INF3580 – Semantic Technologies – Spring 2011

Lecture 15: RDFa

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24th May 2011

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Today's Plan

1. Reminder

2. Linking RDF to HTML

3. RDFa

4. Conclusion

Outline

1. **Reminder**

2. Linking RDF to HTML

3. RDFa

4. Conclusion
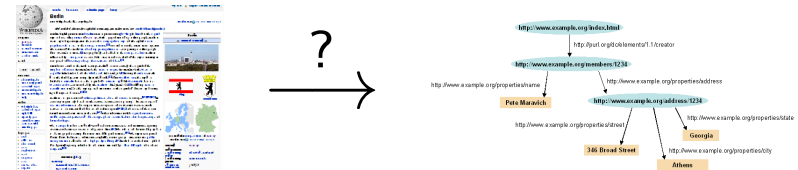

RDF on the Web

- RDF data exists in many forms:
  - In RDF files, downloadable with HTTP, FTP, etc.
    - FOAF profiles
    - data files from dbpedia.org, geonames, etc.
    - In RSS 1.0 feeds
  - As data model behind SPARQL query endpoints
    - for instance dbpedia.org, dblp, and others
  - Published using LOD principles (hash/slash namespaces)
  - Embedded in HTML, as RDFa

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The Problem

- The HTML web contains lots of human-readable information
- How can clients discover the location of corresponding machine-readable information?

Embedding RDF/XML in (X)HTML

- First idea: Embed RDF/XML in HTML or XHTML:

```
<html>
  <head>
    <title>My Homepage</title>
    <rdf:RDF>
      <rdf:Description rdf:about="#me">
        <foaf:name>Martin Giese</foaf:name>
        ...
```

- Not recommended:
- Does not fit HTML or XHTML DTDs
- No satisfactory solution, due to flexible RDF vocabulary
- B.t.w. there *is* a `metadata` element in SVG for this!

HTML LINK elements

- LINK may occur inside HTML `HEAD` elements
- relate a document to other documents
  - CSS style sheets
  - Alternative languages
  - Next, previous, index, etc.
- Can contain attributes:
  - `rel` – the kind of relation
  - `type` – the media type of the related document
  - `href` – the URL of the other document
  - `title` – the title of the other document
  - (and some more)
- E.g. a style sheet:

```
<html>
  <head>
    <title>My Homepage</title>
    <link rel="stylesheet" type="text/css" href="style.css">
```

LINKing to RDF

- To link to an RDF representation:

```
<LINK rel="meta"
      type="application/rdf+xml"
      title="RDF/XML version"
      href="http://dbpedia.org/data/Oslo.xml">
```

- Also: rel="alternate"
  - Note: difference between meta-data and alternative representation
- Various web browser plugins exist to detect these LINKs

HTTP Link: response headers

- Non-standardized proposal, originally by Berners-Lee, 1992
- Generated by a few servers, recognized by a few clients
- Same information as in LINK HTML element, but as HTTP header:

```
Link:  <foaf.rdf>; rel="meta"; type="application/rdf+xml"
```

- Advantage: can be sent also with non-HTML data

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Once More: Embedding RDF in (X)HTML

- Directly embedding RDF/XML in (X)HTML does not work well
- Use a different "serialization" that blends well with (X)HTML!

> From the RDFa specification (http://www.w3.org/TR/rdfa-syntax/)
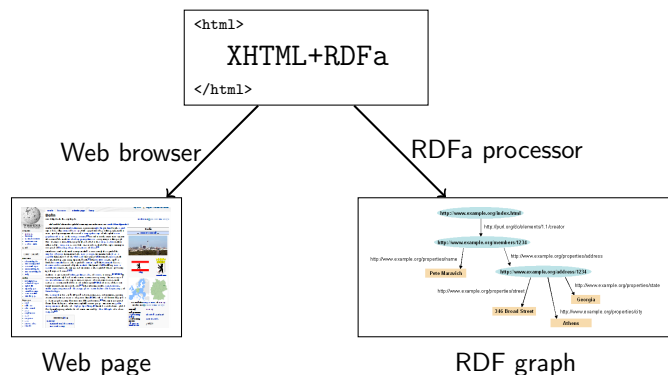>
> The aim of RDFa is to allow a single RDF graph to be carried in various types of document mark-up.

- XHTML in spec., but works with HTML and other XML
- RDFa adds a *fixed* set of attributes to (X)HTML
- Document type:

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML+RDFa 1.0//EN"
     "http://www.w3.org/MarkUp/DTD/xhtml-rdfa-1.dtd">
```

RDFa Processing

- Web browsers ignore RDFa attributes
- RDFa processors extract a *single* RDF graph from a document

RDFa Concepts

- RDFa adds semantic annotations to
  - hyper-links (`href`)
  - textual content
- RDFa attributes can appear in (almost) any element
- As the XHTML is processed, there is always a "current subject" that generated triples refer to
- The current subject starts as the base URI of the document, but can change on the way

Reminder: (X)HTML Meta and Link

- Links and metadata in HTML header:

```
<html xmlns="http://www.w3.org/1999/xhtml">
  <head>
    <title>Page 507</title>
    <meta name="author" content="Sigrid Undset" />
    <link rel="prev" href="page506.html" />
    <link rel="next" href="page508.html" />
  </head>
  <body>...</body>
</html>
```

- Meaning of `name` and `rel` informal
- Only a few values defined by the standard

RDFa `property` and `rel`

- "semantic" `meta` and `link` in RDFa:

```
<html xmlns="http://www.w3.org/1999/xhtml"
      xmlns:foaf="http://xmlns.com/foaf/0.1/"
      xmlns:dc="http://purl.org/dc/elements/1.1/">
  <head>
    <title>MG's home page</title>
    <meta property="dc:creator" content="Martin Giese" />
    <link rel="foaf:topic" href="foaf.rdf#me" />
  </head>
  <body>...</body>
</html>
```

- Extracted triples: (`<>` is base URI!)

```
<> dc:creator "Martin Giese" .
<> foaf:topic <foaf.rdf#me> .
```

Attribute `rel` on A elements

- Any hyper-link can be given a "meaning":

```
This document is licensed under a
<a xmlns:cc="http://creativecommons.org/ns#"
   rel="cc:license"
   href="http://creativecommons.org/licenses/by-nc-nd/3.0/">
   Creative Commons License
</a>.
```

- Extracted triple:

```
<> cc:license <http://creativecommons.org/.../3.0/> .
```

- Can use `rev` instead of `rel` to swap subject and object

The property attribute

- `rel` is for resource objects, `property` for literal objects:

```
<html xmlns="http://www.w3.org/1999/xhtml"
      xmlns:dc="http://purl.org/dc/elements/1.1/">
  <head>...</head>
  <body>
    <h1 property="dc:title">Kransen</h1>
    Written in <span property="dc:created">1920</span>
  </body>
</html>
```

- Extracted triples:

```
<> dc:title "Kransen" ; dc:created "1920" .
```

- Can also use `content` attribute together with `property`:

```
<span property="dc:created" datatype="xsd:dateTime"
      content="2007-09-16T16:00:00-05:00">
September 16th at 4pm
</span>
```

Changing the Subject

- `about` changes subject of contained `rel` and `property` annotations:

```
<div about="http://.../foaf.rdf#me"
     xmlns:foaf="http://xmlns.com/foaf/0.1/">
  <p property="foaf:name">Martin Giese</p>
  <p> Email:
    <a rel="foaf:mbox" href="mailto:mg@mail.no">
    mg@mail.no</a></p>
  <p> Phone:
    <a rel="foaf:phone" href="tel:+47-31415926">
      31 41 59 26</a></p>
</div>
```

- Extracted triples:

```
<http://.../foaf.rdf#me> foaf:name "Martin Giese" ;
                         foaf:mbox <mailto:mg@mail.no> ;
                         foaf:name <tel:+47-31415926> .
```

Types and Blank Nodes

- `typeof` adds an `rdf:type` triple
- Missing URIs can lead to blank nodes:

```
<div typeof="foaf:Person"
     xmlns:foaf="http://xmlns.com/foaf/0.1/">
  <p property="foaf:name">Martin Giese</p>
  <p> Email:
    <a rel="foaf:mbox" href="mailto:mg@mail.no">
    mg@mail.no</a></p>
</div>
```
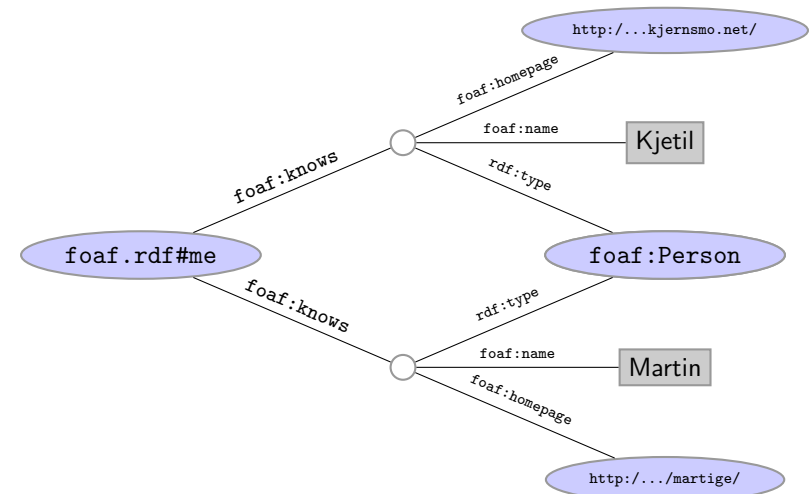
- Extracted triples:

```
[] a foaf:Person ;
   foaf:name "Martin Giese" ;
   foaf:mbox <mailto:mg@mail.no> ;
```

Know Your Friends

- Missing objects collected from contained elements (chaining):

```
<div xmlns:foaf="http://xmlns.com/foaf/0.1/"
    about="foaf.rdf#me" rel="foaf:knows">
  <ul>
    <li typeof="foaf:Person">
      <a property="foaf:name" rel="foaf:homepage"
        href="http://www.kjetil.kjernsmo.net/">Kjetil</a>
    </li>
    <li typeof="foaf:Person">
      <a property="foaf:name" rel="foaf:homepage"
        href="http://heim.ifi.uio.no/martige/">Martin</a>
    </li>
  </ul>
</div>
```

Triples From Chaining Example

RDFa Summary

- Allows to "hide" an RDF graph in an XHTML document
  - XHTML processor can ignore RDFa
  - RDFa processor can extract RDF graph
- Treat links and text as subjects/objects and literals
- Many, many more details!
  - Specification hardly less complicated than RDF/XML
  - See spec. at `http://www.w3.org/TR/rdfa-syntax/`
- *Nothing* you couldn't do with a LINK and an RDF file
- Can be convenient to have information in one place

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Topics Covered

- RDF, principles, Turtle syntax
- The Jena API for RDF
- The SPARQL Query Language
- Basics of the RDFS and OWL ontology languages
- Basics of model semantics and reasoning
- Linked Open Data, RDFa
- Publishing Databases as RDF

Topics *Not* Covered

- Rule Languages (SWRL, RIF, Jena rules, etc.)
- SW application structures
- Semantic Web Services
- Details of RDF/RDFS model semantics
- Some details of OWL
- Details of OWL 2 profiles
- Logical theory: Soundness, Completeness,. . .
  - (You ain't seen nothing yet :-)
- And many more!

Help! I Can't Get Enough!

- For more information on theory:
  - Book on Foundations of SW Technologies
  - Take a course in logic or automated reasoning
- For more information on practical questions:
  - Book on Semantic Web Programming
  - Standards texts on W3C Web pages
  - Google
- Still not enough?
  - Contact us for possible MSc topics!