OWL
Web Ontology Language
(*part 2*)

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Notes from "Semantic Web for the Working Ontologist" Book

Restriction

- Defining classes in terms of other classes
- A Class defined by describing the individuals it contains
  - a description of its members in terms of existing properties and classes.
- owl:Restriction
- owl:Restriction **rdfs:subClassOf owl:Class**

Example

- property orbitsAround
- restrict the value of orbitsAround such that its object must be TheSun
  - The class of all things that orbit around the sun (i.e., our solar system)

Kinds of restrictions

- owl:allValuesFrom
- owl:someValuesFrom
- owl:hasValue

Restriction syntax

- [a **owl:Restriction**;
     owl:onProperty P;
     owl:someValuesFrom C]

(or owl:allValuesFrom or owl:hasValue C)

- Blank node […]
  - Unnamed class

Example

- Ex: AllStarPlayer, "*All individuals for which at least one value of the property playsFor comes from the class AllStarTeam.*"
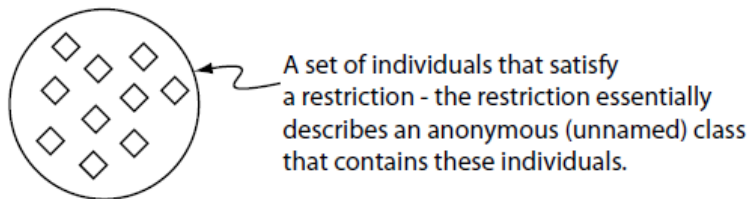
    [a owl:Restriction;
          owl:onProperty :playsFor;
          owl:someValuesFrom :AllStarTeam]

- if an individual actually has some value from the class AllStarTeam for the property playsFor, then it is a member of this restriction class (unnamed).
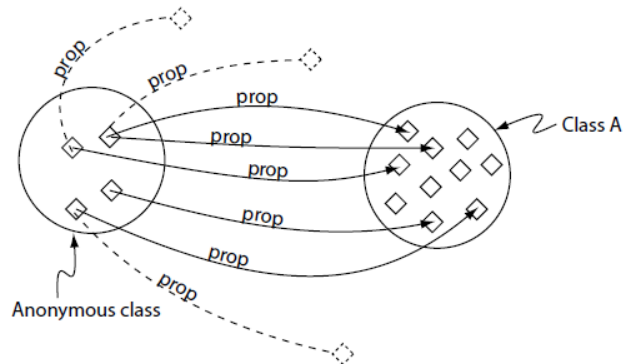
Using restriction classes

- :C **owl:equivalentClass**
      [a owl:Restriction;
              owl:onProperty prop;
              owl:hasValue V;
      ].
- :C **rdfs:subClassOf**
      [a owl:Restriction;
              owl:onProperty prop;
              owl:hasValue V;
      ].
- :a **rdf:type**
      [a owl:Restriction;
              owl:onProperty prop;
              owl:hasValue V;
      ].

Restriction

A set of individuals that satisfy
a restriction - the restriction essentially
describes an anonymous (unnamed) class
that contains these individuals.

owl:someValuesFrom

- [a **owl:Restriction**;
   **owl:onProperty** prop;
    owl:someValuesFrom A]

owl:someValuesFrom

- The existential restriction does not constrain the prop relationship to members of the class ClassA, it just states that **every individual must have at least one prop relationship with a member of ClassA**
    - this is the open world assumption (OWA).

owl:allValuesFrom

- [a **owl:Restriction**;
  owl:onProperty prop;
  owl:allValuesFrom A]

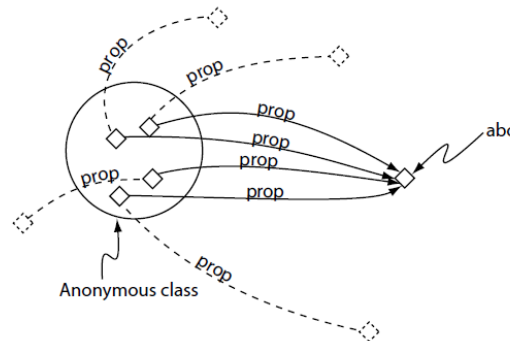Anonymous class / prop / prop / prop / prop / Class A
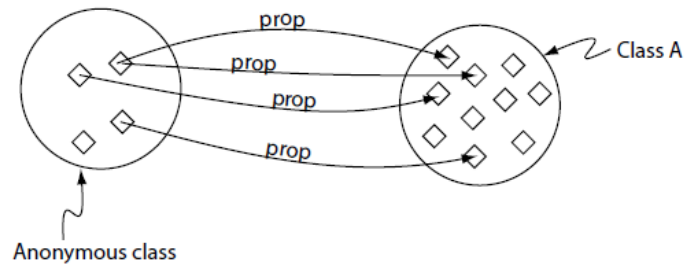
owl:allValuesFrom

- Universal restrictions do not `guarentee' the existence of a relationship for a given property. They merely state that **if such a relationship for the given property exists, then it must be with an individual that is a member of a specied class.**

owl:hasValue

- [a **owl:Restriction**;
 **owl:onProperty** prop;
  owl:hasValue A]

owl:hasValue

- This restriction describes the anonymous class of individuals that have at least one relationship along the prop property to the specific individual abc.

- For a given individual the hasValue restriction does not constrain the property used in the restriction to a relationship with the individual used in the restriction i.e. there could be other relationships along the prop property.
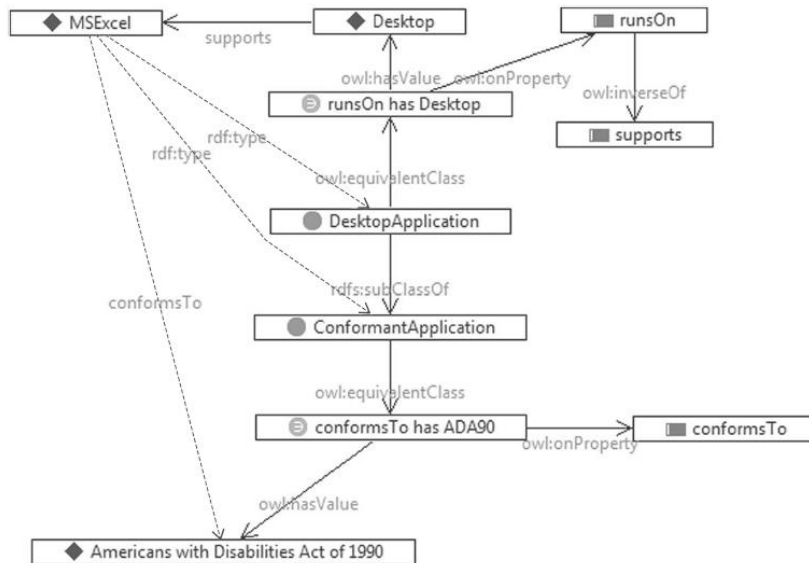
Inferencing

- :**Vegetarian** rdfs:subClassOf
    [a owl:Restriction;
        owl:onProperty :eats;
        owl:allValuesFrom :VegetarianFood].
- :Jen a :Vegetarian.
- => *:Jen a [a owl:Restriction;
        owl:onProperty :eats;
        owl:allValuesFrom :VegetarianFood].*
- :Jen :eats :Marzipan.
- => *:Marzipan a:VegetarianFood.*

Example
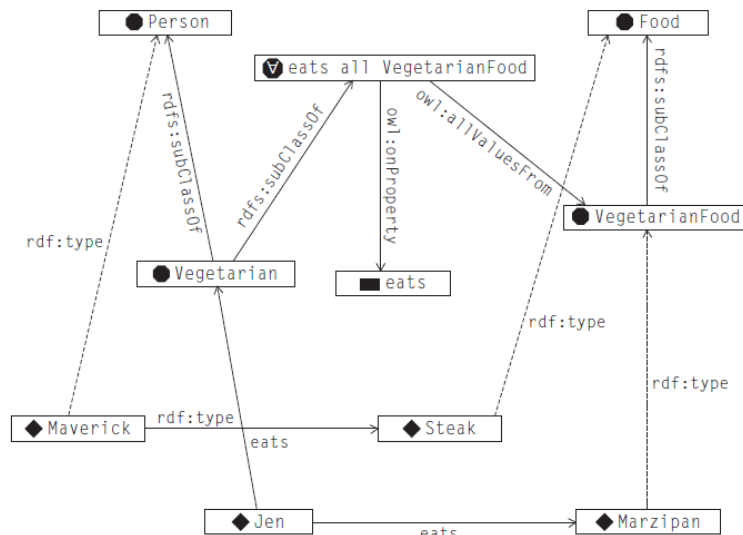
Another example

Union and Instersection

- U1 a owl:Class;
  owl:unionOf (ns:A ns:B...).
- I1 a owl:Class;
  owl:intersectionOf (ns:A ns:B...).

Example

- bb:MajorLeagueBaseballPlayer
    owl:equivalentClass
    [a owl:Class;
            owl:intersectionOf
            (bb:MajorLeagueMember
              bb:Player
              bb:BaseballEmployee)
        ].

Example

- :SolarPlanet a owl:Class;
    owl:intersectionOf
    (:Planet
      [a owl:Restriction;
            owl:onProperty :orbits;
            owl:hasValue :TheSun
        ]
).

Example

- :MajorLeagueBaseballPlayer a owl:Class;
    owl:intersectionOf
     (:BaseballPlayer
       [a owl:Restriction;
            owl:onProperty :playsFor;
    owl:someValuesFrom :MajorLeagueTeam
       ]
).

Enumeration

- owl:oneOf
- ss:SolarPlanet rdf:type owl:Class;
    owl:oneOf
      (ss:Mercury ss:Venus ss:Earth ss:Mars
        ss:Jupiter ss:Saturn ss:Uranus
        ss:Neptune).
- Restriction on open world assumption

Differentiation

- owl:differentFrom
- ss:Earth owl:differentFrom ss:Mars.

Example

- :JamesDeanMovie a owl:Class;
    owl:oneOf (:Giant :EastOfEden :Rebel).
- :RimbaudsMovie rdf:type :JamesDeanMovie.

⟹:RimbaudsMovie is one of the 3, but which one?

- :RimbaudsMovie **owl:differentFrom** :Giant.
- :RimbaudsMovie **owl:differentFrom** :EastOfEden.

=> *:RimbaudsMovie* **owl:sameAs** *:Rebel.*

Differentiating multiple individuals

- [a **owl:AllDifferent**;
    owl:distinctMembers
        (ss:Mercury ss:Venus ss:Earth
          ss:Mars ss:Jupiter ss:Saturn
          ss:Uranus ss:Neptune)
  ].

Cardinality

- [a owl:Restriction;
    owl:onProperty :hasPlayer;
    owl:cardinality 9]
- [a owl:Restriction;
    owl:onProperty :hasPlayer;
    owl:minCardinality 10]
- [a owl:Restriction;
    owl:onProperty :hasPlayer;
    owl:maxCardinality 2]

Set complement

- ex:ClassA **owl:complementOf** ex:ClassB.
  - The complement of a class is another class whose members are all the things not in the complemented class.
- bb:MinorLeaguePlayer owl:complementOf bb:MajorLeaguePlayer.
  - Wrong; bb:MinorLeaguePlayer includes everything
- bb:MinorLeaguePlayer owl:intersectionOf
      ([a owl:Class;
              owl:complementOf bb:MajorLeaguePlayer]
      bb:Player).

Disjoint sets

- :A owl:disjointWith :B
  - two sets have no individual in common