RDF - Serializaciones

Content

- RDF W3C Overview
- The basis of RDF
  - Internationalized Resource Identifier
  - Literals
  - Blank Nodes
- More features of RDF
- RDF Serialisations
  - Turtle
- RDF Vocabularies
- RDF on the Web
- RDF subleties

RDF Serialisations

- Representing graph as linear text (string)
  - E.g., in a file: reading and writing
- Alternative serializations for different needs
  - 1. Intuitive for humans to read/write
    - N-triples, Notation 3
    - Turtle
    - TriG, N-Quads
  - 2. XML-interpretability for machines
    - RDF/XML
    - Existing XML tools available
  - 3. For web programming
    - JSON-LD
  - 4. Embedding in web pages
    - RDFa
    - Publishing information for, e.g., search engines

Format specifications

- RDF 1.1 XML Syntax – W3C Recommendation 25 February 2014
  - https://www.w3.org/TR/rdf-syntax-grammar/RDF 1.1
- N-Triples - A line-based syntax for an RDF graph – W3C Recommendation 25 February 2014
  - https://www.w3.org/TR/n-triples/
- JSON-LD 1.0 - A JSON-based Serialization for Linked Data – W3C Recommendation 16 January 2014
  - https://www.w3.org/TR/json-ld/RDF 1.1
- Turtle Terse RDF Triple Language – W3C Recommendation 25 February 2014
  - https://www.w3.org/TR/turtle/

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Turtle: URI references and triples

Full URIs are surrounded by < and >:

```
<http://dbpedia.org/resource/Oslo>
```

Statements are triples terminated by a period:

```
<http://dbpedia.org/resource/Oslo>
   <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
      <http://dbpedia.org/ontology/Place> .
```

Use 'a' to abbreviate `rdf:type`:

```
<http://dbpedia.org/resource/Oslo>
   a  <http://dbpedia.org/ontology/Place> .
```

Turtle allows any non-zero amount of space between elements in triples.

Turtle: Namespaces

QNames are written without any special characters.

Namespace prefixes are declared with `@prefix`:

```
@prefix dbp: <http://dbpedia.org/resource/> .

dbp:Oslo a <http://dbpedia.org/ontology/Place> .
```

A default namespace may be declared:

```
@prefix dbp: <http://dbpedia.org/resource/> .
@prefix : <http://dbpedia.org/ontology/> .

dbp:Oslo a :Place .
```

Turtle: Literals

Literal values are enclosed in double quotes:

```
@prefix dbp: <http://dbpedia.org/resource/> .
@prefix : <http://dbpedia.org/ontology/> .

dbp:Oslo :officialName "Oslo" .
```

Possibly with type or language information:

```
dbp:Norway rdfs:label "Norge"@no .
dbp:Oslo :population "629313"^^xsd:integer .
```

Numbers and booleans may be written without quotes:

```
dbp:Oslo :population 629313 .
dbp:Oslo :isCapital true .
```

Turtle: Statements sharing elements

Statements may share a subject with ';':

```
dbp:Oslo :officialName "Oslo" ;
         :population 629313 ;
         :leaderName dbp:Fabian_Stang .
```

Statements may share subject and predicate with ',':

```
dbp:Norway rdfs:label "Norway"@en ,
                      "Norwegen"@de ,
                      "Norge"@no .
```

...and in combination:

```
dbp:Norway rdfs:label "Norway"@en, "Norwegen"@de, "Norge"@no ;
           :capital dbp:Oslo .
```

Turtle: Blank nodes

Blank nodes are designated with underscores or `[...]`.

Norway has a capital with population 629313:

```
dbp:Norway :capital _:someplace .
_:someplace :population 629313 .
```

There is a place with official name Oslo:

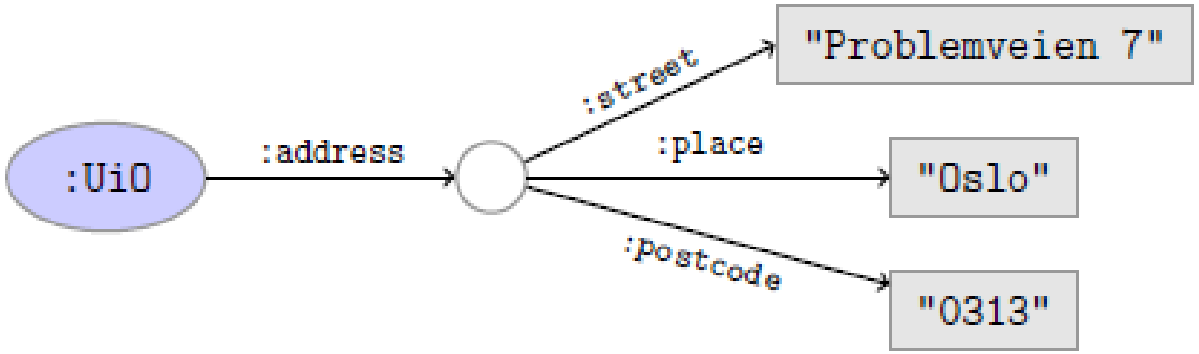
```
[] a :Place ;
   :officialName "Oslo" .
```

UiO has address Problemveien 7, 0313 Oslo:

```
:UiO :address [ :street "Problemveien 7" ;
                :place "Oslo" ;
                :postcode "0313" ] .
```

Question

- The blank node here:



- has no ‘name’
- Why does Turtle use ‘blank node identifiers’ like _:someplace?
- Answer: makes it easy to use same node in several triples.

Turtle: Other things

Use '#' to comment:

```
# This is a comment.
dbp:Oslo a dbpont:Place . # This is another comment.
```

Use '\' to escape special characters:

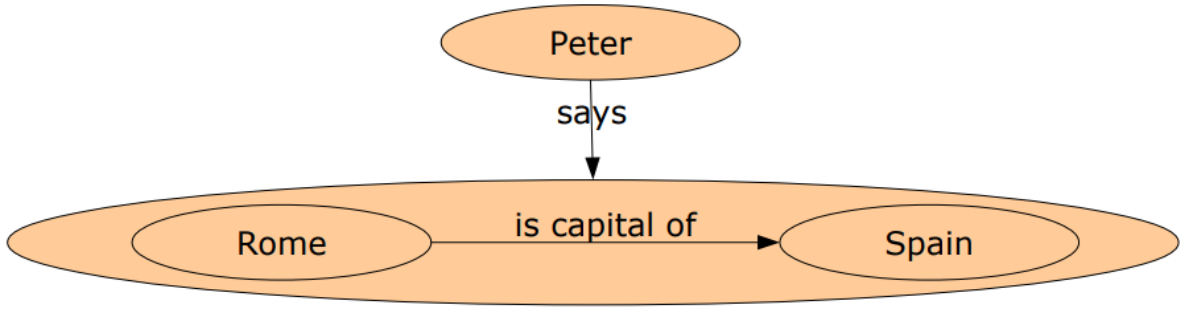
```
:someGuy :foaf:name "James \"Mr. Man\" Olson" .
```

Turtle specification: `http://www.w3.org/TR/turtle/`.

Encoding Reification in Turtle

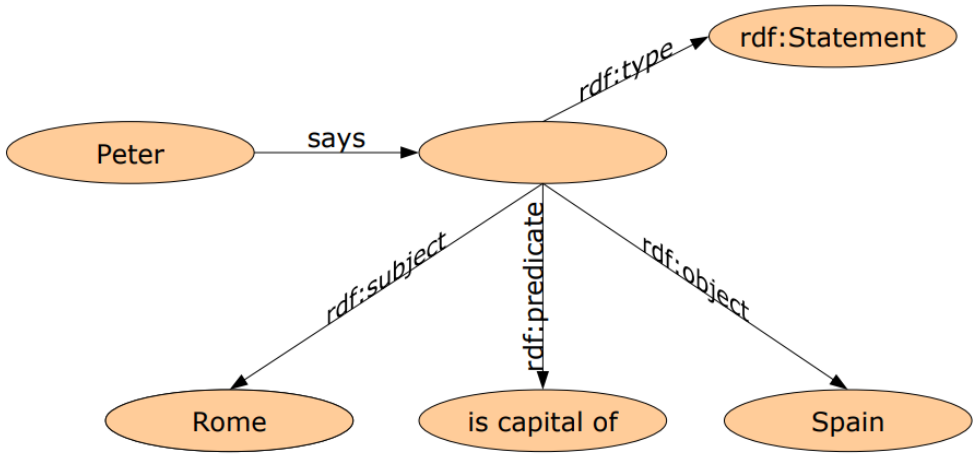
- Variant 1: Named Statement (with URI)

```
:triple1 rdf:type rdf:Statement ;
         rdf:subject :Rome ;
         rdf:predicate :isCapitalOf ;
         rdf:object :Spain .
:Peter :says :triple1 .
```



- Variant 2: Unnamed Statement (Blank Node)

```
:Peter :says [
       a rdf:Statement ;
       rdf:subject :Rome ;
       rdf:predicate :isCapitalOf ;
       rdf:object :Spain .
] .
```



Práctica 8

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RDF Vocabularies

- Families of related notions are grouped into vocabularies.
- Usually the same namespace/prefix is shared.
- Some important, well-known namespaces|and prefixes:
  - rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> - RDF
  - rdfs: <http://www.w3.org/2000/01/rdf-schema#> - RDF Schema
  - foaf: <http://xmlns.com/foaf/0.1/> - Friend of a friend
  - dcterms: <http://purl.org/dc/terms/> - Dublin Core
- Usually, a description is published at the namespace base IRI.
- Note that the prefix is not standardized.
- However, in practice many are.
  - rdf: <http://xmlns.com/foaf/0.1/> would be highly irregular.

Example vocabularies: RDF, RDFS

Some example resources:

RDF: describing RDF graphs.

`rdf:Statement`

`rdf:subject`,
`rdf:predicate`,
`rdf:object`

`rdf:type`

RDFS: describing RDF vocabularies.

`rdfs:Class`

`rdfs:subClassOf`,
`rdfs:subPropertyOf`

`rdfs:domain`,
`rdfs:range`

`rdfs:label`

Examples:

```
dbp:Oslo rdf:type dbp-ont:Place
dbp:Norway rdfs:label "Norge"@no
:Capital rdfs:subClassOf :City
```

Example vocabularies: FOAF, Dublin Core

Some example resources:

FOAF: person data and relations.

`foaf:Person`

`foaf:knows`

`foaf:firstName`,
`foaf:lastName`,
`foaf:gender`

Dublin Core: library metadata.

`dcterms:creator`,
`dcterms:contributor`

`dcterms:format`,
`dcterms:language`,
`dcterms:licence`

Examples:

```
ifi:martingi rdf:type foaf:Person
ifi:martingi foaf:knows ifi:martige
ifi:martingi dcterms:creator :rdf-lecture
```

RDF Vocabularies

- **FOAF Vocabulary Specification 0.99**
  - http://xmlns.com/foaf/spec/
- **Dublin Core Metadata Initiative**
  - http://dublincore.org/documents/dcmi-terms/

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Where is it?

- In files:
  - In some serialisation: XML/RDF, Turtle, . . .
  - Typically small RDF graphs, i.e., max. a few 100 triples, e.g.,
    - Vocabularies: http://xmlns.com/foaf/spec/index.rdf.
    - Tiny datasets: http://folk.uio.no/martingi/foaf.rdf.
- From SPARQL endpoints:
  - Data kept in a triple store, i.e., a database.
  - RDF is served from endpoint as results of SPARQL queries.
  - Exposes data (in different formats)
    - with endpoint frontends, e.g., http://dbpedia.org/resource/Norway, or
    - by direct SPARQL query: http://dbpedia.org/sparql.

Where is it?

There are many RDFizers which convert data to RDF.

W3C keeps a list: http://www.w3.org/wiki/ConverterToRdf.

Publishing RDF on the web

- Make the IRI of your data items dereferencable by using redirects.
- Send the request to a page describing the data item.
- Distinguish the data item IRI from the page that describes it.
  - Example:
    - http://dbpedia.org/resource/Ecuador
    - http://dbpedia.org/data/Ecuador
- Make data available in different formats. Typically:
  - HTML for humans,
  - RDF for computers.
- This is called content negotiation.
- Endpoint frontends will do this for you.

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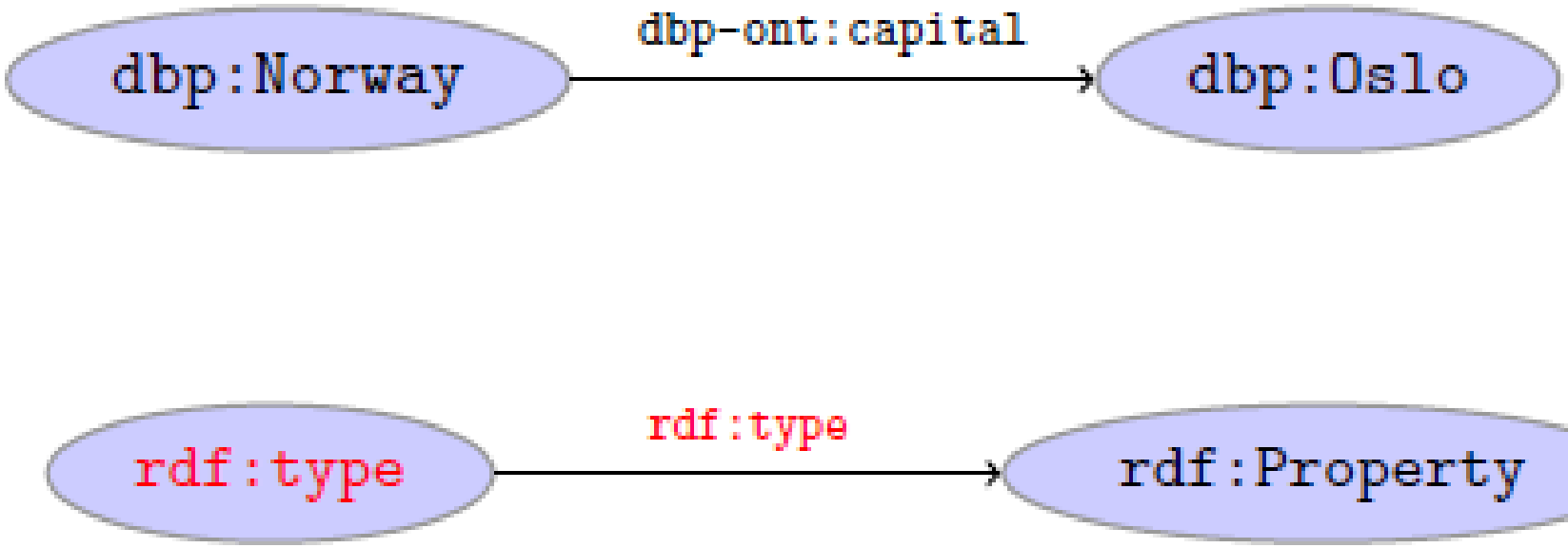
RDF subleties

- RDF graphs are not graphs
- RDF graphs are sets of triples, not graphs.



Be careful when merging RDF files

Merging the two RDF files containing named blank nodes

File 1

```
ifi:martige :owns _:myCar .
_:myCar a  lotus:Esprit .
```

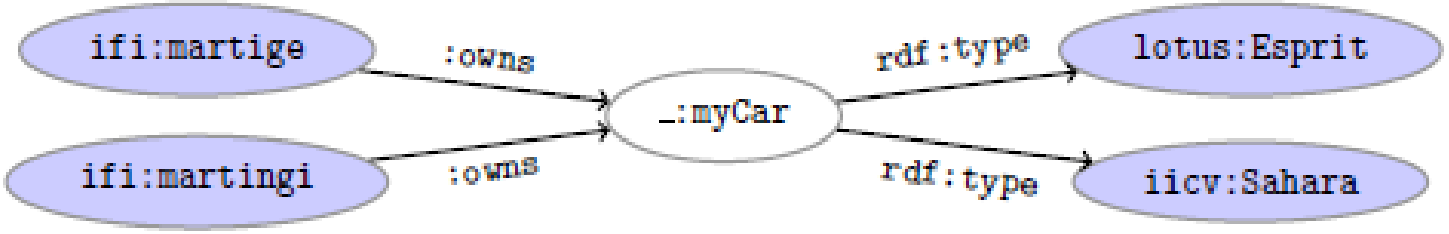
File 2

```
ifi:martingi :owns _:myCar .
_:myCar    a   iicv:Sahara .
```

gives the RDF graph:

File 1 ∪ File 2

```
ifi:martige  :owns _:myCar .
ifi:martingi :owns _:myCar .
_:myCar       a   lotus:Esprit, iicv:Sahara .
```



Rename blank nodes

Renaming `_:myCar` to `_:myCar2` in File 2.

File 1

```
ifi:martige :owns _:myCar .
_:myCar a  lotus:Esprit .
```

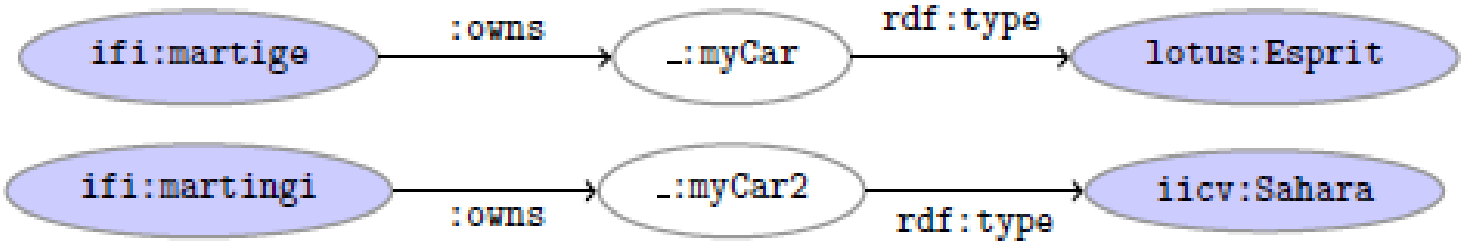
File 2

```
ifi:martingi :owns _:myCar2 .
_:myCar2    a   iicv:Sahara .
```

gives the RDF graph:

File 1 ∪ File 2

```
ifi:martige  :owns _:myCar  .  _:myCar   a   lotus:Esprit .
ifi:martingi :owns _:myCar2 .  _:myCar2  a  iicv:Sahara .
```



Preguntas?