

Introduction to a Web of Linked Data

Week 4: Integration with Other Data Formats and Sources

A Web of "All" Data

W3C

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STANDARDS PARTICIPATE MEMBERSHIP ABOUT W3C

ACTIVE GROUPS

[RDF Working Group](#)
[Linked Data Platform Working Group](#)
[Data on the Web Best Practices Working Group](#)
[CSV on the Web Working Group](#)
[Government Linked Data Working Group](#)
[Semantic Web Interest Group](#)
[Semantic Web Health Care and Life Sciences Interest Group](#)
[Data Activity Coordination Group](#)

NEARBY

[Data Activity Blog](#)
[Activity Statement](#)
[The Digital Publishing Activity](#)
[The XML Activity](#)

ASSOCIATED PROJECTS

[Crosscloud](#)
[Smart Open Data](#)
[Share-PSI 2.0](#)

W3C » Data Activity

W3C DATA ACTIVITY *Building the Web of Data*

More and more Web applications provide a means of accessing data. From simple visualizations to sophisticated interactive tools, there is a growing reliance on the availability of data which can be "big" or "small", of diverse origin, and in different formats; it is usually published without prior coordination with other publishers — let alone with precise modeling or common vocabularies. The Data Activity recognizes and works to overcome this diversity to facilitate potentially Web-scale data integration and processing. It does this by providing standard data exchange formats, models, tools, and guidance.

The overall vision of the Data Activity is that people and organizations should be able to share data as far as possible using their existing tools and working practices but in a way that enables others to derive and add value, and to utilize it in ways that suit them. Achieving that requires a focus not just on the interoperability of data but of communities.

Questions? Contact [Phil Archer](#) <phila@w3.org>, W3C Data Activity Lead.

Context & Vision

The Data Activity merges and builds upon the [eGovernment](#) and [Semantic Web Activities](#). The eGovernment Activity comprised an interest group that offered members a series of interesting talks from well placed speakers in governments around the world, including from countries that are often under-represented at W3C such as Jordan and Uganda. Primary topics have been the use of social media for citizen engagement and open data. The Semantic Web Activity was launched in 2001 to lead the use of the Web as an exchange medium for data as well as documents. That overall aim, along with a series of associated activities by W3C and others, has been highly successful — although not necessarily in the way originally envisioned. For example, the vision was that organizations and individuals would publish data in

vocabularies, which the user community sees as critical companions to Web standards such as XML, RDF and HTML.

The use of the Web as a platform for delivering data has been driven by policy as much as by technology. The [G8 Open Data Charter](#) being a prime example. Other examples include President Obama's [Executive Order](#) and the European Union's [revised PSI Directive](#). These policies apply equally to the areas of government information, scientific research, and cultural heritage and that creates a further source of diversity of workflows, people and the technologies they use.

The W3C Data Activity will support technologists tasked with responding to this political pressure. It will do so in a way that works for those individuals and at the same time delivers maximum return on the political and financial

Toward all forms of data on the web

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WEEK 4: Integration With Other Data Formats and Sources

1. RDFa: an RDF syntax inside HTML
2. GRDDL: extract RDF from X(HT)ML
3. JSON-LD: JSON syntax for RDF
4. Tabular data and metadata (CSV)
5. R2RML: integration with databases
6. LDP: a REST API to linked data

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A Lot of Data Inside HTML Pages



The Man Who Mistook His Wife for a Hat (Picador) **Paperback**
by [Oliver Sacks](#) (Author)
★★★★★ [✓](#) (19 customer reviews)

RRP: ~~£8.99~~
Price: **£6.99** & eligible for **Free UK delivery** on orders over £15 with Super Saver Delivery. [See details and conditions](#)
You Save: **£2.00 (22%)**

Availability: In stock.
Note: this item will be delivered in time for Christmas in the UK. For orders from our third-party sellers, please refer to the seller's page for delivery information. For destinations outside the UK, please see [last-order dates](#). Dispatched from and sold by Amazon.co.uk.

Product details

Paperback: [256 pages](#)
Publisher: [Picador; New Ed edition \(7 Nov 1986\)](#)
Language: [English](#)
ISBN-10: [0330294911](#)
ISBN-13: [978-0330294911](#)
Product Dimensions: [19.7 x 13.1 x 1.9 cm](#)
Average Customer Review: [★★★★★](#) (19 customer reviews)
Amazon.co.uk Sales Rank: 1,107 in Books (See [Bestsellers in Books](#))

Popular in these categories:

- #1 in [Books](#) > [Health, Family & Lifestyle](#) > [Psychology & Psychiatry](#) > [Psychiatry](#)
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- #1 in [Books](#) > [Health, Family & Lifestyle](#) > [Psychology & Psychiatry](#) > [Neuropsychology](#)

(Publishers and authors: [Improve Your Sales](#))

Other Editions: [Hardcover](#) | [Paperback](#) (Large Print e.) | [All Editions](#)

RDFa Means RDF in HTML Attributes



```
<body vocab="http://purl.org/dc/terms/"
```



```
<div resource="http://lib.com/books/0684853949">
```



```
<h2 property="title">The Man Who Mistook His  
Wife For a Hat</h2>
```



```
<h3 property="creator">Oliver Sacks</h3>
```

...



The Man Who Mistook His Wife for a Hat (Picador) (Paperback)

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#1 in [Books](#) > [Science & Nature](#) > [Medicine](#) > [Medical Sciences A-Z](#) > [Psychiatry](#)

#1 in [Books](#) > [Health, Family & Lifestyle](#) > [Psychology & Psychiatry](#) > [Neuropsychology](#)

(Publishers and authors: [Improve Your Sales](#))

Other Editions: [Hardcover](#) | [Paperback](#) (Large Print e.) | [All Editions](#)

RDFa Light Attributes...

vocab: default vocabulary for a section

prefix: declare other vocabularies

resource: identify a resource

typeof: type a resource using current voc

property: link to a value or a resource

RDFa Core Additional Attributes...

content: provide a specific value

datatype: to type values

about: change the subject of a property

rel: decompose object properties (list)

HTML+RDFa Content

(...)

```
<body vocab="http://purl.org/dc/terms/">
  <div resource="/books/web_semantique">
    <h2 property="title" lang="en">A Web of linked data</h2>
    <p>Date: <span property="created">2012-05-01</span>
      <span property="creator" resource="#fg">by</span></p>
  </div>
  <div vocab="http://xmlns.com/foaf/0.1/" resource="#fg" typeof="Person">
    <p> <span property="name">Fabien Gandon</span>,
      phone: <a property="phone" href="tel:+33492965170">+33492965170</a>
      mail: <a property="mbox"
        href="mailto:fabien.gandon@inria.fr">fabien.gandon@inria.fr</a></p>
  </div>
```

(...)

HTML+RDFA Content (in Browser)

(...)

```
<body vocab="http://purl.org/dc/terms/">
  <div resource="/books/web_semantique">
    <h2 property="title" lang="en">A Web of linked data</h2>
    <p>Date: <span property="created">2012-05-01</span>
      <span property="creator" resource="#fg">by</span></p>
  </div>
  <div vocab="http://xmlns.com/foaf/0.1/" resource="#fg" typeof="Person">
    <p> <span property="name">Fabien Gandon</span>,
      phone: <a property="phone" href="tel:+33492965170">+33492965170</a>
      mail: <a property="mbox"
        href="mailto:fabien.gandon@inria.fr">fabien.gandon@inria.fr</a></p>
  </div>
```

(...)



HTML+RDFa Content (Read by RDFa Parser)

(...)

```
<body vocab="http://purl.org/dc/terms/">
  <div resource="/books/web_semantique">
    <h2 property="title" lang="en">A Web of linked data</h2>
    <p>Date: <span property="created">2012-05-01</span>
      <span property="creator" resource="#fg">by</span></p>
  </div>
  <div vocab="http://xmlns.com/foaf/0.1/" resource="#fg" typeof="Person">
    <p> <span property="name">Fabien Gandon</span>,
      phone: <a property="phone" href="tel:+33492965170">+33492965170</a>
      mail: <a property="mbox"
        href="mailto:fabien.gandon@inria.fr">fabien.gandon@inria.fr</a></p>
  </div>
```

(...)

HTML+RDFa Content (Read by RDFa Parser)

(...)

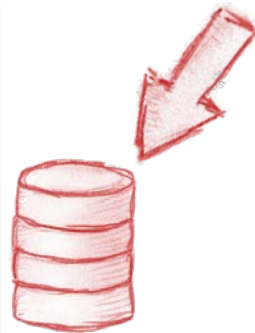
```
<body vocab="http://purl.org/dc/terms/">
  <div resource="/books/web_semantique">
    <h2 property="title" lang="en">A Web of linked data</h2>
    <p>Date: <span property="created">2012-05-01</span>
      <span property="creator" resource="#fg">by</span></p>
  </div>
  <div vocab="http://xmlns.com/foaf/0.1/" resource="#fg" typeof="Person">
    <p> <span property="name">Fabien Gandon</span>,
      phone: <a property="phone" href="tel:+33492965170">+33492965170</a>
      mail: <a property="mbox"
        href="mailto:fabien.gandon@inria.fr">fabien.gandon@inria.fr</a></p>
  </div>
```

(...)

```
@prefix ns1: <http://purl.org/dc/terms/> .
@prefix ns2: <http://xmlns.com/foaf/0.1/> .

</books/web_semantique>
  ns1:title "A Web of linked data"@en ;
  ns1:created "2012-05-01" ;
  ns1:creator <#fg> .

<#fg> a ns2:Person;
  ns2:mbox <mailto:fabien.gandon@inria.fr>;
  ns2:name "Fabien Gandon" ;
  ns2:phone <tel:+33492965170> .
```



Anatomy of HTML+RDFa Content (Vocabularies)

(...)

```
<body vocab="http://purl.org/dc/terms/">
  <div resource="/books/web_semantique">
    <h2 property="title" lang="en">A Web of linked data</h2>
    <p>Date: <span property="created">2012-05-01</span>
      <span property="creator" resource="#fg">by</span></p>
  </div>
```

schemas used

```
<div vocab="http://xmlns.com/foaf/0.1/" resource="#fg" typeof="Person">
  <p> <span property="name">Fabien Gandon</span>,
    phone: <a property="phone" href="tel:+33492965170">+33492965170</a>
    mail: <a property="mbox"
      href="mailto:fabien.gandon@inria.fr">fabien.gandon@inria.fr</a></p>
</div>
```

(...)

Anatomy of HTML+RDFa Content (Subjects)

(...)

```
<body vocab="http://purl.org/dc/terms/">
```

```
<div resource="/books/web_semantique">
```

```
<h2 property="title" lang="en">A Web of linked data</h2>
```

```
<p>Date: <span property="created">2012-05-01</span>
```

```
<span property="creator" resource="#fg">by</span></p>
```

```
</div>
```

```
<div vocab="http://xmlns.com/foaf/0.1/" resource="#fg" typeof="Person">
```

```
<p> <span property="name">Fabien Gandon</span> ,
```

```
phone: <a property="phone" href="tel:+33492965170">+33492965170</a>
```

```
mail: <a property="mbox"
```

```
href="mailto:fabien.gandon@inria.fr">fabien.gandon@inria.fr</a></p>
```

```
</div>
```


(...)

subjects of triples

Anatomy of HTML+RDFa Content (Typing)

(...)

```
<body vocab="http://purl.org/dc/terms/">
  <div resource="/books/web_semantique">
    <h2 property="title" lang="en">A Web of linked data</h2>
    <p>Date: <span property="created">2012-05-01</span>
      <span property="creator" resource="#fg">by</span></p>
  </div>
  <div vocab="http://xmlns.com/foaf/0.1/" resource="#fg" typeof="Person">
    <p> <span property="name">Fabien Gandon</span>,
      phone: <a property="phone" href="tel:+33492965170">+33492965170</a>
      mail: <a property="mbox"
        href="mailto:fabien.gandon@inria.fr">fabien.gandon@inria.fr</a></p>
  </div>
```



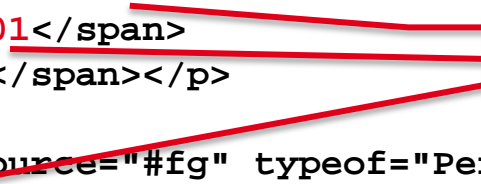
type

(...)

Anatomy of HTML+RDFa Content (Literals)

(...)

```
<body vocab="http://purl.org/dc/terms/">
  <div resource="/books/web_semantique">
    <h2 property="title" lang="en">A Web of linked data</h2>
    <p>Date: <span property="created">2012-05-01</span>
      <span property="creator" resource="#fg">by</span></p>
  </div>
  <div vocab="http://xmlns.com/foaf/0.1/" resource="#fg" typeof="Person">
    <p> <span property="name">Fabien Gandon</span>,
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      mail: <a property="mbox"
        href="mailto:fabien.gandon@inria.fr">fabien.gandon@inria.fr</a></p>
  </div>
```



properties & values

(...)

Anatomy of HTML+RDFa Content (Objects)

(...)

```
<body vocab="http://purl.org/dc/terms/">
  <div resource="/books/web_semantique">
    <h2 property="title" lang="en">A Web of linked data</h2>
    <p>Date: <span property="created">2012-05-01</span>
      <span property="creator" resource="#fg">by</span></p>
  </div>
  <div vocab="http://xmlns.com/foaf/0.1/" resource="#fg" typeof="Person">
    <p> <span property="name">Fabien Gandon</span>,
      phone: <a property="phone" href="tel:+33492965170">+33492965170</a>
      mail: <a property="mbox"
        href="mailto:fabien.gandon@inria.fr">fabien.gandon@inria.fr</a></p>
  </div>
```

properties & objects



(...)

Anatomy of HTML+RDFa Content (Resource)

(...)

```
<body vocab="http://purl.org/dc/terms/">
```

```
  <div resource="/books/web_semantique">
```

```
    <h2 property="title" lang="en">A Web of linked data</h2>
```

```
    <p>Date: <span property="created">2012-05-01</span>
```

```
    <span property="creator" resource="#fg">by</span></p>
```

```
  </div>
```

```
  <div vocab="http://xmlns.com/foaf/0.1/" resource="#fg" typeof="Person">
```

```
    <p> <span property="name">Fabien Gandon</span> ,
```

```
      phone: <a property="phone" href="tel:+33492965170">+33492965170</a>
```

```
      mail: <a property="mbox"
```

```
        href="mailto:fabien.gandon@inria.fr">fabien.gandon@inria.fr</a></p>
```

```
  </div>
```

(...)

property & resource

Anatomy of HTML+RDFa Content (href)

(...)

```
<body vocab="http://purl.org/dc/terms/">
  <div resource="/books/web_semantique">
    <h2 property="title" lang="en">A Web of linked data</h2>
    <p>Date: <span property="created">2012-05-01</span>
      <span property="creator" resource="#fg">by</span></p>
  </div>
  <div vocab="http://xmlns.com/foaf/0.1/" resource="#fg" typeof="Person">
    <p> <span property="name">Fabien Gandon</span>,
      phone: <a property="phone" href="tel:+33492965170">+33492965170</a>
      mail: <a property="mbox"
        href="mailto:fabien.gandon@inria.fr">fabien.gandon@inria.fr</a></p>
  </div>
```

(...)

property & href

Schema.org: Vocabulary by Major Search Engines and Applications

schema.org

HomeSchemasDocumentation

Person

Thing > Person

A person (alive, dead, undead, or fictional).

Usage: Over 1,000,000 domains

[more...]

Property	Expected Type	Description
Properties from Person		
additionalName	Text	An additional name for a Person, can be used for a middle name.
address	PostalAddress or Text	Physical address of the item.
affiliation	Organization	An organization that this person is affiliated with. For example, a school/university, a club, or a team.
alumniOf	EducationalOrganization or Organization	An organization that the person is an alumni of. Inverse property: alumni .
award	Text	An award won by or for this item. Supersedes awards .
birthDate	Date	Date of birth.
birthPlace	Place	The place where the person was born.
brand	Brand or Organization	The brand(s) associated with a product or service, or the brand(s) maintained by an organization or business person.
children	Person	A child of the person.

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Example of RDFa Using schema.org

```
<div vocab="http://schema.org/" typeof="Product">
  
  <span property="name">Dell UltraSharp 30" LCD Monitor</span>

  <div rel="hasAggregateRating" >
    <div typeof="http://schema.org/AggregateRating">
      <span property="ratingValue">87</span>
      out of <span property="bestRating">100</span>
      based on <span property="ratingCount">24</span> user ratings
    </div>
  </div>

  <div rel="offers" >
    <div typeof="http://schema.org/AggregateOffer">
      <span property="lowPrice">$1250</span>
      to <span property="highPrice">$1495</span>
      from <span property="offerCount">8</span> sellers
    </div>
  </div> (...)
```

Example of RDFa Using schema.org

```
<div vocab="http://schema.org/" type="Image" >
  
  <span property="name">Dell UltraSharp
    <div rel="hasAggregateRating" >
      <div typeof="http://schema.org/AggregateRating" >
        <span property="ratingValue">8
          out of <span property="bestRating">10
            based on <span property="ratingCount">438
          </div>
        </div>
      </div>
    </div>
```



Pilot Vanishing Point Collection Retractable Fountain Pen, Black with Rhodium Accents, Blue Ink, Medium Nib (60242)

by [Pilot](#)

★★★★★ 446 customer reviews | 67 answered questions

Was: ~~\$148.28~~

Price: **\$136.50** & **FREE Shipping**. [Details](#)

You Save: **\$11.78 (8%)**

Only 10 left in stock (more on the way).

Want it tomorrow, July 28? Order within **5 hrs 30 mins** and choose **One-Day Shipping** at checkout. [Details](#)

Ships from and sold by Amazon.com. Gift-wrap available.

Size: **Medium Nib**

Color: **Black/Rhodium**

Pilot Vanishing Point Collection Retractable Fountain Pen, Black with ...

<https://www.amazon.com/Pilot-Vanishing-Collection-Retractable.../B0002ZQB1K> ▼

★★★★★ Rating: 4.6 - 438 reviews

Amazon.com : Pilot **Vanishing Point** Collection Retractable Fountain Pen, Black with Rhodium Accents, Blue Ink, Medium Nib (60242) : Office Products.

```
</div>
</div> (...)
```

Facebook OGP Code / "Like" button

```
<html xmlns="http://www.w3.org/1999/xhtml" dir="ltr" lang="en-US"
  xmlns:fb="https://www.facebook.com/2008/fbml">
<head prefix="og: http://ogp.me/ns# fb: http://ogp.me/ns# YOUR_NAMESPACE:
  http://ogp.me/ns/apps/YOUR_NAMESPACE#">
  <meta property="fb:app_id" content="YOUR_APP_ID" />
  <meta property="og:type" content="YOUR_NAMESPACE:recipe" />
  <meta property="og:title" content="Stuffed Cookies" />
  <meta property="og:image" content="http://example.com/cookie.jpg" />
  <meta property="og:description" content="The Turducken of Cookies" />
  <meta property="og:url" content="http://example.com/cookie.html">
  <script type="text/javascript">
    function postCook()
    {   FB.api('/me/YOUR_NAMESPACE:cook' + '?recipe=http://example.com/cookie.html','post',  (...)  });  }
  </script>
</head>
<body>
(...)
  <form>
    <input type="button" value="Cook" onclick="postCook()" />
  </form>
</body>
</html>
```



RDFa Core Initial Context

Predefined prefixes that can be used without defining them

<https://www.w3.org/2011/rdfa-context/rdfa-1.1>

csvw, dcat, qb, grddl, ma, org, owl, prov, rdf, rdfa, rdfs, rif, rr, sd, skos, skosxl, wdr, void, wdrs, xhv, xml, xsd, cc, ctag, dc, dcterms, dc11, foaf, gr, ical, og, rev, sioc, v, vcard, schema...

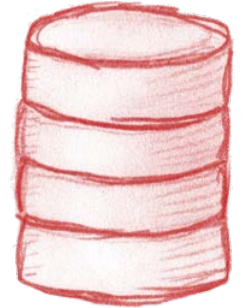
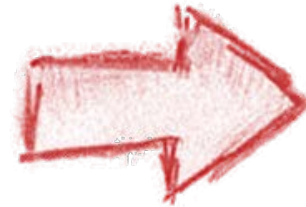
These Data are Available to Everyone

If you apply an RDFa parser to these pages you will obtain these data

Web Page



Data Source



Picture credits

- Screenshot of W3C® website, <https://www.w3.org/2013/data/>
- Screenshot of Amazon website, The Man Who Mistook His Wife for a Hat, Paperback – 2 Sep 2011, Oliver Sacks.
- Screenshot of schema.org, Person
- Screenshot of Amazon website, Pilot Vanishing Point Collection Retractable Fountain Pen
- Facebook like button, Sean MacEntee, CC – BY 2.0
- Icons (iconfinder.com):
 - Drug, injection, virus icon, Everaldo Coelho, LGPL Licence
 - Right icon, Aleksandra Wolska - Free for commercial use
 - Notepad icon, Aleksandra Wolska - Free for commercial use
 - Database icon, Aleksandra Wolska - Free for commercial use

WEEK 4: Integration With Other Data Formats and Sources

1. RDFa: an RDF syntax inside HTML
- 2. GRDDL: extract RDF from X(HT)ML**
3. JSON-LD: JSON syntax for RDF
4. Tabular data and metadata (CSV)
5. R2RML: integration with databases
6. LDP: a REST API to linked data

GRDDL Algorithmic Alternative to RDFa

- Means "Gleaning Resource Descriptions from Dialects of Languages"

- RDFa: markup

≠

- GRDDL: transformation



GRDDL Transformations

- Indicate that a document can be transformed into RDF data (**profile**)
- Reference an RDF extraction algorithms from inside documents (**transformation**)
- Works for HTML and XML

Simple Example in HTML:



```
<head profile="http://www.w3.org/2003/g/data-view">  
  <title>The man who mistook his wife for a hat</title>  
  <link rel="transformation"  
    href="http://www.w3.org/2000/06/dc-extract/dc-extract.xsl" />  
  <meta name="DC.Subject" content="clinical tales" />  
  (...)
```

Simple Example in HTML:



```
<head profile="http://www.w3.org/2003/g/data-view">  
  <title>The man who mistook his wife for a hat</title>  
  <link rel="transformation"  
    href="http://www.w3.org/2000/06/dc-extract/dc-extract.xsl" />  
  <meta name="DC.Subject" content="clinical tales" />  
  (...)
```





Simple Example XML: e.g. Spreadsheet

```
<?xml version="1.0"?>
<?mso-application progid="Excel.Sheet"?>
<Workbook xmlns="urn:schemas-microsoft-com:office:spreadsheet"
  xmlns:grddl="http://www.w3.org/2003/g/data-view#"
  grddl:transformation="excel2rdf.xsl">
  (...)
```



Simple Example XML: e.g. Spreadsheet

```
<?xml version="1.0"?>  
<?mso-application progid="Excel.Sheet"?>  
<Workbook xmlns="urn:schemas-microsoft-com:office:spreadsheet"  
  xmlns:grddl="http://www.w3.org/2003/g/data-view#"   
    grddl:transformation="excel2rdf.xsl">   
  (...)
```



GRDDL Agent Process: Direct Transformation

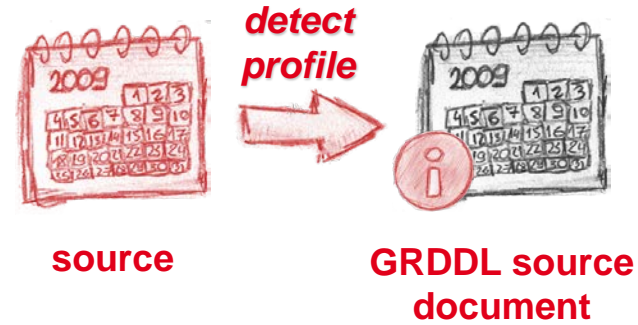
```
<head profile="http://www.w3.org/2003/g/data-view">  
  <title>The man who mistook his wife for a hat</title>  
  <link rel="transformation"  
    href="http://www.w3.org/2000/06/dc-extract/dc-extract.xsl" />  
  <meta name="DC.Subject" content="clinical tales" />  
  (...)
```



source

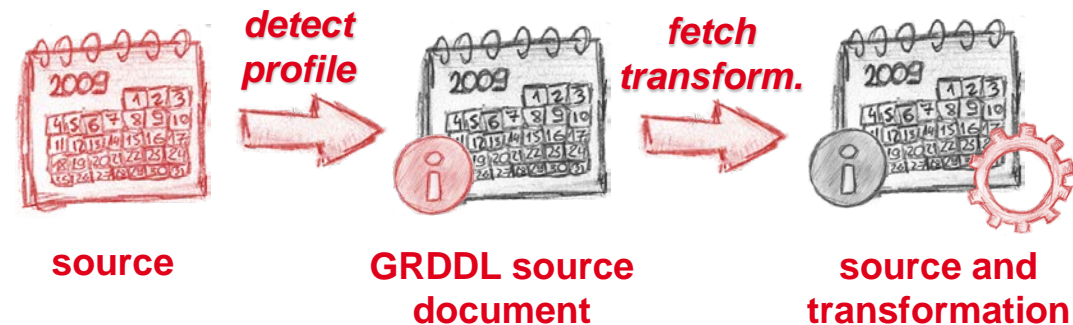
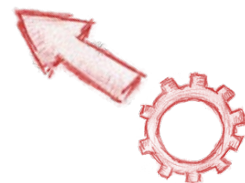
GRDDL Agent Process: Direct Transformation

```
<head profile="http://www.w3.org/2003/g/data-view">
  <title>The man who mistook his wife for a hat</title>
  <link rel="transformation"
    href="http://www.w3.org/2000/06/dc-extract/dc-extract.xsl" />
  <meta name="DC.Subject" content="clinical tales" />
  (...)
```



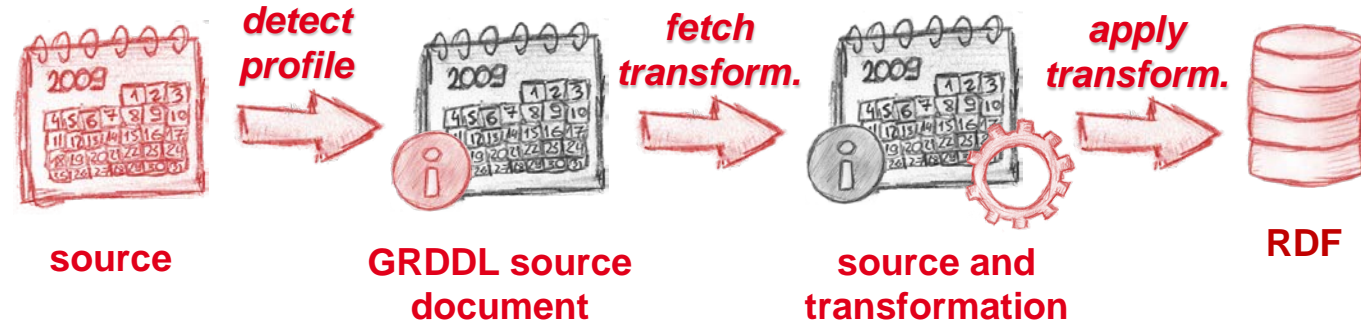
GRDDL Agent Process: Direct Transformation

```
<head profile="http://www.w3.org/2003/g/data-view">  
  <title>The man who mistook his wife for a hat</title>  
  <link rel="transformation"  
    href="http://www.w3.org/2000/06/dc-extract/dc-extract.xsl" />  
  <meta name="DC.Subject" content="clinical tales" />  
  (...)
```



GRDDL Agent Process: Direct Transformation

```
<head profile="http://www.w3.org/2003/g/data-view">  
  <title>The man who mistook his wife for a hat</title>  
  <link rel="transformation"  
    href="http://www.w3.org/2000/06/dc-extract/dc-extract.xsl" />  
  <meta name="DC.Subject" content="clinical tales" />  
  (...)
```

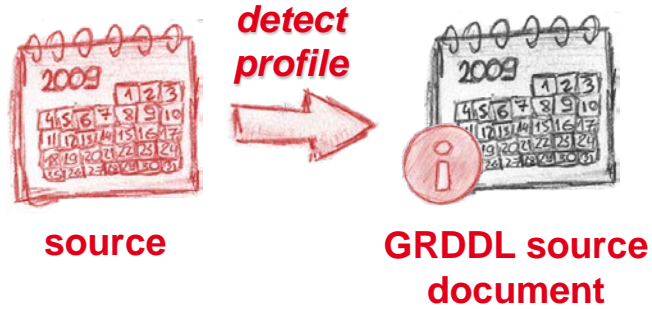


GRDDL Agent Process: Indirect Transformation

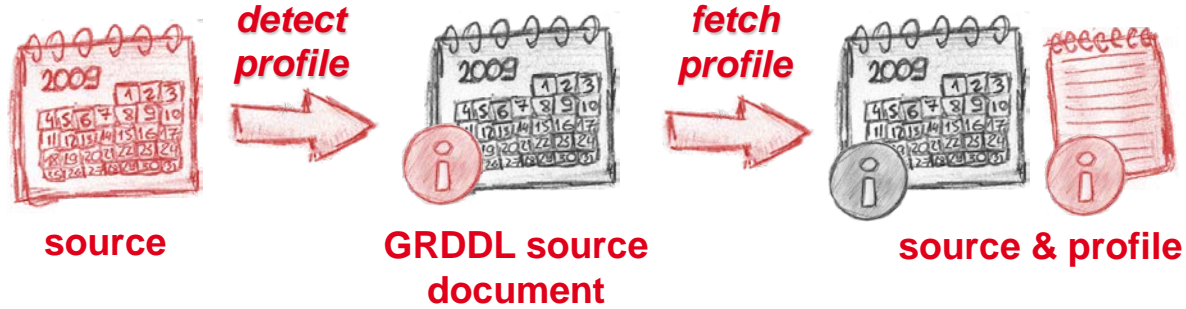


source

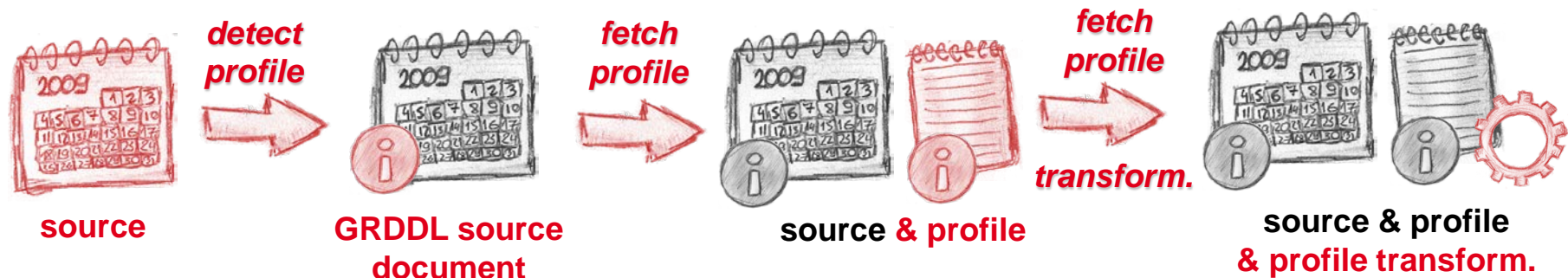
GRDDL Agent Process: Indirect Transformation



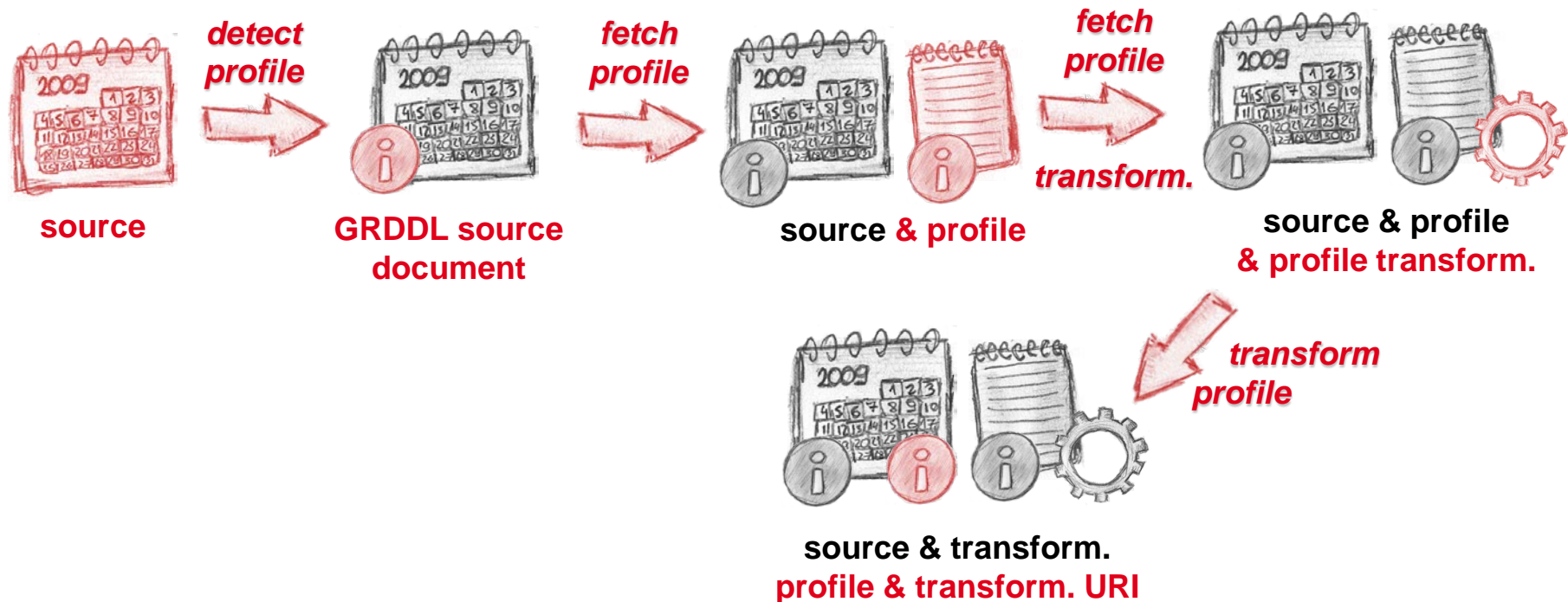
GRDDL Agent Process: Indirect Transformation



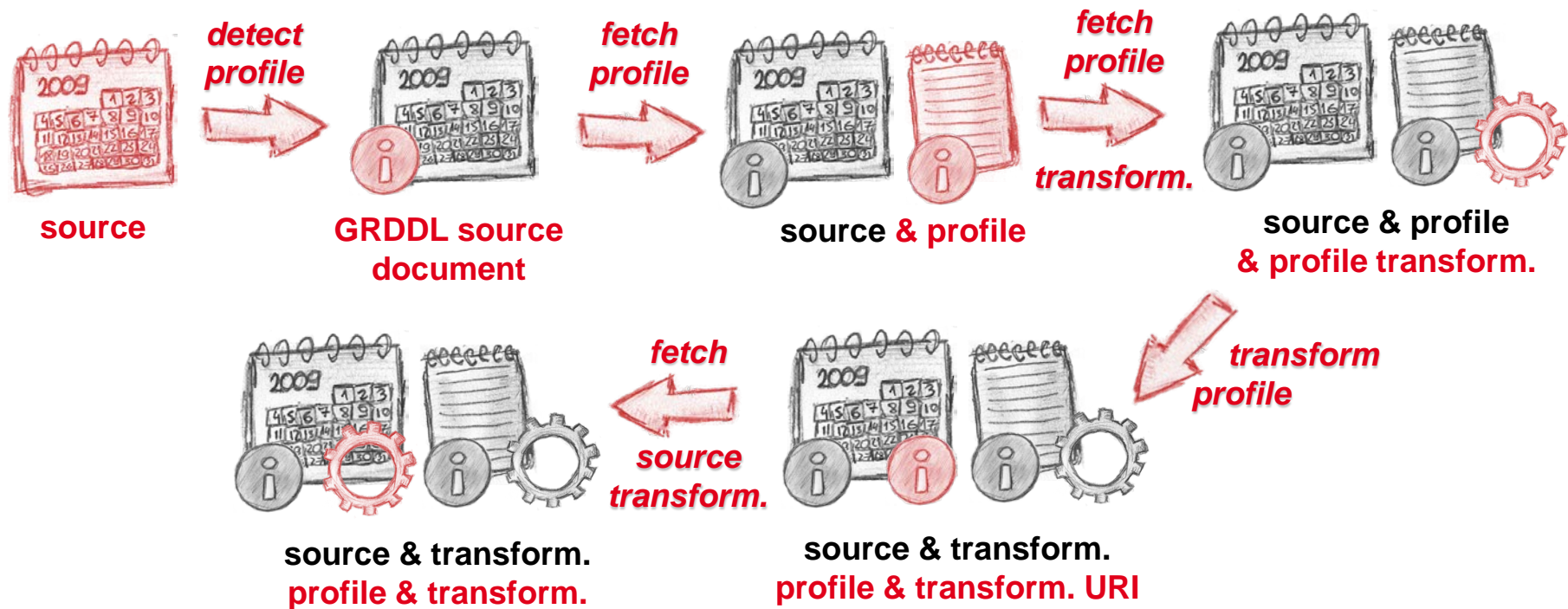
GRDDL Agent Process: Indirect Transformation



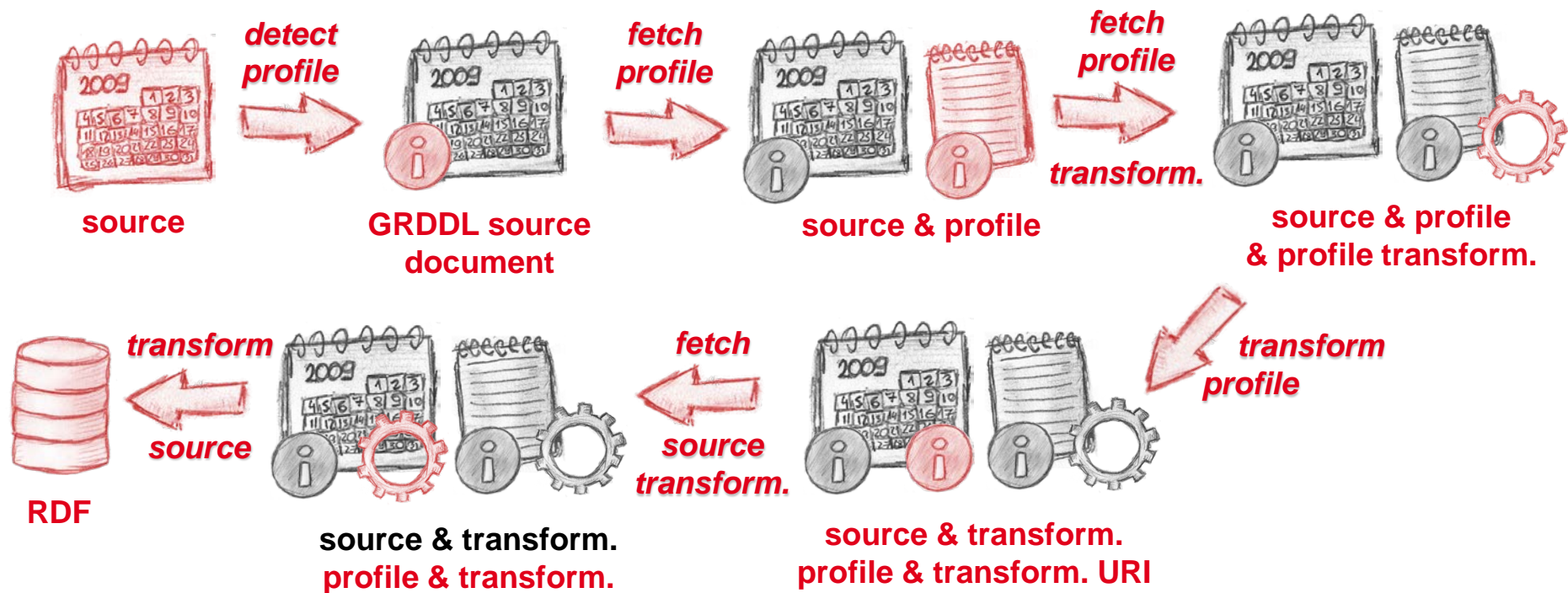
GRDDL Agent Process: Indirect Transformation



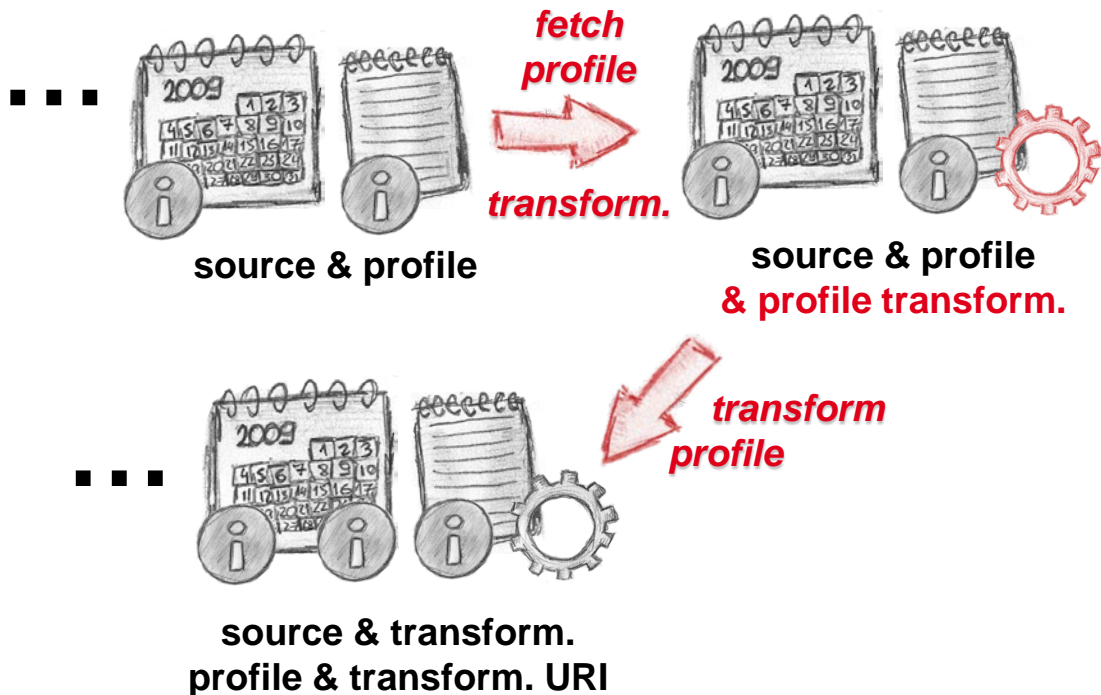
GRDDL Agent Process: Indirect Transformation



GRDDL Agent Process: Indirect Transformation



GRDDL Indirect Transformations: More Resilient



Picture credits

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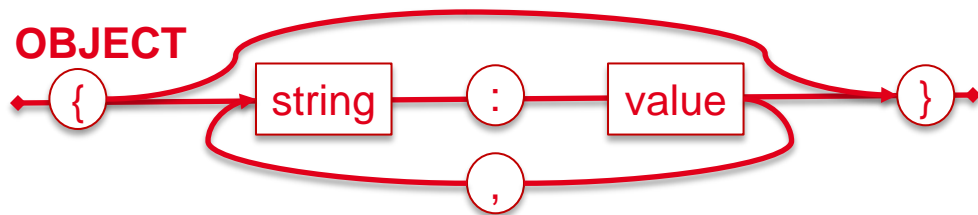
WEEK 4: Integration With Other Data Formats and Sources

1. RDFa: an RDF syntax inside HTML
2. GRDDL: extract RDF from X(HT)ML
- 3. JSON-LD: JSON syntax for RDF**
4. Tabular data and metadata (CSV)
5. R2RML: integration with databases
6. LDP: a REST API to linked data

JSON-LD: JSON syntax for RDF

1. JSON (JavaScript Object Notation)

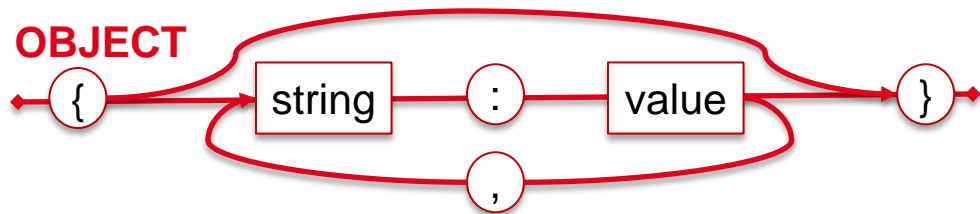
- Hierarchy of name-value pairs.
- Popular format for APIs on the Web.



JSON-LD: JSON syntax for RDF

1. JSON (JavaScript Object Notation)

- Hierarchy of name-value pairs.
- Popular format for APIs on the Web.



2. JSON-LD (JSON for Linked Data)

- Notion of "context" to provide a mapping from JSON model to an RDF model.
- A context can be embedded in a JSON-LD document or in a separate file and referenced.

Specific Reserved Names Prefixed by @

@context: define short names used in the document

@id: identify resources with IRIs or blank nodes

@value: specify the data value of a property

@language: specify the language for a string or the document

@type: set the type of a value or a resource

@vocab: prefix IRI to expand properties and values in @type

@base: used to set the base IRI

@container: used to set the default container type for a term

@index: specify a container is used to index information

@list: an ordered list of data

@set: an unordered set of data

@reverse: express reverse properties

@graph: indicate a graph

Specific Reserved Names Prefixed by @

@context: define short names used in the document

@id: identify resources with IRIs or blank nodes

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@type: set the type of a value or a resource

@vocab: prefix IRI to expand properties and values in @type

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@container: used to set the default container type for a term

@index: specify a container is used to index information

@list: an ordered list of data

@set: an unordered set of data

@reverse: express reverse properties

@graph: indicate a graph

Example with these Data in Turtle

```
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
<http://ns.inria.fr/fabien.gandon#me> a foaf:Person ;
  foaf:familyName "Gandon"@fr ;
  foaf:givenName "Fabien"@fr ;
  foaf:age 40 ;
  foaf:birthday "--07-31"^^xsd:gMonthDay ;
  foaf:homepage <http://fabien.info> ;
  foaf:knows [ a foaf:Person ; foaf:name "Olivier Corby" ],
    [ a foaf:Person ; foaf:name "Catherine Faron-Zucker" ].
```


Example with these Data in Turtle

```
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
<http://ns.inria.fr/fabien.gandon#me> a foaf:Person ;
  foaf:familyName "Gandon"@fr ;
  foaf:givenName "Fabien"@fr ;
  foaf:age 40 ;
  foaf:birthday "--07-31"^^xsd:gMonthDay ;
  foaf:homepage <http://fabien.info> ;
  foaf:knows [ a foaf:Person ; foaf:name "Olivier Corby" ],
    [ a foaf:Person ; foaf:name "Catherine Faron-Zucker" ].
```

properties & values

Example with these Data in Turtle

```
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
<http://ns.inria.fr/fabien.gandon#me> a foaf:Person ;
  foaf:familyName "Gandon"@fr ;
  foaf:givenName "Fabien"@fr ;
  foaf:age 40 ;
  foaf:birthday "--07-31"^^xsd:gMonthDay ;
  foaf:homepage <http://fabien.info> ;
  foaf:knows [ a foaf:Person ; foaf:name "Olivier Corby" ],
    [ a foaf:Person ; foaf:name "Catherine Faron-Zucker" ].
```



link to another resource

Example with these Data in Turtle

```
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
<http://ns.inria.fr/fabien.gandon#me> a foaf:Person ;
  foaf:familyName "Gandon"@fr ;
  foaf:givenName "Fabien"@fr ;
  foaf:age 40 ;
  foaf:birthday "--07-31"^^xsd:gMonthDay ;
  foaf:homepage <http://fabien.info> ;
  foaf:knows [ a foaf:Person ; foaf:name "Olivier Corby" ],
    [ a foaf:Person ; foaf:name "Catherine Faron-Zucker" ].
```



two b-nodes
values

Simple JSON-LD Version

```
{
  "@id": "http://ns.inria.fr/fabien.gandon#me",
  "@type": "http://xmlns.com/foaf/0.1/Person",
  "http://xmlns.com/foaf/0.1/age": 40,
  "http://xmlns.com/foaf/0.1/birthday": {
    "@type": "http://www.w3.org/2001/XMLSchema#gMonthDay", "@value": "--07-31" },
  "http://xmlns.com/foaf/0.1/familyName": { "@value": "Gandon" , "@language": "fr" },
  "http://xmlns.com/foaf/0.1/givenName": { "@value": "Fabien" , "@language": "fr" },
  "http://xmlns.com/foaf/0.1/homepage": { "@id": "http://fabien.info" },
  "http://xmlns.com/foaf/0.1/knows": [
    { "@type": "http://xmlns.com/foaf/0.1/Person",
      "http://xmlns.com/foaf/0.1/name": "Catherine Faron-Zucker" },
    { "@type": "http://xmlns.com/foaf/0.1/Person",
      "http://xmlns.com/foaf/0.1/name": "Olivier Corby" }
  ]
}
```


Simple JSON-LD Version

```
{
  "@id": "http://ns.inria.fr/fabien.gandon#me",
  "@type": "http://xmlns.com/foaf/0.1/Person",
  "http://xmlns.com/foaf/0.1/age": 40,
  "http://xmlns.com/foaf/0.1/birthday": {
    "@type": "http://www.w3.org/2001/XMLSchema#gMonthDay", "@value": "--07-31" },
  "http://xmlns.com/foaf/0.1/familyName": { "@value": "Gandon", "@language": "fr" },
  "http://xmlns.com/foaf/0.1/givenName": { "@value": "Fabien", "@language": "fr" },
  "http://xmlns.com/foaf/0.1/homepage": { "@id": "http://fabien.info" },
  "http://xmlns.com/foaf/0.1/knows": [
    { "@type": "http://xmlns.com/foaf/0.1/Person",
      "http://xmlns.com/foaf/0.1/name": "Catherine Faron-Zucker" },
    { "@type": "http://xmlns.com/foaf/0.1/Person",
      "http://xmlns.com/foaf/0.1/name": "Olivier Corby" }
  ]
}
```

a resource
and its type

Simple JSON-LD Version

```
{
  "@id": "http://ns.inria.fr/fabien.gandon#me",
  "@type": "http://xmlns.com/foaf/0.1/Person",
  "http://xmlns.com/foaf/0.1/age": 40,
  "http://xmlns.com/foaf/0.1/birthday": {
    "@type": "http://www.w3.org/2001/XMLSchema#gMonthDay", "@value": "--07-31" },
  "http://xmlns.com/foaf/0.1/familyName": { "@value": "Gandon", "@language": "fr" },
  "http://xmlns.com/foaf/0.1/givenName": { "@value": "Fabien", "@language": "fr" },
  "http://xmlns.com/foaf/0.1/homepage": { "@id": "http://fabien.info" },
  "http://xmlns.com/foaf/0.1/knows": [
    { "@type": "http://xmlns.com/foaf/0.1/Person",
      "http://xmlns.com/foaf/0.1/name": "Catherine Faron-Zucker" },
    { "@type": "http://xmlns.com/foaf/0.1/Person",
      "http://xmlns.com/foaf/0.1/name": "Olivier Corby" }
  ]
}
```

a property and its value in native datatype

Simple JSON-LD Version

```
{
  "@id": "http://ns.inria.fr/fabien.gandon#me",
  "@type": "http://xmlns.com/foaf/0.1/Person",
  "http://xmlns.com/foaf/0.1/age": 40,
  "http://xmlns.com/foaf/0.1/birthday": {
    "@type": "http://www.w3.org/2001/XMLSchema#gMonthDay", "@value": "--07-31" },
  "http://xmlns.com/foaf/0.1/familyName": { "@value": "Gandon" , "@language": "fr" },
  "http://xmlns.com/foaf/0.1/givenName": { "@value": "Fabien" , "@language": "fr" },
  "http://xmlns.com/foaf/0.1/homepage": { "@id": "http://fabien.info" },
  "http://xmlns.com/foaf/0.1/knows": [
    { "@type": "http://xmlns.com/foaf/0.1/Person",
      "http://xmlns.com/foaf/0.1/name": "Catherine Faron-Zucker" },
    { "@type": "http://xmlns.com/foaf/0.1/Person",
      "http://xmlns.com/foaf/0.1/name": "Olivier Corby" }
  ]
}
```



verbose property names

JSON-LD with Context (Prefixes)

```
{  "@context": {
    "foaf": "http://xmlns.com/foaf/0.1/" ,
    "xsd": "http://www.w3.org/2001/XMLSchema#"
  },
  "@graph": [
    { "@id": "http://ns.inria.fr/fabien.gandon#me",   "@type": "foaf:Person",
      "foaf:age": 40,
      "foaf:birthday": { "@type": "xsd:gMonthDay", "@value": "--07-31" },
      "foaf:familyName": { "@value": "Gandon" , "@language": "fr" },
      "foaf:givenName": { "@value": "Fabien" , "@language": "fr" },
      "foaf:homepage": { "@id": "http://fabien.info" },
      "foaf:knows": [ { "@type": "foaf:Person", "foaf:name": "Olivier Corby" } ,
        { "@type": "foaf:Person", "foaf:name": "Catherine Faron-Zucker" }
      ]
    }
  ]
}
```

JSON-LD with Context (Qnames)

```
{  "@context": {
    "foaf": "http://xmlns.com/foaf/0.1/" ,
    "xsd": "http://www.w3.org/2001/XMLSchema#"
  },
  "@graph": [
    { "@id": "http://ns.inria.fr/fabien.gandon#me",   "@type": "foaf:Person",
      "foaf:age": 40,
      "foaf:birthday": { "@type": "xsd:gMonthDay", "@value": "--07-31" },
      "foaf:familyName": { "@value": "Gandon" , "@language": "fr" },
      "foaf:givenName": { "@value": "Fabien" , "@language": "fr" },
      "foaf:homepage": { "@id": "http://fabien.info" },
      "foaf:knows": [ { "@type": "foaf:Person", "foaf:name": "Olivier Corby" } ,
        { "@type": "foaf:Person", "foaf:name": "Catherine Faron-Zucker" }
      ]
    }
  ]
}
```

JSON-LD with Context (Types)

```
{ "@context": {  
  "foaf": "http://xmlns.com/foaf/0.1/" ,  
  "xsd": "http://www.w3.org/2001/XMLSchema#"  
},  
"@graph": [  
  { "@id": "http://ns.inria.fr/fabien.gandon#me",   "@type": "foaf:Person",  
    "foaf:age": 40,  
    "foaf:birthday": { "@type": "xsd:gMonthDay", "@value": "--07-31" },  
    "foaf:familyName": { "@value": "Gandon" , "@language": "fr" },  
    "foaf:givenName": { "@value": "Fabien" , "@language": "fr" },  
    "foaf:homepage": { "@id": "http://fabien.info" },  
    "foaf:knows": [ { "@type": "foaf:Person", "foaf:name": "Olivier Corby" } ,  
      { "@type": "foaf:Person", "foaf:name": "Catherine Faron-Zucker"}  
    ]  
  }  
]
```

JSON-LD with Context (Language)

```
{ "@context": {
  "foaf": "http://xmlns.com/foaf/0.1/" ,
  "xsd": "http://www.w3.org/2001/XMLSchema#"
},
"@graph": [
  { "@id": "http://ns.inria.fr/fabien.gandon#me",   "@type": "foaf:Person",
    "foaf:age": 40,
    "foaf:birthday": { "@type": "xsd:gMonthDay", "@value": "--07-31" },
    "foaf:familyName": { "@value": "Gandon" , "@language": "fr" },
    "foaf:givenName": { "@value": "Fabien" , "@language": "fr" },
    "foaf:homepage": { "@id": "http://fabien.info" },
    "foaf:knows": [ { "@type": "foaf:Person", "foaf:name": "Olivier Corby" } ,
      { "@type": "foaf:Person", "foaf:name": "Catherine Faron-Zucker" }
    ]
  }
]
```

JSON-LD with Context (Blank Nodes)

```
{ "@context": {
  "foaf": "http://xmlns.com/foaf/0.1/" ,
  "xsd": "http://www.w3.org/2001/XMLSchema#"
},
"@graph": [
  { "@id": "http://ns.inria.fr/fabien.gandon#me",   "@type": "foaf:Person",
    "foaf:age": 40,
    "foaf:birthday": { "@type": "xsd:gMonthDay", "@value": "--07-31" },
    "foaf:familyName": { "@value": "Gandon" , "@language": "fr" },
    "foaf:givenName": { "@value": "Fabien" , "@language": "fr" },
    "foaf:homepage": { "@id": "http://fabien.info" },
    "foaf:knows": [ { "@type": "foaf:Person", "foaf:name": "Olivier Corby" } ,
                    { "@type": "foaf:Person", "foaf:name": "Catherine Faron-Zucker" }
                  ]
  }
]
```


Compact / Expand = Add / Remove Context

```
{
  "@context": {
    "foaf": "http://xmlns.com/foaf/0.1/",
    "xsd": "http://www.w3.org/2001/XMLSchema#"
  },
  "@graph": [
    { "@id": "http://ns.inria.fr/fabien.gandon#me",
      "@type": "foaf:Person",
      "foaf:age": 40,
      "foaf:birthday": { "@type": "xsd:gMonthDay", "@value": "--07-31" },
      "foaf:familyName": "Gandon",
      "foaf:givenName": "Fabien",
      "foaf:homepage": { "@id": "http://fabien.info" },
      "foaf:knows": [
        { "@type": "foaf:Person", "foaf:name": "Catherine Faron-Zucker" },
        { "@type": "foaf:Person", "foaf:name": "Olivier Corby" }
      ]
    }
  ]
}
```


COMPACT

```
[
  {
    "@id": "http://ns.inria.fr/fabien.gandon#me",
    "@type": [ "http://xmlns.com/foaf/0.1/Person" ],
    "http://xmlns.com/foaf/0.1/age": [ { "@value": 40 } ],
    "http://xmlns.com/foaf/0.1/birthday": [
      { "@type": "http://www.w3.org/2001/XMLSchema#gMonthDay",
        "@value": "--07-31" }
    ],
    "http://xmlns.com/foaf/0.1/familyName": [ { "@value": "Gandon" } ],
    "http://xmlns.com/foaf/0.1/givenName": [ { "@value": "Fabien" } ],
    "http://xmlns.com/foaf/0.1/homepage": [ { "@id": "http://fabien.info" } ],
    "http://xmlns.com/foaf/0.1/knows": [ { "@type": [
      "http://xmlns.com/foaf/0.1/Person" ],
      "http://xmlns.com/foaf/0.1/name": [
        { "@value": "Catherine Faron-Zucker" } ]
      },
      { "@type": [ "http://xmlns.com/foaf/0.1/Person" ],
        "http://xmlns.com/foaf/0.1/name": [
          { "@value": "Olivier Corby" } ]
      }
    ]
  }
]
```

EXPAND

Contextualizing JSON from APIs e.g. "LinkedIn"

LinkedIn



Fabien Gandon

Senior Researcher, Wimmics Team Leader,
INRIA AC Representative at W3C

France | Research

500+
connections

Current	INRIA, W3C, Ecole Polytechnique de l'Université de Nice Sophia Antipolis
Previous	ANR, Carnegie Mellon University, Bull
Education	Carnegie Mellon University
Recommendations	2 people have recommended Fabien
Websites	Personal Website RSS Feed AIA, improvisation théâtrale

E.g. Linked in JSON



LinkedIn

Fabien Gandon 500+ connections

Senior Researcher, Wimmics Team Leader,
INRIA AC Representative at W3C

France | Research

Current	INRIA, W3C, Ecole Polytechnique de l'Université de Nice Sophia Antipolis
Previous	ANR, Carnegie Mellon University, Bull
Education	Carnegie Mellon University
Recommendations	2 people have recommended Fabien
Websites	Personal Website RSS Feed AIA, improvisation théâtrale

```
{
  "firstName": "Fabien",
  "headline": "Research Director at Inria",
  "id": "Fg-fjekzI",
  "lastName": "Gandon",
  "siteStandardProfileRequest": {
    "url": "https://www.linkedin.com/profile/view?id=AAAAAA"
  }
}
```

E.g. Linked in JSON (With Context)

```
{
  "@context": {
    "@vocab": "http://schema.org/",
    "@base" : "http://data.org/",
    "id" : "@id",
    "firstName": "givenName",
    "lastName": "familyName",
    "headline": { "@id": "jobTitle", "@language": "en" },
    "siteStandardProfileRequest" : null },

  "firstName": "Fabien",
  "headline": "Research Director at Inria",
  "id": "Fg-fjekzI",
  "lastName": "Gandon",
  "siteStandardProfileRequest": {
    "url": "https://www.linkedin.com/profile/view?id=AAAAAA"
  }
}
```

E.g. Linked in JSON (Voc & Base)

```
{
  "@context": {
    "@vocab": "http://schema.org/",
    "@base" : "http://data.org/",
    "id" : "@id",
    "firstName": "givenName",
    "lastName": "familyName",
    "headline": { "@id": "jobTitle", "@language": "en" },
    "siteStandardProfileRequest" : null },

  "firstName": "Fabien",
  "headline": "Research Director at Inria",
  "id": "Fg-fjekzI",
  "lastName": "Gandon",
  "siteStandardProfileRequest": {
    "url": "https://www.linkedin.com/profile/view?id=AAAAAA"
  }
}
```

E.g. Linked in JSON (Map Properties)

```
{
  "@context": {
    "@vocab": "http://schema.org/",
    "@base" : "http://data.org/",
    "id" : "@id",
    "firstName": "givenName",
    "lastName": "familyName",
    "headline": { "@id": "jobTitle", "@language": "en" },
    "siteStandardProfileRequest" : null },

  "firstName": "Fabien",
  "headline": "Research Director at Inria",
  "id": "Fg-fjekzI",
  "lastName": "Gandon",
  "siteStandardProfileRequest": {
    "url": "https://www.linkedin.com/profile/view?id=AAAAAA"
  }
}
```

E.g. Linked in JSON (Specify the Language)

```
{
  "@context": {
    "@vocab": "http://schema.org/",
    "@base" : "http://data.org/",
    "id" : "@id",
    "firstName": "givenName",
    "lastName": "familyName",
    "headline": { "@id": "jobTitle", "@language": "en" },
    "siteStandardProfileRequest" : null },

  "firstName": "Fabien",
  "headline": "Research Director at Inria",
  "id": "Fg-fjekzI",
  "lastName": "Gandon",
  "siteStandardProfileRequest": {
    "url": "https://www.linkedin.com/profile/view?id=AAAAAA"
  }
}
```

E.g. Linked in JSON (Ignore)

```
{
  "@context": {
    "@vocab": "http://schema.org/",
    "@base" : "http://data.org/",
    "id" : "@id",
    "firstName": "givenName",
    "lastName": "familyName",
    "headline": { "@id": "jobTitle", "@language": "en" },
    "siteStandardProfileRequest" : null },
  "firstName": "Fabien",
  "headline": "Research Director at Inria",
  "id": "Fg-fjekzI",
  "lastName": "Gandon",
  "siteStandardProfileRequest": {
    "url": "https://www.linkedin.com/profile/view?id=AAAAAA"
  }
}
```

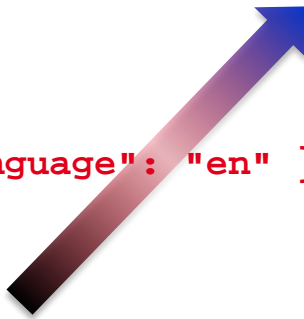

E.g. Linked in JSON to RDF

```
{
  "@context": {
    "@vocab": "http://schema.org/",
    "@base" : "http://data.org/",
    "id" : "@id",
    "firstName": "givenName",
    "lastName": "familyName",
    "headline": { "@id": "jobTitle", "@language": "en" },
    "siteStandardProfileRequest" : null },

  "firstName": "Fabien",
  "headline": "Research Director at Inria",
  "id": "Fg-fjekzI",
  "lastName": "Gandon",
  "siteStandardProfileRequest": {
    "url": "https://www.linkedin.com/profile/view?id=AAAAAA"
  }
}
```

```
@prefix : <http://schema.org/> .
```

```
<http://data.org/Fg-fjekzI> :familyName "Gandon" ;
                             :givenName "Fabien" ;
                             :jobTitle "Research Director at Inria"@en .
```



E.g. Google Knowledge Graph Search API

```
{ "@context": {
  "@vocab": "http://schema.org/",
  "goog": "http://schema.googleapis.com/",
  "resultScore": "goog:resultScore",
  "detailedDescription": "goog:detailedDescription",
  "EntitySearchResult": "goog:EntitySearchResult",
  "kg": "http://g.co/kg"
},
"@type": "ItemList",
"itemListElement": [
  {
    "@type": "EntitySearchResult",
    "result": { "@id": "kg:/m/0dl567", "name": "Taylor Swift",
      "@type": [ "Thing", "Person" ],
      "description": "Singer-songwriter",
      "image": {
        "contentUrl": "https://t1.gstatic.com/images?q=tbn:ANd9GcQmVDAhjhWnN2OWys2ZMO3PGAhupp5tN2LwF_BJmiHgi19hf8Ku",
        "url": "https://en.wikipedia.org/wiki/Taylor_Swift",
        "license": "http://creativecommons.org/licenses/by-sa/2.0"
      },
      "detailedDescription": {
        "articleBody": "Taylor Alison Swift is an American singer-songwriter and actress. Raised in Wyomissing, Pennsylvania, she moved to Nashville, Tennessee, at the age of 14 to pursue a career in country music. ",
        "url": "http://en.wikipedia.org/wiki/Taylor_Swift",
        "license":
          "https://en.wikipedia.org/wiki/Wikipedia:Text_of_Creative_Commons_Attribution-ShareAlike_3.0_Unported_License"
      },
      "url": "http://taylorswift.com/"
    },
    "resultScore": 896.576599
  }
]
}
```



Picture credits

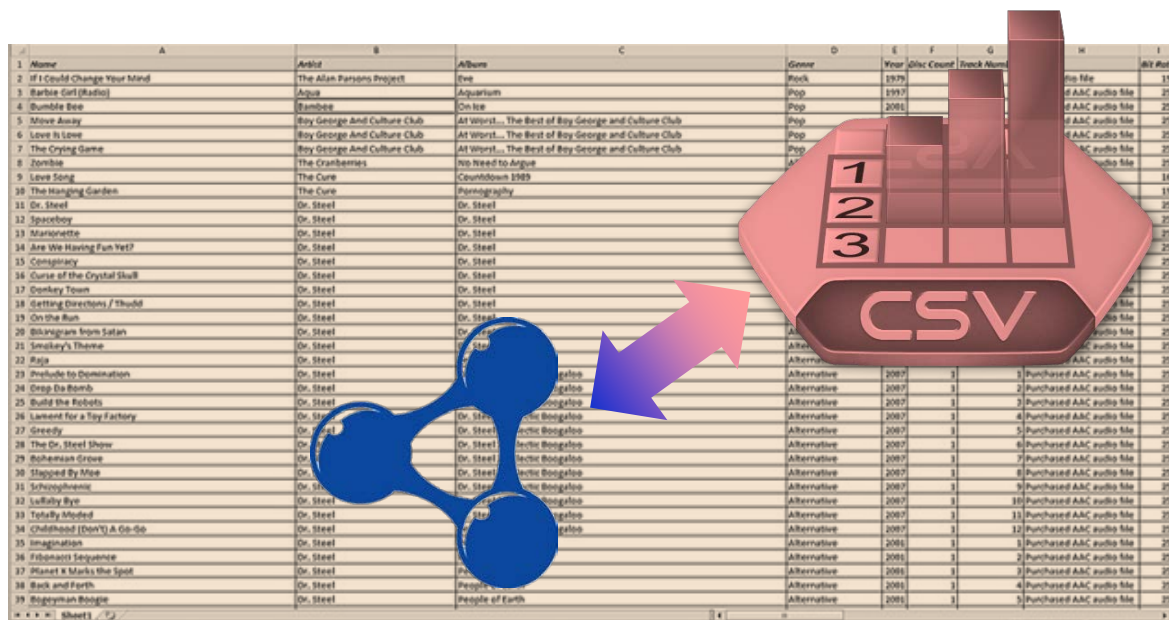
- Screenshots of Fabien Gandon's LinkedIn page
- Icons (iconfinder.com):
 - Right icon, Aleksandra Wolska - Free for commercial use

WEEK 4: Integration With Other Data Formats and Sources

1. RDFa: an RDF syntax inside HTML
2. GRDDL: extract RDF from X(HT)ML
3. JSON-LD: JSON syntax for RDF
- 4. Tabular data and metadata (CSV)**
5. R2RML: integration with databases
6. LDP: a REST API to linked data

Tabular Data and Metadata on the Web (CSV)

Provide context to transform tabular data into JSON or Linked Data



	A	B	C	D	E	F	G	H	I
1	Name	Artist	Album	Genre	Year	Disc Count	Track Number		Buy Price
2	If I Could Change Your Mind	The Alan Parsons Project	Twe	Rock	1979			192	
3	Barbie Girl (Radio)	Aqua	Aquarium	Pop	1997			254	
4	Bumble Bee	Bumblebee	On Ice	Pop	2001			254	
5	Move Away	Boy George And Culture Club	At Worst... The Best of Boy George and Culture Club	Pop				254	
6	Love Is Love	Boy George And Culture Club	At Worst... The Best of Boy George and Culture Club	Pop				254	
7	The Crying Game	Boy George And Culture Club	At Worst... The Best of Boy George and Culture Club	Pop				254	
8	Zombik	The Cranberries	No Need to Argue	Pop				254	
9	Love Song	The Cure	Countdown 1989	Pop				180	
10	The Hanging Garden	The Cure	Photography	Pop				180	
11	Dr. Steel	Dr. Steel	Dr. Steel	Pop				254	
12	Spaceboy	Dr. Steel	Dr. Steel	Pop				254	
13	Marionette	Dr. Steel	Dr. Steel	Pop				254	
14	Are We Having Fun Yet?	Dr. Steel	Dr. Steel	Pop				254	
15	Conspiracy	Dr. Steel	Dr. Steel	Pop				254	
16	Curse of the Crystal Skull	Dr. Steel	Dr. Steel	Pop				254	
17	Donkey Town	Dr. Steel	Dr. Steel	Pop				254	
18	Getting Directions / Should	Dr. Steel	Dr. Steel	Pop				254	
19	On the Run	Dr. Steel	Dr. Steel	Pop				254	
20	Bibbogram from Satan	Dr. Steel	Dr. Steel	Pop				254	
21	Smeiley's Theme	Dr. Steel	Dr. Steel	Pop				254	
22	Raja	Dr. Steel	Dr. Steel	Pop				254	
23	Prelude to Domination	Dr. Steel	Dr. Steel	Pop				254	
24	Drop Da Bomb	Dr. Steel	Dr. Steel	Pop				254	
25	Build the Robots	Dr. Steel	Dr. Steel	Pop				254	
26	Lowest for a Toy Factory	Dr. Steel	Dr. Steel	Pop				254	
27	Greedy	Dr. Steel	Dr. Steel	Pop				254	
28	The Dr. Steel Show	Dr. Steel	Dr. Steel	Pop				254	
29	Bohemian Grove	Dr. Steel	Dr. Steel	Pop				254	
30	Stapped By Me	Dr. Steel	Dr. Steel	Pop				254	
31	Schizophrenic	Dr. Steel	Dr. Steel	Pop				254	
32	LuRaby Bye	Dr. Steel	Dr. Steel	Pop				254	
33	Tyler's Model	Dr. Steel	Dr. Steel	Pop				254	
34	Childhood (Don't) & Go-Go	Dr. Steel	Dr. Steel	Pop				254	
35	Imagination	Dr. Steel	Dr. Steel	Pop				254	
36	Fibonacci Sequence	Dr. Steel	Dr. Steel	Pop				254	
37	Planet X Marks the Spot	Dr. Steel	Dr. Steel	Pop				254	
38	Back and Forth	Dr. Steel	Dr. Steel	Pop				254	
39	Boysman Boogie	Dr. Steel	Dr. Steel	Pop				254	

Same as JSON but...

- Input: tabular data
 - CSV: Comma Separated Values file
 - TSV: Tab-Separated Values file
 - E.g. exported from Excel, Numbers, etc.
- Output: Web data: JSON/RDF

Same as JSON but...

- Input: tabular data
 - CSV: Comma Separated Values file
 - TSV: Tab-Separated Values file
 - E.g. exported from Excel, Numbers, etc.
- Output: Web data: JSON/RDF
- Mechanism: context attachment
- Vocabulary for Tabular Data:
<https://www.w3.org/ns/csvw>
- Namespaces from RDFa initial context & CSVW Namespace or URIs

Example Table from W3C Specifications

country	country group	name (en)	name (fr)	name (de)	latitude	longitude
at	eu	Austria	Autriche	Österreich	47.6965545	13.34598005
be	eu	Belgium	Belgique	Belgien	50.501045	4.47667405
bg	eu	Bulgaria	Bulgarie	Bulgarien	42.72567375	25.4823218

Export to CSV

country	country group	name (en)	name (fr)	name (de)	latitude	longitude
at	eu	Austria	Autriche	Österreich	47.6965545	13.34598005
be	eu	Belgium	Belgique	Belgien	50.501045	4.47667405
bg	eu	Bulgaria	Bulgarie	Bulgarien	42.72567375	25.4823218



`"country","country group","name (en)","name (fr)","name (de)","latitude","longitude"`

|Comma Separated Columns

Export to CSV

country	country group	name (en)	name (fr)	name (de)	latitude	longitude
at	eu	Austria	Autriche	Österreich	47.6965545	13.34598005
be	eu	Belgium	Belgique	Belgien	50.501045	4.47667405
bg	eu	Bulgaria	Bulgarie	Bulgarien	42.72567375	25.4823218



```
"country","country group","name (en)","name (fr)","name (de)","latitude","longitude"  
"at","eu","Austria","Autriche","Österreich","47.6965545","13.34598005"  
"be","eu","Belgium","Belgique","Belgien","50.501045","4.47667405"  
"bg","eu","Bulgaria","Bulgarie","Bulgarien","42.72567375","25.4823218"
```

Comma Separated Values

Attach a Context

```
"country","country group","name (en)","name (fr)","name (de)","latitude","longitude"  
"at","eu","Austria","Autriche","Österreich","47.6965545","13.34598005"  
"be","eu","Belgium","Belgique","Belgien","50.501045","4.47667405"  
"bg","eu","Bulgaria","Bulgarie","Bulgarien","42.72567375","25.4823218"
```

```
{  
  "@context": "http://www.w3.org/ns/csvw",  
  "url": "countries.csv",  
  (...)
```

**this is a CSV metadata file
+ URI of the CSVW vocabulary**



Attach a Context

```
"country","country group","name (en)","name (fr)","name (de)","latitude","longitude"  
"at","eu","Austria","Autriche","Österreich","47.6965545","13.34598005"  
"be","eu","Belgium","Belgique","Belgien","50.501045","4.47667405"  
"bg","eu","Bulgaria","Bulgarie","Bulgarien","42.72567375","25.4823218"
```

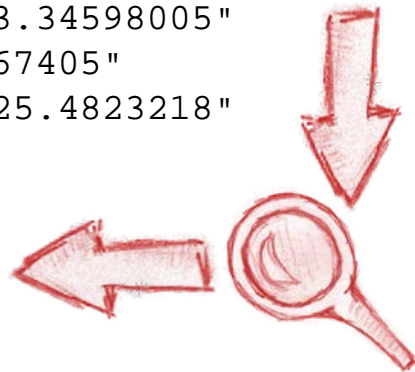
```
{  
  "@context": "http://www.w3.org/ns/csvw",  
  "url": "countries.csv",  
  (...)
```

| URL(s) of the CSV file(s) as the one above



Find a Context

```
"country","country group","name (en)","name (fr)","name (de)","latitude","longitude"  
"at","eu","Austria","Autriche","Österreich","47.6965545","13.34598005"  
"be","eu","Belgium","Belgique","Belgien","50.501045","4.47667405"  
"bg","eu","Bulgaria","Bulgarie","Bulgarien","42.72567375","25.4823218"  
  
{  
  "@context": "http://www.w3.org/ns/csvw",  
  "url": "countries.csv",  
  (...)
```



1. add “-metadata.json” to the end of the name of the CSV file.
e.g. countries.csv data file → countries.csv-metadata.json.
2. if not available, by default, look for a file called
“csv-metadata.json” in the same directory

Document the CSV

```
"country","country group","name (en)","name (fr)","name (de)","latitude","longitude"
"at","eu","Austria","Autriche","Österreich","47.6965545","13.34598005"
"be","eu","Belgium","Belgique","Belgien","50.501045","4.47667405"
"bg","eu","Bulgaria","Bulgarie","Bulgarien","42.72567375","25.4823218"
```

```
{
  "@context": "http://www.w3.org/ns/csvw",
  "dc:title": "Unemployment in Europe (monthly)"
  "dc:description": "Harmonized unemployment data for European countries."
  "dc:creator": "Eurostat",
  "tables": [{
    "url": "countries.csv",
    "dc:title": "Countries"
  }, {"url": "country-groups.csv",
    "dc:title": "Country groups"
  }, {"url": "unemployment.csv",
    "dc:title": "Unemployment (monthly)",
    "dc:description": "The total number of people unemployed"
  }]
}(...)
```

dataset

CSV files



Mapping of the CSV Structure (Create Resources)

```
"country","country group","name (en)","name (fr)","name (de)","latitude","longitude"
"at","eu","Austria","Autriche","Österreich","47.6965545","13.34598005"
"be","eu","Belgium","Belgique","Belgien","50.501045","4.47667405"
"bg","eu","Bulgaria","Bulgarie","Bulgarien","42.72567375","25.4823218"
```



```
{
```

```
  "@context": "http://www.w3.org/ns/csvw",
```

```
  "url": "countries.csv",
```

```
  "tableSchema": {
```

```
    "aboutUrl": "http://example.org/country/{code}",
```

```
    "columns": [{
```

```
      "titles": "country",
```

```
      "name": "code",
```

```
      "suppressOutput": true
```

```
    ]
```

```
(...)
```

generate URIs of resources

map "country" column
to "code" silently

Mapping of the CSV Structure (Map Columns)

```
"country","country group","name (en)","name (fr)","name (de)","latitude","longitude"  
"at","eu","Austria","Autriche","Österreich","47.6965545","13.34598005"  
"be","eu","Belgium","Belgique","Belgien","50.501045","4.47667405"  
"bg","eu","Bulgaria","Bulgarie","Bulgarien","42.72567375","25.4823218"
```



```
{  
(...){  
  "titles": "name (en)",  
  "lang": "en",  
  "propertyUrl": "schema:name"  
}, {  
  "titles": "name (fr)",  
  "lang": "fr",  
  "propertyUrl": "schema:name"  
}, {  
  "titles": "name (de)",  
  "lang": "de",  
  "propertyUrl": "schema:name"  
}, (...)
```

map “name (en)” column
to “schema:name” in english

Mapping of the CSV Structure (Nested Objects)

```
"country","country group","name (en)","name (fr)","name (de)","latitude","longitude"
"at","eu","Austria","Autriche","Österreich","47.6965545","13.34598005"
"be","eu","Belgium","Belgique","Belgien","50.501045","4.47667405"
"bg","eu","Bulgaria","Bulgarie","Bulgarien","42.72567375","25.4823218"
```



```
{
  (... ) {
    "titles": "latitude",
    "datatype": "number",
    "aboutUrl": "http://example.org/country/{code}#geo",
    "propertyUrl": "schema:latitude"
  }, {
    "titles": "longitude",
    "datatype": "number",
    "aboutUrl": "http://example.org/country/{code}#geo",
    "propertyUrl": "schema:longitude"
  }, (... )
}
```

generate a node for coordinates

Mapping of the CSV Structure (Nested Objects)

```
"country","country group","name (en)","name (fr)","name (de)","latitude","longitude"
"at","eu","Austria","Autriche","Österreich","47.6965545","13.34598005"
"be","eu","Belgium","Belgique","Belgien","50.501045","4.47667405"
"bg","eu","Bulgaria","Bulgarie","Bulgarien","42.72567375","25.4823218"
```



```
{
  (... ) {
    "titles": "latitude",
    "datatype": "number",
    "aboutUrl": "http://example.org/country/{code}#geo",
    "propertyUrl": "schema:latitude"
  }, {
    "titles": "longitude",
    "datatype": "number",
    "aboutUrl": "http://example.org/country/{code}#geo",
    "propertyUrl": "schema:longitude"
  }, (... )
```

attach properties

Mapping of the CSV Structure (Nested Objects)

```
"country","country group","name (en)","name (fr)","name (de)","latitude","longitude"
"at","eu","Austria","Autriche","Österreich","47.6965545","13.34598005"
"be","eu","Belgium","Belgique","Belgien","50.501045","4.47667405"
"bg","eu","Bulgaria","Bulgarie","Bulgarien","42.72567375","25.4823218"
```



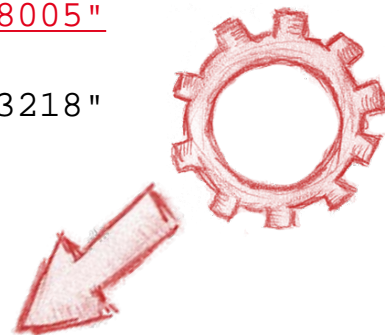
```
{
  (...) {
    "virtual": true,
    "propertyUrl": "rdf:type",
    "valueUrl": "schema:Country"
  }, {
    "virtual": true,
    "propertyUrl": "schema:geo",
    "valueUrl": "http://example.org/country/{code}#geo"
  }, {
    "virtual": true,
    "aboutUrl": "http://example.org/country/{code}#geo",
    "propertyUrl": "rdf:type",
    "valueUrl": "schema:GeoCoordinates"
  }
}
```

attach node of coordinates

JSON Result

"country","country group","name (en)","name (fr)","name (de)","latitude","longitude"
"at","eu","Austria","Autriche","Österreich","47.6965545","13.34598005"
"be","eu","Belgium","Belgique","Belgien","50.501045","4.47667405"
"bg","eu","Bulgaria","Bulgarie","Bulgarien","42.72567375","25.4823218"

```
[{
  "@id": "http://example.org/country/at",
  "@type": "schema:Country",
  "schema:name": ["Austria", "Autriche",
    "Österreich"],
  "schema:geo": {
    "@id": "http://example.org/country/at#geo",
    "@type": "schema:GeoCoordinates",
    "schema:latitude": 47.6965545,
    "schema:longitude": 13.34598005
  }
}, {
  "@id": "http://example.org/country/be",
  "@type": "schema:Country",
  "schema:name": ["Belgium", "Belgique",
    "Belgien"],
  "schema:geo": {
    "@id": "http://example.org/country/be#geo",
    "@type": "schema:GeoCoordinates",
    "schema:latitude": 50.501045,
    "schema:longitude": 4.47667405
  }
}, {
  "@id": "http://example.org/country/bg",
  "@type": "schema:Country",
  "schema:name": ["Bulgaria", "Bulgarie",
    "Bulgarien"],
  "schema:geo": {
    "@id": "http://example.org/country/bg#geo",
    "@type": "schema:GeoCoordinates",
    "schema:latitude": 42.72567375,
    "schema:longitude": 25.4823218
  }
}]
```



e.g. first line in JSON

RDF Result

```
"country","country group","name (en)","name (fr)","name (de)","latitude","longitude"  
"at","eu","Austria","Autriche","Österreich","47.6965545","13.34598005"
```

```
"be","eu","Belgium","Belgique","Belgien","50.501045","4.47667405"
```

```
"bg","eu","Bulgaria","Bulgarie","Bulgarien","42.72567375","25.4823218"
```

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
```

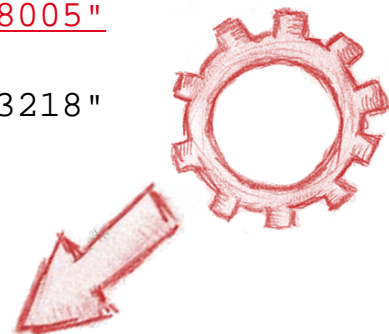
```
@prefix schema: <http://schema.org/> .
```

```
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
```

```
<http://example.org/country/at> a schema:Country;  
  schema:geo <http://example.org/country/at#geo>;  
  schema:name "Austria"@en, "Autriche"@fr, "Österreich"@de .  
<http://example.org/country/at#geo> a schema:GeoCoordinates;  
  schema:latitude 4.76965545e1; schema:longitude 1.334598005e1 .
```

```
<http://example.org/country/be> a schema:Country;  
  schema:geo <http://example.org/country/be#geo>;  
  schema:name "Belgium"@en, "Belgique"@fr, "Belgien"@de .  
<http://example.org/country/be#geo> a schema:GeoCoordinates;  
  schema:latitude 5.0501045e1; schema:longitude 4.47667405e0 .
```

```
<http://example.org/country/bg> a schema:Country;  
  schema:geo <http://example.org/country/bg#geo>;  
  schema:name "Bulgaria"@en, "Bulgarie"@fr, "Bulgarien"@de .  
<http://example.org/country/bg#geo> a schema:GeoCoordinates;  
  schema:latitude 4.272567375e1; schema:longitude 2.54823218e1 .
```



e.g. first line in Turtle

Picture credits

- Raider3 Is Making A List Music! by raider3_anime - CC BY-NC 2.0 <https://flic.kr/p/7DDSun>
- Icons:
 - Office excel csv Icon by Senary Icons Arrioch - CC-BY-NC-ND 4.0 <http://www.iconarchive.com/show/senary-icons-by-arrioch/Office-excel-csv-icon.html>
 - RDF Resource Description Framework, http://www.w3.org/RDF/icons/rdf_flyer.64 Drug, injection, virus icon, Everaldo Coelho, LGPL Licence
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 - ✓ Execute, gears, panel, settings, utilities icon, Dark Glass by Alessandro Rei – GPL

WEEK 4: Integration With Other Data Formats and Sources

1. RDFa: an RDF syntax inside HTML
2. GRDDL: extract RDF from X(HT)ML
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- 5. R2RML: integration with databases**
6. LDP: a REST API to linked data

Transforming a Relational Database into RDF

- default transformation
[A Direct Mapping of Relational Data to RDF]

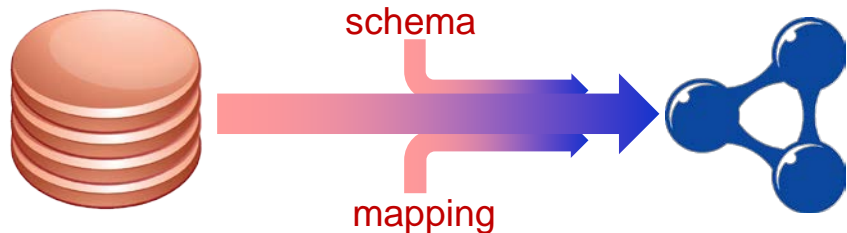


Transforming a Relational Database into RDF

- default transformation
[A Direct Mapping of Relational Data to RDF]




- customized transformation
[R2RML: RDB to RDF Mapping Language]



Default Transformation / Direct Mapping

name	fname	age
gandon	fabien	39
buttier	thomas	38
...	...	



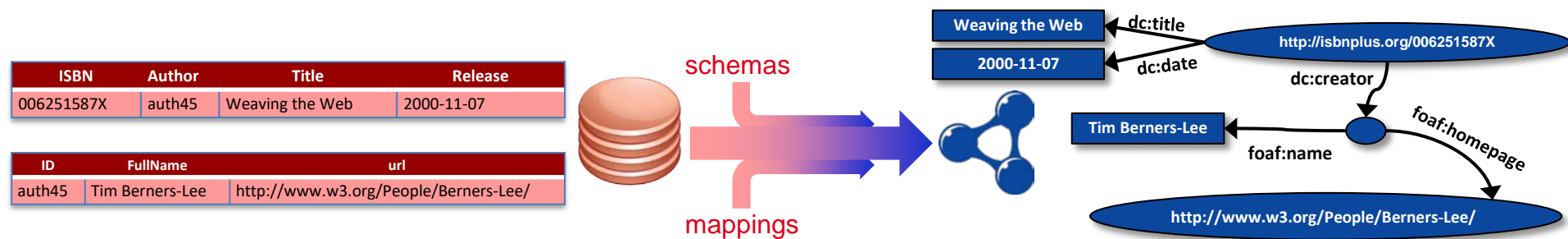
```
#s1 :name "gandon"  
#s1 :fname "fabien"  
#s1 :age "39"  
#s2 :name "buttier"  
#s2 :fname "thomas"  
#s2 :age "38"  
#s3 ...
```



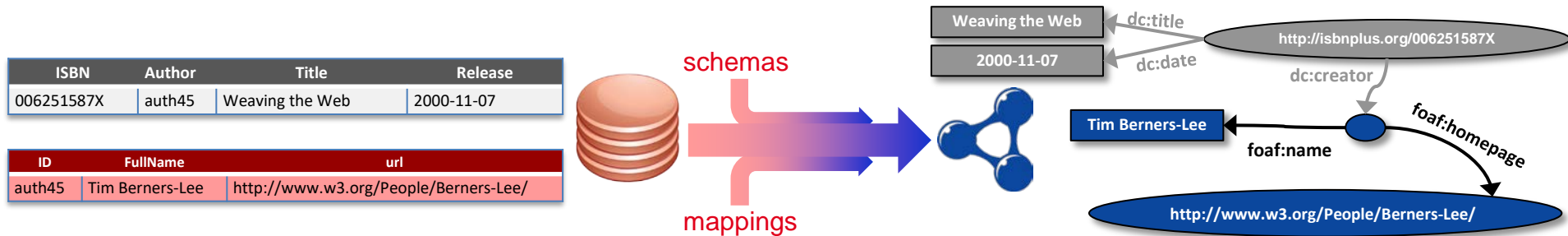
Triple generation rules:

1. All the cells of a given row have the same subject
2. The names of the columns become the names of properties
3. The value of a cell gives the value of the properties
4. Links between tables are maintained

Customized Transformation / Mapping

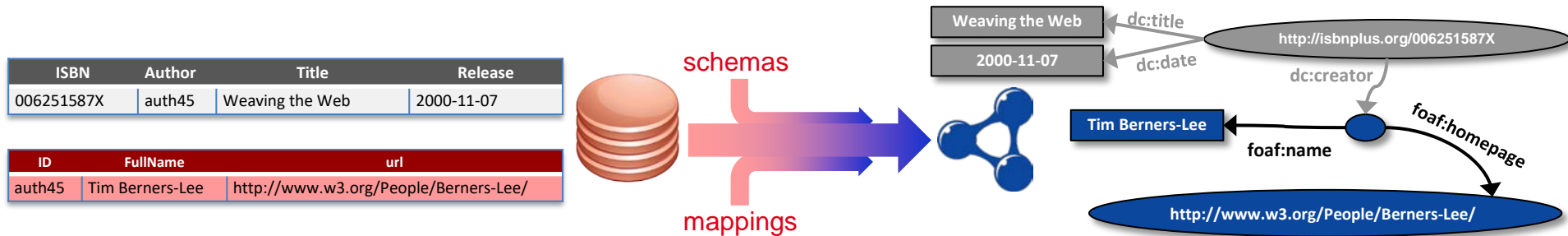


Customized Transformation / Mapping



```
:Author_Table rdf:type rr:TriplesMap ;
  rr:subjectMap [
    rr:termtype "BlankNode" ;
    rr:column "ID" ;
  ] ;
  rr:predicateObjectMap [
    rr:predicateMap [ rr:predicate foaf:name ];
    rr:objectMap [ rr:column "FullName" ]
  ] ;
  rr:predicateObjectMap [
    rr:predicateMap [ rr:predicate foaf:homepage ];
    rr:objectMap [ rr:column "url" ; rr:termtype "IRI" ]
  ] .
```

Customized Transformation / Mapping

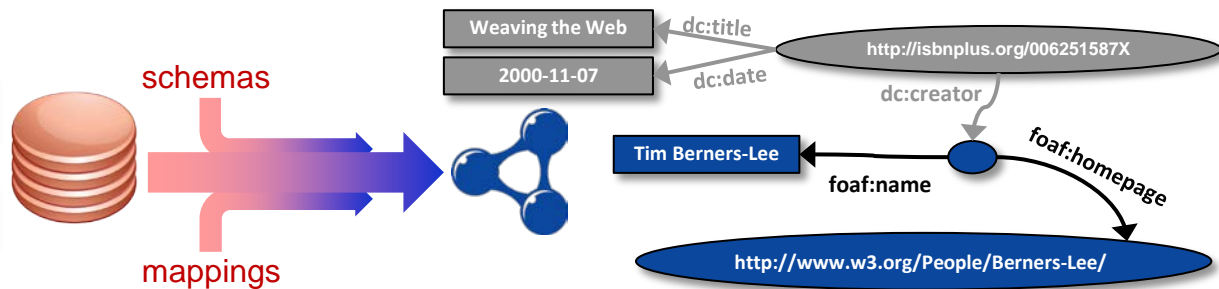


```
:Author_Table rdf:type rr:TriplesMap ;
rr:subjectMap [
  rr:termtype "BlankNode" ;
  rr:column "ID" ;
] ;
rr:predicateObjectMap [
  rr:predicateMap [ rr:predicate foaf:name ];
  rr:objectMap [ rr:column "FullName" ]
] ;
rr:predicateObjectMap [
  rr:predicateMap [ rr:predicate foaf:homepage ];
  rr:objectMap [ rr:column "url" ; rr:termtype "IRI" ]
] .
```

Customized Transformation / Mapping

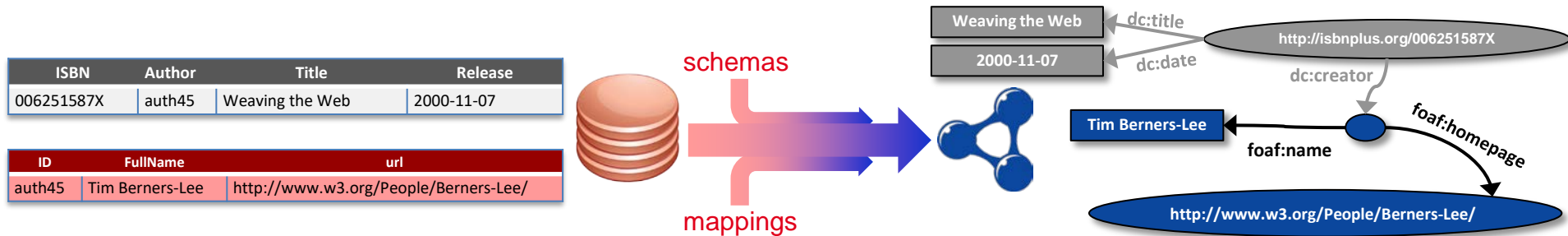
ISBN	Author	Title	Release
006251587X	auth45	Weaving the Web	2000-11-07

ID	FullName	url
auth45	Tim Berners-Lee	http://www.w3.org/People/Berners-Lee/



```
:Author_Table rdf:type rr:TriplesMap ;
rr:subjectMap [
  rr:termtype "BlankNode" ;
  rr:column "ID" ;
] ;
rr:predicateObjectMap [
  rr:predicateMap [ rr:predicate foaf:name ] ;
  rr:objectMap [ rr:column "FullName" ]
] ;
rr:predicateObjectMap [
  rr:predicateMap [ rr:predicate foaf:homepage ] ;
  rr:objectMap [ rr:column "url" ; rr:termtype "IRI" ]
] .
```

Customized Transformation / Mapping

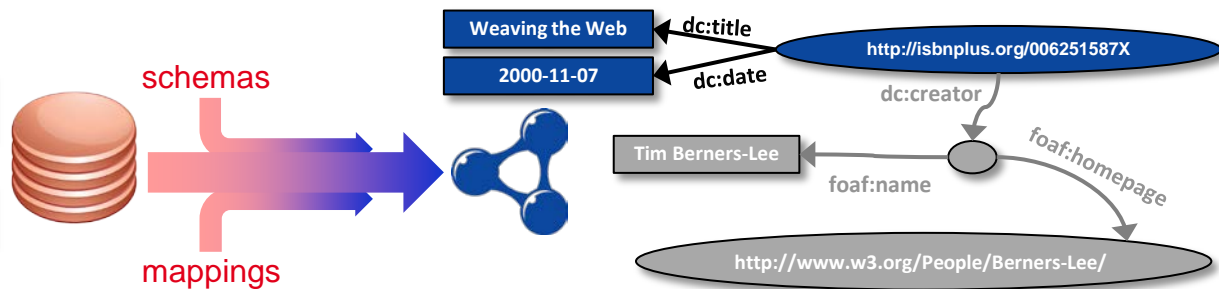


```
:Author_Table rdf:type rr:TriplesMap ;  
  rr:subjectMap [  
    rr:termtype "BlankNode" ;  
    rr:column "ID" ;  
  ] ;  
  rr:predicateObjectMap [  
    rr:predicateMap [ rr:predicate foaf:name ] ;  
    rr:objectMap [ rr:column "FullName" ]  
  ] ;  
  rr:predicateObjectMap [  
    rr:predicateMap [ rr:predicate foaf:homepage ] ;  
    rr:objectMap [ rr:column "url" ; rr:termtype "IRI" ]  
  ] .
```

Customized Transformation / Mapping

ISBN	Author	Title	Release
006251587X	auth45	Weaving the Web	2000-11-07

ID	FullName	url
auth45	Tim Berners-Lee	http://www.w3.org/People/Berners-Lee/



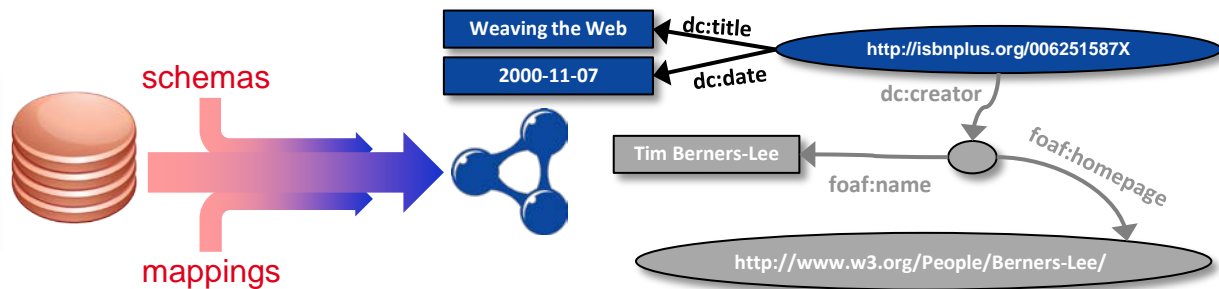
```
:Book_Table rdf:type rr:TriplesMap ;
  rr:subjectMap [ rr:template "http://isbnplus.org/{ISBN}"; ];
  rr:predicateObjectMap [
    rr:predicateMap [ rr:predicate dc:title ];
    rr:objectMap [ rr:column "Title" ]
  ] ;
  rr:predicateObjectMap [
    rr:predicateMap [ rr:predicate dc:date ];
    rr:objectMap [ rr:column "Release" ; ]
  ] ;
```

...

Customized Transformation / Mapping

ISBN	Author	Title	Release
006251587X	auth45	Weaving the Web	2000-11-07

ID	FullName	url
auth45	Tim Berners-Lee	http://www.w3.org/People/Berners-Lee/

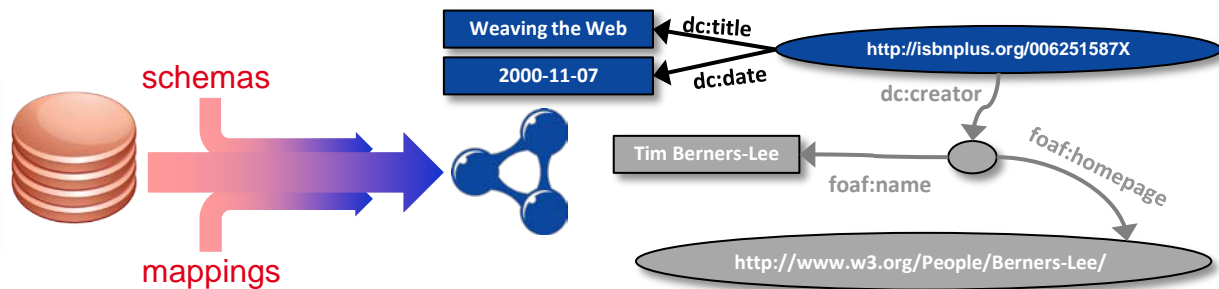


```
:Book_Table rdf:type rr:TriplesMap ;  
  rr:subjectMap [ rr:template "http://isbnplus.org/{ISBN}"; ];  
  rr:predicateObjectMap [  
    rr:predicateMap [ rr:predicate dc:title ];  
    rr:objectMap [ rr:column "Title" ]  
  ] ;  
  rr:predicateObjectMap [  
    rr:predicateMap [ rr:predicate dc:date ];  
    rr:objectMap [ rr:column "Release" ; ]  
  ] ;  
...
```

Customized Transformation / Mapping

ISBN	Author	Title	Release
006251587X	auth45	Weaving the Web	2000-11-07

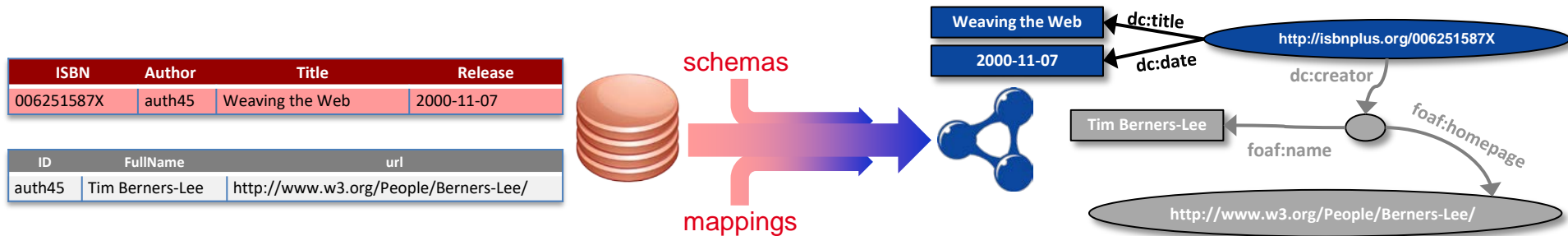
ID	FullName	url
auth45	Tim Berners-Lee	http://www.w3.org/People/Berners-Lee/



```
:Book_Table rdf:type rr:TriplesMap ;
  rr:subjectMap [ rr:template "http://isbnplus.org/{ISBN}"; ];
  rr:predicateObjectMap [
    rr:predicateMap [ rr:predicate dc:title ];
    rr:objectMap [ rr:column "Title" ]
  ] ;
  rr:predicateObjectMap [
    rr:predicateMap [ rr:predicate dc:date ];
    rr:objectMap [ rr:column "Release" ; ]
  ] ;
```

...

Customized Transformation / Mapping



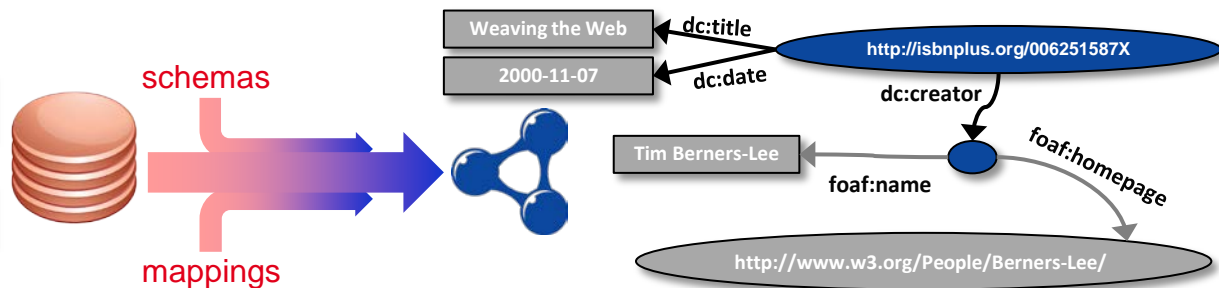
```
:Book_Table rdf:type rr:TriplesMap ;
  rr:subjectMap [ rr:template "http://isbnplus.org/{ISBN}"; ];
  rr:predicateObjectMap [
    rr:predicateMap [ rr:predicate dc:title ];
    rr:objectMap [ rr:column "Title" ]
  ] ;
  rr:predicateObjectMap [
    rr:predicateMap [ rr:predicate dc:date ];
    rr:objectMap [ rr:column "Release" ; ]
  ] ;
```

...

Customized Transformation / Mapping

ISBN	Author	Title	Release
006251587X	auth45	Weaving the Web	2000-11-07

ID	FullName	url
auth45	Tim Berners-Lee	http://www.w3.org/People/Berners-Lee/



```
:Book_Table rdf:type rr:TriplesMap ;  
...  
rr:refPredicateObjectMap [  
  rr:refPredicateMap [ rr:predicate dc:creator ];  
  rr:refObjectMap  
    [ rr:parentTriplesMap :Author_Table ;  
      rr:joinCondition "{child}.Author= {parent}.ID"  
    ]  
].
```

Picture credits

- Tableur icône, Marco Martin, LGPL Licence, <http://icones.pro/tableur-4-image-png.html>
- RDF Resource Description Framework, http://www.w3.org/RDF/icons/rdf_flyer.64

WEEK 4: Integration With Other Data Formats and Sources

1. RDFa: an RDF syntax inside HTML
2. GRDDL: extract RDF from X(HT)ML
3. JSON-LD: JSON syntax for RDF
4. Tabular data and metadata (CSV)
5. R2RML: integration with databases
- 6. LDP: a REST API to linked data**

Linked Data Platform

Standardized HTTP and RDF practices to build clients and servers that create, read, and write Linked Data Resources

Linked Data Platform: two kinds of resources

- With RDF representations

vs.

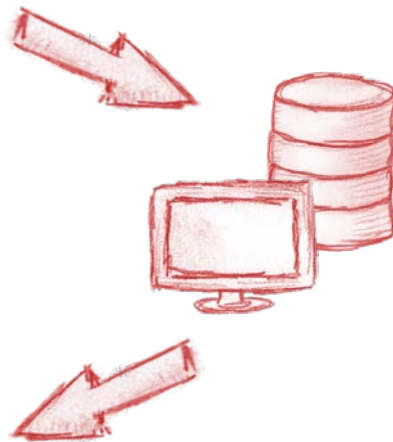
- Using other formats
(HTML files, images, other binary files)

Linked Data Platform: three kinds of containers

- **Containers:** collections of resources, often homogeneous ones (e.g. collection of documents).
- **Basic Containers** with simple containment vocabulary and access
- **Direct Container:** domain-specific membership assertions (e.g. author)
- **Indirect Container:** control the URI of the new domain-specific member resource.

LDP HTTP Operations

Resource type	Method	Result
A container	GET	Lists all the members of the container
	POST	Create a new member of the container
	PUT	Update the description of the container
	PATCH	Partial update of the description of the container
	DELETE	Delete the container
Any other resource type	GET	Retrieve a representation of the resource
	PUT	Update the resource description
	PATCH	Partial update of the resource description
	DELETE	Delete the resource description
Container or resource	OPTIONS	Discover the allowed operations over a resource
	HEAD	Only retrieve meta-information about a resource



LDP Vocabulary Extract

@prefix : <http://www.w3.org/ns/ldp#>

:Resource : A HTTP-addressable resource whose lifecycle is managed by a LDP server.

:RDFSSource : LDP Resource whose state is represented as RDF.

:NonRDFSSource : LDP Resource whose state is NOT represented as RDF.

:Container : RDF Source that conforms to patterns and conventions for managing membership.

:member : Default membership predicate.

:contains : Links a container with resources created through the container.

:BasicContainer : Container that uses an LDP simple predicate to link to contained resources.

:DirectContainer : Container that allows a custom properties to link contained resources.

:IndirectContainer : Container that allows maximum flexibility to form the membership triples.

:hasMemberRelation : Indicates the predicate linking a specified resource to a new member URI.

:isMemberOfRelation : Indicates the predicate linking a new member URI to a specified resource.

:membershipResource : Indicates the URI of the fixed resource of a membership triple.

:insertedContentRelation : Indicates the property in a creation request with a member-URI value.

LDP Vocabulary Extract (Resources)

@prefix : <<http://www.w3.org/ns/ldp#>>

:Resource : A HTTP-addressable resource whose lifecycle is managed by a LDP server.

:RDFSSource : LDP Resource whose state is represented as RDF.

:NonRDFSSource : LDP Resource whose state is NOT represented as RDF.

:Container : RDF Source that conforms to patterns and conventions for managing membership.

:member : Default membership predicate.

:contains : Links a container with resources created through the container.

:BasicContainer : Container that uses an LDP simple predicate to link to contained resources.

:DirectContainer : Container that allows a custom properties to link contained resources.

:IndirectContainer : Container that allows maximum flexibility to form the membership triples.

:hasMemberRelation : Indicates the predicate linking a specified resource to a new member URI.

:isMemberOfRelation : Indicates the predicate linking a new member URI to a specified resource.

:membershipResource : Indicates the URI of the fixed resource of a membership triple.

:insertedContentRelation : Indicates the property in a creation request with a member-URI value.

LDP Vocabulary Extract (Basic Containment)

@prefix : <http://www.w3.org/ns/ldp#>

:Resource : A HTTP-addressable resource whose lifecycle is managed by a LDP server.

:RDFSSource : LDP Resource whose state is represented as RDF.

:NonRDFSSource : LDP Resource whose state is NOT represented as RDF.

:Container : RDF Source that conforms to patterns and conventions for managing membership.

:member : Default membership predicate.

:contains : Links a container with resources created through the container.

:BasicContainer : Container that uses an LDP simple predicate to link to contained resources.

:DirectContainer : Container that allows a custom properties to link contained resources.

:IndirectContainer : Container that allows maximum flexibility to form the membership triples.

:hasMemberRelation : Indicates the predicate linking a specified resource to a new member URI.

:isMemberOfRelation : Indicates the predicate linking a new member URI to a specified resource.

:membershipResource : Indicates the URI of the fixed resource of a membership triple.

:insertedContentRelation : Indicates the property in a creation request with a member-URI value.

LDP Vocabulary Extract (Container Types)

@prefix : <http://www.w3.org/ns/ldp#>

:Resource : A HTTP-addressable resource whose lifecycle is managed by a LDP server.

:RDFSSource : LDP Resource whose state is represented as RDF.

:NonRDFSSource : LDP Resource whose state is NOT represented as RDF.

:Container : RDF Source that conforms to patterns and conventions for managing membership.

:member : Default membership predicate.

:contains : Links a container with resources created through the container.

:BasicContainer : Container that uses an LDP simple predicate to link to contained resources.

:DirectContainer : Container that allows a custom properties to link contained resources.

:IndirectContainer : Container that allows maximum flexibility to form the membership triples.

:hasMemberRelation : Indicates the predicate linking a specified resource to a new member URI.

:isMemberOfRelation : Indicates the predicate linking a new member URI to a specified resource.

:membershipResource : Indicates the URI of the fixed resource of a membership triple.

:insertedContentRelation : Indicates the property in a creation request with a member-URI value.

LDP Vocabulary Extract (Customized Membership)

@prefix : <http://www.w3.org/ns/ldp#>

:Resource : A HTTP-addressable resource whose lifecycle is managed by a LDP server.

:RDFSSource : LDP Resource whose state is represented as RDF.

:NonRDFSSource : LDP Resource whose state is NOT represented as RDF.

:Container : RDF Source that conforms to patterns and conventions for managing membership.

:member : Default membership predicate.

:contains : Links a container with resources created through the container.

:BasicContainer : Container that uses an LDP simple predicate to link to contained resources.

:DirectContainer : Container that allows a custom properties to link contained resources.

:IndirectContainer : Container that allows maximum flexibility to form the membership triples.

:hasMemberRelation : Indicates the predicate linking a specified resource to a new member URI.

:isMemberOfRelation : Indicates the predicate linking a new member URI to a specified resource.

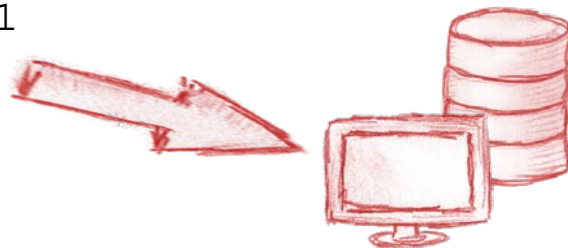
:membershipResource : Indicates the URI of the fixed resource of a membership triple.

:insertedContentRelation : Indicates the property in a creation request with a member-URI value.

RESTful Access to LDP Resources (OPTIONS)

OPTIONS /fabien/ HTTP/1.1

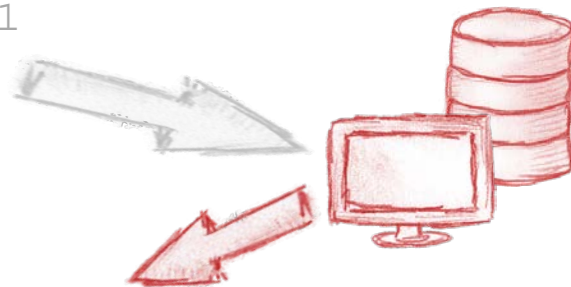
Host: inria.fr



RESTful Access to LDP Resources (OPTIONS)

OPTIONS /fabien/ HTTP/1.1

Host: inria.fr



HTTP/1.1 204 No Content

Allow: OPTIONS,HEAD,GET,POST,PUT,PATCH

Accept-Post: text/turtle, application/ld+json, image/bmp, image/jpeg

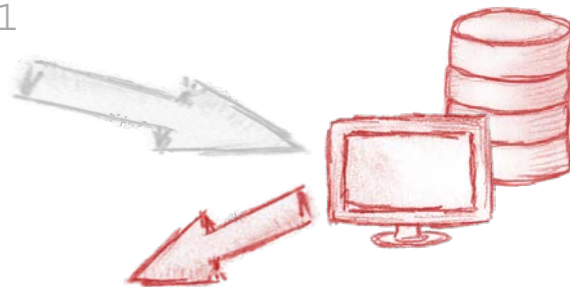
Accept-Patch: text/ldpatch

Link: <http://www.w3.org/ns/ldp#BasicContainer>; rel="type",
<http://www.w3.org/ns/ldp#Resource>; rel="type"

RESTful Access to LDP Resources (OPTIONS)

OPTIONS /fabien/ HTTP/1.1

Host: inria.fr



HTTP/1.1 204 No Content

Allow: OPTIONS, HEAD, GET, POST, PUT, PATCH

Accept-Post: text/turtle, application/ld+json, image/bmp, image/jpeg

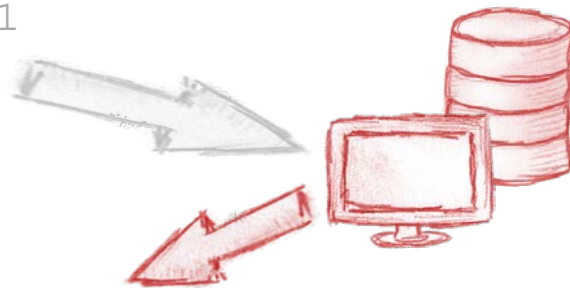
Accept-Patch: text/ldpatch

Link: <http://www.w3.org/ns/ldp#BasicContainer>; rel="type",
<http://www.w3.org/ns/ldp#Resource>; rel="type"

RESTful Access to LDP Resources (OPTIONS)

OPTIONS /fabien/ HTTP/1.1

Host: inria.fr



HTTP/1.1 204 No Content

Allow: OPTIONS,HEAD,GET,POST,PUT,PATCH

Accept-Post: text/turtle, application/ld+json, image/bmp, image/jpeg

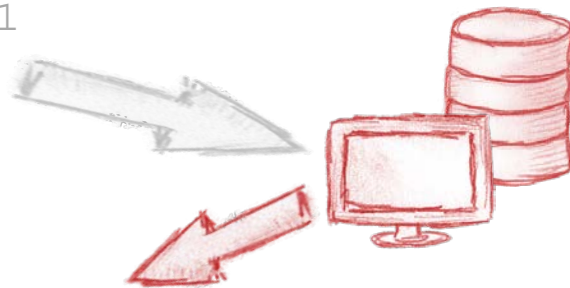
Accept-Patch: text/ldpatch

Link: <http://www.w3.org/ns/ldp#BasicContainer>; rel="type",
<http://www.w3.org/ns/ldp#Resource>; rel="type"

RESTful Access to LDP Resources (OPTIONS)

OPTIONS /fabien/ HTTP/1.1

Host: inria.fr



HTTP/1.1 204 No Content

Allow: OPTIONS,HEAD,GET,POST,PUT,PATCH

Accept-Post: text/turtle, application/ld+json, image/bmp, image/jpeg

Accept-Patch: text/ldpatch

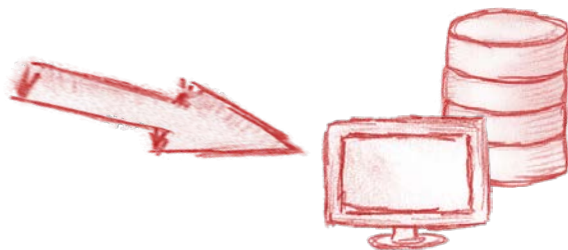
Link: <http://www.w3.org/ns/ldp#BasicContainer>; rel="type",
<http://www.w3.org/ns/ldp#Resource>; rel="type"

RESTful Access to LDP Resources (GET)

GET /fabien/ HTTP/1.1

Host: inria.fr

Accept: text/turtle

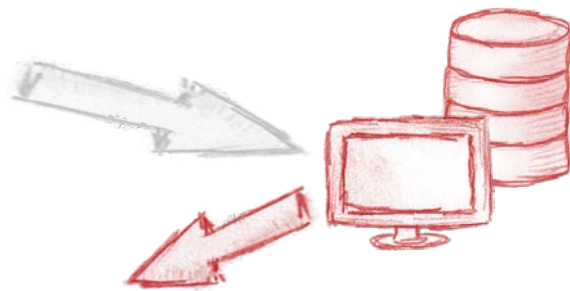


RESTful Access to LDP Resources (GET)

GET /fabien/ HTTP/1.1

Host: inria.fr

Accept: text/turtle



HTTP/1.1 200 OK

Content-Type: text/turtle; charset=UTF-8

Link: <http://www.w3.org/ns/ldp#BasicContainer>; rel="type", <http://www.w3.org/ns/ldp#Resource>; rel="type"

Allow: OPTIONS,HEAD,GET,POST,PUT,PATCH

Accept-Post: text/turtle, application/ld+json, image/bmp, image/jpeg

Accept-Patch: text/ldpatch

Content-Length: 250

ETag: W/'09a15b892e673c71'

@prefix dcterms: <http://purl.org/dc/terms/>.

@prefix ldp: <http://www.w3.org/ns/ldp#>.

<http://inria.fr/fabien/> a ldp:BasicContainer;

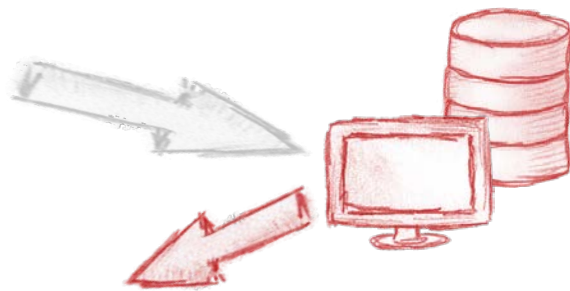
dcterms:title "Fabien's data storage on the Web" .

RESTful Access to LDP Resources (GET)

GET /fabien/ HTTP/1.1

Host: inria.fr

Accept: text/turtle



HTTP/1.1 200 OK

Content-Type: text/turtle; charset=UTF-8

Link: <http://www.w3.org/ns/ldp#BasicContainer>; rel="type", <http://www.w3.org/ns/ldp#Resource>; rel="type"

Allow: OPTIONS,HEAD,GET,POST,PUT,PATCH

Accept-Post: text/turtle, application/ld+json, image/bmp, image/jpeg

Accept-Patch: text/ldpatch

Content-Length: 250

ETag: W/'09a15b892e673c71'

@prefix dcterms: <http://purl.org/dc/terms/>.

@prefix ldp: <http://www.w3.org/ns/ldp#>.

<http://inria.fr/fabien/> a ldp:BasicContainer;

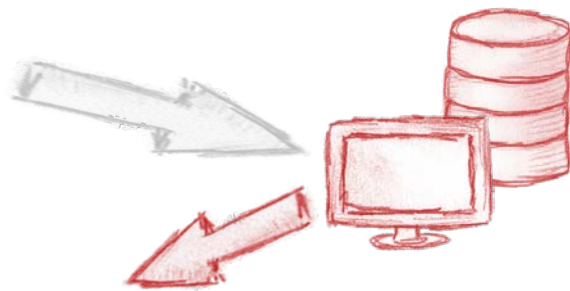
dcterms:title "Fabien's data storage on the Web" .

RESTful Access to LDP Resources (GET)

GET /fabien/ HTTP/1.1

Host: inria.fr

Accept: text/turtle



HTTP/1.1 200 OK

Content-Type: text/turtle; charset=UTF-8

Link: <http://www.w3.org/ns/ldp#BasicContainer>; rel="type", <http://www.w3.org/ns/ldp#Resource>; rel="type"

Allow: OPTIONS,HEAD,GET,POST,PUT,PATCH

Accept-Post: text/turtle, application/ld+json, image/bmp, image/jpeg

Accept-Patch: text/ldpatch

Content-Length: 250

ETag: W/'09a15b892e673c71'

@prefix dcterms: <http://purl.org/dc/terms/>.

@prefix ldp: <http://www.w3.org/ns/ldp#>.

<http://inria.fr/fabien/> a ldp:BasicContainer;

dcterms:title "Fabien's data storage on the Web" .



RESTful Access to LDP Resources (POST)

POST /fabien/ HTTP/1.1

Host: inria.fr

Link: <http://www.w3.org/ns/ldp#Resource>; rel="type"

Content-Type: text/turtle

Slug: foaf

@prefix foaf: <http://xmlns.com/foaf/0.1/> .

@prefix dc: <http://purl.org/dc/terms/> .

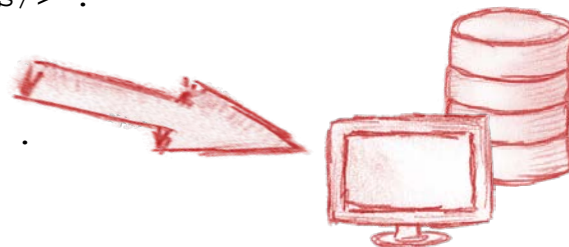
<> a foaf:PersonalProfileDocument;

foaf:primaryTopic <#me> ;

dc:title 'Fabien's FOAF profile' .

<#me> a foaf:Person;

foaf:name 'Fabien Gandon' .



RESTful Access to LDP Resources (POST)

POST /fabien/ HTTP/1.1

Host: inria.fr

Link: <http://www.w3.org/ns/ldp#Resource>; rel="type"

Content-Type: text/turtle

Slug: foaf

@prefix foaf: <http://xmlns.com/foaf/0.1/> .

@prefix dc: <http://purl.org/dc/terms/> .

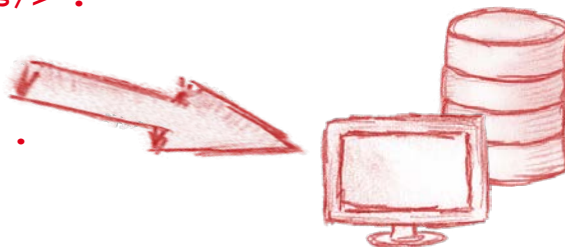
<> a foaf:PersonalProfileDocument;

foaf:primaryTopic <#me> ;

dc:title 'Fabien's FOAF profile' .

<#me> a foaf:Person;

foaf:name 'Fabien Gandon' .



RESTful Access to LDP Resources (POST)

POST /fabien/ HTTP/1.1

Host: inria.fr

Link: <http://www.w3.org/ns/ldp#Resource>; rel="type"

Content-Type: text/turtle

Slug: foaf

@prefix foaf: <http://xmlns.com/foaf/0.1/> .

@prefix dc: <http://purl.org/dc/terms/> .

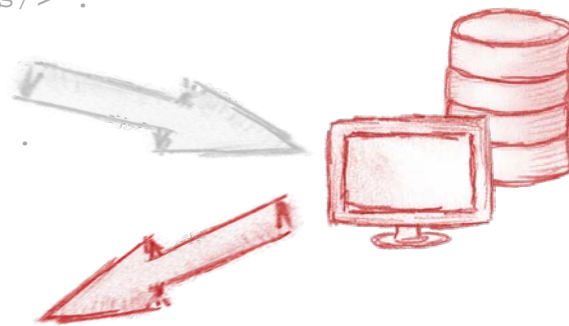
<> a foaf:PersonalProfileDocument;

foaf:primaryTopic <#me> ;

dc:title 'Fabien's FOAF profile' .

<#me> a foaf:Person;

foaf:name 'Fabien Gandon' .



HTTP/1.1 201 Created

Location: http://inria.fr/fabien/foaf

Link: <http://www.w3.org/ns/ldp#Resource>; rel="type"

Content-Length: 0

RESTful Access to LDP Resources (PUT)

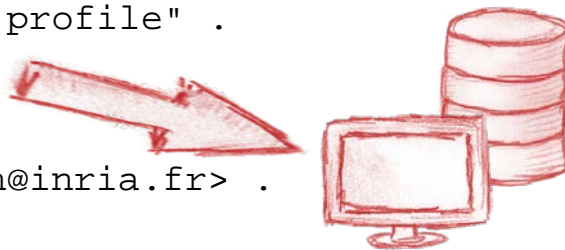
PUT /fabien/foaf HTTP/1.1

Host: inria.fr

Content-Type: text/turtle

If-Match: W/"7ab4819c5ed84"

```
@prefix dc: <http://purl.org/dc/terms/> .  
@prefix foaf: <http://xmlns.com/foaf/0.1/> .  
<> a foaf:PersonalProfileDocument;  
    foaf:primaryTopic <#me> ;  
    dc:title "Fabien Gandon's FOAF profile" .  
<#me> a foaf:Person;  
    foaf:name "Fabien Gandon" ;  
    foaf:mail <mailto:fabien.gandon@inria.fr> .
```



RESTful Access to LDP Resources (PUT)

PUT /fabien/foaf HTTP/1.1

Host: inria.fr

Content-Type: text/turtle

If-Match: W/"7ab4819c5ed84"

@prefix dc: <http://purl.org/dc/terms/> .

@prefix foaf: <http://xmlns.com/foaf/0.1/> .

<> a foaf:PersonalProfileDocument;

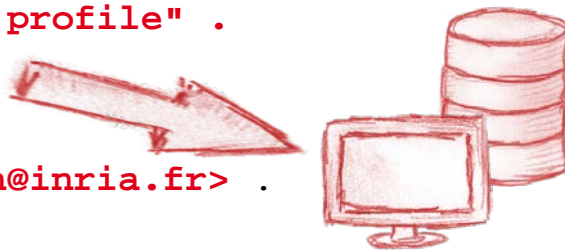
foaf:primaryTopic <#me> ;

dc:title "Fabien Gandon's FOAF profile" .

<#me> a foaf:Person;

foaf:name "Fabien Gandon" ;

foaf:mail <mailto:fabien.gandon@inria.fr> .



RESTful Access to LDP Resources (PUT)

```
PUT /fabien/foaf HTTP/1.1
```

```
Host: inria.fr
```

```
Content-Type: text/turtle
```

```
If-Match: W/"7ab4819c5ed84"
```

```
@prefix dc: <http://purl.org/dc/terms/> .
```

```
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
```

```
<> a foaf:PersonalProfileDocument;
```

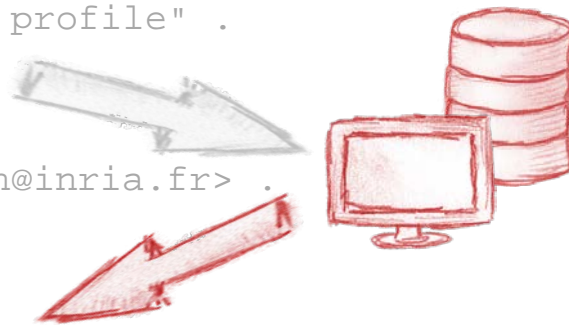
```
    foaf:primaryTopic <#me> ;
```

```
    dc:title "Fabien Gandon's FOAF profile" .
```

```
<#me> a foaf:Person;
```

```
    foaf:name "Fabien Gandon" ;
```

```
    foaf:mail <mailto:fabien.gandon@inria.fr> .
```



HTTP/1.1 204 No Content

```
Link: <http://www.w3.org/ns/ldp#Resource>; rel="type"
```

RESTful Access to LDP Containers (POST)

POST /fabien/ HTTP/1.1

Host: inria.fr

Content-Type: text/turtle

Link: <http://www.w3.org/ns/ldp/BasicContainer>; rel="type"

Slug: papers

@prefix ldp: <http://www.w3.org/ns/ldp#> .

@prefix dcterms: <http://purl.org/dc/terms/> .

<> a ldp:Container, ldp:BasicContainer;

dcterms:title "Papers" ;

dcterms:description "Fabien's articles." .



RESTful Access to LDP Containers (POST)

POST /fabien/ HTTP/1.1

Host: inria.fr

Content-Type: text/turtle

Link: <http://www.w3.org/ns/ldp/BasicContainer>; rel="type"

Slug: papers

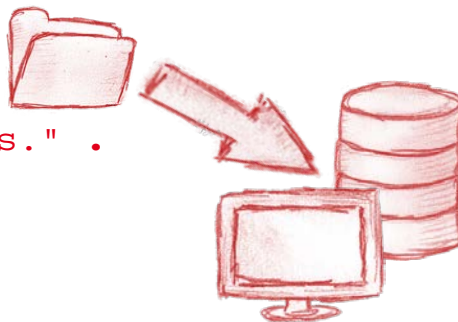
@prefix ldp: <http://www.w3.org/ns/ldp#> .

@prefix dcterms: <http://purl.org/dc/terms/> .

<> a ldp:Container, ldp:BasicContainer;

dcterms:title "Papers" ;

dcterms:description "Fabien's articles." .



RESTful Access to LDP Containers (POST)

POST /fabien/ HTTP/1.1

Host: inria.fr

Content-Type: text/turtle

Link: <http://www.w3.org/ns/ldp/BasicContainer>; rel="type"

Slug: papers

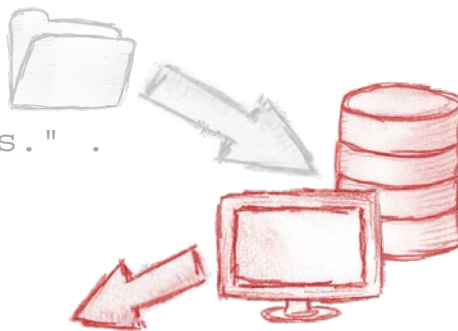
@prefix ldp: <http://www.w3.org/ns/ldp#> .

@prefix dcterms: <http://purl.org/dc/terms/> .

<> a ldp:Container, ldp:BasicContainer;

dcterms:title "Papers" ;

dcterms:description "Fabien's articles." .



HTTP/1.1 201 Created

Location: http://inria.fr/fabien/papers/

Link: <http://www.w3.org/ns/ldp#Resource>; rel="type"

Content-Length: 0

RESTful Access to LDP Direct Containers

POST /fabien/ HTTP/1.1

Host: inria.fr

Content-Type: text/turtle

Link: <http://www.w3.org/ns/ldp/BasicContainer>; rel="type"

Slug: papers

@prefix ldp: <http://www.w3.org/ns/ldp#> .

@prefix dcterms: <http://purl.org/dc/terms/> .

<> a ldp:Container, **ldp:DirectContainer**;

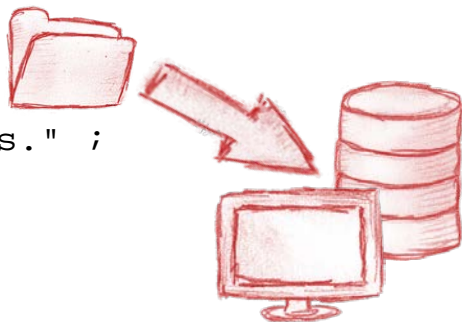
dcterms:title "Papers" ;

dcterms:description "Fabien's articles." ;

ldp:isMemberOfRelation dc:creator ;

ldp:membershipResource

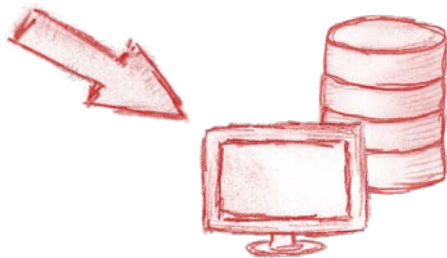
<http://inria.fr/fabien/foaf#me> .



RESTful Access to LDP Resources (PUT)

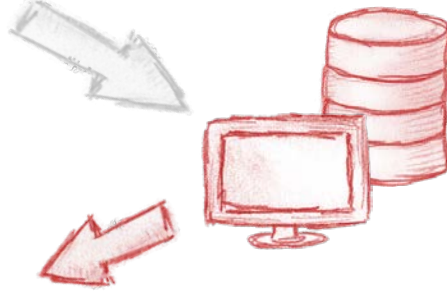
DELETE /fabien/foaf HTTP/1.1

Host: inria.fr



RESTful Access to LDP Resources (PUT)

```
DELETE /fabien/foaf HTTP/1.1  
Host: inria.fr
```



HTTP/1.1 204 No Content

```
Link: <http://www.w3.org/ns/ldp#Resource>; rel="type"
```

Picture credits

- Icons (iconfinder.com):
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WEEK 4: Integration With Other Data Formats and Sources

1. RDFa: an RDF syntax inside HTML
2. GRDDL: extract RDF from X(HT)ML
3. JSON-LD: JSON syntax for RDF
4. Tabular data and metadata (CSV)
5. R2RML: integration with databases
6. LDP: a REST API to linked data

CONCLUSION

identify

HTTP URI

describe & link

RDF

query

HTTP, SPARQL, LDP

embed

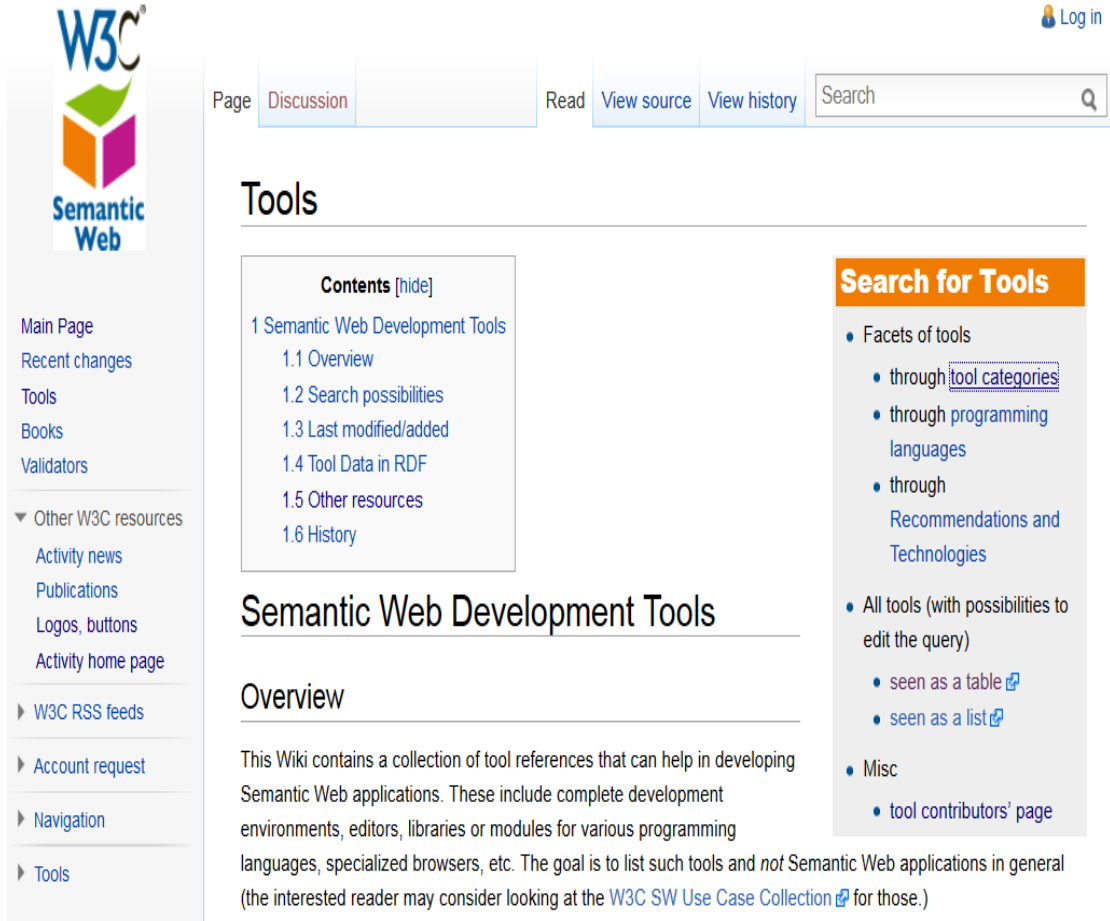
RDFa

map

JSON-LD, CSVW,
R2RML, GRDDL

GOALS AND MEANS

Many Tools e.g.



The screenshot shows the Semantic Web Development Tools Wiki page. At the top left is the W3C Semantic Web logo. Below it is a sidebar with navigation links: Main Page, Recent changes, Tools, Books, Validators, Other W3C resources (Activity news, Publications, Logos, buttons, Activity home page), W3C RSS feeds, Account request, Navigation, and Tools. The main content area has a top navigation bar with 'Page Discussion', 'Read View source View history', and a search box. The title 'Tools' is prominently displayed. Below it is a 'Contents [hide]' section listing the page structure: 1 Semantic Web Development Tools, 1.1 Overview, 1.2 Search possibilities, 1.3 Last modified/added, 1.4 Tool Data in RDF, 1.5 Other resources, and 1.6 History. The 'Overview' section follows, stating that the wiki contains tool references for developing Semantic Web applications. On the right, a 'Search for Tools' sidebar lists categories like 'Facets of tools' (through tool categories, programming languages, Recommendations and Technologies), 'All tools (with possibilities to edit the query)' (seen as a table or list), and 'Misc' (tool contributors' page).

W3C
Semantic Web

Main Page
Recent changes
Tools
Books
Validators
▼ Other W3C resources
Activity news
Publications
Logos, buttons
Activity home page
► W3C RSS feeds
► Account request
► Navigation
► Tools

Page Discussion Read View source View history Search

Tools

Contents [hide]

- 1 Semantic Web Development Tools
 - 1.1 Overview
 - 1.2 Search possibilities
 - 1.3 Last modified/added
 - 1.4 Tool Data in RDF
 - 1.5 Other resources
 - 1.6 History

Semantic Web Development Tools

Overview


This Wiki contains a collection of tool references that can help in developing Semantic Web applications. These include complete development environments, editors, libraries or modules for various programming languages, specialized browsers, etc. The goal is to list such tools and *not* Semantic Web applications in general (the interested reader may consider looking at the [W3C SW Use Case Collection](#) for those.)

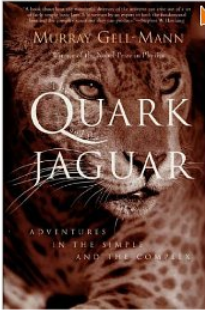
Search for Tools

- Facets of tools
 - through [tool categories](#)
 - through programming languages
 - through Recommendations and Technologies
- All tools (with possibilities to edit the query)
 - [seen as a table](#)
 - [seen as a list](#)
- Misc
 - [tool contributors' page](#)

<http://www.w3.org/2001/sw/wiki/Tools>

Web 1.0, 2.0, 3.0 ...





Click to **LOOK INSIDE!**

The Quark and the Jaguar: Adventures in the Simple and the Complex [Paperback]

[Murray Gell-Mann](#) (Author)

★★★★☆ (30 customer reviews)

Price: **\$13.59**

In Stock.

Ships from and sold by **Amazon.com**.

Formats	Amazon Price	New from	Used from
Hardcover	--	\$13.67	\$0.55
Paperback	\$13.59	\$10.01	\$7.84

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Publisher: St. Martin's Griffin (September 15, 1995)

Language: English

ISBN-10: 0805072535

ISBN-13: 978-0805072532

Product Dimensions: 9.1 x 6.1 x 1.2 inches

Shipping Weight: 1.2 pounds ([view shipping rates and policies](#))

Web 1.0, 2.0, 3.0 ...



[Click to LOOK INSIDE!](#)



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Average Customer Review: ★★★★★ (30 customer reviews)

Amazon Bestsellers Rank: #373,365 in Books

Customer Reviews

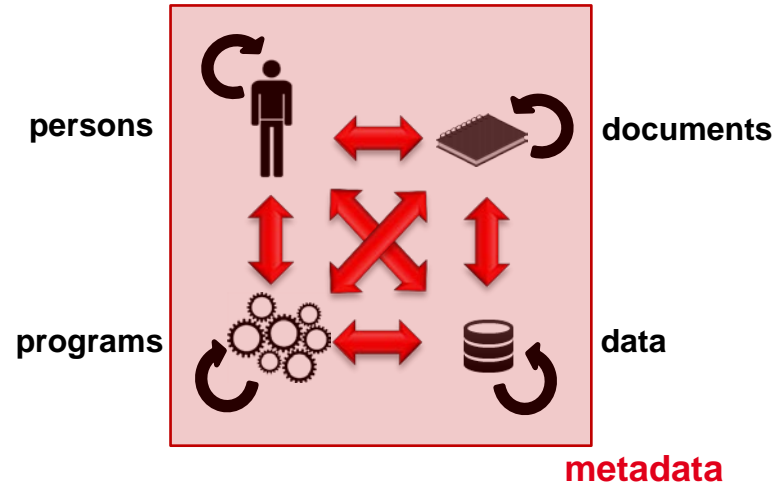
30 Reviews

5 star:		(9)
4 star:		(8)
3 star:		(7)
2 star:		(4)
1 star:		(2)

Average Customer Review

★★★★☆ (30 customer reviews)

One Web ... A unique space in every sense:



He who controls metadata, controls the web
and through the *world-wide* web many things in our world



Fabien Gandon - @fabien_gandon - <http://fabien.info>

Web-**I**nstrumented **M**an-**M**achine **I**nteractions, **C**ommunities and **S**emantics



Picture credits

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