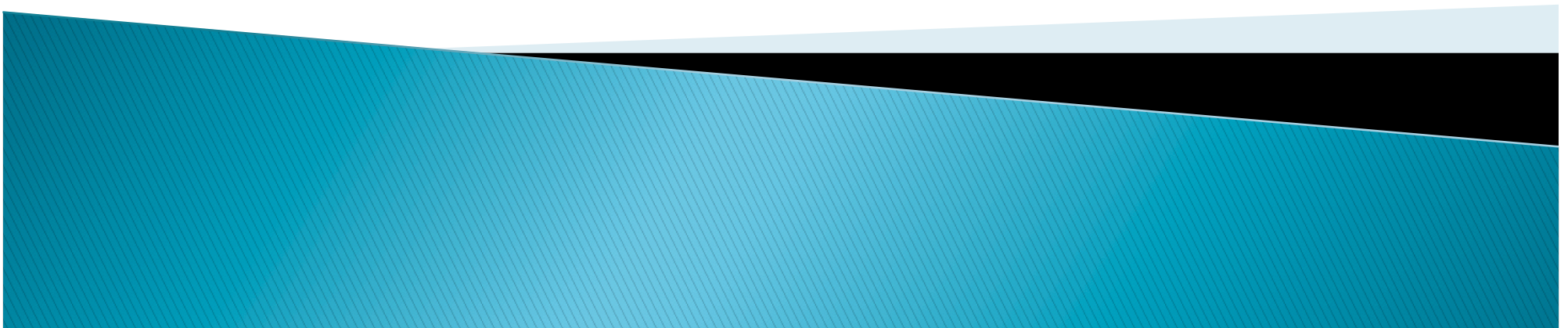


# A year on the Semantic Web @ W3C (with more details on RDFa)

Pontifícia Universidade Católica do Rio de Janeiro,  
2010-10-25

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# The past...

- ▶ Some technologies have been finalized:
  - OWL 2
  - Rule Interchange Format (RIF)



# The present...

- ▶ Technical work is going on
  - SPARQL 1.1
  - RDFa 1.1
  - RDB2RDF
- ▶ “Community” contacts at W3C are also happening with
  - health care and life science community
  - financial world, e.g., XBRL
  - (digital) library world
  - eGovernment

# The (possible) future

- ▶ Finalize the present 😊
- ▶ Possible new technical activities:
  - provenance
  - revision of RDF
  - ...

# OWL 2

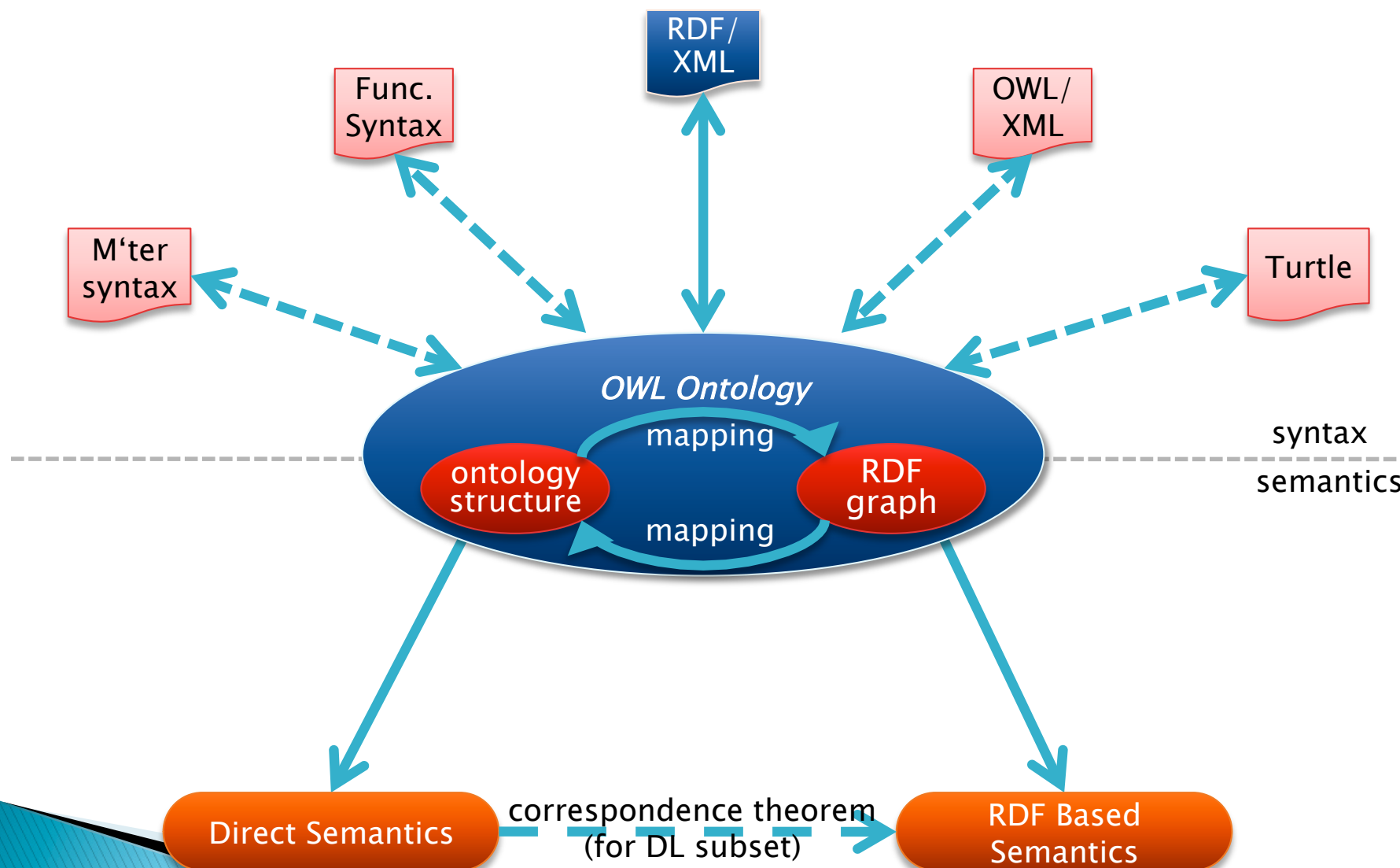
# OWL 2

- ▶ A small revision of the 2004 version of OWL
- ▶ Some new features:
  - keys
  - extended datatypes facilities
    - e.g., numerical intervals without relying on XML Schemas
  - property chains
    - the “uncle” example can now be formulated in OWL
  - profiles
  - ...
- ▶ Better documents, clearer structures

# It was a slightly stormy process...

- ▶ There were misunderstanding between the “core” RDF and the OWL communities
  - “does OWL abandon RDF?”
  - will there be an OWL 2 Full specification at all?
- ▶ Luckily, all those were really just misunderstandings

# The overall structure has *not* changed

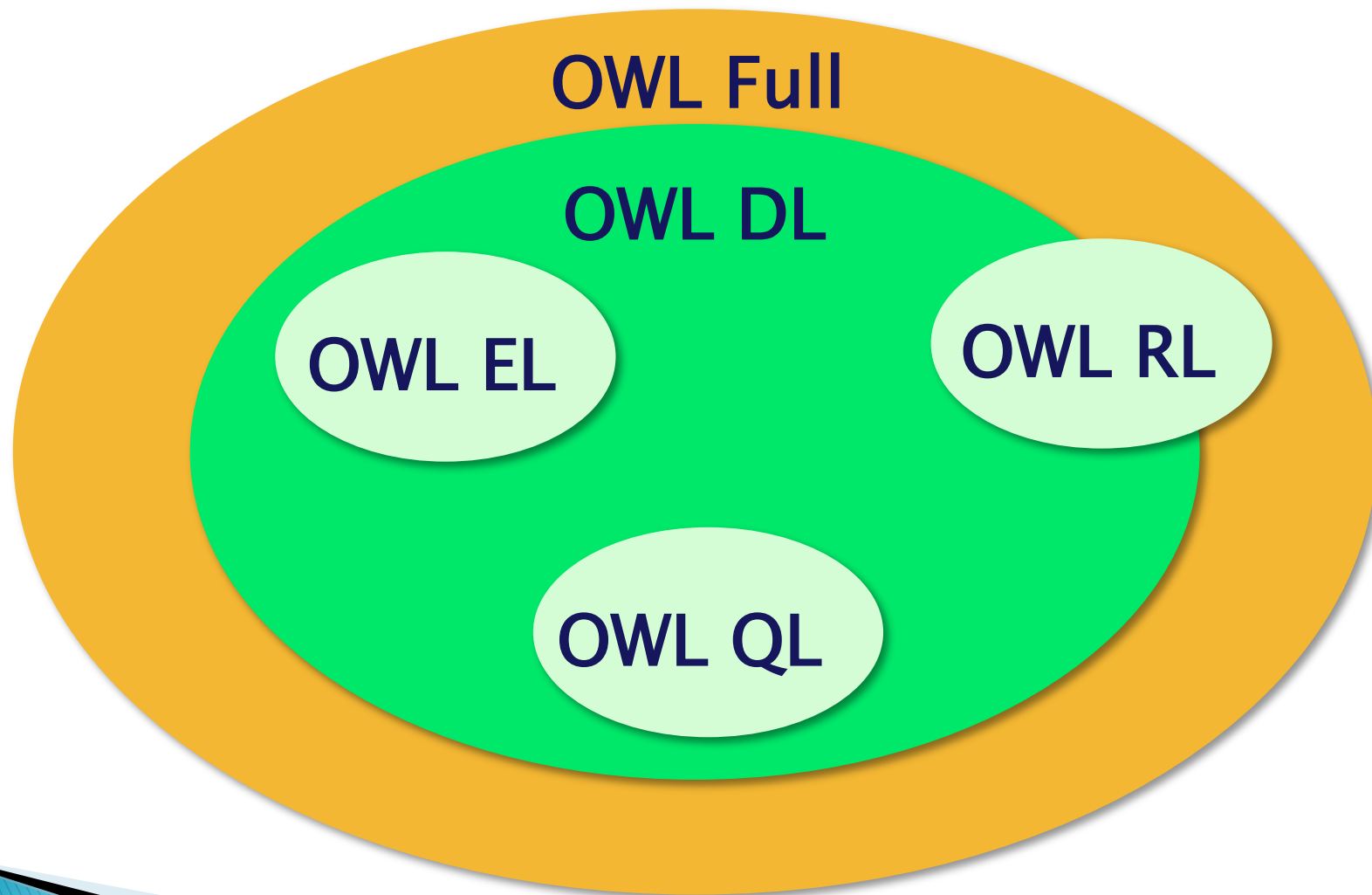




# OWL 2 profiles

- ▶ OWL 2 maintains the OWL Full and OWL DL “duality”
- ▶ But OWL Lite has been replaced by “profiles”:
  - syntactic restrictions to OWL
  - restricted facilities  $\Leftrightarrow$  better reasoning performance
- ▶ Goal is to make lighter OWL reasoners possible

# OWL profiles



# An example: OWL RL

- ▶ Goal: to be implementable through rule engines
- ▶ Usage follows a similar approach to RDFS:
  - merge the ontology and the instance data into an RDF graph
  - use the rule engine to add new triples (as long as it is possible)
  - then, for example, use SPARQL to query the resulting (expanded) graph
- ▶ This application model is very important for RDF based applications

# What can be done in OWL RL?

- ▶ Many features are available:
  - identity of classes, instances, properties
  - subproperties, subclasses, domains, ranges
  - union and intersection of classes (though with some restrictions)
  - property characterizations (functional, symmetric, etc)
  - property chains
  - keys
  - some property restrictions

# Rule Interchange Format (RIF)

# Why rules on the Semantic Web?

- ▶ Some conditions may be complicated in ontologies (ie, OWL)
  - e.g., Horn rules:  $(P1 \ \& \ P2 \ \& \ \dots) \rightarrow C$
- ▶ In many cases applications just want 2–3 rules to complete integration
- ▶ I.e., rules may be an alternative to (OWL based) ontologies



# Things you may want to express

- ▶ An example from a bookshop domain:
  - “I buy a novel with over 500 pages if it costs less than \$20”
  - something like (in an ad-hoc syntax):

```
{
  ?x rdf:type p:Novel;
    p:page_number ?n;
    p:price [
      p:currency p:$;
      rdf:value ?z
    ].
  ?n > "500"^^xsd:integer.
  ?z < "20.0"^^xsd:double.
}
=>
{ <me> p:buys ?x }
```

# RIF (Rule Interchange Format)

- ▶ The goals of the RIF:
  - define simple rule language(s) for the Semantic Web
  - define interchange formats for rule based systems
- ▶ RIF defines several “dialects” of languages
  - some are geared towards production rule systems, for example
  - i.e., RIF is not bound to RDF only
- ▶ RIF is also a general framework to define/interchange rule languages

# RIF Core

- ▶ The simplest RIF “dialect”
- ▶ A Core document is
  - some directives like import, prefix settings for URIs, etc
  - a sequence of logical implications
  - can use the familiar datatypes and operators
  - has the notion of “anonymous” resources, a bit like blank nodes

# RIF Syntaxes

- ▶ RIF defines
  - a “presentation syntax”
    - a bit like the functional syntax for OWL
  - a standard XML syntax to encode and exchange the rules
  - there is a note for expressing Core in RDF
    - just like OWL is represented in RDF

# Remember the what we wanted from Rules?

```
{
  ?x rdf:type p:Novel;
    p:page_number ?n;
    p:price [
      p:currency p:$;
      rdf:value  ?z
    ].
  ?n > "500"^^xsd:integer.
  ?z < "20.0"^^xsd:double.
}
=>
{ <me> p:buys ?x }
```

# The same with RIF Presentation syntax

```
Document (  
  Prefix ...  
  Group (  
    Forall ?x ?n ?z (  
      <me>[p:buys->?x] :-  
        And(  
          ?x rdf:type p:Novel  
          ?x[p:page_number->?n p:price->_abc]  
          _abc[p:currency->p:$ rdf:value->?z]  
          External(pred:numeric-greater-than(?n "500"^^xsd:integer))  
          External(pred:numeric-less-than(?z "20.0"^^xsd:double))  
        )  
      )  
    )  
  )  
)
```



# A word on the syntax

- ▶ The RIF Presentation syntax is... only syntax
- ▶ It can express more than what RDF needs
- ▶ Hopefully, a syntax will emerge with
  - close to one of the RDF syntaxes with a better integration of rules
  - can be mapped on Core implementations

# Usage of rule with RDF

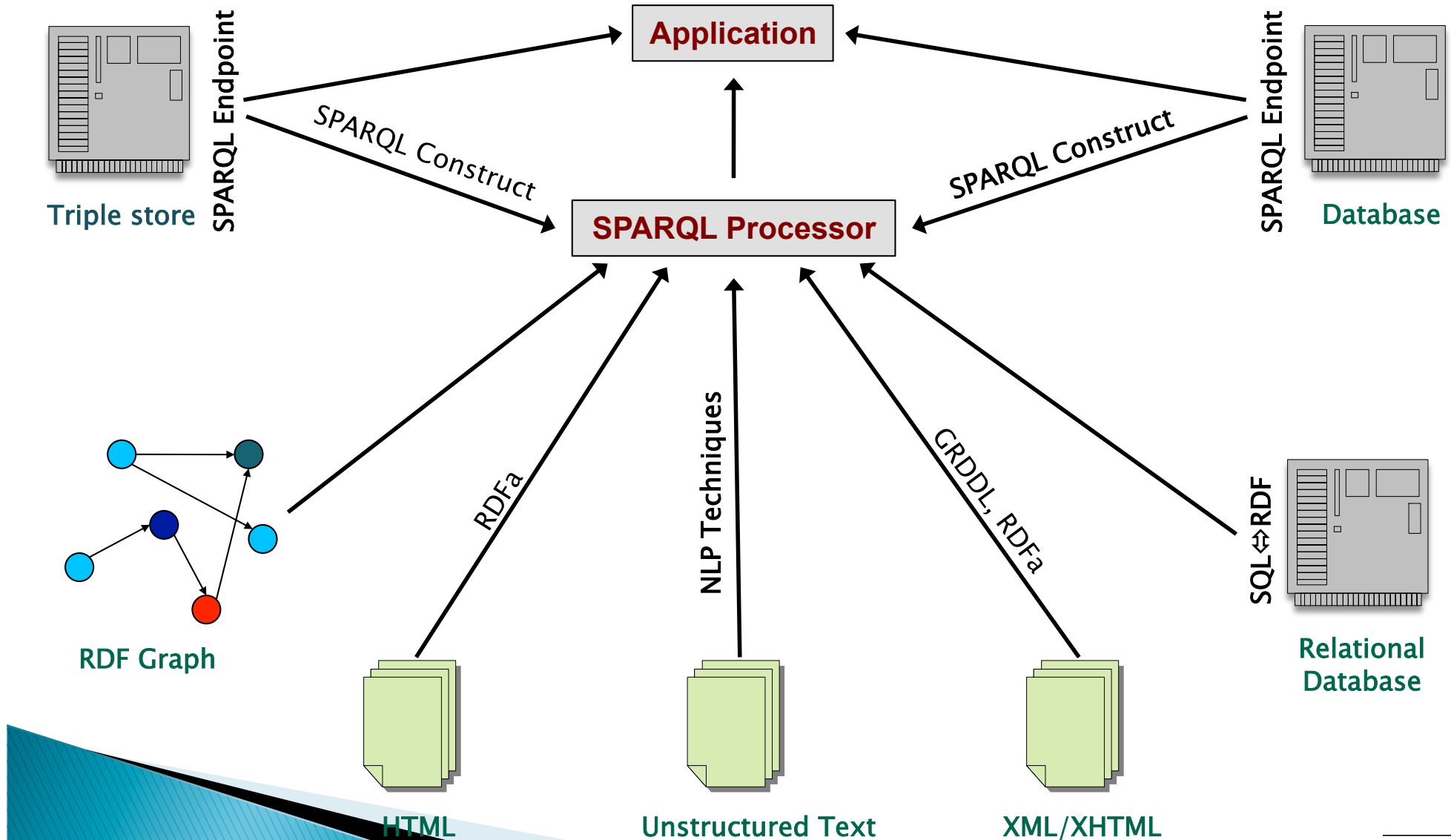
- ▶ A system gets
  - a set of RIF Core rules in some syntax
  - data in RDF
  - new RDF triples are generated
- ▶ Sounds familiar? Remember OWL RL?

# What about OWL RL?

- ▶ OWL RL stands for “Rule Language”...
- ▶ OWL RL is in the intersection of RIF Core and OWL
  - inferences in OWL RL can be expressed with rules
    - the rules are precisely described in the OWL spec
  - there are OWL RL implementations that are based on RIF
- ▶ An application may also “declare” a subset of OWL RL rules it uses and let a RIF engine do the rest...

# SPARQL 1.1

# SPARQL as a unifying point

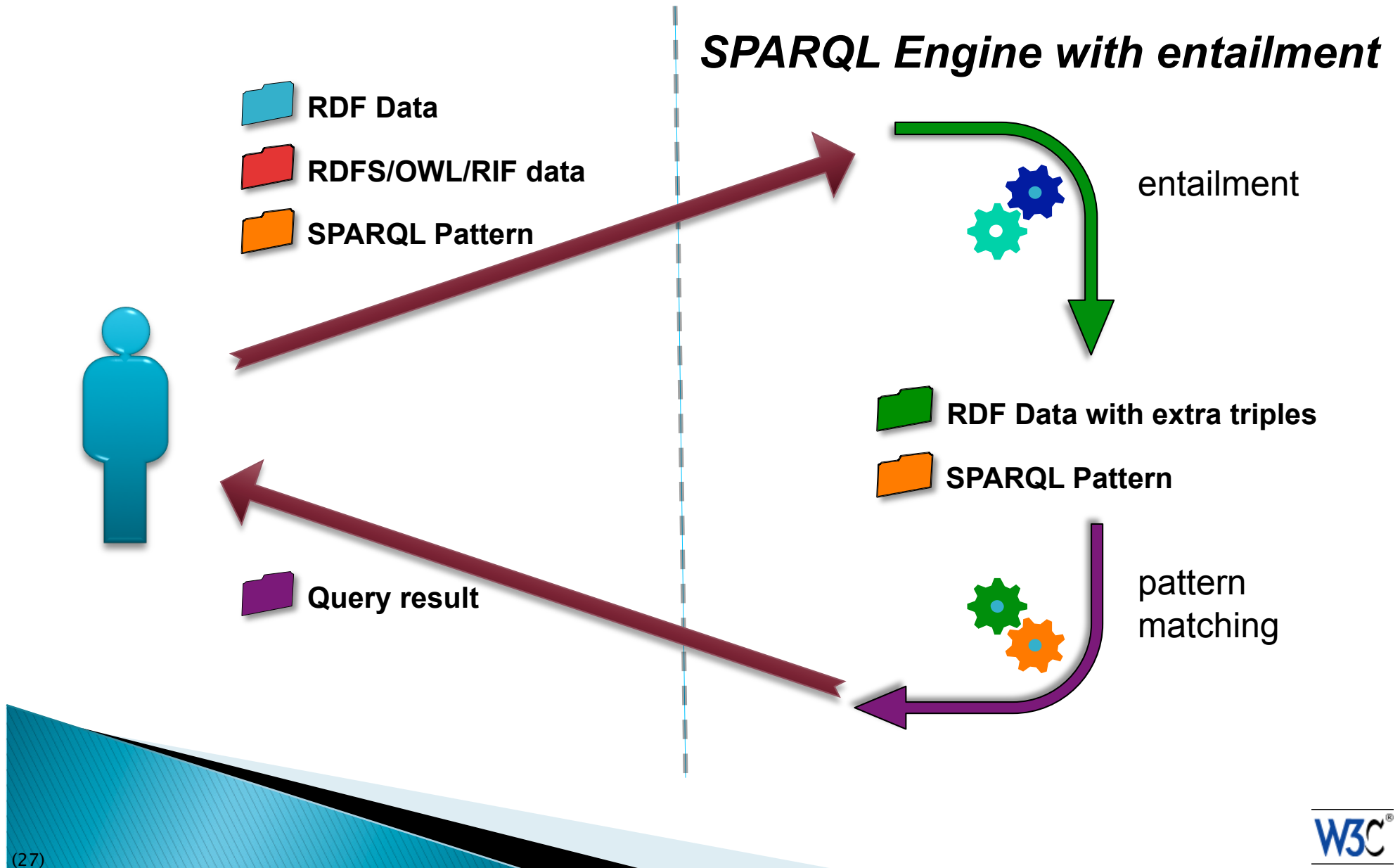


# SPARQL 1.1: filling some missing features

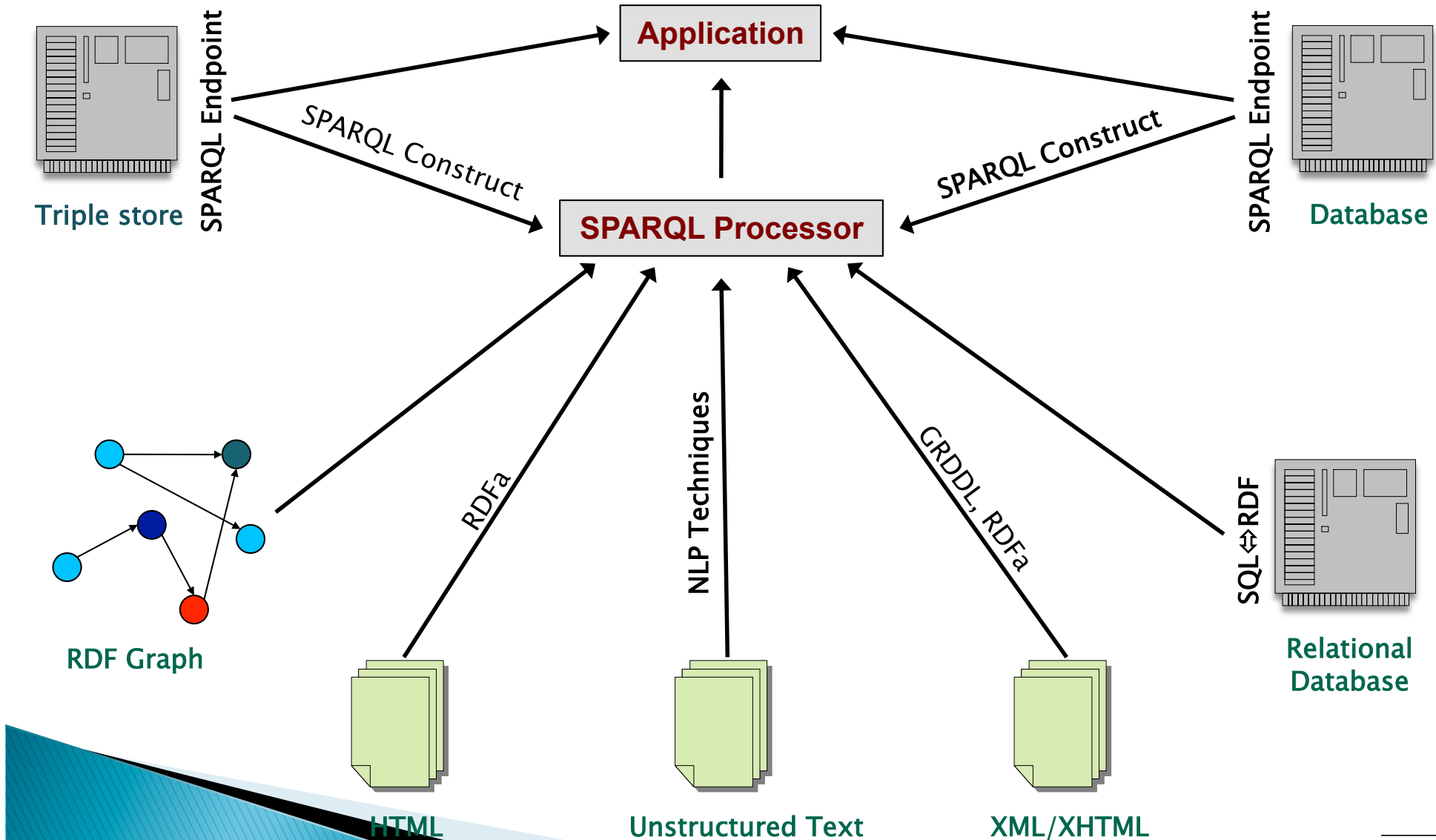
- ▶ Update, i.e., to change the RDF store
  - remove or add triples
- ▶ Nested queries (i.e., SELECT within a WHERE clause)
- ▶ Negation (MINUS, and a NOT EXIST filter)
- ▶ Aggregate functions in SELECT (SUM, MIN, MAX...)
- ▶ Property path expressions (?x foaf:knows+ ?y)
- ▶ Basic federated queries
- ▶ Combination with entailment regimes (RDFS, OWL, RIF)



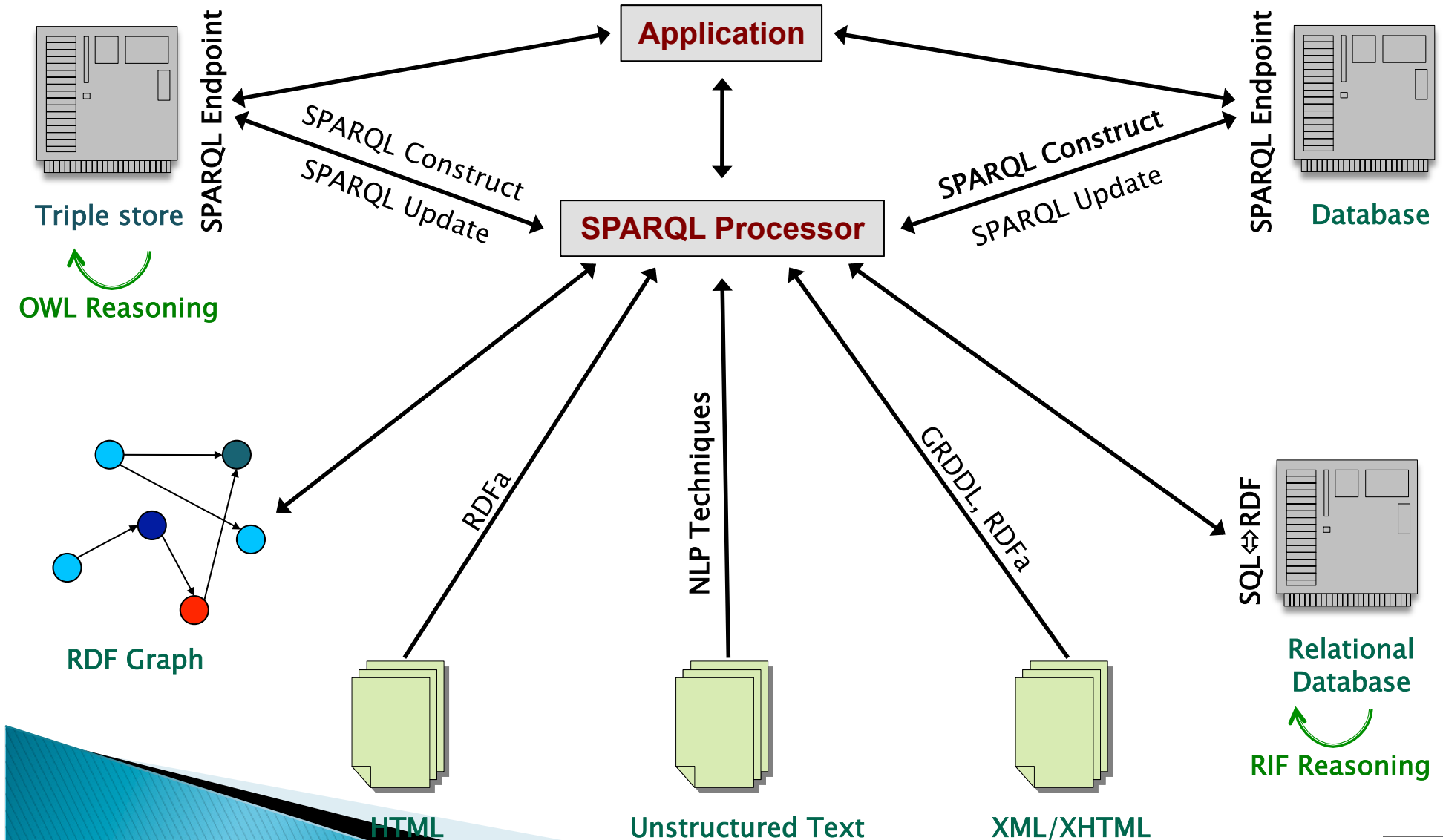
# SPARQL 1.1 and RDFS/OWL/RIF



# SPARQL as a unifying point



# SPARQL 1.1 as a unifying point



# Revision of RDF?

# History

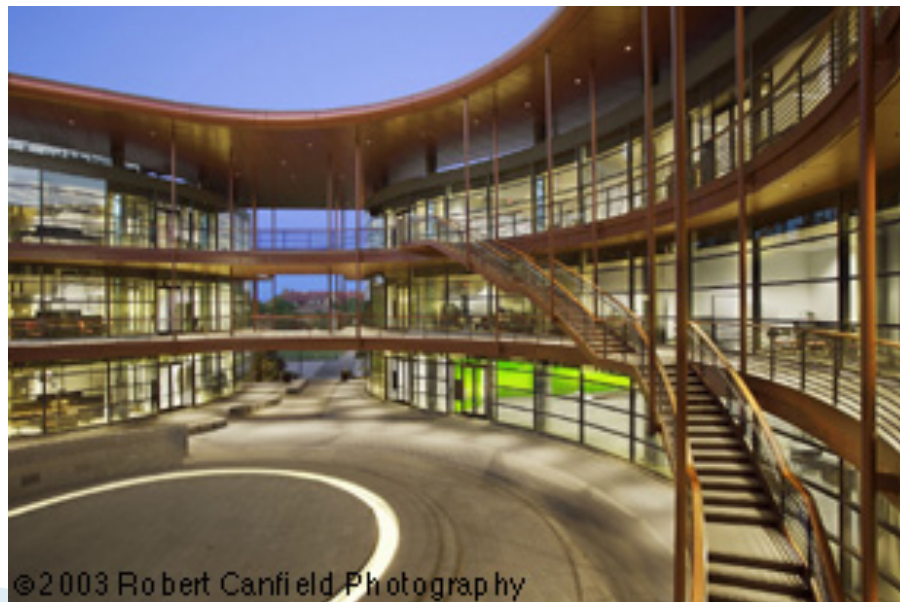
- ▶ RDF has been published in 2004
- ▶ Significant deployment since then
  - implementation experiences
  - users' experiences
- ▶ Some cracks, missing functionalities, etc, came to the fore

# The question

- ▶ Shall we
  - live with the issues and go on with our lives?
  - dump it and start all over again?
  - do some minimal changes?

# The W3C “RDF Next Step” Workshop

- ▶ W3C organized a Workshop in June 2010
  - 32 submissions, 28 accepted, 18 were presented at the workshop
  - 2 busy days at Stanford, courtesy of NCBO









# What we did...

- ▶ Try to answer the question: live with it, redo it, mend it...
  - if something has to be changed, what is it and with what priority?
- ▶ Give a list of possible work items, with priorities

# The general feeling...

- ▶ Yes, it is probably o.k. to touch *some* issues
- ▶ But we have to be very careful not to send the wrong signal to adopters, tool providers, etc.
- ▶ I.e.: *keep the changes to the minimum*

# The straw poll result

Proposed Work Item	WG must do it	WG should/may do it	WG must not do it
<a href="#">Standardize Model for Graph Identification</a>	✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	✓✓✓✓	
<a href="#">Modify Semantics to Support Graph Identification</a>	✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	✓✓	
<a href="#">Switch to Improved Inference Rules</a>	✓✓✓✓✓✓✓✓✓✓✓✓✓✓	✓✓✓✓✓✓✓✓✓✓✓✓	
<a href="#">Apply Fixes to Known Spec Errors</a>	✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓		
<a href="#">Standardize a JSON RDF Syntax</a>	✓✓✓✓✓✓✓✓✓✓	✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	
<a href="#">Make Turtle a W3C Standard</a>	✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	✓✓✓✓	
<a href="#">Add Graphs to Turtle</a>	✓✓✓✓✓✓✓✓✓✓✓✓✓✓	✓✓✓✓✓✓	
<a href="#">Add Graphs to RDF/XML</a>	✓✓✓✓✓✓	✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	✗✗
<a href="#">Revise Blank Node Semantics</a>	✓	✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	
<a href="#">Specify Linked Data Style of RDF</a>	✓✓	✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	✗
<a href="#">Weakly Deprecate some RDF/XML Features</a>	✓✓✓	✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	
<a href="#">Define alternatives to owl:sameAs</a>	✓✓✓✓	✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	✗✗✗✗
<a href="#">Weakly Deprecate some Data Model Feature</a>	✓✓	✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	✗
<a href="#">Namespace Profiles</a>		✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	
<a href="#">Weakly Deprecate some RDF Semantics Features</a>		✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	
<a href="#">Have Explicit Support for Annotations</a>		✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	✗✗✗✗
<a href="#">Align RDF Semantics with SPARQL</a>	✓	✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	✗✗✗✗✗
<a href="#">Improve rdf:List Support in RDF/XML</a>		✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	✗✗✗✗✗
<a href="#">Explain How to Determine What a URI Means</a>		✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	✗✗✗✗✗✗✗
<a href="#">Allow Literals as Subjects</a>		✓✓✓✓✓✓✓✓✓✓	✗✗✗✗✗✗✗✗✗✗✗✗✗✗✗✗✗✗✗✗

# Follow up

- ▶ Workshop report published:
  - <http://www.w3.org/2009/12/rdf-ws/Report.html>
- ▶ W3C Team began working on chartering
- ▶ ...but felt the larger community should be asked
- ▶ A questionnaire was published in August 2010
  - <http://www.w3.org/2002/09/wbs/1/rdf-2010/results>
- ▶ And, of course, lots of discussion on various fora

# “Main Charter candidates”

# The obvious issues

- ▶ There are some errata that have to be taken care of
  - exact relationship to IRI-s
  - more flexible references to XML versions
  - etc

# “Graph identification”

- ▶ A.k.a. “named graphs”, “quoted graphs”, “knowledge bases”
- ▶ Is on the top of all priority lists...
- ▶ But the semantics is not absolutely clear
  - e.g., are we talking about a mutable or immutable collection of triples?
  - maybe we have two different concepts here...

# Turtle serialization syntax

- ▶ We have a stable “team submission”, widely used by the community
  - another top priority item...
- ▶ Additional syntax should be added for graph identification



# JSON serialization syntax

- ▶ Is essential for Web Developers
- ▶ It may not be a complete syntax; to be decided as we go
  - e.g., no blank nodes, only syntax for Skolemized nodes
- ▶ The syntax may also include tools for lists, graph identification, etc.

# Deprecation

- ▶ Some features may be deprecated: reification, containers, ...
- ▶ Unclear what “deprecation” means in this context
  - old RDF graphs should not become invalid...

# Reconcile semantics documents

- ▶ A number of semantics extensions and features have appeared in Recommendations since
  - `rdf:plainLiteral`
  - “finite” versions of RDF(S) semantics as part of the SPARQL 1.1 entailment regimes
  - bridge between URI-s as strings and RDF resources in POWDER
- ▶ Probably useful to reconcile these in one place for wider and easier adoption

# “Secondary Charter candidates”

# Bnode Skolemization

- ▶ General guidelines for bnode Skolemization
  - e.g., define a scheme of the form
    - <http://bnode.w3.org/{uuid}>
  - ... that could be used by some syntaxes, ie, consumers would know that this is, in fact, an anonymous node
- ▶ There are a number of Recommendation that rely on Skolemization (e.g., SPARQL)

# Harmonize plain literal management

- ▶ We currently have plain literal, xsd:string, rdf:plainLiteral...
  - it leads to, e.g., convoluted SPARQL queries
- ▶ These should be harmonized

# RDFa

(a mini tutorial...)

# What is RDFa?

- ▶ For RDF people, it *sounds* very simple:
  - RDFa is a serialization of RDF embedded in XHTML, HTML, or XML in general



So why bother? Why should we care?  
Why is that of any importance?

RDFa may become the single biggest source of RDF triples on the Web after direct database access!

# Data for a Web of Data

- ▶ Apart from relational databases, most of the data on the Web are in... (X)HTML content
- ▶ New content is generated every day
- ▶ How would one get structured data from that information?

# Authors of the “traditional Web”...

- ▶ Do *not* generate RDF/XML files separately
  - RDF/XML is complex
  - it requires a separate storage, generation, etc mechanism
    - that is also valid for, e.g., Turtle
    - even when authoring with, say, Emacs, creating an extra file is a load

# Solution

- ▶ Add extra structured content to the (X)HTML pages
- ▶ Let processors extract those and turn into RDF

## ▶ RDFa

- adds new (X)HTML/XML attributes
- has namespaces and URIs at its core; i.e., mixing vocabulary is just as easy as in RDF
- is a complete serialization of RDF
- generic processing becomes possible to generate RDF

RDFa is a complete bridge between the  
Web of Documents and the Web of Data

# Therefore...

- ▶ It is very important for RDF experts to
  - know RDFa
  - parse it alongside Turtle, RDF/XML or other
  - when appropriate, generate RDFa pages



# What does RDFa look like ?

# Main principles of RDFa

- ▶ RDFa means “*RDF in attributes*”. I.e.,:
  - all RDF contents are defined through XML attributes (no elements)
  - the XML/HTML *tree structure* is used
  - many of the attributes are defined by RDFa
    - some attributes (@href, @rel) are also reused
  - if possible, the text content is also reused (for literals) as well as @href values

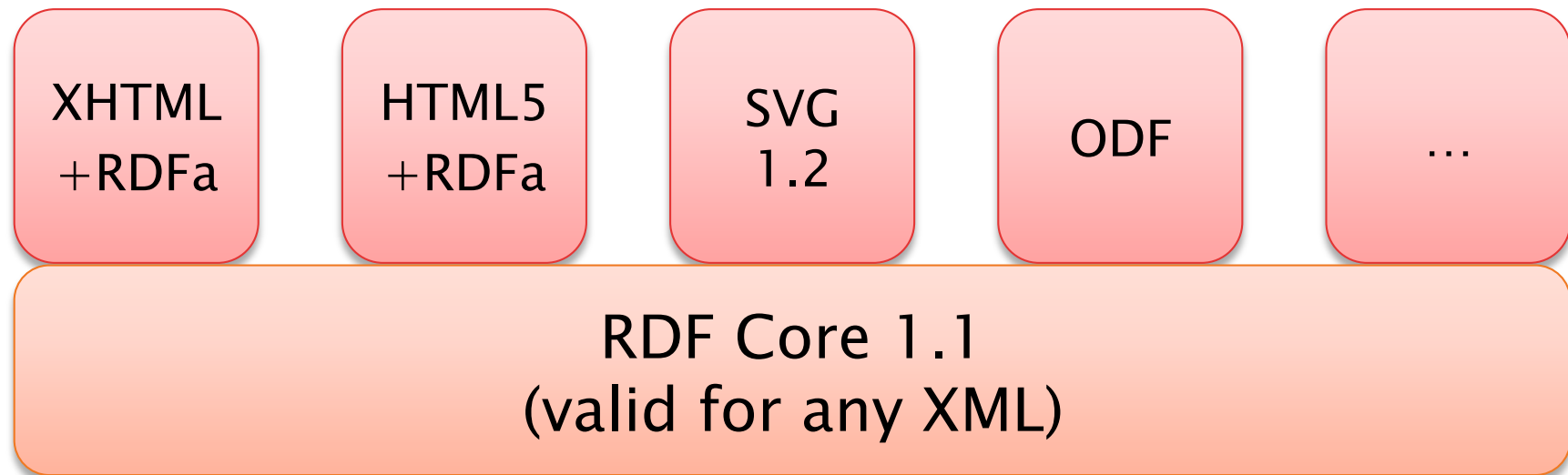
# What does this mean in practice?

- ▶ The same (X)HTML file:
  - is used, unchanged, by browsers
    - they ignore attributes they do not know
  - can be used by specialized processors (or APIs) to extract RDF triples

# Before getting into details...

- ▶ The current Recommendation is RDFa 1.0
- ▶ There is an RDFa1.1 in the making, almost ready
- ▶ *I will talk about RDFa1.1* and warn when the feature is not available in RDFa1.0

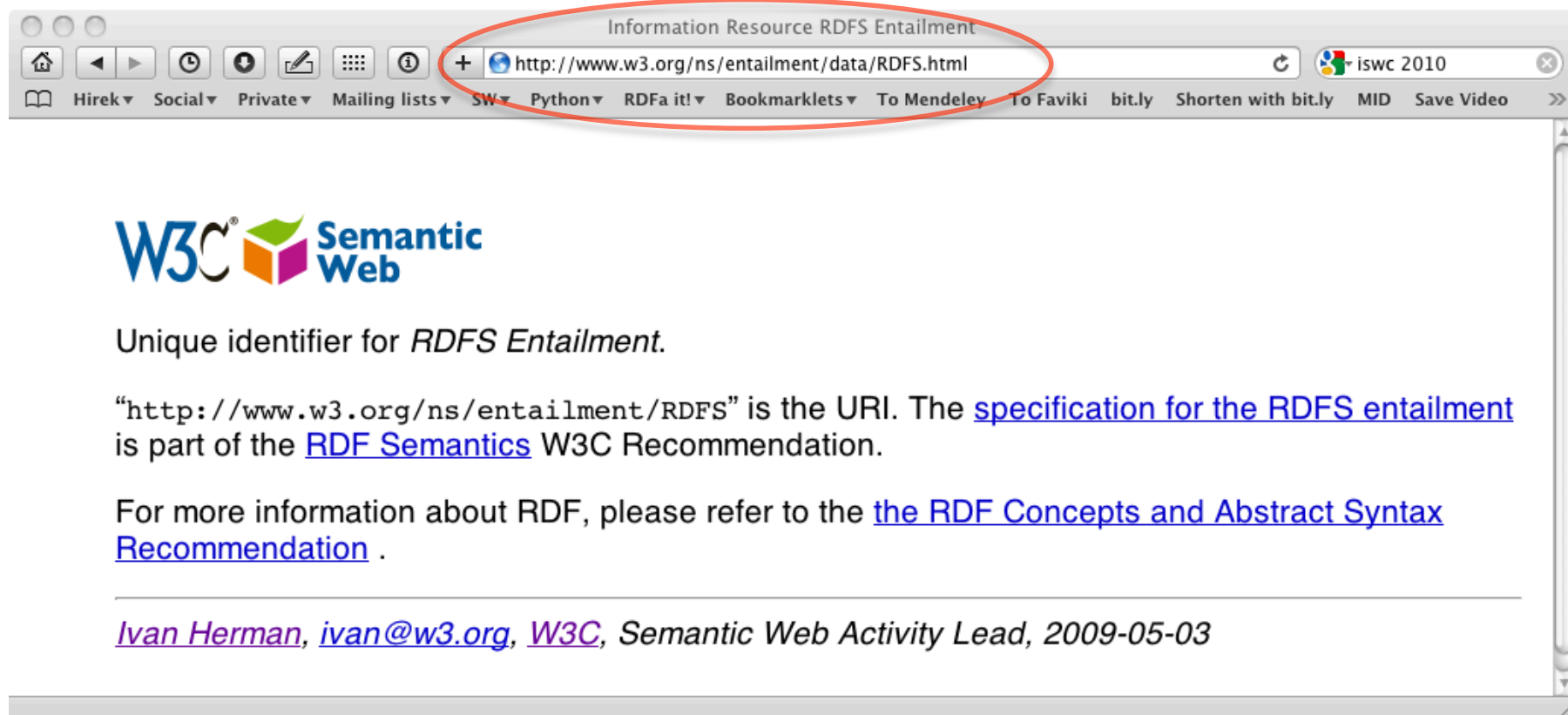
# XML or (X)HTML?



- ▶ Formally:
  - RDFa WG defines Core and XHTML
  - HTML WG defines HTML5
- ▶ we will use XHTML examples

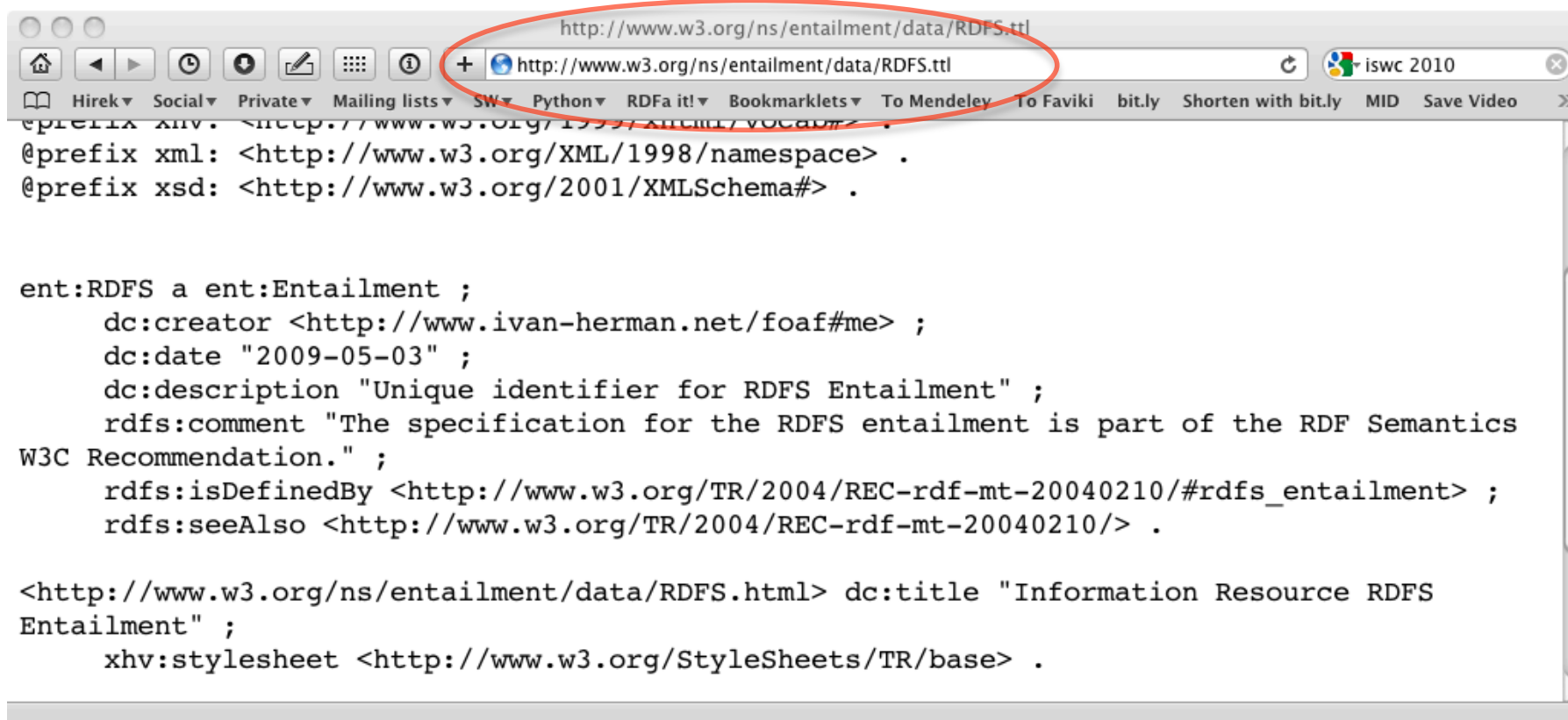
# A typical usage pattern

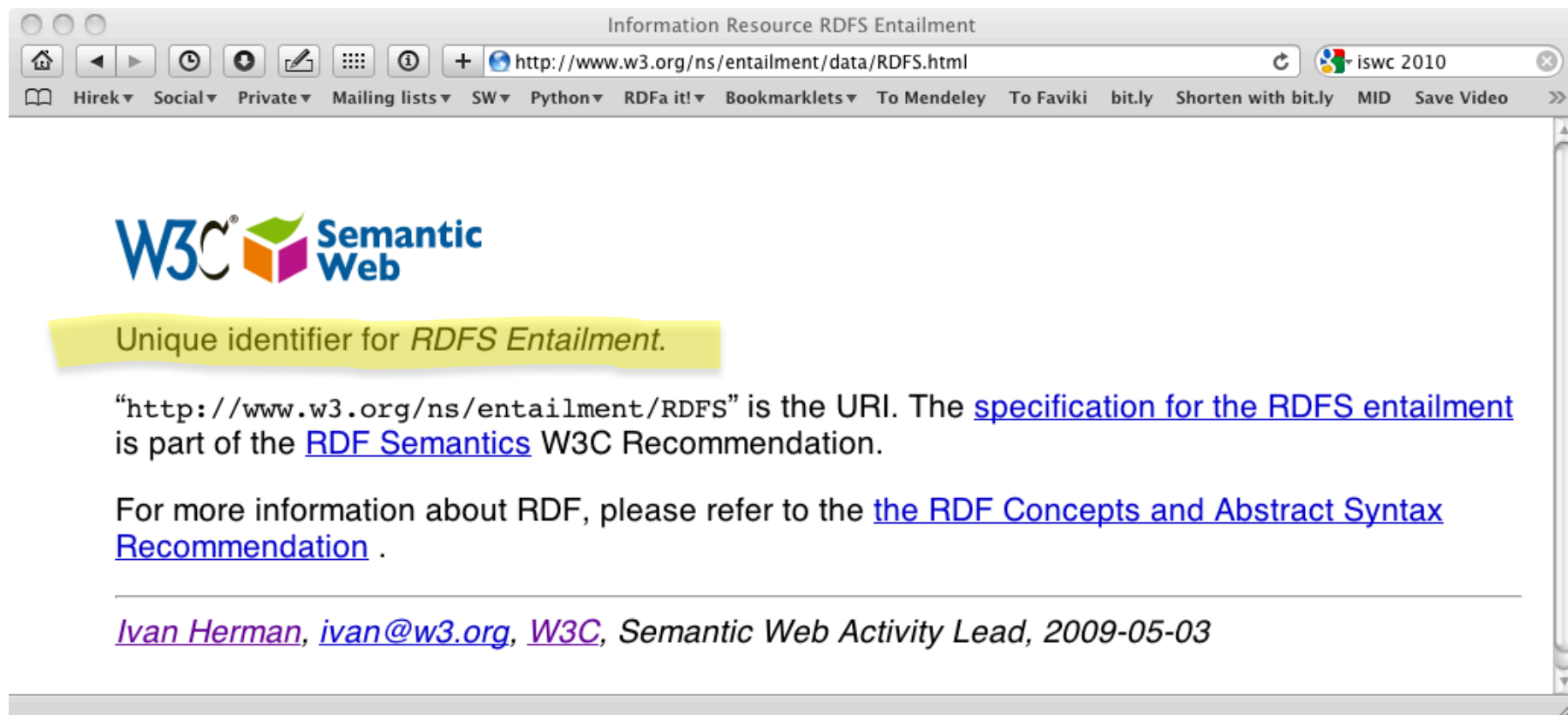
- ▶ The client asks for HTML



# A typical usage pattern

- ▶ But a client could ask for, say, Turtle:







# The source and generated RDF...

```
<p about="http://www.w3.org/ns/entailment/RDFS"  
  property="http://purl.org/dc/terms/description">  
  Unique identifier for <em>RDFS Entailment</em>.</p>
```

# The source and generated RDF...

```
<p about="http://www.w3.org/ns/entailment/RDFS"  
  property="http://purl.org/dc/terms/description">  
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```

```
<http://www.w3.org/ns/entailment/RDFS>
```

```
... .
```

# The source and generated RDF...

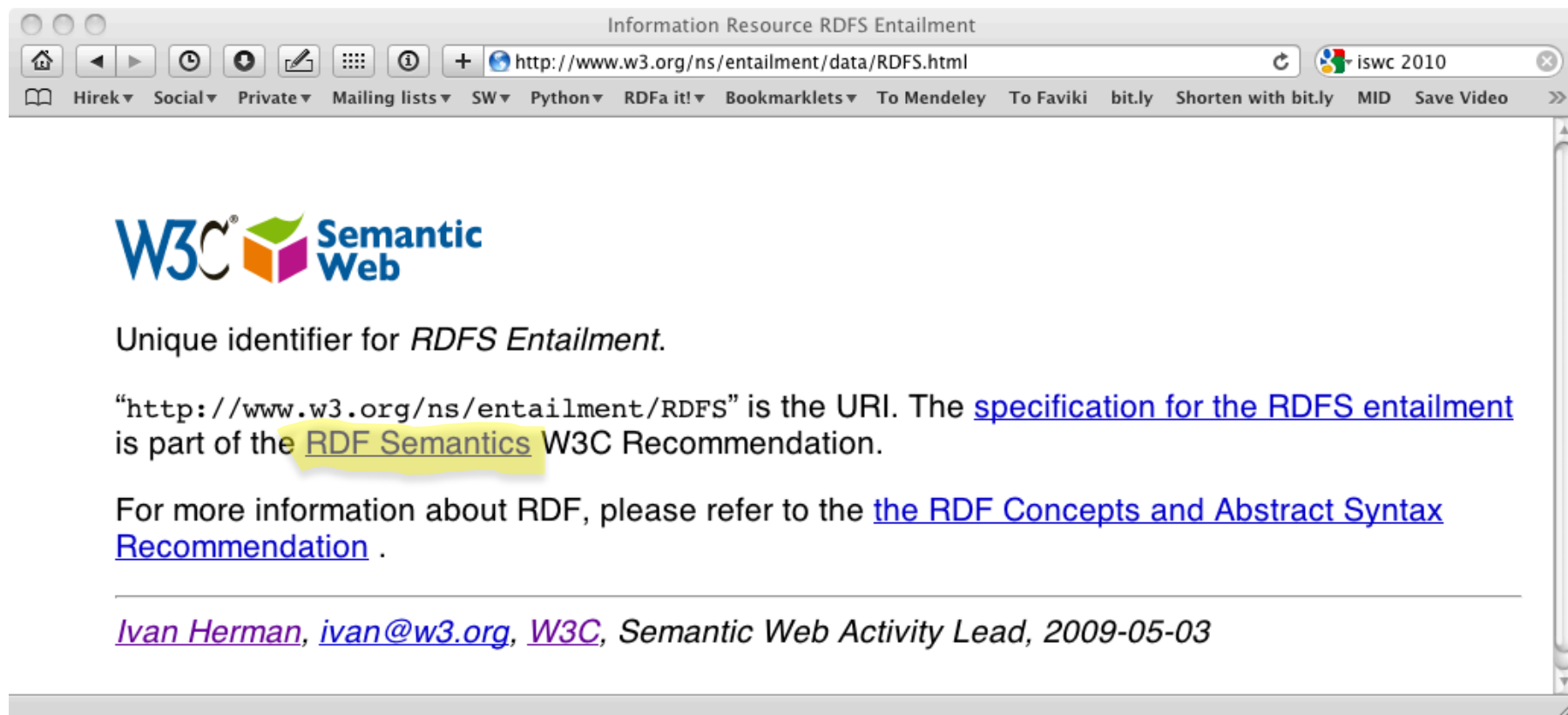
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<p about="http://www.w3.org/ns/entailment/RDFS"  
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    Unique identifier for <em>RDFS Entailment</em>.</p>
```

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<http://www.w3.org/ns/entailment/RDFS>  
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```

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<http://www.w3.org/ns/entailment/RDFS>  
  <http://purl.org/dc/terms/description>  
    "Unique identifier for RDFS Entailment." .
```



# The source and generated RDF...

```
<a about="http://www.w3.org/ns/entailment/RDFS"  
    rel="http://www.w3.org/2000/01/rdf-schema#seeAlso"  
    href="http://www.w3.org/TR/2004/REC-rdf-mt-20040210/">  
    RDF Semantics.  
</a>
```

# The source and generated RDF...

```
<a about="http://www.w3.org/ns/entailment/RDFS"  
  rel="http://www.w3.org/2000/01/rdf-schema#seeAlso"  
  href="http://www.w3.org/TR/2004/REC-rdf-mt-20040210/">  
  RDF Semantics.  
</a>
```

```
<http://www.w3.org/ns/entailment/RDFS>
```

...

# The source and generated RDF...

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<a about="http://www.w3.org/ns/entailment/RDFS"  
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</a>
```

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  <http://www.w3.org/2000/01/rdf-schema#seeAlso>  
    ... .
```



# The source and generated RDF...

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<a about="http://www.w3.org/ns/entailment/RDFS"  
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<http://www.w3.org/ns/entailment/RDFS>  
  <http://www.w3.org/2000/01/rdf-schema#seeAlso>  
    <http://www.w3.org/TR/2004/REC-rdf-mt-20040210/> .
```

Is that it?

# What we have is... NTriples in HTML

- ▶ The combination of @about with @rel/@property and possibly @href covers most of we need...
- ▶ But this is too complex for authors

# Just compare

```
<http://www.w3.org/ns/entailment/RDFS>  
  <http://purl.org/dc/terms/description>  
    "Unique identifier for RDFS Entailment." .  
<http://www.w3.org/ns/entailment/RDFS>  
  <http://www.w3.org/2000/01/rdf-schema#seeAlso>  
    <http://www.w3.org/TR/2004/REC-rdf-mt-20040210/> .
```

▶ with

```
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .  
@prefix dc: <http://purl.org/dc/terms/> .  
  
<http://www.w3.org/ns/entailment/RDFS>  
  rdfs:seeAlso  
    <http://www.w3.org/TR/2004/REC-rdf-mt-20040210/> ;  
  dc:description "Unique identifier for RDFS Entailment." .
```

# The “Turtle” aspects of RDFa

- ▶ Use compact URI-s when possible
- ▶ Make use of XML structure for
  - shared subjects
  - shared predicates
  - create blank nodes
  - ...

# Compact URIs (“CURIE”s)

- ▶ Just like in Turtle:
  - define a prefix via @prefix
  - use prefix:reference to abbreviate a URI

# CURIE definition and usage

```
<html>
...
<p about="http://www.w3.org/ns/entailment/RDFS"
  property="http://purl.org/dc/terms/description">
  Unique identifier for <em>RDFS Entailment</em>.</p>
...
</html>
```

- ▶ can be replaced by:

```
<html prefix="dc: http://purl.org/dc/terms/">
...
<p about="http://www.w3.org/ns/entailment/RDFS"
  property="dc:description">
  Unique identifier for <em>RDFS Entailment</em>.</p>
...
</html>
```

# Some details on @prefix

- ▶ Can be anywhere in the XML tree and is valid for the whole sub-tree
  - i.e., the html element is not the only place to have it
- ▶ The same @prefix attribute can hold several definitions:
  - `prefix="dc: http://purl.org... rdfs: http://..."`



# Some details on @prefix

- ▶ An alternative (deprecated) syntax is
  - `xmlns:dc="http://purl.org/dc/terms/"`
- ▶ CURIEs and “real” URIs can be mixed
  - if an attribute value can be interpreted as a CURIE, fine
  - alternatively, it is considered as a URI
- ▶ CURIEs can be used on RDFa attributes only!
  - e.g., not for `@href`

# RDFa 1.0 Warnings on CURIes

- ▶ In RDFa 1.0
  - only the `xslt:XXX` syntax is usable
  - CURIes on `@about` can only be used with the syntax:  
`about="[pref:ref]"`
  - Only CURIes can be used on, e.g., `@property` or `@rel`  
(no fallback on URIs)

# Sharing subjects

- ▶ The basic principle: @about is inherited by children nodes
  - i.e., no reason to repeat it

# Shared subject example

```
<html prefix="dc: http://purl.org/dc/terms/  
        rdfs: http://www.w3.org/2000/01/rdf-schema#">  
  
...  
<body about="http://www.w3.org/ns/entailment/RDFS">  
  
...  
<p property="dc:description">  
  Unique identifier for <em>RDFS Entailment</em>.</p>  
<p>...<a rel="rdfs:seeAlso"  
  href="http://www.w3.org/TR/2004/REC-rdf-mt-20040210">  
  RDFS Semantics</a>...</p>
```

# ... yielding

```
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
```

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

```
<http://www.w3.org/ns/entailment/RDFS>
```

```
  rdfs:seeAlso
```

```
    <http://www.w3.org/TR/2004/REC-rdf-mt-20040210/> ;
```

```
  dc:description "Unique identifier for RDFS Entailment.".
```

Subjects, and objects, and subjects  
again...

# The rules until now

- ▶ What we said is:
  - @about sets the subject
  - @href sets the object
- ▶ But that is not always good enough
  - we do not always want active links (i.e., the "a" element)

# We may not always want links...

- ▶ The RDFa `@resource` attribute is equivalent to `@href`
  - it sets the object, just like `@href`
  - but it is ignored by a browser, i.e., not a link!
  - e.g.,:

```
<span about="http://www.ivan-herman.net/foaf#me">  
  <span rel="rdfs:seeAlso"  
    resource="http://www.ivan-herman.net/foaf">  
    Activity Lead</span>  
</span>
```



# “Chaining”

- ▶ Here is what we would like to have in RDFa

```
<http://www.w3.org/ns/entailment/RDFS>  
  dc:creator <http://www.ivan-herman.net/foaf#me> .
```

```
<http://www.ivan-herman.net/foaf#me>  
  foaf:mailbox <mailto:ivan@w3.org> ;  
  foaf:workplaceHomepage <http://www.w3.org> .
```

# “Chaining”

- ▶ A straightforward way:

```
<body about="http://www.w3.org/ns/entailment/RDFS">
...
<address>
  <span rel="dc:creator"
    resource="http://www.ivan-herman.net/foaf#me"/>
  <span about="http://www.ivan-herman.net/foaf#me">
    <a rel="foaf:mailbox"
      href="mailto:ivan@w3.org">ivan@w3.org</a>,
    <a rel="foaf:workplaceHomepage"
      href="http://www.w3.org">W3C</a>
  </span>
</address>
```

# “Chaining”

- ▶ A straightforward way:

```
<body about="http://www.w3.org/ns/entailment/RDFS">
...
<address>
  <span rel="dc:creator"
    resource="http://www.ivan-herman.net/foaf#me"/>
  <span about="http://www.ivan-herman.net/foaf#me">
    <a rel="foaf:mailbox"
      href="mailto:ivan@w3.org">ivan@w3.org</a>,
    <a rel="foaf:workplaceHomepage"
      href="http://www.w3.org">W3C</a>
  </span>
</address>
```

# “Chaining”: objects become subjects...

- ▶ An alternative:

```
<body about="http://www.w3.org/ns/entailment/RDFS">
...
<address>
  <span rel="dc:creator"
    resource="http://www.ivan-herman.net/foaf#me">
    <a rel="foaf:mailbox"
      href="mailto:ivan@w3.org">ivan@w3.org</a>,
    <a rel="foaf:workplaceHomepage"
      href="http://www.w3.org">W3C</a>
  </span>
</address>
```

# Chaining means

- ▶ @resource (or @href) becomes a subject *for the sub-tree*
- ▶ This feature is a bit like in RDF/XML

# Some extra features

# Some extra features we do not have time for...

- ▶ Blank nodes can be created using “\_:XX”
- ▶ Datatypes for literals can be set
- ▶ Shorthand for RDF types
- ▶ An API is being defined for Web Applications
- ▶ Prefix definitions can be put into a separate “profile” file
  - e.g., Google may define which prefixes it understands

# Publishing RDFa

- ▶ RDFa gives an easy way of publishing RDF data on the Web
- ▶ Often, the same RDF data is available in different formats, including RDFa
  - it is up to the client to choose which one to use
  - *Web Applications* would rely on RDFa, though...



# LOC example

## Semantic Web

From Library of Congress Subject Headings

**Details** Visualization Suggest Terminology

**Semantic Web**

**URI**  
<<http://id.loc.gov/authorities/sh2002000569#concept>>

**Type**  
Topical Term

**Broader Terms**

- > [Semantic integration \(Computer systems\)](#)
- > [Semantic networks \(Information theory\)](#)
- > [World Wide Web](#)

**Related Terms**

- > [Microformats](#)

**Sources**

- > Engr. index online, May 6, 2002 (identifier: Semantic Web)
- > ASTI on FirstSearch, May 6, 2002: in titles (semantic Web)
- > Work cat.: 2002070545: The Semantic Web--ISWC 20002, 2002.

**LC Classification**  
TK5105.88815

# LOC example

```
Source of http://id.loc.gov/authorities/sh2002000569
<p rel="skos:inScheme" resource="http://id.loc.gov/authorities#topicalTerms">topical
Term</p>
</li>

<li>
  <h3>Broader Terms</h3>
  <ul class="std">
    <li>
      <a href="http://id.loc.gov/authorities/sh2004000479#concept" rel="skos:broader">
        <span property="skos:prefLabel" xml:lang="en">Semantic integration (Computer
systems)</span>
      </a>
    </li>
    <li>
      <a href="http://id.loc.gov/authorities/sh92004914#concept" rel="skos:broader">
        <span property="skos:prefLabel" xml:lang="en">Semantic networks (Information
theory)</span>
      </a>
    </li>
    <li>
      <a href="http://id.loc.gov/authorities/sh95000541#concept" rel="skos:broader">
        <span property="skos:prefLabel" xml:lang="en">World Wide Web</span>
      </a>
    </li>
  </ul>
</li>
```

# Consuming RDFa

- ▶ Various search engines begin to consume RDFa
  - Google, Yahoo, ...
    - they may specify which vocabularies they “understand”
    - this is still an evolving area
- ▶ Facebook’s “social graph” is based on RDFa

# Google's rich snippet

- ▶ Embedded metadata (in microformat or RDFa) is used to improve search result page
  - at the moment only a few vocabularies are recognized, but that will evolve over the years




# Effects of, e.g., Google

- ▶ A number of popular sites publish RDFa as part of their normal pages:
  - Tesco, BestBuy, Slideshare, The London Gazette, Newsweek, O'Reilly Catalog, the White House...
  - Creative Commons snippets are in RDFa

# BestBuy Example for RDFa Usage


My Account | Order Status | Customer Service | Español


**BEST BUY** Weekly Ad Store Locator Outlet Center Services ▾ Gifts ▾  Items

TV & VIDEO AUDIO CAR & GPS CAMERAS & CAMCORDERS COMPUTERS MOBILE PHONES & OFFICE MUSIC, MOVIES & BOOKS VIDEO GAMES & GADGETS HOME & APPLIANCES

Search  All Categories  Keyword or Item #  Credit Cards Reward Zone\*

## Best Buy - Carbondale

 Print



1270 E Main St  
Carbondale, IL 62901  
Phone: 618-351-1700  
GEO: 37.732719, -89.192314


Customer Reviews:  
☆☆☆☆☆  
[Be the first to write a store review.](#)

[Maps & Directions](#) | [Weekly Ad](#)

**Store Hours**  
Mon: 10-9; Tue: 10-9; Wed: 10-9; Thurs: 10-9; Fri: 10-9; Sat: 10-9; Sun: 11-7;  
4/4 - 4/10, 2010  
Mon: 10-9; Tues: 10-9; Wed: 10-9; Thurs: 10-9; Fri: 10-9; Sat: 10-9; Sun: Closed

### Events

**Avatar Midnight Release!**




The biggest movie of 2009 is coming to Best Buy on April 22nd! Carbondale Best Buy is hosting a special midnight release! We will open the doors at 12:00am on 4/22! We'll have door prizes including movie posters available only to those in attendance at the midnight release! Local band "Ravenhill" will be playing, as well! You don't want to miss this special event! Check back for more information as we get closer to the release date!


### Local Selections


Check out these special product selections at our store.


**Open Box Items (25)** [View](#)


### At This Location

 **Geek Squad**  
Computer setup & services, plus home theater, appliance and car installation.

 **Best Buy Mobile**  
Get informed advice from noncommissioned mobile phone specialists.

 **Small Business Solutions**  
Featuring Professional Series products and trained staff to help with small business needs.

 **Apple Shop**  
Mac, iPod and more at this Apple store-within-a-store.

 **Electronics Recycling**  
We offer electronics recycling at this and all other U.S. stores.



# BestBuy Example for RDFa Usage

My Account | Order Status | Customer Service | Español

**BEST BUY** Weekly Ad Store Locator Outlet Center Services Gifts cart items

TV & VIDEO AUDIO CAR & GPS CAMERAS & CAMCORDERS COMPUTERS MOBILE PHONES & OFFICE MUSIC, MOVIES & BOOKS VIDEO GAMES & GADGETS HOME & APPLIANCES

Search All Categories

**Best Buy - Carbondale**

1270 E Main St  
Carbondale, IL 62901  
Phone: 618-351-1700  
GEO: 37.732719, -89.192314

Customer Reviews:  
★★★★★  
Be the first to write a store review.

Store Hours  
Mon: 10-9; Tue: 10-9; Wed: 10-9; Thurs: 10-9; Fri: 10-9; Sat: 10-9; Sun: 11-7;

The biggest movie of 2009 is coming to Best Buy on April 22nd! Carbondale Best Buy is hosting a special midnight release! We will open the doors at 12:00am on 4/22! We'll have door prizes including movie posters available only to those in attendance at the midnight release! Local band "Ravenhill" will be playing, as well! You don't want to miss this special event! Check back for more information as we get closer to the release date!

**RDFa Snippets:**

```
<div class="fn n" property="foaf:name rdfs:label vcard:fn gr:legalName">
  <h1 class="org" property="geo:lat_long" content="37.732719,-89.192314">Best
  Buy - Carbondale</h1>
</div>
```

```
<div class="adr" rel="vcard:adr">
  <div typeof="vcard:Address">
    <div class="street-address"
      property="vcard:street-address">1270 E Main
      St</div>
    <span class="locality"
      property="vcard:locality">Carbondale</span>,
    <span class="region"
      property="vcard:region">IL</span> <span
      class="postal-code" property="vcard:postal-
      code">62901</span></div>
    <div class="tel"
      property="vcard:tel" class="phone-
      number">618-351-1700</span>
    </div>
    <div class="geo" rel="vcard:geo">GEO:
    <span class="latitude"
      property="vcard:latitude">37.732719</span>,
    <span class="longitude"
      property="vcard:longitude">-89.192314</span>
    </div>
  </div>
```

```
<div class="hours" rel="gr:hasOpeningHoursSpecification">
  <div typeof="gr:OpeningHoursSpecification" about="#regularhours">
    <span typeof="gr:OpeningHoursSpecification">
      <span rel="gr:hasOpeningHoursDayOfWeek" resource="http://
      purl.org/goodrelations/v1#Monday" class="dow">Mon:</
      span>&nbsp;<span property="gr:opens" datatype="xsd:time">10</
      span><span property="gr:closes" datatype="xsd:time">9</span>;
    </span>
    ...
  </div>
</div>
```

# Effects on BestBuy

- ▶ Reported in a BestBuy blog:
  - GoodRelations+RDFa improved Google rank tremendously
  - 30% increase in traffic on BestBuy store pages
  - Yahoo observes a 15% increase in click-through rate
- ▶ Not bad... 😊



# That is all I have time for...

- ▶ There are many issues that were not discussed
  - provenance, linked data, open government initiatives, applications, open R&D issues, ...
- ▶ There is work for everyone!

# Thank you for your attention!

These slides are also available on the Web:

<http://www.w3.org/2010/Talks/I025-Rio-IH/>

