

Web 2.0

Lecture 7: Annotations

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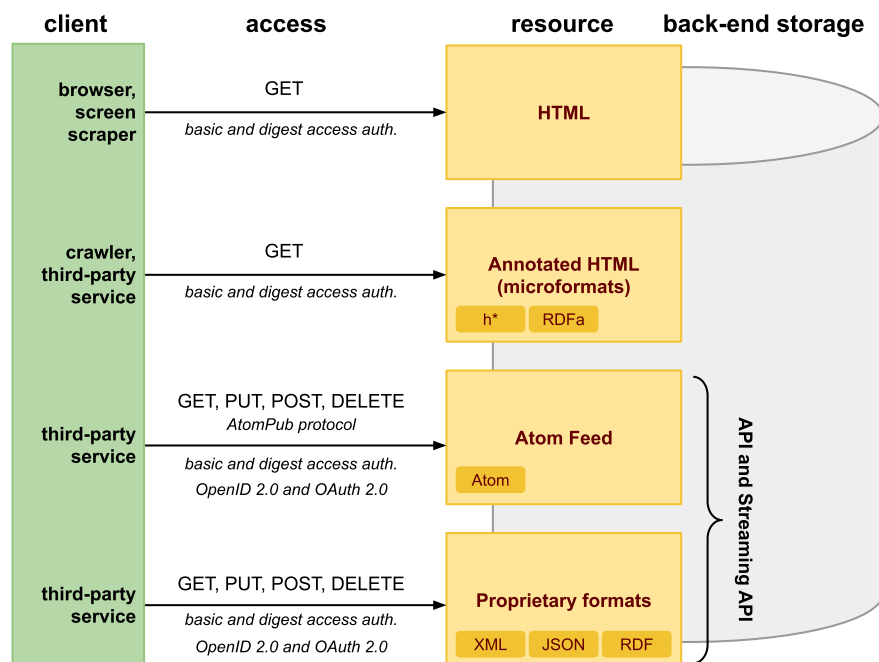
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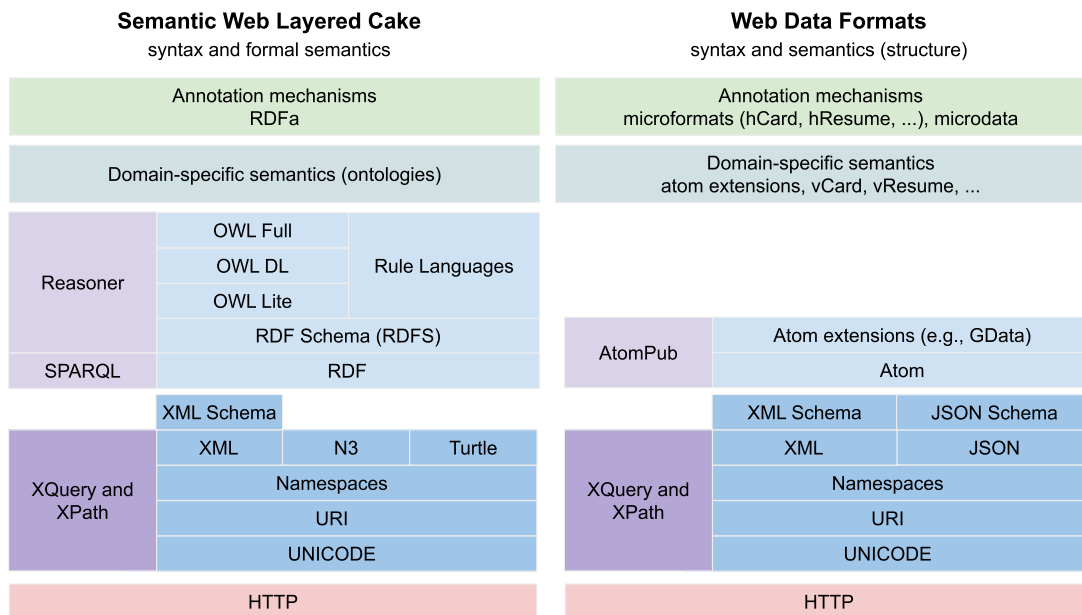
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Modified: Mon Apr 29 2019, 08:53:27
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Data on the Web



Data Syntax, Structure and Semantics



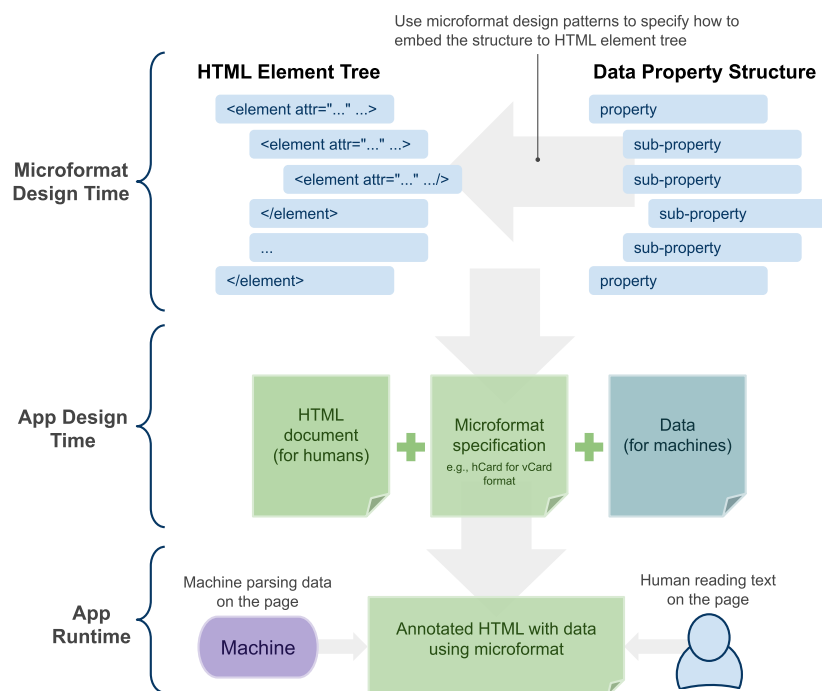
Overview

- **Microformats**
- Microdata
- RDF and RDFa
- OpenGraph Protocol

Microformats

- What is a microformat
 - How to embed data in HTML, XHTML, Atom, and XML
 - data: vCard, vResume, vRecipe
 - micorformat: hCard, hResume, hRecipe
 - Browsers display HTML, machines process data
 - Microformat vs. POSH format
 - POSH is same as microformat but data is not a standard format
- Difference to Atom feeds
 - Microformats require only a **single HTML document**
 - clients run GET to retrieve all data (human readable and machine readable)
 - No significant increase of the size of document
 - No requirements on data representation
 - can be in any representation
 - should be defined in a well-established format spec
 - a microformat spec needs to be defined for every data

Microformats Usage



Principles

- Design Patterns
 - How to embed data in HTML elements or elements' attributes
 - Applied for a particular microformat specification
- Follow semantics of (X)HTML elements
 - Use the most appropriate semantic HTML element [↗](#)
 - if not available, use `` or `<div>`
- XHTML Metadata Profiles (XMDP)
 - Definition of metadata of a microformat in (X)HTML page
 - Machine and human readable, not a Web standard
 - Uses **profile** attribute on `<head>` element
 - Is deprecated in HTML5
 - Is an analogy to a namespace but not really a namespace!
 - See XHTML Metadata Profiles [↗](#) specification

vCard Example

- Describes contact information

```
1  PROPERTY:value1;value2;...;valueN
2  PROPERTY:SUBPROPERTY1="value";...SUBPROPERTY2="value";...
3
1  BEGIN:VCARD
2  VERSION:4.0
3  N:Vitvar;Tomas;Ing.;Doc.;PhD
4  FN: Doc. Ing. Tomas Vitvar, Ph.D.
5  ORG:Czech Technical University in Prague
6  TITLE:Associate Professor
7  PHOTO:http://vitvar.com/img/tomvit-portrait.jpg
8  TEL;TYPE="work,voice";VALUE=uri:tel:+420-2-334-334
9  TEL;TYPE="home,voice";VALUE=uri:tel:+420-2-443-554
10 ADR;TYPE=work;LABEL="Thákurova 6, Praha 6, Czech Republic"
11   ;;Thákurova 6;Praha 6;Czech Republic
12 EMAIL:tomas.vitvar@fit.cvut.cz
13 END:VCARD
14
```

 - **N** – a structured representation of the name (person/organization)
 - **FN** – formatted name string
 - **ORG** – name of the organization and associated units
 - **TITLE** – job title, functional position
 - **LABEL** – Addressing label

Design Patterns Rules

- **class-design-pattern**

- semantic meaning indicated on HTML content by **class** attribute

```
1 <div class="vcard">
2   <a class="url fn" href="http://www.vitvar.com">
3     Tomas Vitvar</a>,
4   <span class="org">UIBK</span>
5 </div>
```

- **value-class-pattern**

- embedding data structure when a property has subproperties
(vCard fragment is TEL;TYPE=WORK:+43 554 554 556)

```
1 <span class="tel">
2   <span class="type">Work</span>:
3   <span class="value">+43 554 554 556</span>
4 </span>
```

- sometimes value needs to be split into multiple pieces as follows
(note that dialing +430554554556 is not valid)

```
1 <span class="tel">
2   <span class="type">Work</span>:
3   <span class="value">+43</span>(0)
4   <span class="value">554 554 556</span>
5 </span>
```

Design Patterns Rules (cont.)

- **include-pattern**

- to include a subset of data from one area of a page to the other area of the same page (same data to be reused by multiple microformats)

- **cannot be used to include content from other URLs!**

- Example, a verbose hCard on a page:

```
1 <div class="vcard" id="uibk-card">
2   <div class="fn org">University of Innsbruck</div>
3   <div class="adr">
4     <span class="street-address">Technikestrasse 21a</span>,
5     <span class="locality">Tirol</span>
6     <span class="postal-code">6020</span>
7   </div>
8 </div>
9 </div>
10
```

- Reviews on the same page:

- (parser replaces the whole **<a>** element including its content)

```
1 <div class="hreview">
2   <h1 class="summary">A place to study computer science!</h1>
3   <div class="item"><a class="include" href="#uibk-card">Innsbruck Uni</a>
4   <p class="description">Courses in English, fields of computer science.<
5   </div>
6
```

hCard Microformat Example

- hCard profile, options:

```
1 | <link rel="profile" href="http://microformats.org/profile/hcard">
2 |
1 | <...>This content uses <a rel="profile"
2 |   href="http://microformats.org/profile/hcard">hCard.</...>
3 |
1 | <head profile="http://microformats.org/profile/hcard">...</head>
```

- Example specific rules

- vCard properties that do not make sense for hCard
 - e.g., NAME, PROFILE, SOURCE, PRODID, VERSION
 - publishers should not use them, parses should ignore them
- if **fn** == **org** (i.e, **class="fn org"**)
 - hCard is a contact for a company, organization or a place
 - **N** (person's name) property should not be used or be the empty string
- if **fn** != **org** AND **fn** contains two words
 - **fn** is split into **given-name** and **last-name**
 - sub-properties of **N** property (by a whitespace or a comma)
- see a complete specification in hCard Microformat Specification [🔗](#)

Known Issues

- Name conflicts and scalability
 - More microformats on a page may cause naming conflicts
 - no namespace support, **microformats do not scale**
 - functionality of tools may break when data formats change
- No formal semantics, no reasoning support
 - How important is it?
 - Semantics defined in XMDP profiles
 - no formal basis though machine processable
 - lack of compatibility with RDF/RDFa
 - See Microformats and RDF/RDFa compatibility [🔗](#) for details.

Uptake and some statistics

- Two billion pages annotated with hCard
 - Google Rich Snippets
 - Content indexing with microformats, microdata, RDFa
 - see *Google Rich Snippets* [↗](#)
 - 94% of the rich snippets data uses microformats
- [Pizza Pizzas Recipe : Alton Brown : Food Network](#)
[www.foodnetwork.com](#) > Recipes > Italian
★★★★★ 229 reviews - 24 hrs 45 mins
Food Network invites you to try this **Pizza Pizzas** recipe from Alton Brown.
- Firefox 3
 - Native API to parse and process microformats in JavaScript
 - see *Microformats support in Firefox 3* [↗](#)
 - Facebook
 - hCalendar and hCard for events
 - see *Microformats in Facebook* [↗](#)

Overview

- Microformats
- **Microdata**
- RDF and RDFa
- OpenGraph Protocol

Microdata

- Part of HTML5 specification
 - Google is the main driver (rich snippets support)
 - spec includes:
 - Microdata vocabularies
 - Microdata Global Attributes
 - see W3C working draft
- Idea similar to microformats, but
 - items (collection of properties) have ids (URIs)
 - Microdata vocabulary, a formal description of terms
 - <http://schema.org> is becoming a standard
 - e.g., Event, Organization, Person, Product, Review
 - Created and supported by Google, Microsoft, Yahoo!
 - have RDF representation too
 - data formats not directly based on formats such as vCard, vCalendar, they define its own "simple" vocabulary

Global Attributes

- Attributes on any HTML element
- **Itemscope**
 - identifies an element which descendants contain some properties

```
1 | <div itemscope>...</div>
```
- **Itemtype**
 - pointer to a vocabulary that describes the item and its properties
 - <http://www.data-vocabulary.org/Person/>
- **Itemid**
 - global identifier of the item (URI)
 - such as a book's ISBN in urn schema, <urn:isbn:0-330-34032-8>
- **Itemprop**
 - a term from the vocabulary which value is in the element's content

```
1 | <span itemprop="nickname">Johny</span>
```
- **Itemref**
 - a reference to other item within the same document

```
1 | <div itemscope itemref="myprofile"/>
```


Example

- Non-annotated HTML text

```
1 <section>
2   My name is Peter Brown and I work as a post-doc at the Innsbruck University.
3   My friends often call me Pete. My office address is
4   Technikestrasse 21a, 6020, Innsbruck, and you can also visit my homepage at
5   <a href="http://peter-brown.org">http://peter-brown.org</a>
6 </section>
```

- Annotated HTML text with microdata

```
1 <section itemscope itemtype="http://schema.org/Person">
2   My name is <span itemprop="name">Peter Brown</span> and I work as a
3   <span itemprop="title">post-doc</span> at the
4   <span itemprop="affiliation">Innsbruck University</span>.
5   My friends often call me <span itemprop="nickname">Pete</span>.
6   <section itemprop="address" itemscope itemtype="http://schema.org/Address">
7     My office address is <span itemprop="street-address">Technikestrasse 21a</span>
8     <span itemprop="postal-code">6020</span>,
9     <span itemprop="locality">Innsbruck</span>
10   </section>
11   and you can also visit my homepage at
12   <a href="http://peter-brown.org" itemprop="url">http://peter-brown.org</a>
13 </section>
14
```

Microformats vs. Microdata

- Scalability

- *Microformats specs are complicated because of specific rules tailored for vCard, vResume, etc.*
- *Microdata can be easily extensible, when new property occur they can be added without breaking conformance of tools*

- Standards-based

- *Microdata is a standard part of HTML5 effort*
- *Microformats is an "ad-hoc" group of enthusiastic people, though widely supported*
 - *Strength is in underlying well-established formats*
- *Microdata have links to Semantic Web efforts and Linked Data (via RDF), microformats not*

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 - *Structured Property Values*
 - *Encoding RDF in XML (RDF/XML)*
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RDF

- Resource Description Framework (RDF)
 - *Resource – as defined in Web architecture*
 - *usually anything that can be conveyed electronically*
 - *plus abstract concepts that have no representation*
 - *RDF is at the bottom of Semantic Web stack of languages*
- References
 - *W3C Recommendations:*
 - *RDF Suite of W3C Recommendations* [🔗](#),
 - *RDF Primer* [🔗](#)

Meaning of Data in XML

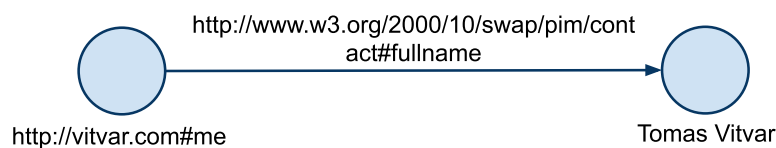
- A resource with URI <http://www.vitvar.com/data-about-me>

```
1 <person xmlns="http://example.org/people">
2   <name>Tomas Vitvar</name>
3   <mailbox>tomas@vitvar.com</mailbox>
4   <city>Innsbruck</city>
5 </person>
```

- No explicit meaning of terms
 - `person`, `name`, `mailbox`, ... are terms defined in namespace <http://example.org/people> but there is no URI assigned to them
this does not work here: <http://example.org/people#name>
- No explicit meaning of relationships
 - a person has name with value Tomas Vitvar (\rightarrow Tomas Vitvar is a person),
this person has mailbox with value tomas@vitvar.com (\rightarrow tomas@vitvar.com is a mailbox), etc.
BUT this person lives?, works?, was born?, ... in a city Innsbruck
- Need for a language to describe statements
 \rightarrow Resource Description Framework

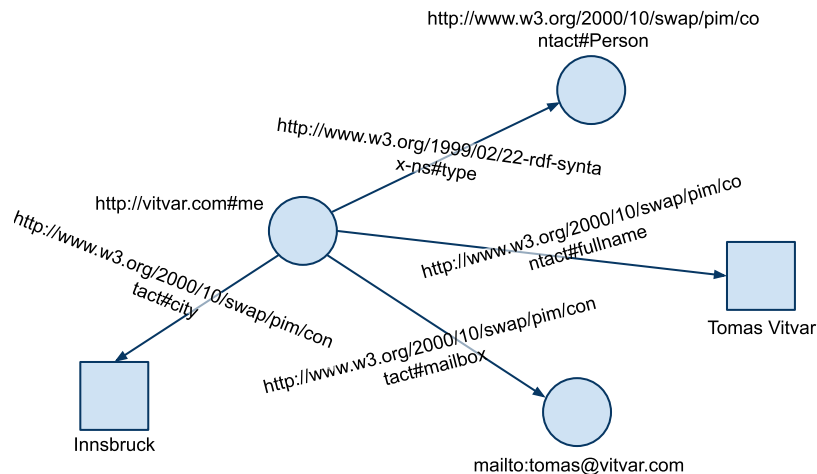
RDF Statement

- RDF Tripple: **subject** – **predicate** – **object**
 - a thing the statement describes (subject)
 - a specific property of the object (predicate)
 - a value of the property (subject)



- Representation of statements
 - using a graph notation
 - \rightarrow nodes are subject and objects (rectangles are literals)
 - \rightarrow arcs are predicates
 - identifiers to identify subject, predicate, object
 - \rightarrow URI references (URIs)
 - machine processable language
 - \rightarrow RDF serializations in triples, RDF/XML, N3, Turtle notations

Meaning of Data in RDF



- **individuals:** Tomas Vitvar identified by `http://vitvar.com#me`
- **kinds of things:** Person identified by `#Person`
 - *properties of those things, e.g., mailbox, identified by #mailbox*
 - *values of those properties, e.g. `mailto:tomas@vitvar.com`*
 - + *values of other data types such as strings, integers, dates, etc.*

References in statements

- **URI identifies**
 - *network-accessible things (electronic documents) → URL*
 - *things that are not network-accessible, such as human beings*
 - *abstract concepts that do not physically exist, such as "fullname"*
 - **RDF uses URI references to identify subjects, predicates, objects**
- **URI references (or URIref in short)**
 - *URI with an optional fragment identifier*
 - `http://www.w3.org/2000/10/swap/pim/contact#fullname`
 - **RDF resource is anything that can be identified with URIref**
 - *a set of URIrefs is called a **RDF vocabulary***
- **Literals**
 - *character strings to represent property values*
 - *can only be assigned to objects in RDF*
(in other words, objects can be either URIrefs or literals)
 - *they cannot be assigned to subjects or properties*
 - *two kinds: **plain literals** and **typed literals***

RDF Serializations – Triples Notation

- Triples notation

- *list of all triples from RDF graph*
- *the full triples notation requires that URI references be written out completely (in angled brackets)*
- *very long documents, some URIrefs need to be repeated*

```
1 | <http://www.example.org/index.html> <http://purl.org/dc/elements/1.1/creator>
```

- Simplicity for examples

- *QNames without angle brackets*
- *Common prefixes and namespaces:*

```
1 | rdf: http://www.w3.org/1999/02/22-rdf-syntax-ns#
2 | rdfs: http://www.w3.org/2000/01/rdf-schema#
3 | dc: http://purl.org/dc/elements/1.1/
4 | ex: http://www.example.org/
5 | ext: http://www.example.org/terms
6 | xsd: http://www.w3.org/2001/XMLSchema#
```

- *example*

```
1 | ex:index.html dc:creator "Tomas" .
2 | ex:index.html dc:language "en" .
```

Kinds of Things

- Property **rdf:type**

- *defines a type of a resource*

```
1 | ex:me rdf:type ext:Person .
```

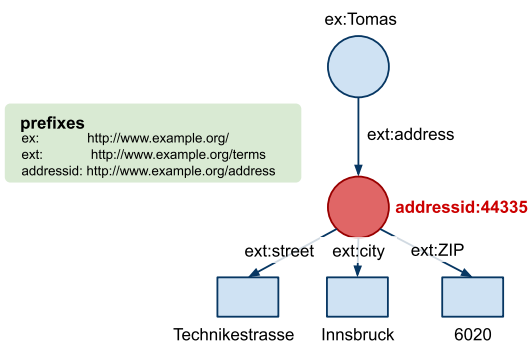
- *corresponds to "is a member of" relationship*
- **ext:Person** understood as a class
 - *however, RDF language does not define its semantics*
 - *RDF Schema language provides additional vocabulary for class semantics*

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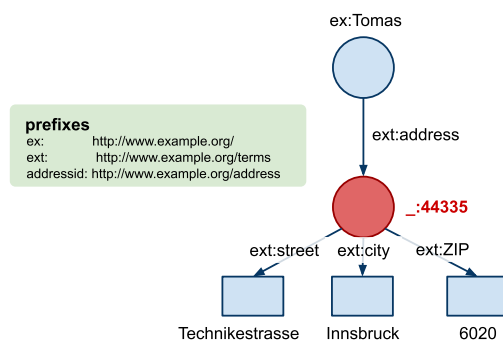
Structured Property Values

- Consider real-world complex structures
 - *Tomas works at Technikestrasse 21a, 6020 Innsbruck, Austria*
 - *One option to describe this using RDF:*
 - 1 | `ex:Tomas ext:works "Technikestrasse 21a, 6020 Innsbruck, Austria" .`
 - *But this is not often sufficient, such statements usually need to be recored as a structure, i.e. a street, a city, ZIP, ...*
 - *describe Tomas's **address** as a resource that has a URIref*



Blank Nodes

- Does every structure need to have a URIref?
 - When referenced from outside of the graphs yes, otherwise not
- Blank nodes
 - Nodes that do not need to be referenced from outside of the graph
 - No need for URIref, they are only used within the graph
- Blank node identifier
 - local within a graph: `_:LocalID`, must be unique within the graph
 - two blank nodes in two graphs with the same IDs are not the same!



Modeling with Blank Nodes

- N-ary relationships
 - In fact, a blank node is a way to model an n-ary relationships
 - A blank node breaks down an n-ary to binary relationships
 - 3-ary relationship between Tomas and (Technikestr, Innsbruck, 6020)
Tomas – Technikestr, Tomas – Innsbruck, Tomas – 6020
- Unidentified things
 - not always good to use URIs such as e-mails to identify people
 - e-mails may change, disappear, ...
 - sometimes no need to assign unique ids to people
 - Example
 - the author of the book is `mailto:tomas@vitvar.com`, as opposed to it is a person with e-mail `mailto:tomas@vitvar.com`
 - A person is an **abstract concept** that can be modeled using a blank node

```
1 | ex:book23 ext:author _:author1 .
2 | _:author1 ext:email <mailto:tomas@vitvar.com .
3 | _:author1 ext:name "Tomas Vitvar" .
4 | _:author1 rdf:type ex:person .
```

Untyped and Typed Literals

- Untyped Literals

- *No information about how to interpret a value of the plain literal*
- *a programme must have a knowledge how to interpret the value*

```
1 | ex:person1 ext:age "24" .
```

- Typed literals

- *pairing a string with a URIref that identifies a particular datatype*
(*xsd:* refers to <http://www.w3.org/2001/XMLSchema#>)

```
1 | ex:person1 ext:age "24"^^xsd:integer
```

- *RDF does not define its own data types (except `rdf:XMLLiteral`)*
 - *no need to map external to native ones*
- *RDF uses external data types defined in XML Schema*
 - *not all are suitable, only basic ones such as `string`, `integer`, `date`*

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Basic Rules

- Representation of RDF in XML language
- Example RDF triple
 - a page `index.html` was created on August 16, 1999
- 1 | `ex:index.html` `ext:creation-date` "Aug 16, 1999" .
- RDF/XML representation
 - We can interpret a RDF statement as:
a **description** that is **about** a subject of the statement
 - XML element (QName) of the description is the **predicate**
 - a value of the element is the **object**

```
1  <?xml version="1.0"?>
2  <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
3    xmlns:ext="http://www.example.org/terms/">
4
5    <rdf:Description rdf:about="http://www.example.org/index.html">
6      <ext:creation-date>August 16, 1999</ext:creation-date>
7    </rdf:Description>
8  </rdf:RDF>
```

- URIs must be written out when in attribute values

Multiple Statements and Typed Literals

- Example RDF triples
- 1 | `ex:index.html` `ext:creation-date` "Aug 16, 1999" .
- 2 | `ex:index.html` `dc:language` "en" .
- 3 | `ex:index.html` `ext:rank` "3"^^`xsd:decimal` .
- 4 | `ex:index.html` `dc:creator` <`http://www.vitvar.com#me`> .

- RDF/XML representation

```
1  <?xml version="1.0"?>
2  <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
3    xmlns:dc="http://purl.org/dc/elements/1.1/"
4    xmlns:ext="http://www.example.org/terms/">
5
6    <rdf:Description rdf:about="http://www.example.org/index.html">
7      <ext:creation-date>August 16, 1999</ext:creation-date>
8      <dc:language>en</dc:language>
9      <ext:rank
10        rdf:datatype="http://www.w3.org/2001/XMLSchema#decimal">
11        3</ext:rank>
12      <dc:creator rdf:resource="http://www.vitvar.com#me"/>
13    </rdf:Description>
14  </rdf:RDF>
15
```

- a description may combine all properties for a single subject but there also can be a description for every subject (such representations are the same)

Blank Nodes

- Example RDF triples

```
1 | ex:index.html    ext:editor    _:editor332 .
2 | _editor332      ext:name      "Tomas Vitvar" .
3 | _editor332      ext:homepage   <http://www.vitvar.com> .
```

- RDF/XML representation

```
1 | <?xml version="1.0"?>
2 | <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
3 |   xmlns:ext="http://www.example.org/terms/">
4 |
5 |   <rdf:Description rdf:about="http://www.example.org/index.html">
6 |     <ext:editor rdf:nodeId="editor332"/>
7 |   </rdf:Description>
8 |
9 |   <rdf:Description rdf:nodeId="editor332">
10 |     <ext:name>Tomas Vitvar<ext:name>
11 |     <ext:homepage rdf:resource="http://www.vitvar.com"/>
12 |   </rdf:Description>
13 |
14 | </rdf:RDF>
```

– A node with id **editor332** can be referenced from within the RDF graph, not outside of the RDF graph

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RDFa

- Embedding RDF data in XHTML
 - *XHTML only, is extensible, HTML not*
 - *RDFa defines a number of extension attributes*
 - *Parsers may recognize RDFa annotations in HTML too*
 - *RDFa is generic to embed arbitrary RDF data*
 - *however, only standard (commonly agreed) vocabularies make sense*
- W3C Recommendations:
 - *RDFa Specification* [↗](#)
 - *RDFa Primer* [↗](#)

Property and Object Values as Resources

- Creating a property using **rel** attribute
 - *assume, following text is at <http://blog.vitvar.com/?p=107>*

```
1 | Content on this page is licensed under
2 | <a xmlns:ext="http://www.example.org/terms"
3 |   rel="ext:license"
4 |   href="http://creativecommons.org/licenses/by/3.0">
5 |   a Creative Commons License - attribution
6 | </a>
```

- *This corresponds to the RDF triple*

```
1 | <http://blog.vitvar.com/?p=107> ext:license
2 |   <http://creativecommons.org/licenses/by/3.0> .
```

→ *When the subject is not explicitly stated, then the subject is the URL of the XHTML page being described*

Property and Object Values as Literals

- Creating a property using **property** attribute

- *RDFa defines a **property** extension attribute*

- *assume, following text is at <http://blog.vitvar.com/?p=107>*

```
1 <div xmlns:dc="http://purl.org/dc/elements/1.1/">
2   <h3 property="dc:creator">Tomas</h3>
3 </div>
```

- *This corresponds to the RDF triple*

```
1 <http://blog.vitvar.com/?p=107> dc:creator "Tomas" .
```

- Typed literals

- *RDFa defines a **datatype** extension attribute*

```
1 <div xmlns:dc="http://purl.org/dc/elements/1.1/"
2   xmlns:xsd="http://www.w3.org/2001/XMLSchema#">
3   <h3 property="dc:creator" datatype="xsd:string">Tomas</h3>
4 </div>
```

- Alternative content

- *RDFa defines **content** extension attribute*

- *replaces the object value that is in the element's value*

```
1 <div xmlns:dc="http://purl.org/dc/elements/1.1/">
2   <h3 property="dc:date" content="2011-04-08">8 April</h3>
3 </div>
4
```

Subject

- Creating a subject using **about** attribute

- *RDFa defines **about** extension attribute*

- *Let the following text is at <http://blog.vitvar.com/?p=107>*

```
1 <div xmlns:dc="http://purl.org/dc/elements/1.1/"
2   about="/p/107" >
3   <h3 property="dc:creator">Tomas</h3>
4 </div>
```

- *This corresponds to the RDF triple*

```
1 <http://blog.vitvar.com/p/107> dc:creator "Tomas".
```

- *Also possible to use multiple subjects on a single page*

Types and Blank Nodes

- Types
 - RDFa defines **typeof** extension attribute
 - corresponds to **rdf:type** property
- Blank node
 - When annotation has **typeof** but not **about**
 - blank node, that is, a node without a subject

```
1 <div about="#me" rel="foaf:knows"
2   xmlns:foaf="http://xmlns.com/foaf/0.1">
3 <div typeof="foaf:person">
4   <p property="foaf:name">Peter<p>
5   <p>
6     Email: <a rel="foaf:mbox" href="mailto:peter@novak.cz">
7       peter@novak.cz</a>
8   <p>
9 </div>
```

- I know Peter who has e-mail petr@novak.cz

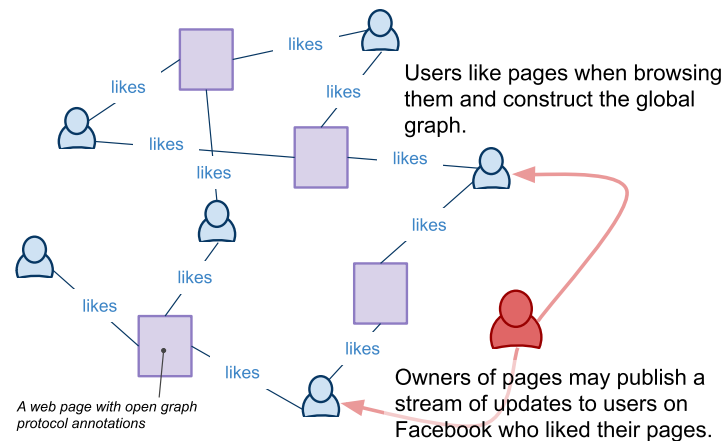
Overview

- Microformats
- Microdata
- RDF and RDFa
- **OpenGraph Protocol**

OpenGraph Protocol

- Global Social Graph

- *important adoption of RDFa, see Open Graph Protocol*
- *defines meta-data for pages' description so that it can be easily included in a global graph connecting people and pages through "likes" (a person – likes – a page)*



Page Annotations

- Open Graph protocol main properties

- *a page is the subject in the RDF triple*
- **og:title** – *title of the page*
- **og:type** – *type of the content (e.g., movie)*
- **og:image** – *URL of the image for the page*
- **og:url** – *a canonical URL of the page to be used as its permanent ID in the graph*

- HTML page annotation RDFa example

```
1 <html xmlns:og="http://ogp.me/ns#">
2 <head>
3   <title>The Rock (1996)</title>
4   <meta property="og:title" content="The Rock" />
5   <meta property="og:type" content="movie" />
6   <meta property="og:url" content="http://www.imdb.com/title/402/" />
7   <meta property="og:image" content="http://media-imdb.com/rock.jpg" />
8   ...
9 </head>
10 ...
11 </html>
```

Publishing updates

- Ownership
 - Page must be associated with a Facebook application
 - using **fb:app_id** meta tag
 - Owners can publish a stream of updates using the Facebook Graph API [🔗](#)

- Getting access

```
1 curl -F type=client_cred \  
2     -F client_id=app_id \  
3     -F client_secret=app_secret \  
4     https://graph.facebook.com/oauth/access_token
```

- Publishing updates

```
1 curl -F 'access_token=...' \  
2     -F 'message=Hello Likers' \  
3     -F 'id=http://www.mydomain.com/great_page.html' \  
4     https://graph.facebook.com/feed
```