

# Web 2.0

## Lecture 7: Annotations

doc. Ing. Tomáš Vitvar, Ph.D.

tomas@vitvar.com • @TomasVitvar • <http://vitvar.com>



Czech Technical University in Prague

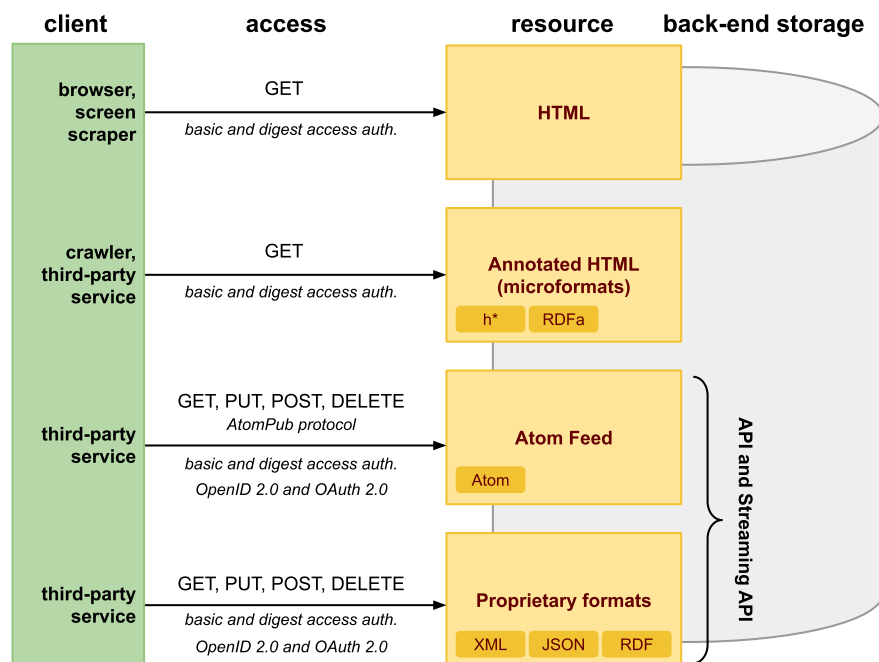
Faculty of Information Technologies • Software and Web Engineering • <http://vitvar.com/courses/w20>



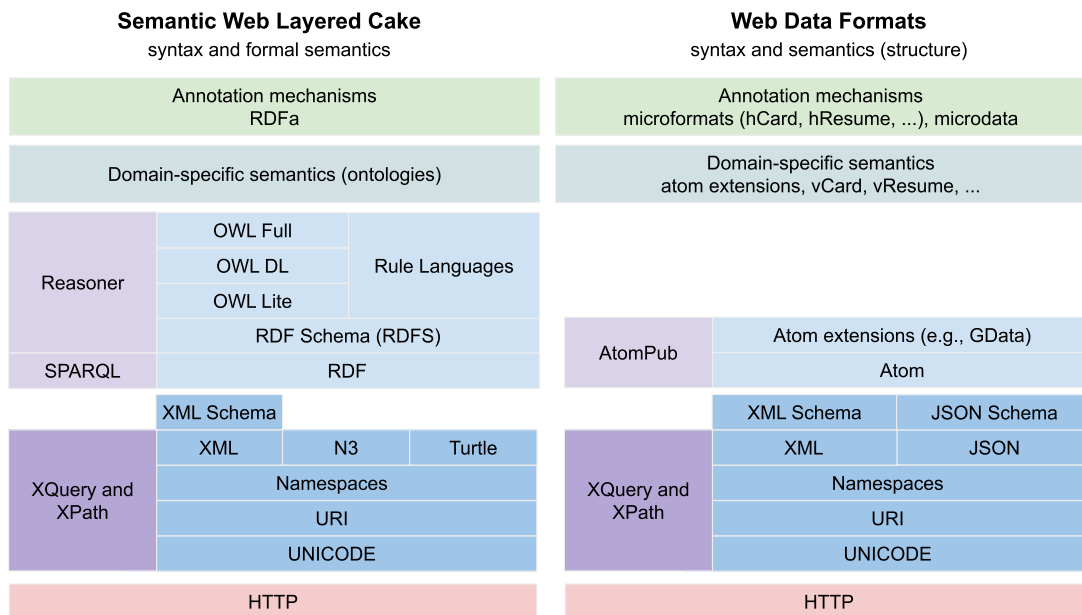
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## Data on the Web



# Data Syntax, Structure and Semantics



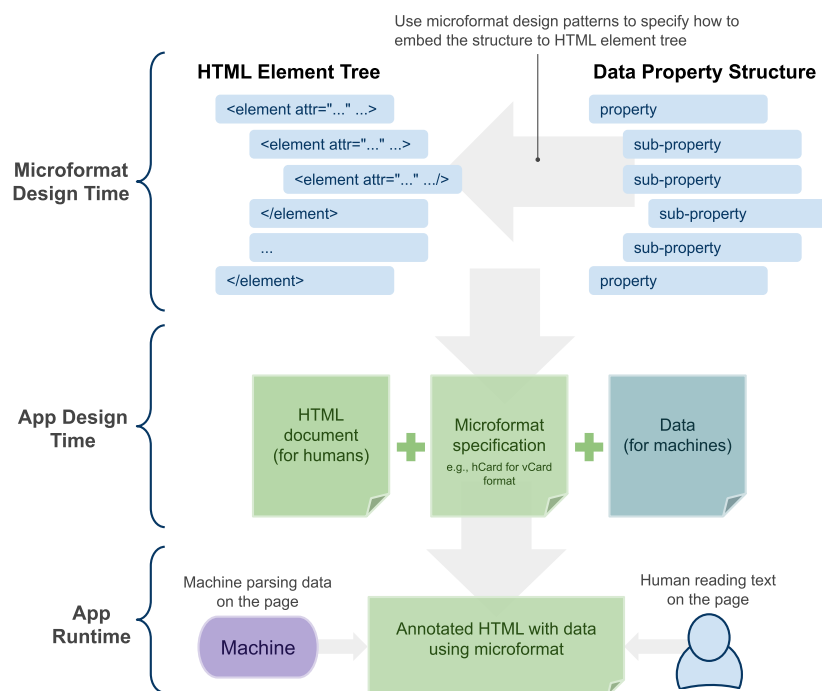
## Overview

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

  - **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*

## Overview

- Microformats
- Microdata
- **RDF and RDFa**
  - *Structured Property Values*
  - *Encoding RDF in XML (RDF/XML)*
  - *RDF-in attributes (RDFa)*
- OpenGraph Protocol

## 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

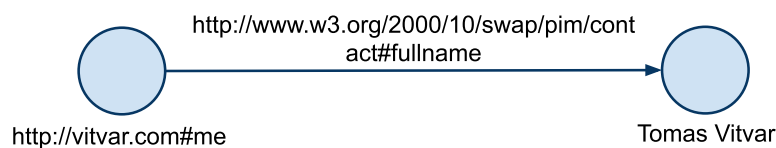
- A resource with URI <http://www.vitvar.com/data-about-me>

```
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

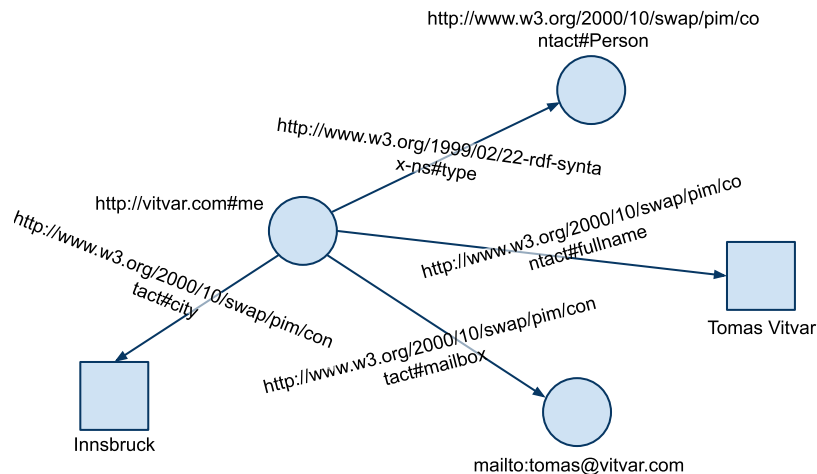
## RDF Statement

- 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*

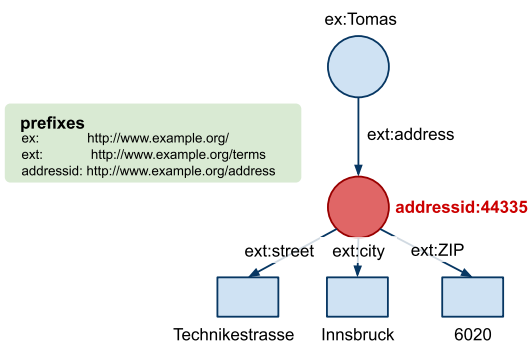
→ *RDF Schema language provides additional vocabulary for class semantics*

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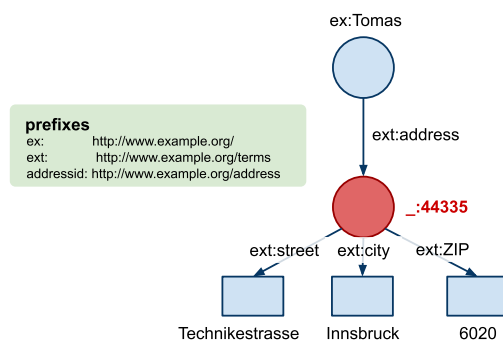
## Structured Property Values

- 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

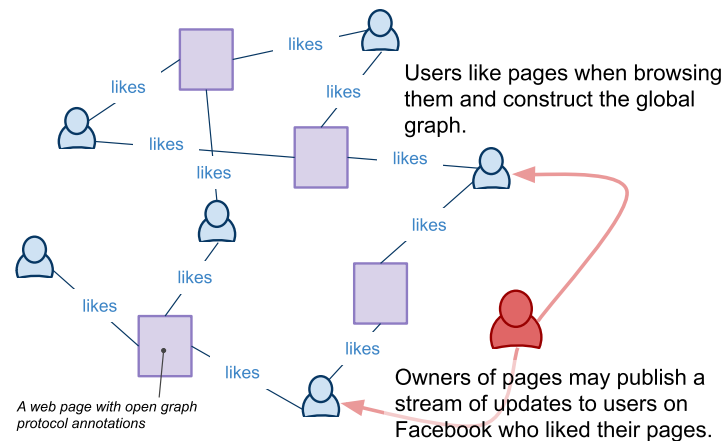
## Overview

- 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
```