Web 2.0
Lecture 10: Annotations

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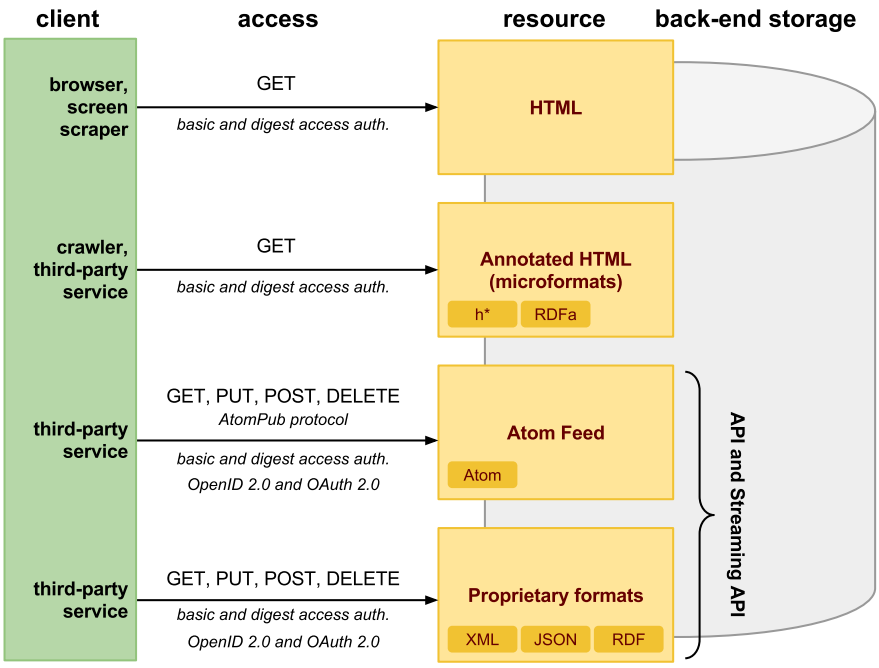
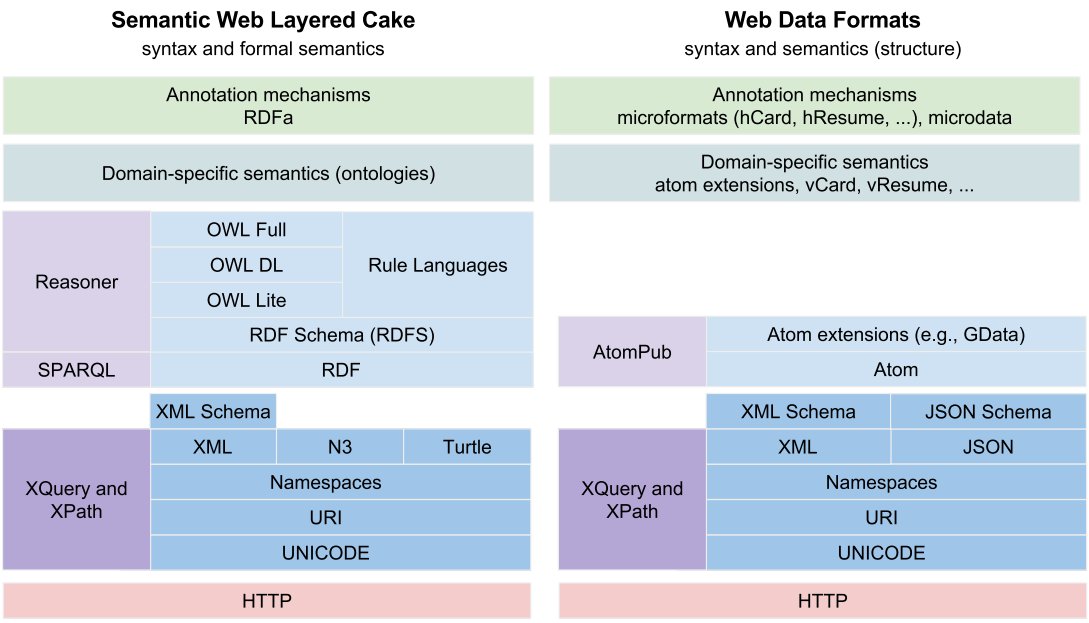
Data on the Web



Data Syntax, Structure and Semantics



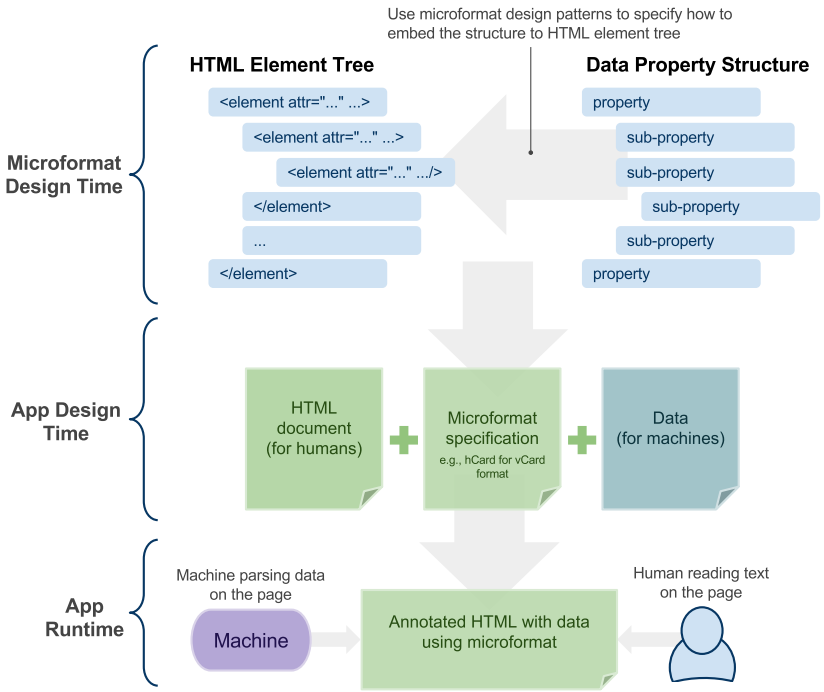
Overview

- 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

```
PROPERTY:value1;value2;...;valueN
PROPERTY:SUBPROPERTY1="value";...SUBPROPERTY2="value";...
```

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

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

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

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

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

```
<span class="tel">
    <span class="type">Work</span>:
    <span class="value">+43</span>(0)
    <span class="value">554 554 556</span>
</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:*

```
<div class="vcard" id="uibk-card">
    <div class="fn org">University of Innsbruck</div>
        <div class="adr">
            <span class="street-address">Technikestrasse 21a</span>,
            <span class="locality">Tirol</span>
            <span class="postal-code">6020</span>
        </div>
     </div>
</div>
```

  - *Reviews on the same page: (parser replaces the whole* `<a>` *element including its content)*

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

hCard Microformat Example

- hCard profile, options:

```
<link rel="profile" href="http://microformats.org/profile/hcard">
```

```
<...>This content uses <a rel="profile"
    href="http://microformats.org/profile/hcard">hCard.</...>
```

```
<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` *peoperty (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*

- 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

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

- Annotated HTML text with microdata

```
<section itemscope itemtype="http://schema.org/Person">
  My name is <span itemprop="name">Peter Brown</span> and I work as a
  <span itemprop="title">post-doc</span> at the
  <span itemprop="affiliation">Innsbruck University</span>.
  My friends often call me <span itemprop="nickname">Pete</span>.
  <section itemprop="address" itemscope itemtype="http://schema.org/Address">
    My office address is <span itemprop="street-address">Tchnikestrasse 21a</s
    <span itemprop="postal-code">6020<span>,
    <span itemprop="locality">Innsbruck</span>
  <section>
  and you can also visit my homepage at
  <a href="http://peter-brown.org" itemprop="url">http://peter-brown.org</a>
</section>

```


Microformats vs. Microdata

- Scalability
  - *Microformats specs are complicated because of specific rules tailored for vCard, vResume, etc.*
  - *Microdata can be easilly extensible, when new property occur they can be added witout breaking conformance of tools*
- Standards-based
  - *Microdata is a standard part of HTML5 effort*
  - *Microformats is an "ad-hoc" group of ethusiastic people, though widely supported*
    → Strength is in underyling 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)*
  - *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

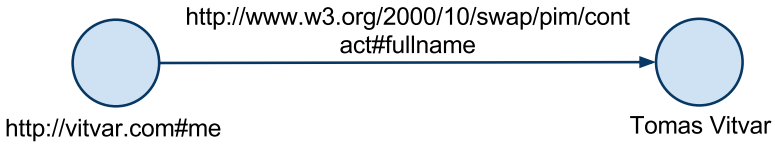
- A resource with URI `http://www.vitvar.com/data-about-me`

```xml
<person xmlns="http://example.org/people">
    <name>Tomas Vitvar</name>
    <mailbox>tomas@vitvar.com</mailbox>
    <city>Innsbruck</city>
</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 (→ Tomas Vitvar is a person), this person has mailbox with value tomas@vitvar.com (→ 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
  → Resource Description Framework

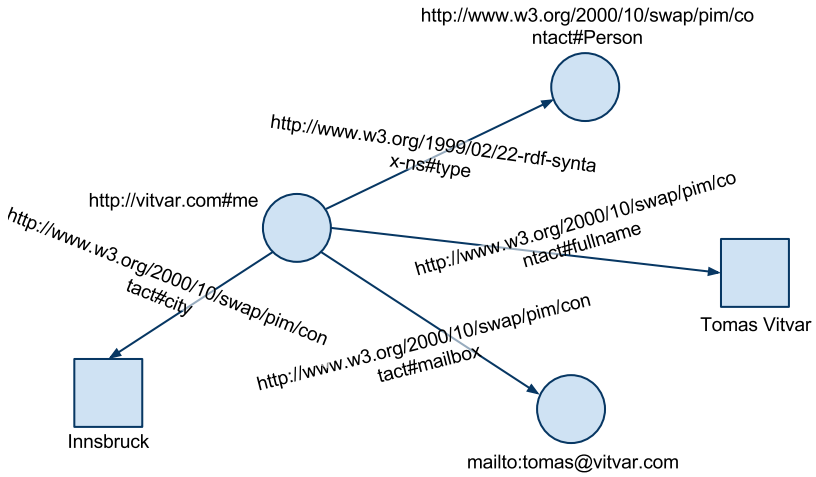
RDF Statement

- 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*
    → nodes are subject and objects (rectangles are literals)
    → arcs are predicates
  - *identifiers to identify subject, predicate, object*
    → URI references (URIrefs)
  - *machine processable language*
    → 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*

```
<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:*

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

  - *example*

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


Kinds of Things

- Property `rdf:type`
  - *defines a type of a resource*

```
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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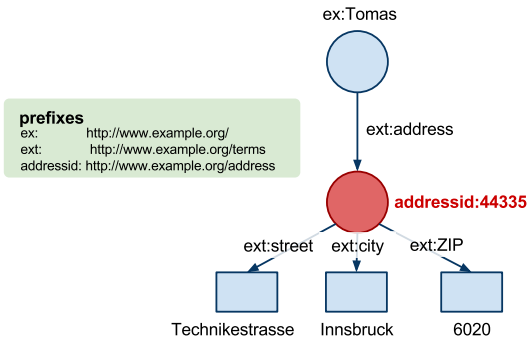
Structured Property Values

- Consider real-world complex structures
  - *Tomas works at Technikestrasse 21a, 6020 Innsbruck, Austria*
  - *One option to describe this using RDF:*

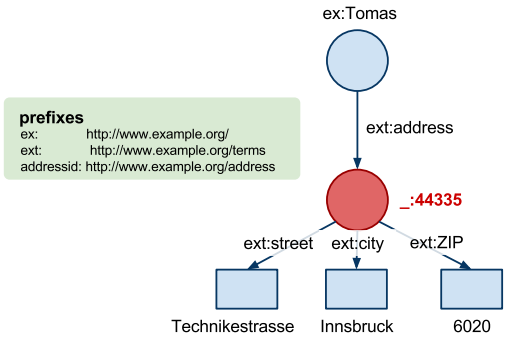
```
1 | ex:Tomas ext:works "Technikestrasse 21a, 6020 Innsbruck, Austria" .
```

  - *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 uniqie 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 oposed 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*

```
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***

```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:ext="http://www.example.org/terms/">

    <rdf:Description rdf:about="http://www.example.org/index.html">
        <ext:creation-date>August 16, 1999</ext:creation-date>
    </rdf:Description>
</rdf:RDF>
```

  - ***URIrefs must be written out when in attribute values***

Multiple Statements and Typed Literals

- Example RDF triples

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

- RDF/XML representation

```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:dc="http://purl.org/dc/elements/1.1/"
    xmlns:ext="http://www.example.org/terms/">

    <rdf:Description rdf:about="http://www.example.org/index.html">
        <ext:creation-date>August 16, 1999</ext:creation-date>
        <dc:language>en</dc:language>
        <ext:rank
           rdf:datatype="http://www.w3.org/2001/XMLSchema#decimal">
              3</ext:rank>
        <dc:creator rdf:resource="http://www.vitvar.com#me"/>
    </rdf:Description>
</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

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

- RDF/XML representation

```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:ext="http://www.example.org/terms/">

    <rdf:Description rdf:about="http://www.example.org/index.html">
        <ext:editor rdf:nodeId="editor332"/>
    </rdf:Description>

    <rdf:Description rdf:nodeId="editor332">
        <ext:name>Tomas Vitvar<ext:name>
        <ext:homepage rdf:resource="http://www.vitvar.com"/>
    </rdf:Description>

</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`

```
Content on this page is licensed under
<a xmlns:ext="http://www.example.org/terms"
   rel="ext:license"
   href="http://creativecommons.org/license/by/3.0">
   a Creative Commons License – attribution
</a>
```

  - *This corresponds to the RDF triple*

```
<http://blog.vitvar.com/?p=107> ext:license
    <http://creativecommons.org/license/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`

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

  - *This corresponds to the RDF triple*

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

- Typed literals
  - *RDFa defines a* `datatype` *extension attribute*

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

- Alternative content
  - *RDFa defines* `content` *extension attribute*

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

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

```


Subject

- Creating a subject using `about` attribute
  - *RDFa defines* `about` *extension attribute*
  - *Let the following text is at* `http://blog.vitvar.com/?p=107`

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

  - *This corresponds to the RDF triple*

```
<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*

```
<div about="#me" rel="foaf:knows"
  xmlns:foaf="http://xmlns.com/foaf/0.1">
<div typeof="foaf:person">
  <p property="foaf:name">Peter<p>
  <p>
     Email: <a rel="foaf:mbox" href="mailto:peter@novak.cz">
       peter@novak.cz</a>
  <p>
</div>
```

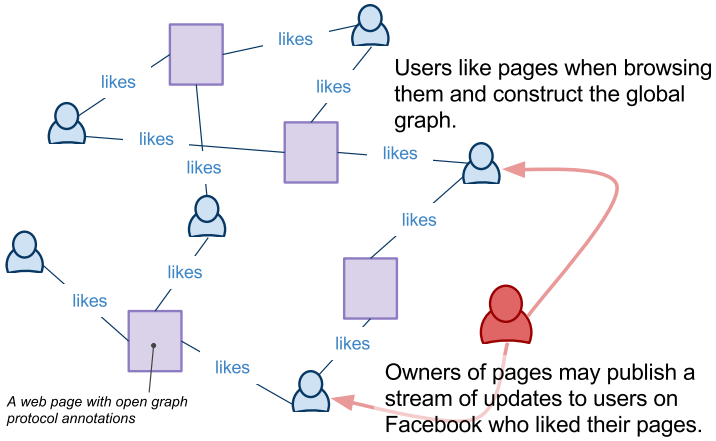
  - *I know Peter who has e-mail petr@novak.cz*

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

```
<html xmlns:og="http://ogp.me/ns#">
  <head>
    <title>The Rock (1996)</title>
    <meta property="og:title" content="The Rock" />
    <meta property="og:type" content="movie" />
    <meta property="og:url" content="http://www.imdb.com/title/402/" />
    <meta property="og:image" content="http://media-imdb.com/rock.jpg" />
    ...
   </head>
   ...
</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

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

- Publishing updates

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