

ADM PROJECT PART III

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Part 1

Model in RDFS/OWL the main classes and the main properties modeled as entities and associations in the conceptual schema designed in PART II.

@prefix owl: <http://example.org/#> .

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

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

@prefix xsd: <http://prova.org/#> .

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

ex:Department rdf:type rdfs:Class .

ex:Device rdf:type rdfs:Class .

ex:Sensor rdf:type rdfs:Class .

ex:Room rdf:type rdfs:Class .

ex:install rdf:type owl:ObjectProperty .

ex:install rdfs:domain ex:Department .

ex:install rdfs:range ex:Device .

ex:installedIn rdf:type owl:ObjectProperty .

ex:installedIn rdfs:domain ex:Device .

ex:installedIn rdfs:range ex:Department .

ex:install owl:inverseOf ex:installedIn .

ex:equip rdf:type owl:ObjectProperty .

ex:equip rdfs:domain ex:Device .
ex:equip rdfs:range ex:Sensor .
ex:equippedOn rdf:type owl:ObjectProperty .
ex:equippedOn rdfs:domain ex:Sensor .
ex:equippedOn rdfs:range ex:Device .
ex:equippedOn owl:inverseOf ex:equipped .

ex:containedIn rdf:type owl:ObjectProperty .
ex:containedIn rdfs:domain ex:Sensor .
ex:containedIn rdfs:range ex:Room .
ex:contain rdf:type owl:ObjectProperty .
ex:contain rdfs:domain ex:Room .
ex:contain rdfs:range ex:Sensor .
ex:contain owl:inverseOf ex:containedIn .

ex:has rdf:type owl:ObjectProperty .
ex:has rdfs:domain ex:Department .
ex:has rdfs:range ex:Room .
ex:isSituating rdf:type owl:ObjectProperty .
ex:isSituating rdfs:domain ex:Room .
ex:isSituating rdfs:range ex:Department .
ex:has owl:inverseOf ex:isSituating .

ex:Department owl:disjointWith ex:Device .
ex:Department owl:disjointWith ex:Sensor .
ex:Department owl:disjointWith ex:Room .
ex:Device owl:disjointWith ex:Sensor .
ex:Device owl:disjointWith ex:Room .

ex:Sensor owl:disjoinWith ex:Room .

ex:name rdf:type owl:DatatypeProperty .

ex:name rdfs:domain ex:Department .

ex:name rdfs:range xsd:string .

ex:name rdf:type owl:FunctionalProperty .

ex:locality rdf:type owl:DatatypeProperty .

ex:locality rdfs:domain ex:Department .

ex:locality rdfs:range xsd:string .

ex:name rdf:type owl:FunctionalProperty .

_:a rdfs:subClassOf owl:Restriction .

_:a owl:onProperty ex:name .

_:a owl:minCardinality 1 .

ex:Department rdfs:subClassOf _:a .

_:b rdfs:subClassOf owl:Restriction .

_:b owl:onProperty ex:install .

_:b owl:minCardinality 1 .

_:b owl:maxCardinality 1 .

ex:Department rdfs:subClassOf _:b .

ex:id_device rdf:type owl:DatatypeProperty .

ex:id_device rdfs:domain ex:Device .

ex:id_device rdfs:range xsd:int .

ex:id_device rdf:type owl:FunctionalProperty .

ex:type rdf:type owl:DatatypeProperty .

ex:type rdfs:domain ex:Device .

ex:type rdfs:range xsd:string .

ex:type rdf:type owl:FunctionalProperty .

_:c rdfs:subClassOf owl:Restriction .

_:c owl:onProperty ex:id_device .

_:c owl:minCardinality 1.

ex:Device rdfs:subClassOf _:c .

_:d rdfs:subClassOf owl:Restriction .

_:d owl:onProperty ex:installedIn .

_:d owl:minCardinality 1.

_:d owl:maxCardinality 1.

ex:Device rdfs:subClassOf _:d .

_:e rdfs:subClassOf owl:Restriction .

_:e owl:onProperty ex:equip .

_:e owl:minCardinality 1.

ex:Device rdfs:subClassOf _:e .

ex:id_sensor rdf:type owl:DatatypeProperty .

ex:id_sensor rdfs:domain ex:Sensor .

ex:id_sensor rdfs:range xsd:float .
ex:id_sensor rdf:type owl:FunctionalProperty .

ex:date_time rdfs:type owl:DatatypeProperty .
ex:date_time rdfs:domain ex:Sensor .
ex:date_time rdfs:range xsd:timestamp .
ex:date_time rdf:type owl:FunctionalProperty .

ex:temperature rdfs:type owl:DatatypeProperty .
ex:temperature rdfs:domain ex:Sensor .
ex:temperature rdfs:range xsd:float .
ex:temperature rdf:type owl:FunctionalProperty .

ex:pressure rdfs:type owl:DatatypeProperty .
ex:pressure rdfs:domain ex:Sensor .
ex:pressure rdfs:range xsd:float .
ex:pressure rdf:type owl:FunctionalProperty .

ex:humidity rdfs:type owl:DatatypeProperty .
ex:humidity rdfs:domain ex:Sensor .
ex:humidity rdfs:range xsd:int .
ex:humidity rdf:type owl:FunctionalProperty .

_:f rdfs:subClassOf owl:Restriction .
_:f owl:onProperty ex:id_sensor .
_:f owl:minCardinality 1.

_:g rdfs:subClassOf owl:Restriction .

_:g owl:onProperty ex:date_time .

_:g owl:minCardinality 1.

ex:Sensor rdfs:subClassOf _:f .

ex:Sensor rdfs:subClassOf _:g .

_:h rdfs:subClassOf owl:Restriction .

_:h owl:onProperty ex:equippedOn .

_:h owl:minCardinality 1.

_:h owl:maxCardinality 1.

ex:Sensor rdfs:subClassOf _:h .

ex:number rdf:type owl:DatatypeProperty .

ex:number rdfs:domain ex:Room .

ex:number rdfs:range xsd:int .

ex:number rdf:type owl:FunctionalProperty .

_:i rdfs:subClassOf owl:Restriction .

_:i owl:onProperty ex:number .

_:i owl:minCardinality 1.

ex:Sensor rdfs:subClassOf _:i .

_:l rdfs:subClassOf owl:Restriction .

_:l owl:onProperty ex:contain .

_:l owl:minCardinality 1 .

_:l owl:maxCardinality 1 .

ex:Room rdfs:subClassOf _:l .

_:m rdfs:subClassOf owl:Restriction .

_:m owl:onProperty ex:containedIn .

_:m owl:minCardinality 1 .

_:m owl:maxCardinality 1 .

ex:Sensor rdfs:subClassOf _:m .

_:n rdfs:subClassOf owl:Restriction .

_:n owl:onProperty ex:has .

_:n owl:minCardinality 1 .

ex:Department rdfs:subClassOf _:n .

_:o rdfs:subClassOf owl:Restriction .

_:o owl:onProperty ex:isSituating .

_:o owl:minCardinality 1 .

_:o owl:maxCardinality 1 .

ex:Room rdfs:subClassOf _:o .

Part 2

Model in RDF few instances among those used in PART II to populate your schema.

ex:DIME rdf:type ex:Department .

ex:DIME ex:name "DIME" .

ex:DIME ex:locality "Albaro" .

ex:DIME ex:install ex:Arduino .

ex:DIME ex:has ex:Room503 .

ex:Arduino rdf:type ex:Device .

ex:Arduino ex:id_device 5 .

ex:Arduino ex:type "Arduino" .

ex:Arduino ex:equip ex:Sensor5.

ex:DIME ex:installedIn ex:DIME .

ex:Sensor5 rdf:type ex:Sensor .

ex:Sensor5 ex:id_sensor 5.3 .

ex:Sensor5 ex:date_time 1643548195.

ex:Sensor5 ex:temperature 21.852694530501584 .

ex:Sensor5 ex:humidity 62 .

ex:Sensor5 ex:pressure 1013.4323456755068 .

ex:Sensor5 ex:containedIn ex:Room503 .

ex:Sensor5 ex:equippedOn ex:Arduino .

ex:Room503 rdf:type ex:Room .

ex:Room503 ex:number 503 .

ex:Room503 ex:contain ex:Sensor5 .
ex:Room503 ex:isSituating ex:DIME .

ex:DIBRIS rdf:type ex:Department .
ex:DIBRIS ex:name "DIBRIS" .
ex:DIBRIS ex:locality "San Martino" .
ex:DIBRIS ex:install ex:RaspberryPi4 .
ex:DIBRIS ex:has ex:Room402 .

ex:RaspberryPi4 rdf:type ex:Device .
ex:RaspberryPi4 ex:id_device 4 .
ex:RaspberryPi4 ex:type "RaspberryPi" .
ex:RaspberryPi4 ex:equip ex:Sensor4 .
ex:RaspberryPi4 ex:installedIn ex:DIBRIS .

ex:Sensor4 rdf:type ex:Sensor .
ex:Sensor4 ex:id_sensor 4.2 .
ex:Sensor4 ex:date_time 1643548195 .
ex:Sensor4 ex:temperature 19.80245810383065 .
ex:Sensor4 ex:humidity 53 .
ex:Sensor4 ex:pressure 1013.3321258503087 .
ex:Sensor4 ex:containedIn ex:Room402 .
ex:Sensor4 ex:equippedOn ex:RaspberryPi4 .

ex:Room402 rdf:type ex:Room .
ex:Room402 ex:number 402 .
ex:Room402 ex:contain ex:Sensor4 .
ex:Room402 ex:isSituating ex:DIBRIS .

ex:DIMA rdf:type ex:Department .
ex:DIMA ex:name "DIMA" .
ex:DIMA ex:locality "San Martino" .
ex:DIMA ex:install ex:RaspberryPi2.
ex:DIMA ex:has ex:Room201 .

ex:RaspberryPi2 rdf:type ex:Device .
ex:RaspberryPi2 ex:id_device 2 .
ex:RaspberryPi2 ex:type "RaspberryPi" .
ex:RaspberryPi2 ex:equip ex:Sensor2 .
ex:RaspberryPi2 ex:installedIn ex:DIMA .

ex:Sensor2 rdf:type ex:Sensor .
ex:Sensor2 ex:id_sensor 2.1 .
ex:Sensor2 ex:time 1643548195.
ex:Sensor2 ex:temperature 21.04141394078114 .
ex:Sensor2 ex:humidity 30 .
ex:Sensor2 ex:pressure 1013.5922680083936 .
ex:Sensor2 ex:containedIn ex:Room201 .
ex:Sensor2 ex:equippedOn ex:RaspberryPi2 .

ex:Room201 rdf:type ex:Room .
ex:Room201 ex:number 201 .
ex:Room201 ex:contain ex:Sensor2 .
ex:Room201 ex:isSituaded ex:DIMA .

ex:DIME owl:differentFrom ex:DIBRIS .

ex:DIME owl:differentFrom ex:DIMA .

ex:DIBRIS owl:differentFrom ex:DIMA .

ex:Arduino owl:differentFrom ex:RaspberryPi4 .

ex:Arduino owl:differentFrom ex:RaspberryPi2 .

ex:RaspberryPi4 owl:differentFrom ex:RaspberryPi2 .

ex:Sensor5 owl:differentFrom ex:Sensor4 .

ex:Sensor5 owl:differentFrom ex:Sensor2 .

ex:Sensor4 owl:differentFrom ex:Sensor2 .

ex:Room201 owl:differentFrom ex:Room402 .

ex:Room201 owl:differentFrom ex:Room503 .

ex:Room402 owl:differentFrom ex:Room503 .

Part 3

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

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

PREFIX owl: <http://example.org/#>

PREFIX xsd: <http://prova.org/#>

PREFIX ex: <http://www.aulaweb.org/#>

1. Retrieve the temperature, the humidity and the pressure acquired by the sensors in date timestamp 1643548195. (equals to query number 7 in PART II)

```

SELECT ?temperature ?humidity ?pressure
WHERE {
    ?sensor rdf:type ex:Sensor .
    ?sensor ex:temperature ?temperature .
    ?sensor ex:humidity ?humidity .
    ?sensor ex:pressure ?pressure .
    ?sensor ex:date_time ?time .
    FILTER (?time = 1643548195) .
}

```

Result

```

1  -----
2  | temperature          | humidity | pressure          |
3  =====
4  | 19.80245810383065   | 53       | 1013.3321258503087 |
5  | 21.852694530501584 | 62       | 1013.4323456755068 |
6  -----

```

2. Retrieve the name of the departments which have devices of type 'RaspberryPi' or 'Arduino'. (similar to query 4 in PART II)

```

SELECT ?name_dep
WHERE {
    ?dep rdf:type ex:Department .
    ?dep ex:name ?name_dep .
    ?dep ex:install ?device .
    ?device ex:type ?t .
}

```

```

    FILTER(?t = "Arduino" || ?t = "RaspberryPi")
}

```

Result

```

1  -----
2  | name_dep |
3  =====
4  | "DIME"   |
5  | "DIMA"   |
6  | "DIBRIS" |
7  -----

```

3. Retrieve all the departments that have installed a device of type “Arduino” and all the rooms that contain sensor equipped on device of type “Arduino”.

```

SELECT ?name_dep ?nbRoom
WHERE {
    {
        ?dep rdf:type ex:Department .
        ?dep ex:install ?device .
        ?device ex:type "RaspberryPi" .
        ?dep ex:name ?name_dep .
    }
    UNION
    {

```

```

?room rdf:type ex:Room .
?room ex:contain ?sensor .
?sensor rdf:type ex:Sensor .
?sensor ex:equippedOn ?device .
?device ex:type "RaspberryPi" .
?room ex:number ?nbRoom .
}
}

```

Result

```

1  -----
2  | name_dep | nbRoom |
3  =====
4  | "DIMA"   |        |
5  | "DIBRIS" |        |
6  |          | 201    |
7  |          | 402    |
8  -----

```

4. Retrieve the number of the rooms that are situated in departments which locality is not 'Albaro'

```
SELECT ?nbRoom
```

```
WHERE {
```

```
    ?room rdf:type ex:Room .
```

```
    ?room ex:number ?nbRoom .
```

```
    ?room ex:isSituaded ?dep .
```

```
    MINUS{?dep ex:locality 'Albaro'}
```

```
}
```

Result

```
1  -----
2  | nbRoom |
3  =====
4  | 201    |
5  | 402    |
6  -----
```

5. Retrieve an RDF graph containing all the rooms with the id of the sensor contained in each of them.

CONSTRUCT

```
{ ?s rdf:type ex:Room .
  ?c ex:id_sensor ?id .}
```

WHERE



```
{ ?s rdf:type ex:Room .
  ?s ex:contain ?c .
  ?c ex:id_sensor ?id .
}
```


Result


```
1 (graph
2   (triple ex:Sensor2 ex:id_sensor 2.1)
3   (triple ex:Room402 rdf:type ex:Room)
4   (triple ex:Room503 rdf:type ex:Room)
5   (triple ex:Sensor5 ex:id_sensor 5.3)
6   (triple ex:Room201 rdf:type ex:Room)
7   (triple ex:Sensor4 ex:id_sensor 4.2)
8 )
```

Part 4

I checked both sparql queries and RDF dataset on RDF playground, all correct from a syntactical view point.

 **RDF Playground** 

 CORRECT SYNTAX

 PREFIX LOOKUP

SEE THE GRAPH AS:

TEXT

GRAPH

BROWSE

```
Describe a graph here using Turtle (ttl)
267 ex:DIBRIS owl:differentFrom ex:DIMA .
268
269 ex:Arduino owl:differentFrom ex:RaspberryPi4 .
270 ex:Arduino owl:differentFrom ex:RaspberryPi2 .
271 ex:RaspberryPi4 owl:differentFrom ex:RaspberryPi2 .
272
273 ex:Sensor5 owl:differentFrom ex:Sensor4 .
274 ex:Sensor5 owl:differentFrom ex:Sensor2 .
275 ex:Sensor4 owl:differentFrom ex:Sensor2 .
276
277 ex:Room201 owl:differentFrom ex:Room402 .
278 ex:Room201 owl:differentFrom ex:Room503 .
279 ex:Room402 owl:differentFrom ex:Room503 .
280
281
```

7972

SPARQL

OWL

SHACL

SHEX

Query your graph...

1 PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
2 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
3 PREFIX owl: <http://example.org/#>
4 PREFIX xsd: <http://prova.org/#>
5 PREFIX ex: <http://www.aulaweb.org/#>
6
7
8
9

SELECT * WHERE {...}

240

SELECT Text

RUN QUERY

RESET