RDF Model 1.1

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- RDF W3C Overview
- The basis of RDF
    - Internationalized Resource Identifier
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- More features of RDF
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- RDF on the Web
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RDF: W3C Overview

- It extends the linking structure of the Web to use ~~URIs~~ IRIs to name the relationship between things as well as the two ends of the link (called "triple")

- IRI: Internationalized Resource Identifier (in RDF 1.0, it was URI references)

- This linking structure forms a directed, labeled graph.

RDF: W3C Overview

- RDF stands for Resource Description Framework

- RDF is more than XML: XML has a tree-based model, RDF has a graph-based model

- Standardized and commonly used
  - W3C draft 1999
  - W3C recommendation RDF 1.0, 10.2.2004
  - W3C recommendation RDF 1.1, 25.2.2014

- The RDF 1.1 abstract syntax is specified at:
  http://www.w3.org/TR/rdf11-concepts/

- RDF 1.1 Primer is a gentle introduction to RDF 1.1:
  http://www.w3.org/TR/rdf11-primer/

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The basis of RDF: resources

Resources: objects identified with IRIs (URIs)
- – document (text, picture) on the Web (URL)
  - **http://www.cs.vu.nl/index.html**
- – specific part of a document (URL fragment identifier)
  - **http://example.org/cities.html#Amsterdam**
- – book in the library, 'real-world' object
  - **isbn://5031-4444-3333**
- – person at university, 'real-world' object
  - **http://eyaloren.org/foaf.rdf#me**
- – concept
  - **http://cyc.org/Concept/Mammal**
  - **http://cyc.org/Concept/Dog**

RDF Triples

- All information in RDF is expressed using a triple pattern.
- A triple consists of a subject, a predicate, and an object.
- Examples:
  - subject predicate object
  - Azuay has capital Cuenca
  - Cuenca has mayor Pedro Palacios
  - Pedro Palacios born year 1976
- Another word for an RDF triple is a statement or fact.
- The elements of an RDF triple are either
  - ~~URI~~ IRIS references,
  - blank nodes, or
  - literals.

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 .
- is an RDF graph containing two triples.
- RDF graphs are often represented as a directed labeled graph:
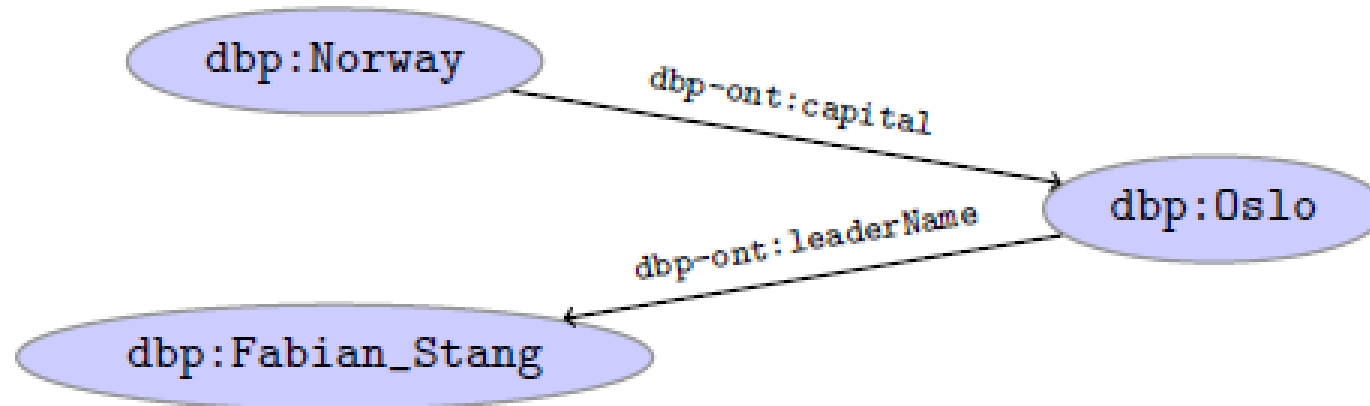
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Internationalized Resource Identifier

- Used for giving an identity to a resource, so that the resource can be described and referred to

- Global identifiers for resources
  - URI
  - URL
  - URN
  - IRI

IRI

URI

URL   URN
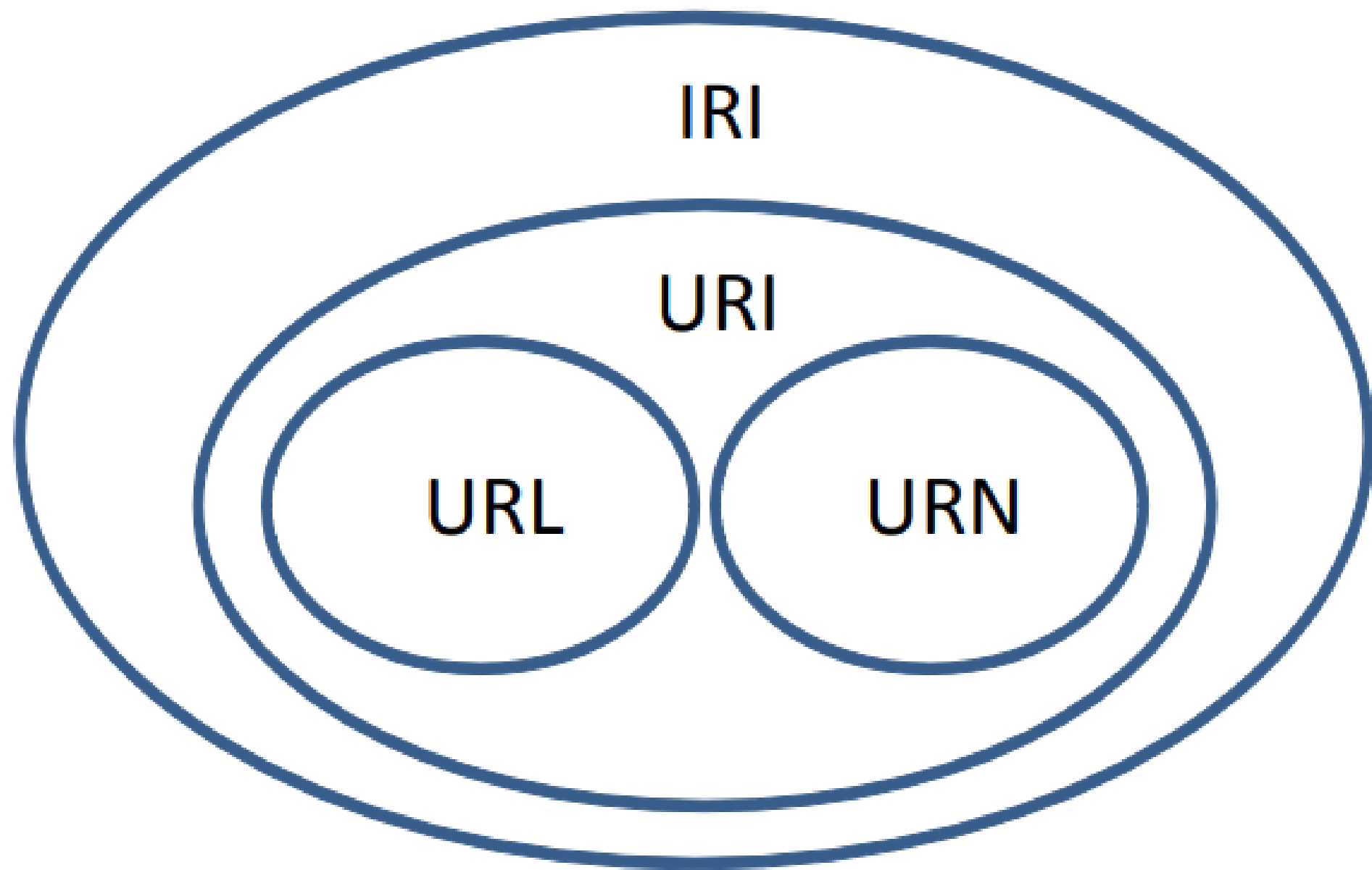
IRI schemes

- In RDF, IRIs typically look like 'normal' URLs, often with fragment identifiers to point at specific parts of a document (such as a section in HTML) #

http://dublincore.org/usage/documents/principles/#element

Type IRI in a browser and you get useful info back!

IRIS(URIs) and QNames

- IRIs are often long and hard to read and write.

- Most serialisations use an abbreviation mechanism.

- Define "prefixes", "namespaces".

- RDF/XML format: XML namespaces and entities.
  - E.g., in Turtle serialisation:
  - @prefix dbp: <http://dbpedia.org/resource/> .
  - @prefix dbp-ont: <http://dbpedia.org/ontology/> .

- A QName like dbp:Cuenca stands for http://dbpedia.org/resource/Cuenca

Question

- Using IRIs to identify things. . .
    - 1 . . . ensures that there are not two different names (IRIs) for the same thing
    - 2 . . . ensures that one name (IRI) is not used for two different things
    - 3 . . . makes it easier to avoid using one name (IRI) for two different things

    Correct answer: 3
    1 and 2 are impossible to achieve!

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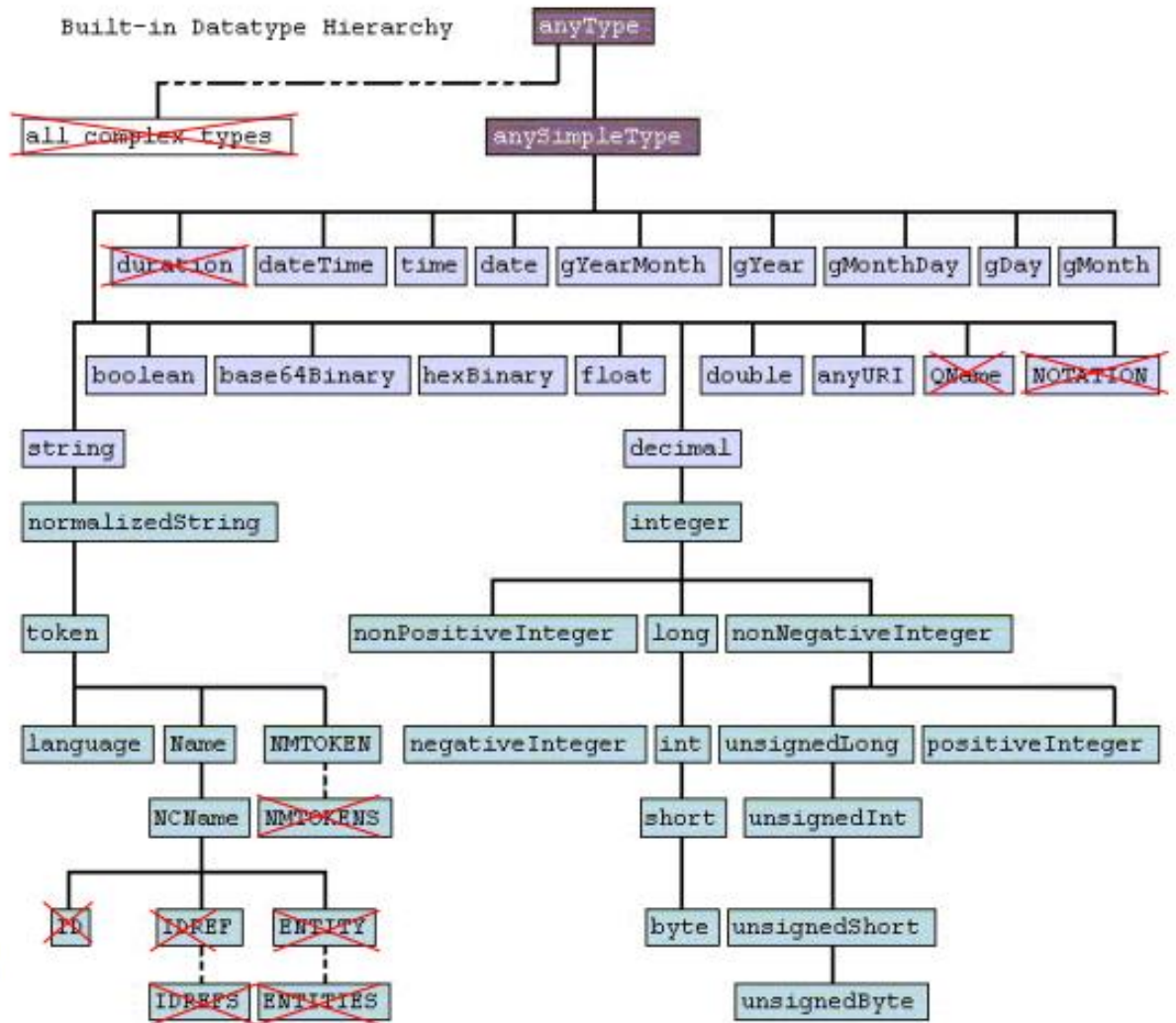- RDF Vocabularies
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Literals

- Literals are used to represent data values.
- 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 "629313"^^xsd:integer .
- But not both, i.e., typed and with a language tag.
- Usually represented with rectangles:
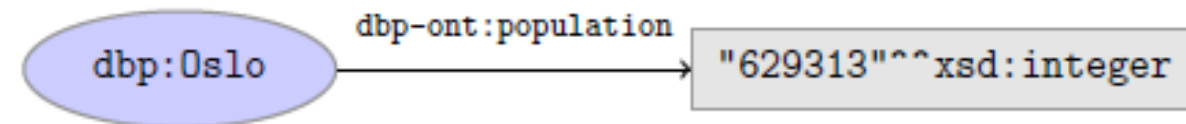
Datatypes for Literals

- (Almost) all XML Schema datatypes may be used

- Exception:
  - XML specific types
  - The underspecified type "duration"
  - sequence types

Built-in Datatype Hierarchy

XML Schema Part 2: Datatypes Second Edition
http://www.w3.org/TR/xmlschema-2/

Language Tags for Literals

- Literals may be defined in different natural languages
  - "München"@de
  - "Munich"@en
- Note: the Semantic Web is multilingual!
- Language codes according to ISO 963
  - ISO 963-1 (1963): two-digit codes, 136 languages
  - ISO 963-2 (1998): three-digit codes, 464 languages

    http://www.loc.gov/standards/iso639-2/php/English_list.php

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Blank nodes

- Blank nodes are like resources without a URI.
- Use when resource is unknown, or has no (natural) identifier.
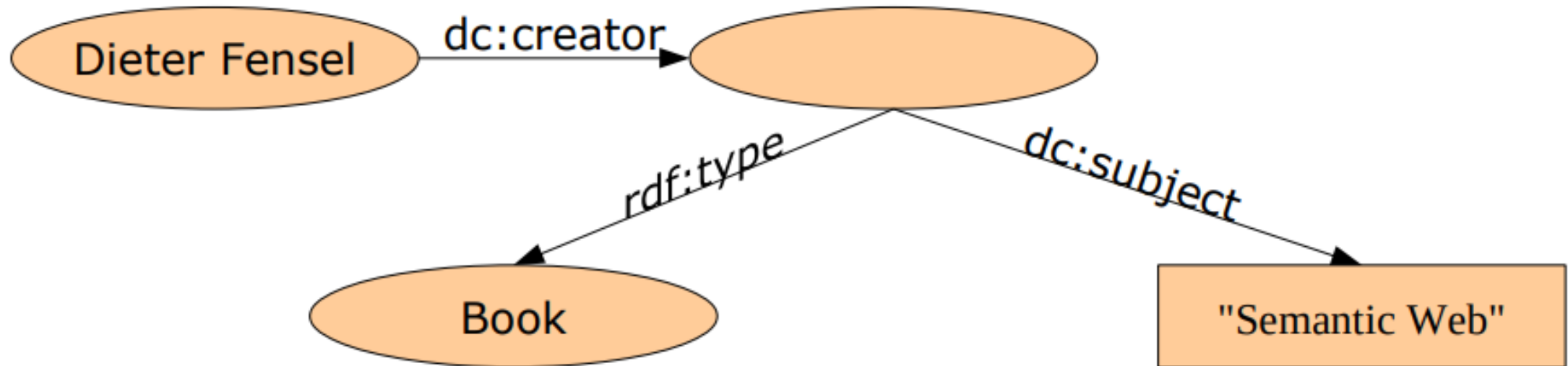- Norway's capital has population 629313:
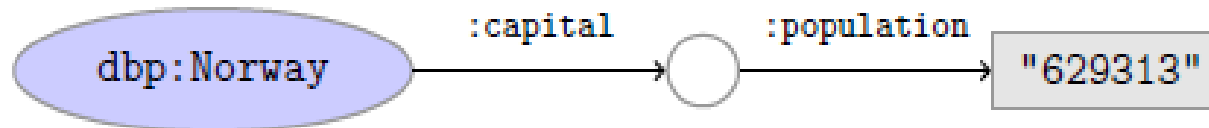
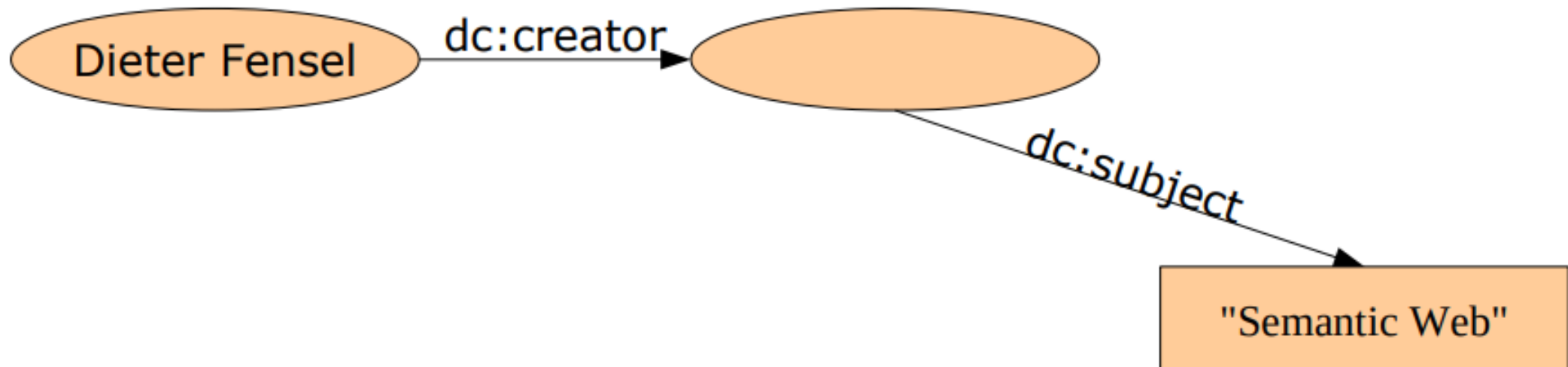- The address of UiO is Problemveien 7, 0313, Oslo:
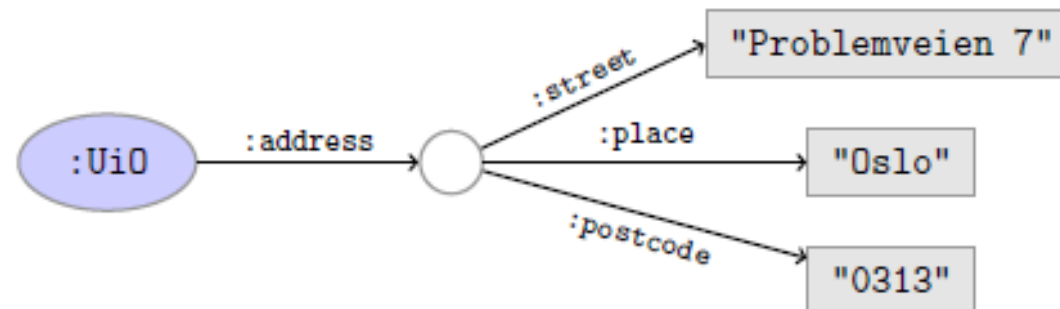
Blank Nodes: samples

- Information that is not or cannot be specified
  - "Dieter Fensel has written a book about the Semantic Web"

Blank Nodes: samples

- Information that is not or cannot be specified
  - "Dieter Fensel has written something about the Semantic Web."

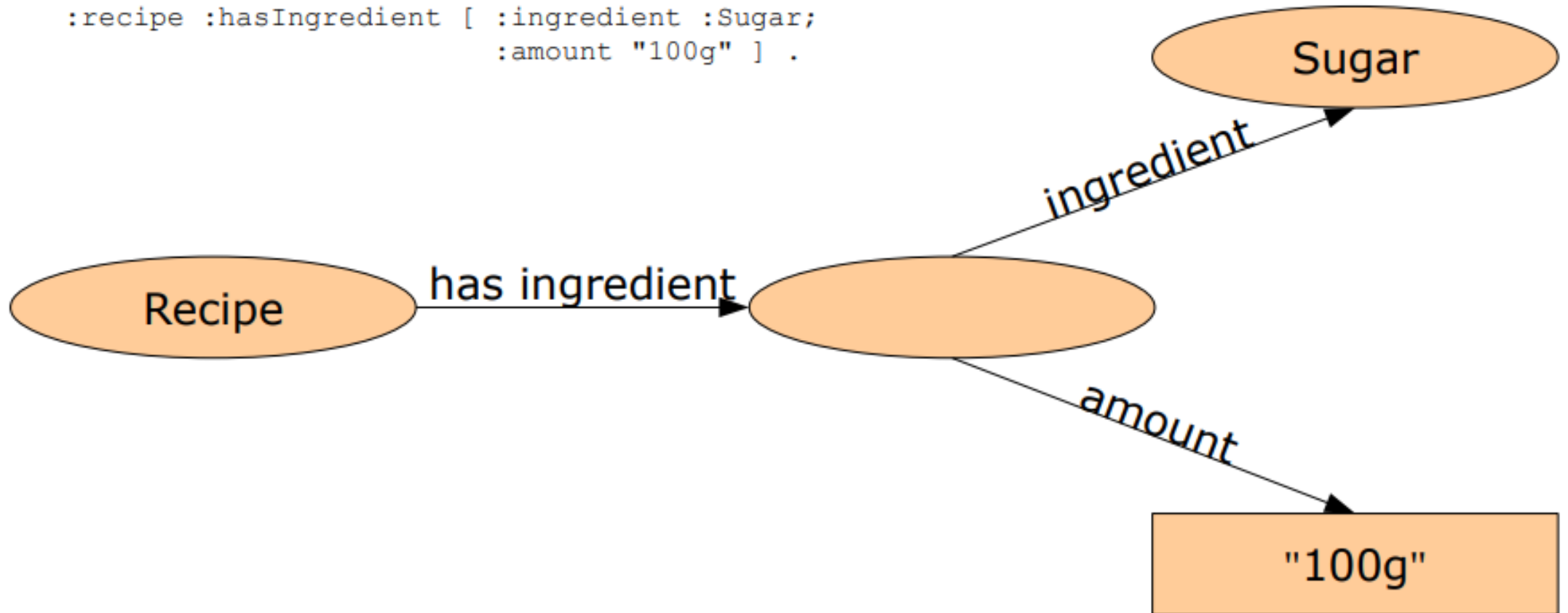# Application of Blank Nodes: n-ary Predicates

- RDF predicates always connect a subject and an object
  - i.e., in the sense of predicate logic, they are binary predicates

    :Mauricio :works_for :UCuenca .

    $\Leftrightarrow$ works_for(Mauricio, UCuenca) .

- Sometimes, n-ary predicates are needed
  - has_ingredient(Recipe, Sugar, 100g)
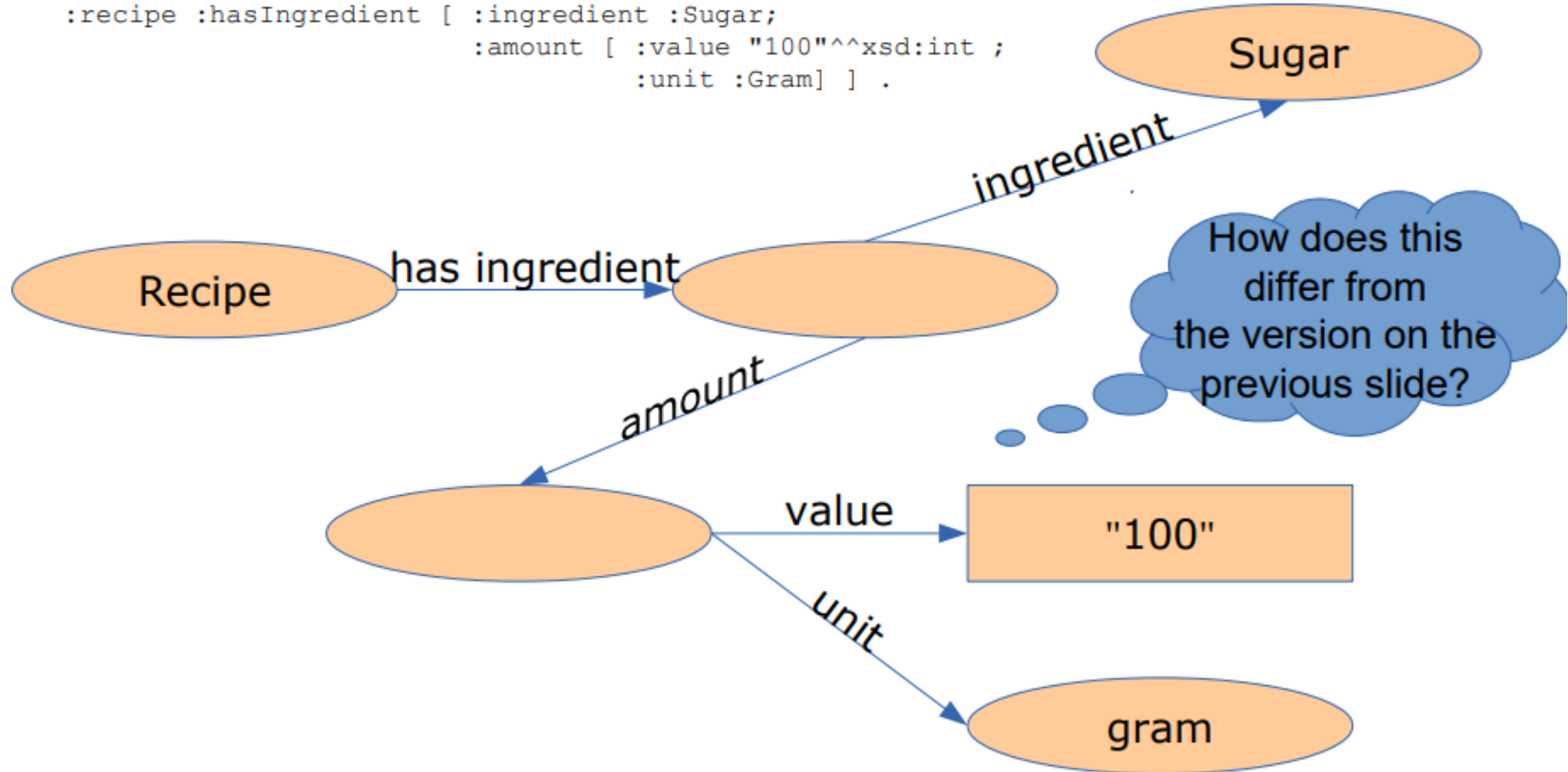
Application of Blank Nodes: n-ary Predicates

```
:recipe :hasIngredient [ :ingredient :Sugar;
                         :amount "100g" ] .
```

Application of Blank Nodes: n-ary Predicates

RDF Triple Grammar

- Literals and blank nodes may not appear everywhere in triples

	s	p	o
URI references may occur in all positions	✔	✔	✔
Literals may only occur in object position	✘	✘	✔
Blank nodes may not occur in predicate position	✔	✘	✔

Práctica 6