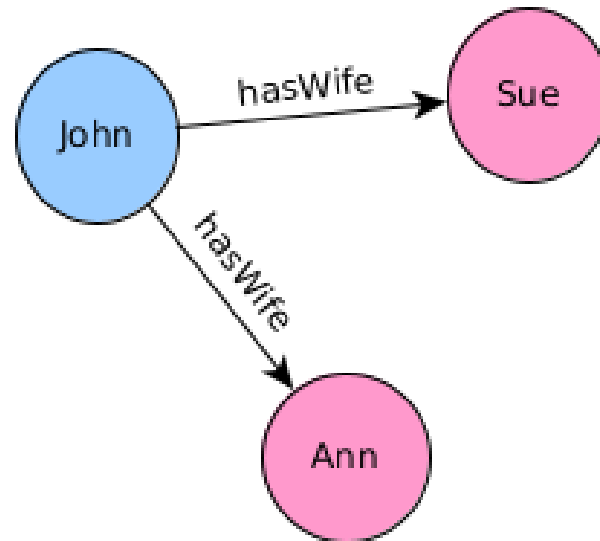
How to make this in OWL?

Create validation rules in OWL

- Download osw8.owl and open it in protége.

- Create new class "Camping in a tent", requiring usage of exactly one tent for overnight stay.

- Create two instances of a tent and two instances of a "Camping in a tent". Make one instance using both tents and other instance no tent. Run reasoner.

# Problems with validation through OWL

What happened?

- Reasoner sees the rule that

  'probíhá s použitím přístřešku' exactly 1 Stan

but sees two instances of "Tent". Based on the rule it expects the tents must be one tent using two various resources. Reasoner creates owl:sameAs relation between the tents.

Try to state that both tents are different individuals – there will be an error in reasoner.

Problems with validation through OWL
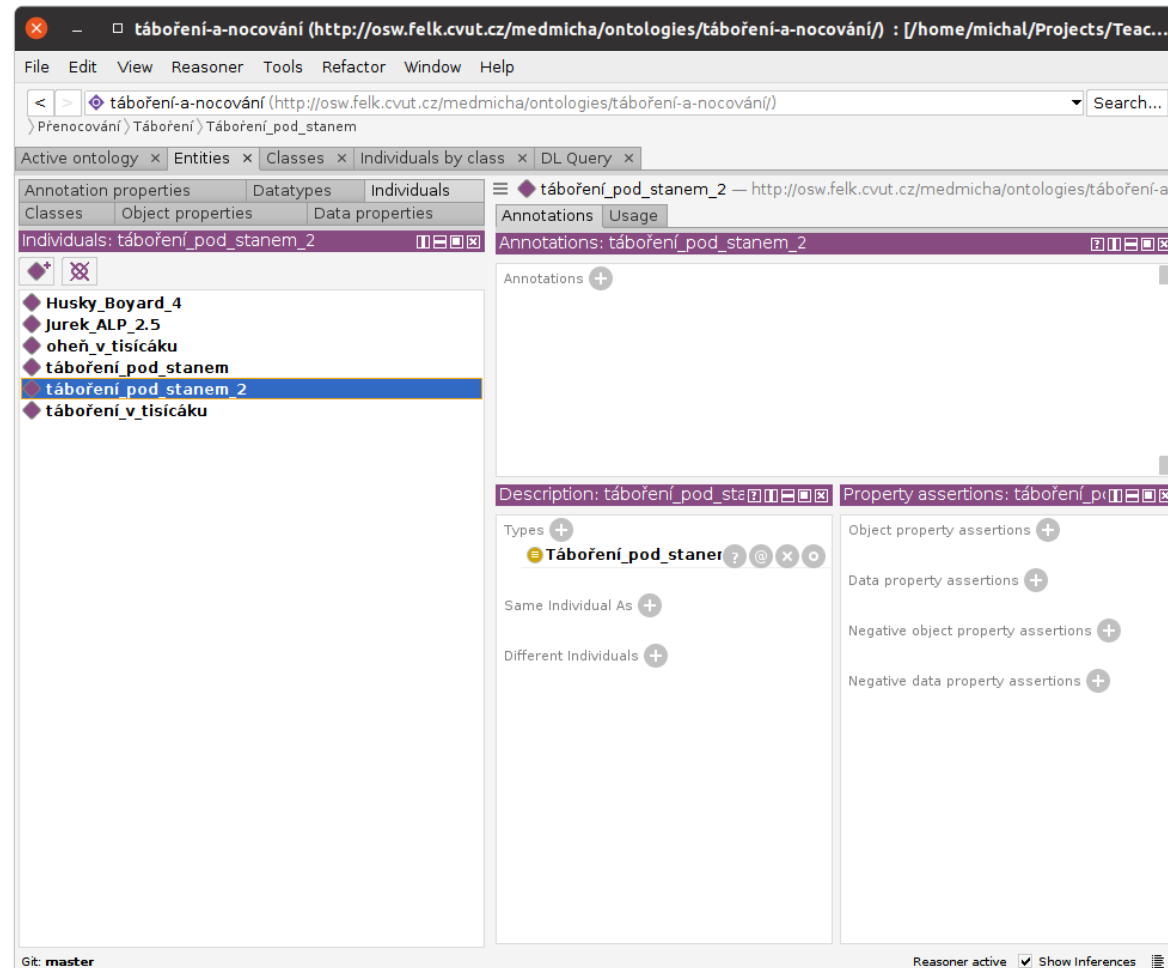
Why is there no error?

- Reasoner sees the rule that

  'probíhá s použitím přístřešku' exactly 1 Stan

and uses OWA to expect, that given this rule, there must be at exactly one tent used, otherwise it could not be "Camping in a tent", so tableau creates anonymous instance of Tent and assignes it to this particular camping.

How to check if data are valid?

Use SHACL

What is SHACL

- Shapes Constraint Language

- W3C recommendation

- https://www.w3.org/TR/shacl/

- http://shacl.org/playground/

Playground

- Open http://shacl.org/playground/ and insert following shape:

```
:MarriedManShape a sh:NodeShape ;
        sh:targetClass :MarriedMan ;
        sh:property [
                sh:path :hasWife ;
                sh:minCount 1 ;
                sh:maxCount 1 ;
        ] .
```

Playground

- Try to validate this snippet:

```
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .

@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

@prefix : <http://onto.fel.cvut.cz/ontologies/medmicha/>.



:John :hasWife :Sue .

:John :hasWife :Ann .

:John a :Man .

:hasWife rdfs:domain :MarriedMan ;

                    rdfs:range :MarriedWoman ;

                    rdfs:subPropertyOf :hasRelative .
```
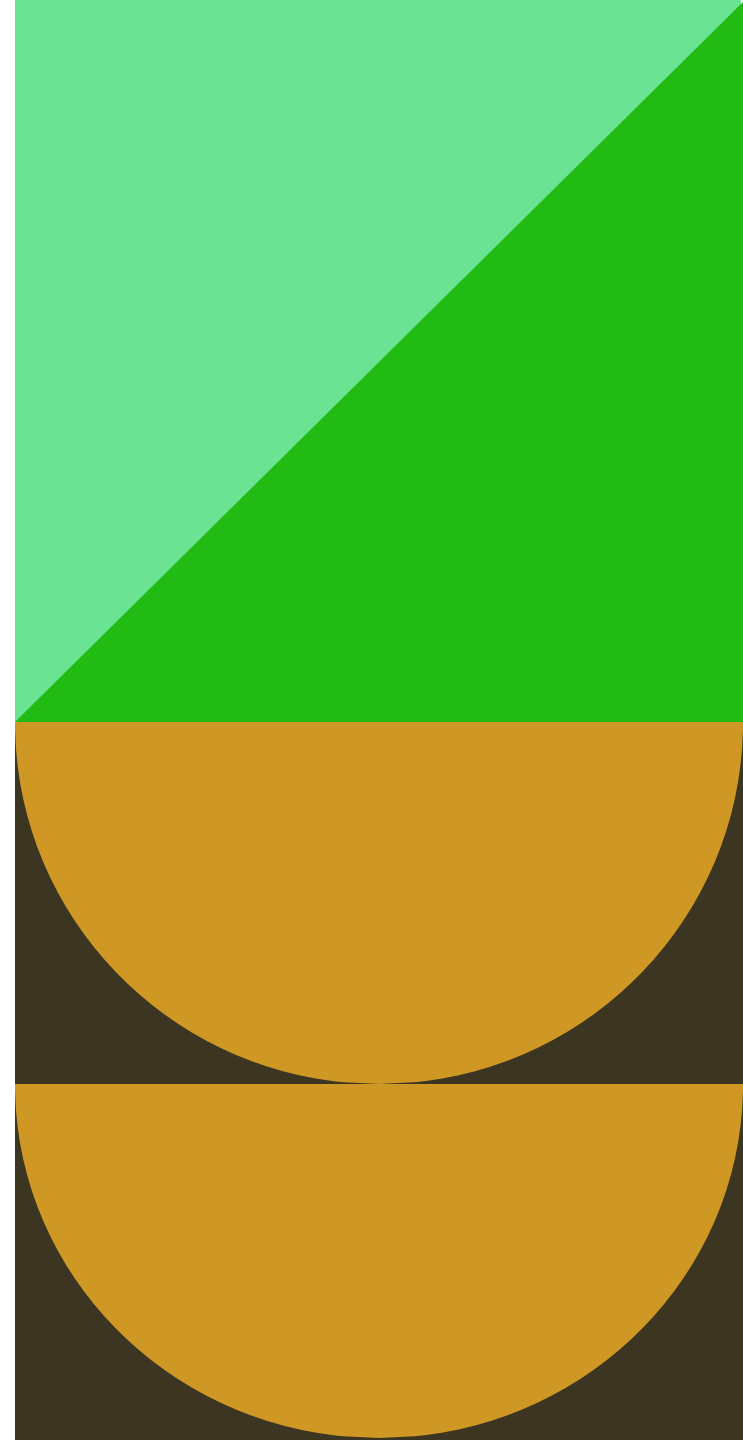
Why is it valid?

SHACL in protégé

- Install SHACL plugin

- Restart protégé

- Window -> Tabs -> SHACL editor

SHACL in protégé

- Write a SHACL shape rule to check that every "Camping in a tent" has exactly one used "Tent".

- Check what happens for the two instances of "Camping in a tent" created before.

SHACL in protégé

```
@prefix sh:      <http://www.w3.org/ns/shacl#> .

@prefix ex:      <http://www.example.org/#> .

@prefix :        <http://osw.felk.cvut.cz/medmicha/ontologies/táboření-a-nocování/>


ex:CampingShape

    a sh:NodeShape ;

    sh:targetClass :Táboření_pod_stanem ;

    sh:property [

        sh:path :probíhá_s_použitím_přístřešku ;

        sh:maxCount 1 ;

        sh:minCount 1 ;

    ] .
```

Data validation in GraphDB

- GraphDB allows validation of data using SHACL under following conditions:

  Create a repository with *Supports SHACL validation* option on

  Import shapes as data into the repository

  SHACL rules must be imported into named graph http://rdf4j.org/schema/rdf4j#SHACLShapeGraph

  Other imported data re tested during import and ARE NOT imported if not valid.

  Details and list of supported SHACL features:

  https://graphdb.ontotext.com/documentation/9.3/standard/shacl-validation.html