

Web 2.0

Lecture 8: Annotations

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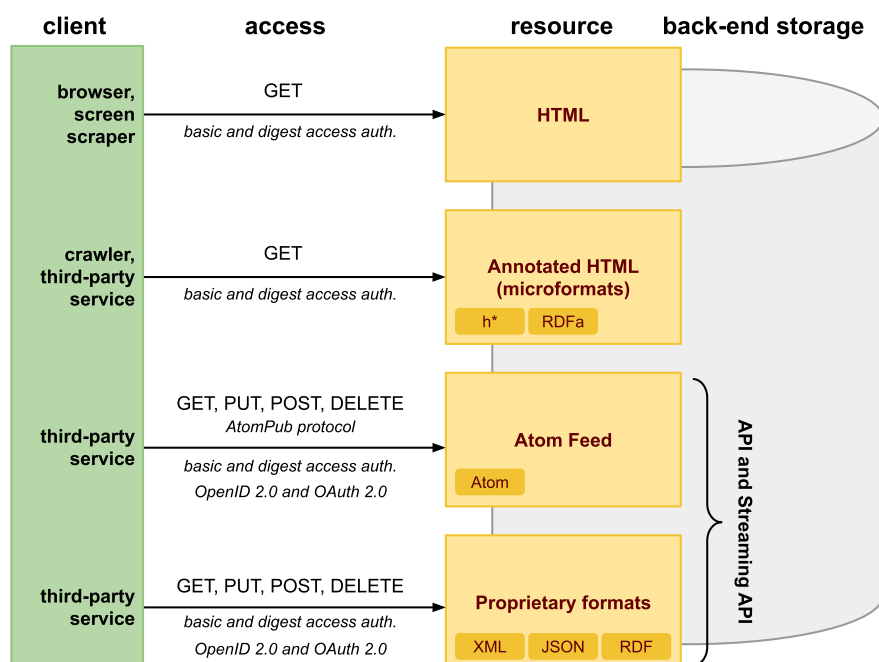
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Faculty of Information Technologies • Software and Web Engineering • <https://courses.fit.cvut.cz/MI-W20/>



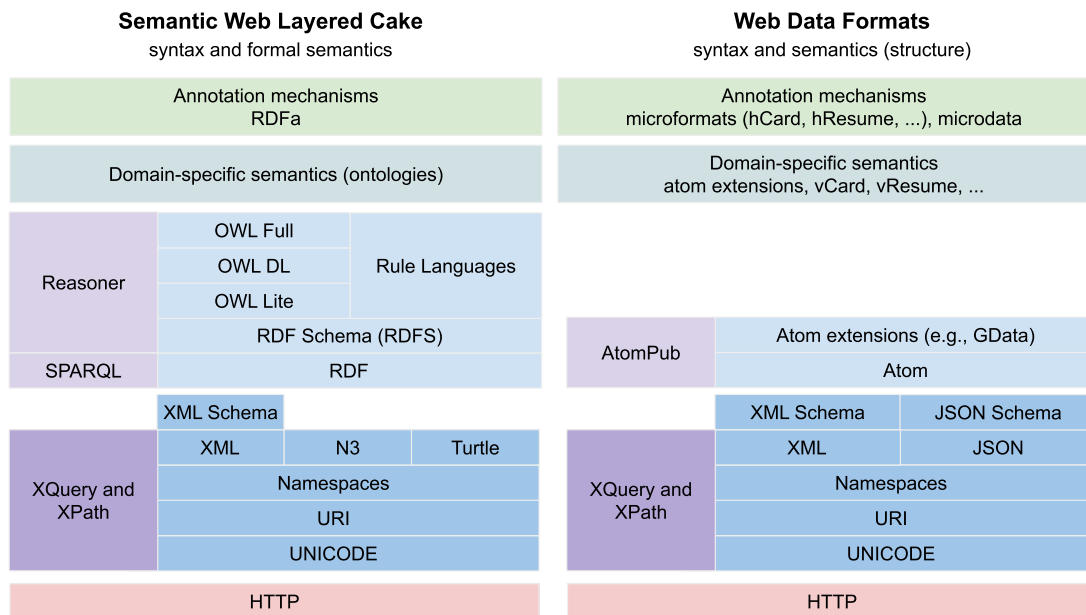
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Data on the Web



Data Syntax, Structure and Semantics



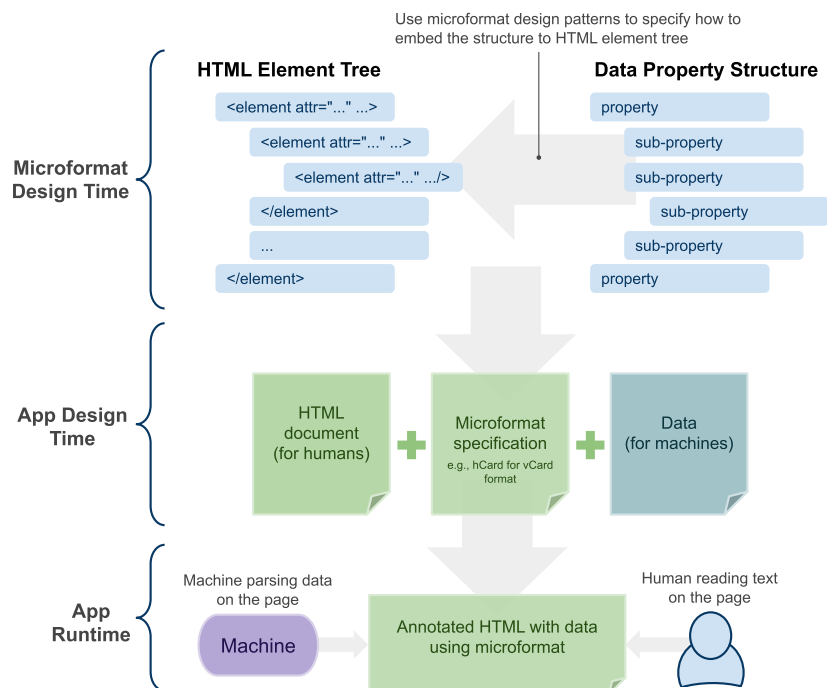
Overview

- 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 `` 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>
```

- 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 U
4   <p class="description">Courses in English, fields of computer scie
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">Johnny</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 Univer
3   My friends often call me Pete. My office address is
4   Technikestrasse 21a, 6020, Innsbruck, and you can also visit my homepage
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 21
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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- **RDF and RDFa**
 - *Structured Property Values*
 - *Encoding RDF in XML (RDF/XML)*
 - *RDF-in attributes (RDFa)*
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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>

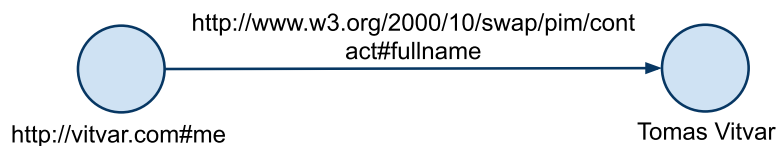
```
1 <person xmlns="http://example.org/people">
2   <name>Tomas Vitvar</name>
3   <mailbox>tomas@vitvar.com</mailbox>
4   <city>Innsbruck</city>
5 </person>
```

- 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

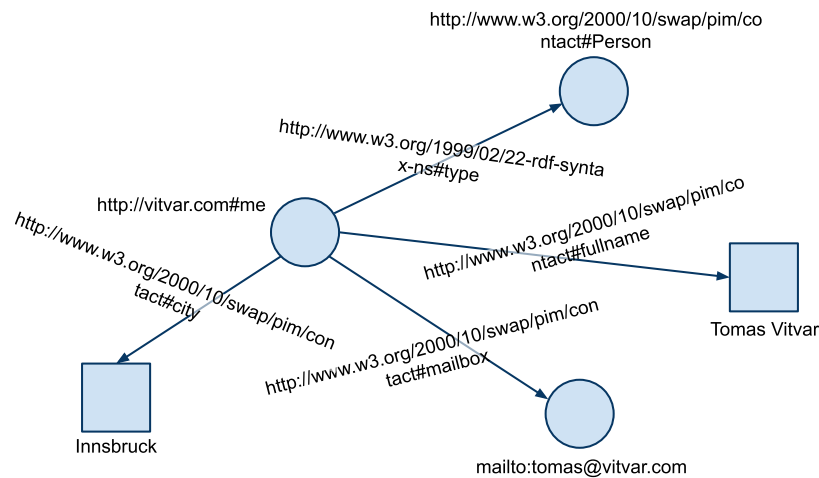
- RDF Tripple: **subject** – **predicate** – **object**

- 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 URIs 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 URIs**
 - a set of URIs 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 URIs 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/crea
```

- 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*

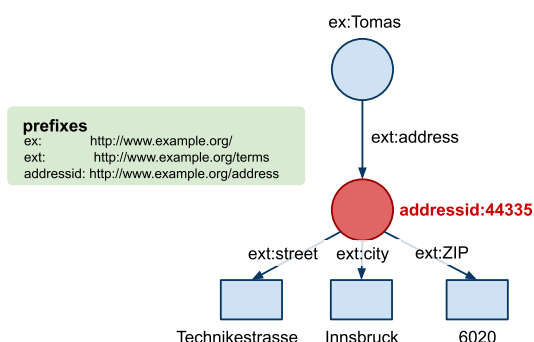
```
1 | ex:me rdf:type ext:Person .
```
 - *corresponds to "is a member of" relationship*
 - **ext:Person** understood as a class
 - *however, RDF language does not define its semantics*
 - *RDF Schema language provides additional vocabulary for class semantics*

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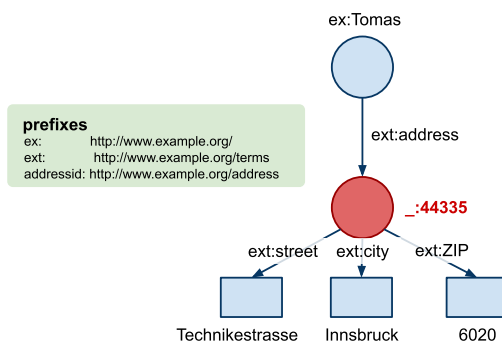
Structured Property Values

- 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>
```

– 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
 - Parses 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**

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
```