



XML

XML

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Chapter 18

SPARQL



SPARQL

- **SPARQL Query Language for RDF**

- **W3C Recommendation 15 January 2008** <http://www.w3.org/TR/rdf-sparql-query/>
- Sparql 1.1 (W3C Recommendation):
<http://www.w3.org/TR/sparql11-query/>
- “SQL for Semantic Web”

- **Sample initial situation**

```
StmtIterator iter=model.listStatements(subject,null,null);
while(iter.hasNext()) {
    st = iter.next();
    p = st.getProperty();
    o = st.getObject();
    now_do_something(p,o);
}
```

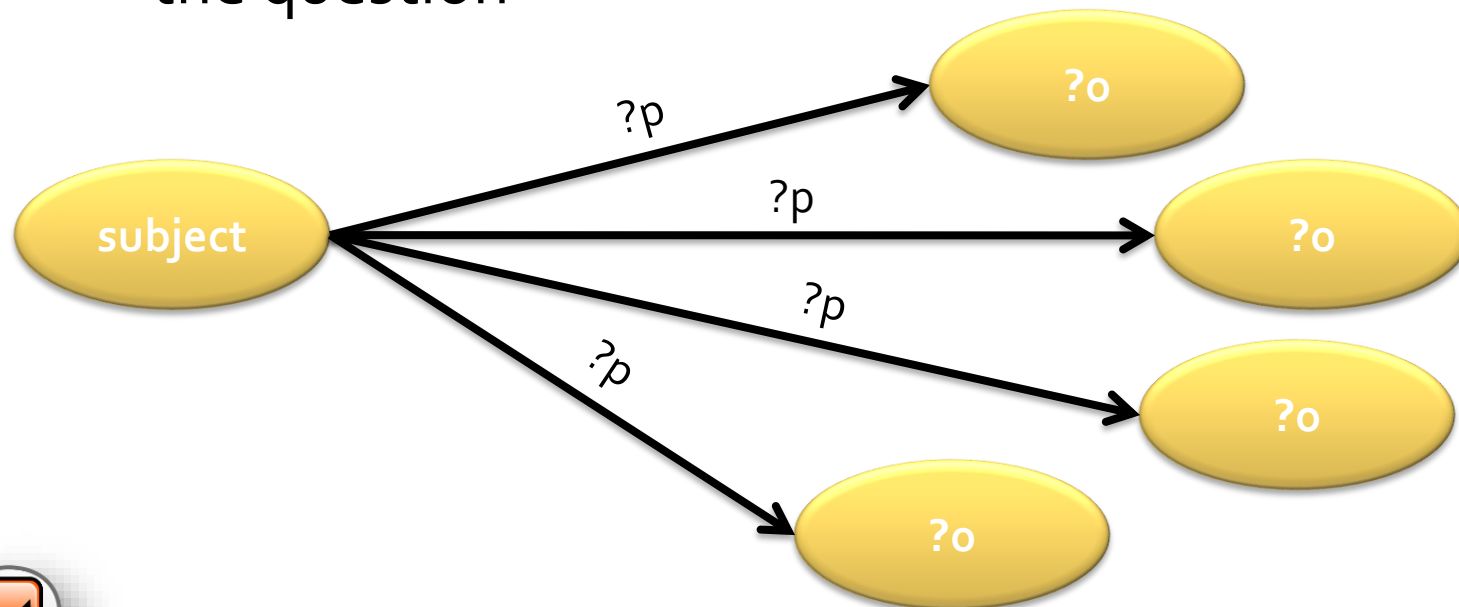
- **This is not very exciting, right?**

- What about more complex expressions?
- And, especially: What if the data is distributed over the Web?



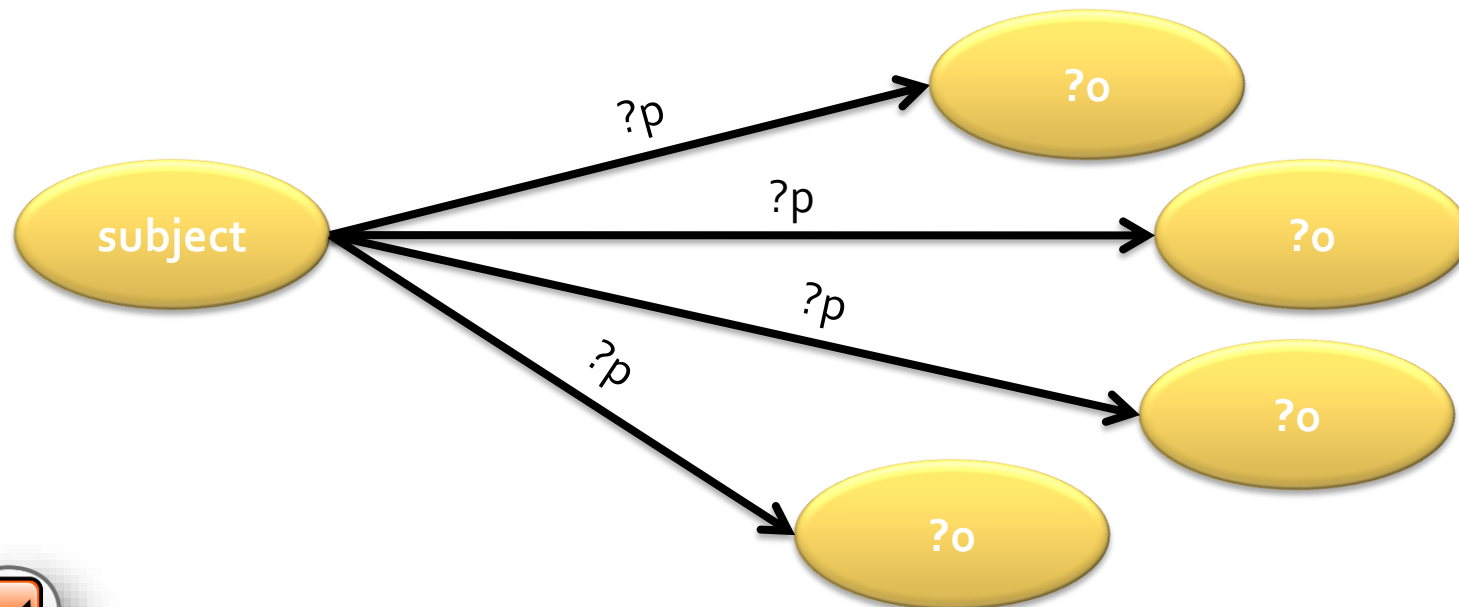
SPARQL Idea

- Idea – Queries correspond to graph patterns
 - (subject, ?p, ?o) is a pattern for a question:
I'm looking for all triples with a subject subject
- SPARQL creates a subgraph for the query
 - Statements of the subgraph constitute the answer to the question



SPARQL and SQL

- SPARQL notation mimics SQL
- Jena example in SPARQL
 - **SELECT ?p ?o**
WHERE {subject ?p ?o}



SPARQL Example

■ RDF Data (Example in Turtle)

- @prefix foaf: <http://xmlns.com/foaf/0.1/> .
- _:a foaf:name "Johnny Lee Outlaw" .
- _:a foaf:mbox <mailto:jlow@example.com> .
- _:b foaf:name "Peter Goodguy" .
- _:b foaf:mbox <mailto:peter@example.org> .
- _:c foaf:mbox <mailto:carol@example.org> .

■ Query

- PREFIX foaf: <http://xmlns.com/foaf/0.1/>
- SELECT ?name ?mbox
- WHERE {
 - ?x foaf:name ?name .
 - ?x foaf:mbox ?mbox
- }

Response:

"Johnny Lee Outlaw"	<mailto:jlow@example.com>
"Peter Goodguy"	<mailto:peter@example.org>



SPARQL Outlook

- SPARQL is already supported by many tools
- **SPARQL Protocol for RDF**
 - <http://www.w3.org/TR/rdf-sparql-protocol/>
 - W3C Recommendation 15 January 2008
 - W3C Candidate Recommendation 6 April 2006
 - SPARQL Protocol describes the use of SPARQL (data requests) in a distributed context – defines the basis for use of distributed data sets
 - Use of WSDL for description of SPARQL-capable endpoints



Chapter 19

ONTOLOGIES (OWL)



Introduction

- RDFS very useful, but not very powerful
- Examples:
 - Consider:
 - `<A> <isLeftOf> `,
 - ` <isLeftOf> <C>`
 - Is `<A> <isLeftOf> <C>` ?
 - There exist two vocabularies
 - `{A, B, C}` `{D, E, F}` are they the same?
- One needs something powerful to describe concepts and relationships, which describe and represent domain knowledge



- OWL Web Ontology Language
 - W3C Recommendation 10 February 2004
 - <http://www.w3.org/TR/owl-features/>
 - Sidenote [Duden Dictionary, translation]: Science of being, of regulatory, conceptual and natural rules of existence.
- OWL
 - Enables (by means of additional vocabulary bound to formal semantics) stronger interpretation possibilities of Web contents such as XML, RDF and RDFS
 - OWL consists of three sub-languages with increasing expressive power: OWL Lite, OWL DL , OWL Full.



OWL: Short Overview

- OWL Lite
 - Easy to implement and made for simple taxonomies
 - equivalence, i.e. owl:sameAs
 - Property characteristics, i.e. owl:InverseOf
 - Many further aspects: property restrictions, cardinality, intersections
- OWL DL
 - Allows a decidable set of first-order logic
- OWL Full
 - Same constructs as in OWL DL, but without restrictions; not decidable statements can also be described. Ontology is undecidable, but it, thus, enables higher order predicate logic.



Chapter 20

RDF AND HTML



Introduction

■ Initial situation

- RDF use in XML applications is simple if schemas can be used
- HTML (Hypertext Markup Language) is an application of SGML

■ Questions

- How can metadata be encoded in **HTML**?
- Better: *how can RDF be combined with HTML?*



HTML and Metadata/RDF – Ideas#1

- HTML 1.x
 - Metadata: Title, Author, etc. → different discussions
 - Different conventions
 - Further problem in this case: title and DC.title – seen and unseen metadata of a document (extremely hard to maintain, see ex. “WSDL Description vs. Definition”)
 - ```
<head><title>Some Page Title Metadata</title>
<meta name="DC.title" content="SomeValue">
<link rel=Schema.dc href="http://purl.org/metadat/dublin_core">
</head>
```
- HTML <link>
  - Metadata/RDF in an **external** resource (weak connection to an HTML resource)
  - ```
<head>  
<link rel="meta" type="application/rdf+xml" href="meta.rdf"/>  
</head>
```
- HTML <a>
 - Metadata/RDF in an **external** resource (weak connection to an HTML resource)
 - ```
<body>
Text...
```



# HTML and Metadata/RDF – Ideas#2

- XML/RDF in XHTML

- Obvious approach – however, validation is impossible (XHTML-DTDs)

- **<head>**

- <title>Beispiel</title>**

- <rdf:RDF**

- xmlns:rdf="http://www.w3.org/1999/0..."**

- xmlns:dc="http://purl.org/dc/elements/1.1/">**

- <rdf:Description**

- rdf:about="http://example.org/"**

- dc:title="Beispiel"/>**

- </rdf:RDF>**

- </head>**



# HTML and Metadata/RDF – Ideas#3

## ■ XML/RDF in HTML comments

- HTML comments enable people to provide other people with information about the code – not made for machines
- ```
<!--  
<rdf:RDF xmlns="http://web.resource.org/cc/"  
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">  
  <License rdf:about="http://creativecommons.org/licenses/by-nc-sa/1.0">  
    <requires rdf:resource="http://web.resource.org/cc/Attribution" />  
    <requires rdf:resource="http://web.resource.org/cc/ShareAlike" />  
    <requires rdf:resource="http://web.resource.org/cc/Notice" />  
    <prohibits rdf:resource="http://web.resource.org/cc/CommercialUse" />  
    <permits rdf:resource="http://web.resource.org/cc/Reproduction" />  
    <permits rdf:resource="http://web.resource.org/cc/Distribution" />  
    <permits rdf:resource="http://web.resource.org/cc/DerivativeWorks" />  
  </License>  
</rdf:RDF> -->
```

■ XML/RDF in URI scheme

- RFC 2397 defines data as a URI scheme
- Format: `data:[<MIME-type>][;base64],<data>`
- Example

```
<A SRC="data:application/rdf+xml ;base64; PHJkZjpsREYg....">  
Text with metadata</a>
```



HTML and Metadata/RDF – Ideas#4

■ Microformats

- Use existing standards, such as vCard (RFC 2426) and defined (or “standardized”) representation in (X)HTML
- Further information: <http://microformats.org>
- Example
 - vCard notation
TEL;TYPE=HOME:+49.123.456789
 - Defined representation in (X)HTML
**
home:
+49(123) 456789
**



Example - Microformats

```
1 <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
2 <html xmlns="http://www.w3.org/1999/xhtml" >
3 <head>
4   <title>Microformats Beispiel</title>
5 </head>
6 <body><h1>Willkommen</h1>
7 <p>Mein Name ist
8 <div class="vcard">
9   <a class="url fn" href="http://gaedke.com/">Martin Gaedke</a>,
10   Sie erreichen mich an der <div class="org">TU Chemnitz</div>
11   telefonisch unter <br />
12   <span class="tel"><span class="type">Büro</span>:
13   <span class="value">+49(999) 123456789</span> </span>
14   <span class="tel"><span class="type">Private</span>:
15   <span class="value">+49(999) 123456780</span> </span>
16 </div></p>
17 </body>
18 </html>
```

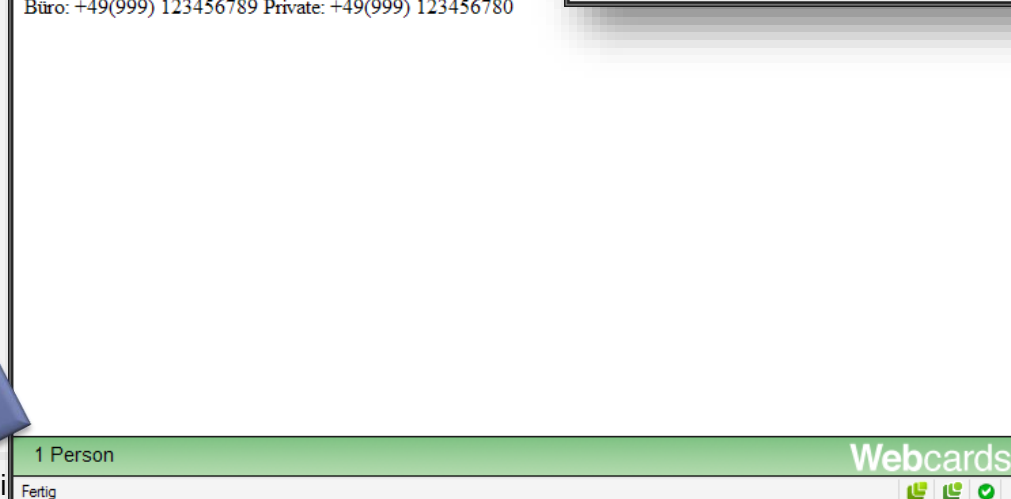
Example - Microformats

```
1 <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
2 <html xmlns="http://www.w3.org/1999/xhtml">
3 <head>
4   <title>Microformats Beispiel</title>
5 </head>
6 <body><h1>Willkommen</h1>
7 <p>Mein Name ist
8 <div class="vcard">
9   <a class="url fn" href="http://gaedke.com/">Martin Gaedke</a>,
10  Sie erreichen mich an der <div class="org">TU Chemnitz</div>
11  telefonisch unter <br />
12  <span class="tel"><span class="type">
13  <span class="value">+49(999) 1234567
14  <span class="tel"><span class="type">
15  <span class="value">+49(999) 1234567
16 </div></p>
17 </body>
18 </html>
```

Without
Microformats

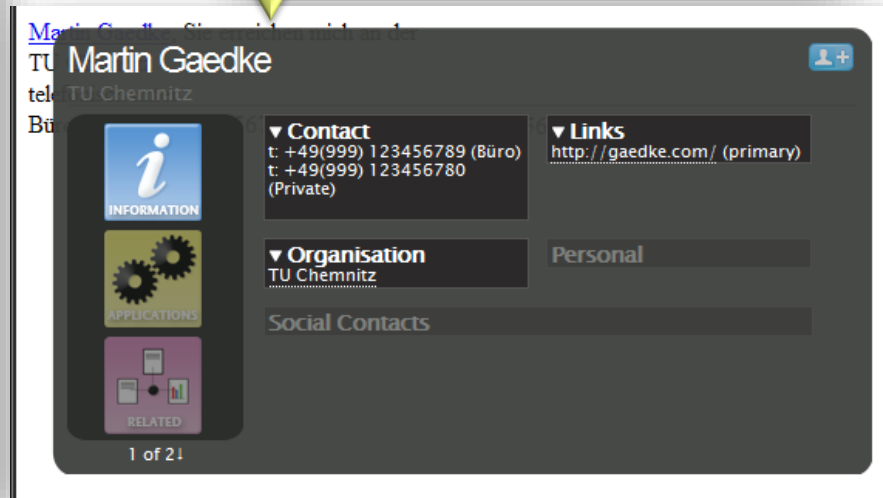
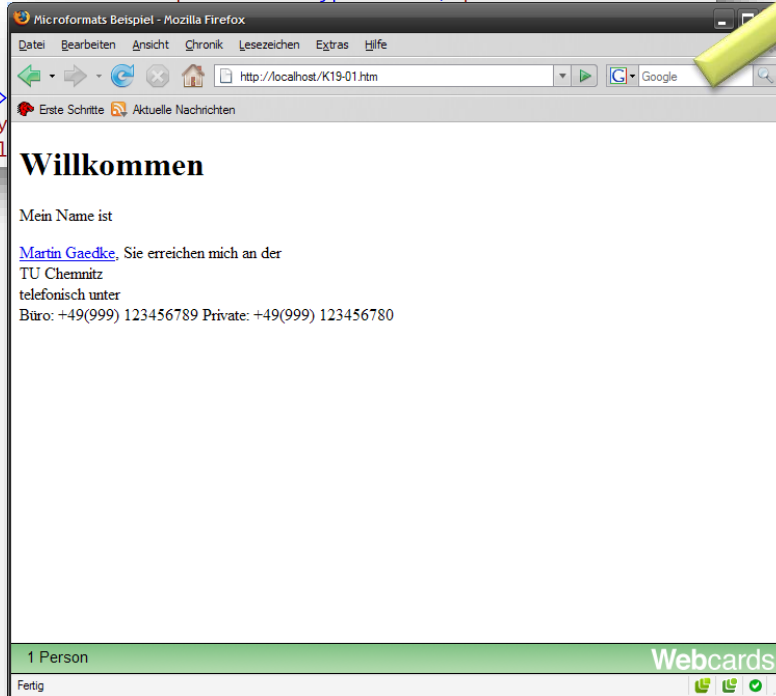


Microformats
Extension



Example - Microformats

```
1 <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/1999/xhtml" >
2 <html xmlns="http://www.w3.org/1999/xhtml" >
3 <head>
4   <title>Microformats Beispiel</title>
5 </head>
6 <body><h1>Willkommen</h1>
7 <p>Mein Name ist
8 <div class="vcard">
9   <a class="url fn" href="http://gaedke.com/">Martin Gaedke</a>,
10  Sie erreichen mich an der <div class="org">TU Chemnitz</div>
11  telefonisch unter <br />
12  <span class="tel"><span class="type">Büro</span>:
13  <span>
14  <span>
15  <span>
16 </div>
17 </body>
18 </html>
```



HTML and Metadata/RDF – Ideas#5

- HyperRDF (W3C Note by Dan Connolly)
 - Idea: RDF must be easily extractable by XSLT
 - `<head id="rel" profile="http://www.w3.org/2000/07/hs78#">`
`<link id="c" rel="rel:classes"`
`href="http://www.w3.org/2000/07/hs78#" />`
 - Further developments: <http://www.w3.org/2004/01/rdxh/specbg>
- ... various further developments...
- **Trend: Blending RDF with (X)HTML**
 - Seen and unseen metadata is easier to maintain (no data duplicates → **consistency**)
 - Different metadata formats → **Extraction** from (X)HTML
 - Approaches for this approach introduce notation rules to be able to use it together with existing technologies like (X)HTML, CSS etc. (for example, Embedded RDF `"."`-notation in the Head Element and `"-"`-body for schema declarations)
 - Examples: Microformats, Embedded RDF (is replaced by RDFa), GRDDL, RDFa

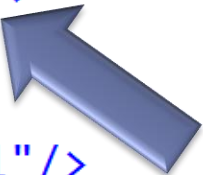


- Gleaning Resource Descriptions from Dialects of Languages (GRDDL)
 - W3C Recommendation 11 September 2007
 - GRDDL is a mechanism of obtaining RDF data from XML documents (especially XHTML documents)
 - Thereby, authors can link their documents to a transformation algorithm (especially XSLT) by using a link element
 - GRDDL-aware agents can execute the transformation algorithm and process the retrieved RDF data
 - <http://www.w3.org/TR/grddl-primer/>



GRDDL – Example(1)

```
1 <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.1//EN"
2 "http://www.w3.org/TR/xhtml11/DTD/xhtml11.dtd">
3
4 <html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en"
5   <head profile="http://www.w3.org/2003/g/data-view">
6     <title>My GRDDL-Demo Page</title>
7     <link rel="transformation"
8       href="http://www.w3.org/2002/12/cal/glean-hcal"/>
9   </head>
10  <body>
11    ...
12  </body>
13 </html>
```



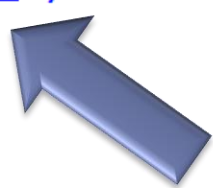
XHTML
(profile)

Analysis

- Uses HTML profile attribute
 - Profile is used to describe that the document uses a certain metadata scheme
 - Here, a profile URI for GRDDL is used
<http://www.w3.org/2003/g/data-view>

GRDDL – Example(2)

```
1 <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.1//EN"
2 "http://www.w3.org/TR/xhtml11/DTD/xhtml11.dtd">
3
4 <html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en"
5   <head profile="http://www.w3.org/2003/g/data-view">
6     <title>My GRDDL-Demo Page</title>
7     <link rel="transformation"
8       href="http://www.w3.org/2002/12/cal/glean-hcal"/>
9   </head>
10  <body>
11    ...
12  </body>
13 </html>
```



XHTML
with
GRDDL

Analysis

- Search for a link element with a transformation
- Load the transformation

XSLT

GRDDL – Example (3)

```
1 <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.1//EN"
2 "http://www.w3.org/TR/xhtml11/DTD/xhtml11.dtd">
3
4 <html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en"
5   <head profile="http://www.w3.org/2003/g/data-view">
6     <title>My GRDDL-Demo Page</title>
7     <link rel="transformation"
8       href="http://www.w3.org/2002/12/cal/glean-hcal"/>
9   </head>
10  <body>
11    ...
12  </body>
13 </html>
```

RESULT

XHTML
with
GRDDL

XSLT

Transform

RDF

```
1 <rdf:Description rdf:about="...">
  <dc:subject>Some subject</dc:subject>
  <dc:date>2006-01-02</dc:date>
</rdf:Description>
```

RDFa

- RDFa (previously called RDF/A)
 - Collection of attributes for layering RDF on XML languages
 - W3C Recommendation 22 August 2013
 - <http://www.w3.org/TR/rdfa-syntax>
- Focus
 - Extension of Link and Meta elements (by changing/complementing XHTML)
 - i.e. Meta elements can have sub-elements
 - Defines generic attributes to enable metadata for all elements
 - Similar to microformats – but with explicit metadata attributes



RDFa - Example

- XHTML (with unclear meaning):
- A photo of `Schmitt`.

RDF: `<photo1.jpg> <dc:creator> <Literal:"Schmitt">`.

- XHTML + RDFa:
- A photo of `Schmitt`.



RDFa – Another Example

■ RDFa

- **Attributes rel, rev, property** – indicate a new statement whose name is the value of the attribute
- Subject and object are determined via subject or object resolutions accordingly

■ Example

```
<div about="photo1.jpg">
```

A photo with a name

```
<span property="dc:title">Ö</span> of
```

```
<a rel="dc:creator" rev="foaf:img"
```

```
href="http://example.org/">
```

```
Schmitt</a>
```

```
</div>.
```

■ RDF :

RDF:

```
<photo1.jpg><dc:title> <Literal:"Ö">.
```

```
<photo1.jpg><dc:creator> <http://example.org>.
```

```
<http://example.org><foaf:img> <photo1.jpg>.
```



Homework

- How is Metadata implemented in HTML5?
- Homework: Find the specification, and look it up – add some Metadata to your homepage
- What are *the data-* attributes*?
 - Can we use them in HTML4 as well – If yes, what do we have to take care of?
- **This year it might be relevant for the exam!**

