

# Semantic Days 2012 Tutorial

## Semantic Web Technologies

### Lecture 2: RDF, The Resource Description Framework

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# Outline

- 1 The RDF data model
- 2 The Turtle syntax

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1 The RDF data model

2 The Turtle syntax

# The conceptual components of RDF

The RDF data model in a nutshell:

- Information is encoded in *triples*.
  - Triples = subject-predicate-object patterns
- Things (in a broad sense) are labelled with *URIs*
  - URIs act as globally valid names
- Sets of names are organized in *vocabularies*
  - Vocabularies are demarcated by *namespaces*

We shall look at each in turn.

# Triples

- All information in RDF is expressed as *triples*
- A triple consists of
  - A **subject**
  - A **predicate**
  - An **object**
- For instance
  - **Norway** **has capital** **Oslo**
  - **Oslo** **has mayor** **Fabian Stang**
  - **Fabian Stang** **has year of birth** **1955**
- Any other representation of information can be transformed to triples
- Another word for an RDF triple is a *statement*

# Uniform Resource Identifiers

- RDF (Resource Description Framework) talks about *resources*
  - Resources can be pretty much anything
- Resources are identified by URIs
  - Uniform Resource Identifiers
- e.g. in `dbpedia.org` :
  - Norway: `http://dbpedia.org/resource/Norway`
  - has capital: `http://dbpedia.org/ontology/capital`
  - Oslo: `http://dbpedia.org/resource/Oslo`
  - has mayor: `http://dbpedia.org/ontology/leaderName`
  - Fabian Stang: `http://dbpedia.org/resource/Fabian_Stang`
- Not necessarily dereferenceable
  - Separate a web page from what it talks about!
- Helps to avoid name clashes
- Can be used for cross-referencing

# QNames

- URLs are often long and hard to type
- Most serializations use an abbreviation mechanism
  - Define “prefixes”, “namespaces”
  - RDF/XML format: XML namespaces and entities
- E.g. in Turtle format:

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

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

- A *QName* like `dbp:Oslo` stands for  
`http://dbpedia.org/resource/Oslo`
- Remember: It's all just URIs!

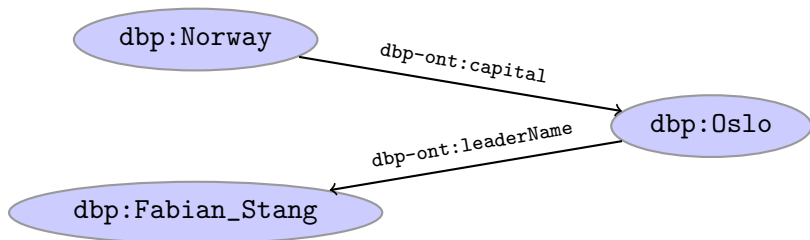
# RDF Graphs

- An *RDF graph* is a set of triples. E.g.

```
dbp:Norway dbp-ont:capital dbp:Oslo .
```

```
dbp:Oslo dbp-ont:leaderName dbp:Fabian_Stang .
```

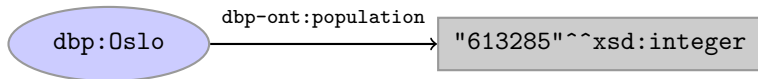
- Often represented as a directed graph:





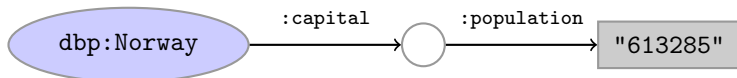
# Literals

- *Objects* of triples can also be *literals*
  - I.e. nodes in an RDF graph can be *resources* or *literals*
  - Subjects and predicates of triples can *not* be literals
- Literals can be
  - Plain, without language tag:  
`dbp:Oslo dbp-ont:officialName "Oslo" .`
  - Plain, with language tag:  
`dbp:Norway rdfs:label "Norge"@no .`  
`dbp:Norway rdfs:label "Norwegen"@de .`
  - Typed, with a URI indicating the type:  
`dbp:Oslo dbp-ont:population "613285"^^xsd:integer .`
- Usually represented with rectangles:

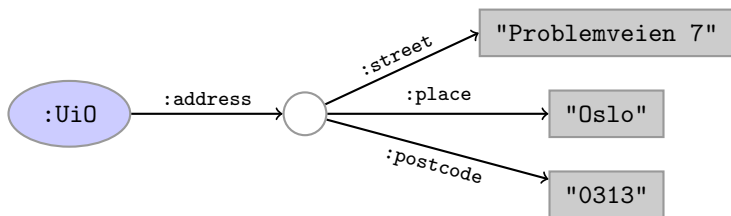


# Blank nodes

- Blank nodes are like resources without a URI
- Can be used as subject or object, but not as predicate
- Norway's capital has population 613285:



- The address of UiO is Problemveien 7, 0313 Oslo:



# Vocabularies

- Families of related notions are grouped into *vocabularies*
- Usually the same namespace/prefix is shared
- Usually, a description is published at the namespace base URI
- Important, well-known namespaces:

rdf: <<http://www.w3.org/1999/02/22-rdf-syntax-ns#>> – RDF  
 rdfs: <<http://www.w3.org/2000/01/rdf-schema#>> – RDF Schema  
 dcterms: <<http://purl.org/dc/terms/>> – Dublin Core  
 foaf: <<http://xmlns.com/foaf/0.1/>> – Friend of a friend

- Important predicates:
  - dbp:Oslo **rdf:type** dbp-ont:Place
  - dbp:Norway **rdfs:label** "Norge"@no
  - :rdf-lecture **dcterms:creator** :martingi
  - dbp:Fabian\_Stang **foaf:name** "Fabian Stang"

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# RDF Serializations

There are many serializations for the RDF data model:

**RDF/XML** the W3C standard. Very complicated!

```
<?xml version="1.0"?>
<rdf:RDF xmlns:dbp="http://dbpedia.org/resource/"
  xmlns:foaf="http://xmlns.com/foaf/0.1/"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
  <rdf:Description rdf:about="http://dbpedia.org/resource/Fabian_Stang">
    <foaf:name>Fabian Stang</foaf:name>
  </rdf:Description>
</rdf:RDF>
```

**N-triples** one triple per line. No abbreviations.

```
<http://dbpedia.org/resource/Fabian_Stang> <http://xmlns.com/foaf/0.1/name> "Fabian Stang" .
```

**Turtle/N3** convenient, human readable/writable.

```
@prefix dbp: <http://dbpedia.org/resource/> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .

dbp:Fabian_Stang foaf:name "Fabian Stang" .
```

**Others** TriX, TriG, RDF/JSON,...

# Statements/assertions/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> .
```

rdf:type may be abbreviated with 'a':

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

# Namespaces

Namespace prefixes are declared with `@prefix`:

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

A base namespace may be declared:

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

# 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 and language information:

```
dbp:Norway rdfs:label "Norge"@no .  
dbp:Oslo :population "613285"^^xsd:integer .
```



## Statements with shared subjects

### Statements may share a subject with ';'

```
dbp:Oslo :officialName "Oslo" ;  
         :population "613285"^^xsd:integer ;  
         :leaderName dbp:Fabian_Stang .
```

### Statements may share subject and predicate with ','

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

## Blank nodes

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

Norway has a capital with population 613285

```
dbp:Norway :capital _:someplace .
_:someplace :population "613285"^^xsd:integer .
```

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" ] .
```

## Supplementary reading—W3C specs:

- Concepts and Abstract Syntax:
  - <http://www.w3.org/TR/2004/REC-rdf-concepts-20040210/>
- RDF/XML Syntax Specification:
  - <http://www.w3.org/TR/2004/REC-rdf-syntax-grammar-20040210/>
- RDF Semantics:
  - <http://www.w3.org/TR/2004/REC-rdf-mt-20040210/>
- RDF Primer:
  - <http://www.w3.org/TR/2004/REC-rdf-primer-20040210/>



## Exercise: RDF

- Write RDF in Turtle format
- Validate RDF using online validators
- Visualize RDF graph

Go to <http://sws.ifi.uio.no/event/semdays2012/> for more information.