



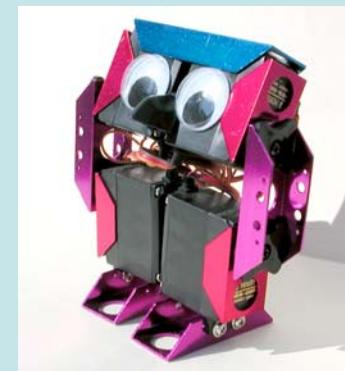
From Atom's to OWL's:

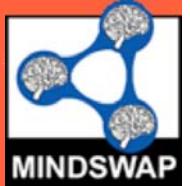
The new ecology of the WWW

Jim Hendler

Handler@cs.umd.edu

<http://www.cs.umd.edu/~hendler>



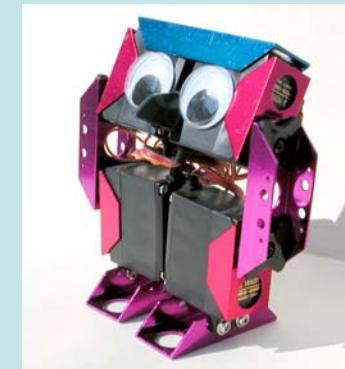


From Atom*'s to OWL§s: The new ecology of the WWW

Jim Hendler

Handler@cs.umd.edu

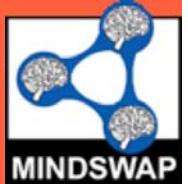
<http://www.cs.umd.edu/~hendler>



* syntax
§ semantics

mindswap

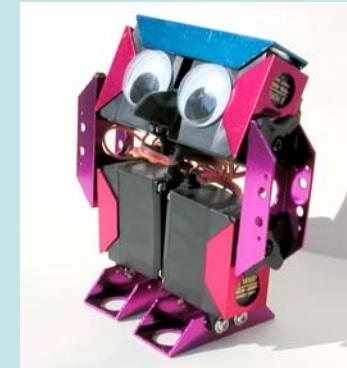
maryland information and network dynamics lab semantic web agents project



Syntax to Semantics

XML 2005 Conference & Exposition
Syntax to Semantics
November 14-18, 2005
Hilton Atlanta, Atlanta, GA

XML
2005
Conference & Exhibition





Acknowledgements

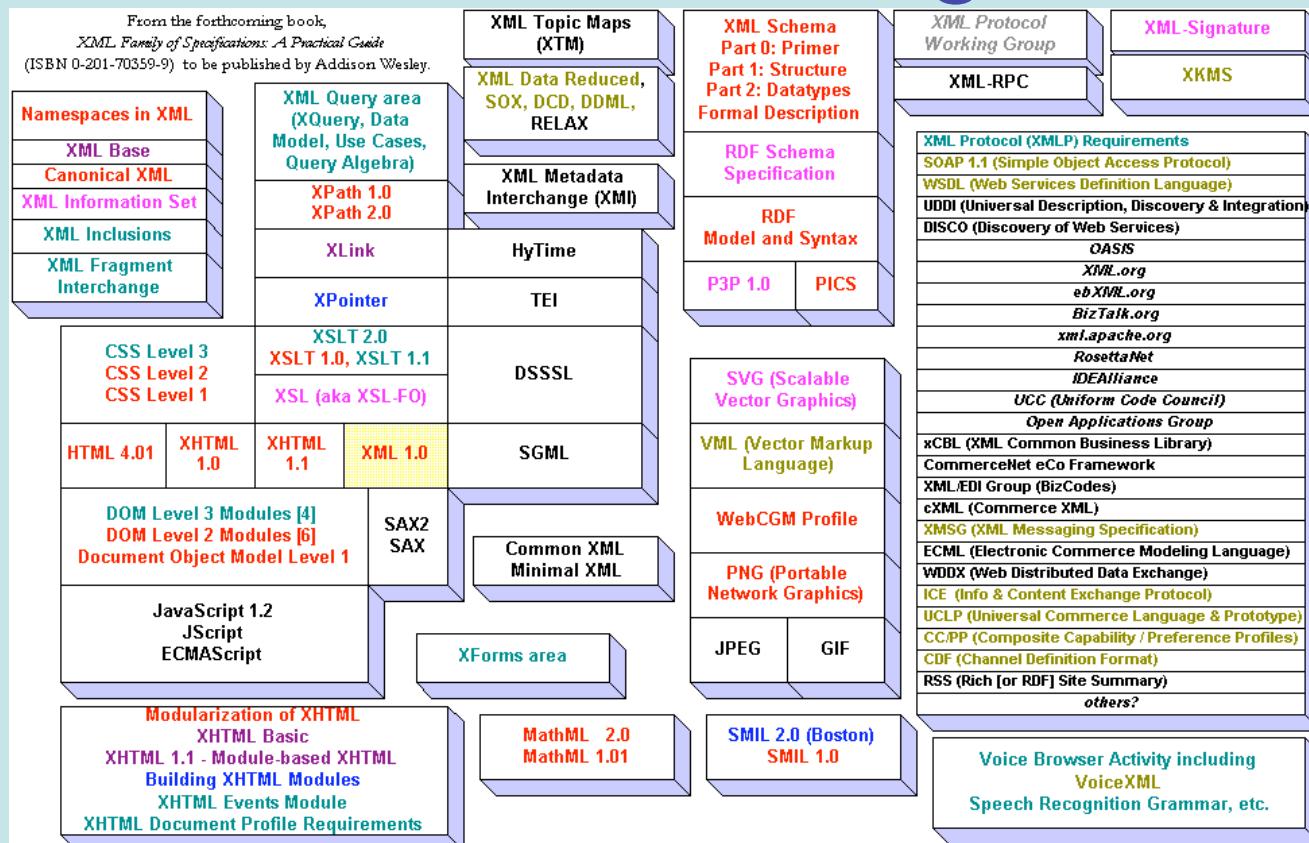
- In preparing this talk I have mostly ignored the advice of a great many people including Tim Berners-Lee, Dan Connolly, Wendy Hall, Eric Miller, Brand Nieman, Bijan Parsia, Guus Schreiber, Nigel Shadbolt, and Frank VanHarmelen
- I owe much to my research group
 - Details at <http://www.mindswap.org/> (Our Semantic Web Portal)



The Web used to be easy (ca. 1990)

- Documents (HTML)
 - Emacs or vi via some cutting and pasting and it showed in your browser - woohoo!
- And Links (HTTP)
 - Install LibWWW, customize parameters, and you were up and running - woohoo!

But that didn't last long... (ca 2000)



The XML Family of Specifications: The Big Picture

Last Updated: May 16, 2001

Recommendation

Proposed
Recommendation

Candidate
Recommendation

Last Call
Working Draft

Working Draft

Note submitted
to W3C

Not a W3C
specification

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Excelsior ...

- **Syndication**
 - Atom, JSON, YAML...
- **Microformats**
 - hCard, hCalendar, hReview, XFN, ...
- **XML specs**
 - XML 1.1, Xinclude, XML:id, ...
- **Semantic Web specs**
 - RDF (XMP), RDFS, OWL, SPARQL, Rules ...
- **Web Service languages**
 - WSDL 2.0, WSPL, WS Adressing, CDL, ...
 - (and all of the above applied to services
 - UDDI v3, XOXO, XML Protocol, WSDL-RDF, ...)



What is this all about?

Text pages	A	Single pages
Music	A-	© and access issues
Images	B+	Lacks precision
Video	C+	Promising start
Personal Info	C	Splintered/ imprecise
Services	C-	Need to play together better
Data	F	Not working at a Web scale

Web Search Report Card



Common Goal...

XML: Its primary purpose is to facilitate the sharing of data across different systems, particularly systems connected via the Internet. (Wikipedia)

Sem Web: The Semantic Web provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries (W3C SWA)

It's the data, stupid.



Increasingly Common Syntax

- The new ecology is all in XML ...

Atom (XML)

```
<?xml version="1.0" encoding="utf-8"?>
<feed version="0.3" xmlns="http://purl.org/atom/ns#">
  <title>dive into mark</title>
  <link rel="alternate" type="text/html"
    href="http://diveintomark.org/" />
  <modified>2003-12-13T18:30:02Z</modified>
  <author>
    <name>Mark Pilgrim</name>
  </author>
  <entry>
    <title>Atom 0.3 snapshot</title>
    <link rel="alternate" type="text/html"
      href="http://diveintomark.org/2003/12/13/atom03" />
    <id>tag:diveintomark.org,2003:3.2397</id>
    <issued>2003-12-13T08:29:29-04:00</issued>
    <modified>2003-12-13T18:30:02Z</modified>
  </entry>
</feed>
```

Use XML in syndication



Adobe XMP (RDF-based)

```
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
  <rdf:Description rdf:about="">
    xmlns:pdf="http://ns.adobe.com/pdf/1.3/"
    <pdf:Producer>Acrobat Distiller 7.0.5 for Macintosh</pdf:Producer>
  </rdf:Description>
  <rdf:Description rdf:about="">
    xmlns:dc="http://purl.org/dc/elements/1.1/">
    <dc:format>application/pdf</dc:format>
    <dc:creator>
      <rdf:Seq>
        <rdf:li>James Hendler</rdf:li>
      </rdf:Seq>
    </dc:creator>
    <dc:title>
      <rdf:Alt>
        <rdf:li xml:lang="x-default">XMLideas.ppt</rdf:li>
      </rdf:Alt>
    </dc:title>
  </rdf:Description>
  <rdf:Description rdf:about="">
    xmlns:xapMM="http://ns.adobe.com/xap/1.0/mm/">
    <xapMM:DocumentID>uuid:93277c40-5534-11da-a3f2-000a95d6b344</xapMM:DocumentID>
    <xapMM:InstanceID>uuid:9327882b-5534-11da-a3f2-000a95d6b344</xapMM:InstanceID>
  </rdf:Description>
</rdf:RDF>
```

Embed meta-data in PDF, etc.



FOAF (RDF(S))

```
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:foaf="http://xmlns.com/foaf/0.1/">
  <foaf:Person>
    <foaf:name>Jim Hendler</foaf:name>
    <foaf:title>Dr</foaf:title>
    <foaf:firstName>Jim</foaf:firstName>
    <foaf:surname>Hendler</foaf:surname>
    <foaf:mbox_sha1sum>be972c7a602683f7cf3c7a1fd0949c565debe4d3
      </foaf:mbox_sha1sum>
    <foaf:homepage rdf:resource="http://www.cs.umd.edu/~hendler"/>
    <foaf:depiction rdf:resource="http://www.semanticgrid.org/q-iantbljim.jpg"/>
    <foaf:workplaceHomepage rdf:resource="http://owl.mindswap.org"/>
  </foaf:Person>
</rdf:RDF>
```

Semantic Web Social Networking

FEA-RMO (OWL)

```
<owl:Ontology rdf:about="file:/C:/Models/eGov/FEA/all.owl">
  <owl:versionInfo>Version 1.0</owl:versionInfo>
  <dc:contributor>Dean Allemang, TopQuadrant</dc:contributor>
  <dc:description>FEA Reference Model Ontology</dc:description>
    <owl:imports rdf:resource="http://purl.org/dc/elements/1.1/">
  <dc:source>FEAPMO</dc:source>
  <dc:source>The Performance Reference Model Version 1.0, FEAPMO</dc:source>
  <dc:date>January 2005</dc:date>
  <dc:contributor>Irene Polikoff, TopQuadrant</dc:contributor>
  <dc:contributor>Ralph Hodgson, TopQuadrant</dc:contributor>
</owl:Ontology>

<owl:Class rdf:about="http://www.osera.gov/owl/2004/11/fea/brm#SF_GeneralScienceAndInnovation">
  <owl:disjointWith>
    <owl:Class rdf:about="http://www.osera.gov/owl/2004/11/fea/brm#SF_Heath"/>
  </owl:disjointWith>
  <owl:disjointWith>
    <owl:Class rdf:about="http://www.osera.gov/owl/2004/11/fea/brm#SF_IntelligenceOperations"/>
  </owl:disjointWith>
```

Application specific vocabulary (ontology) definition



So what is the difference?

Documents: XML is a system for defining, validating, and sharing **document formats**. XML uses tags to distinguish document structures, and attributes to encode extra document information. XML will look very familiar to those who know about SGML and HTML.
(XML FAQ)

Links: RDF is based on the idea of **identifying things using Web identifiers** (called Uniform Resource Identifiers, or URIs), and describing resources in terms of simple properties and property values. This enables RDF to represent simple statements about resources as a graph of nodes and arcs representing the resources, and their properties and values.(RDF Primer)



Extending the Web

- Bringing new document types, media types, services, and (especially) data to the Web requires BOTH
 - More complex document processing
 - Formats improvement, correctness checking, subdocument components
 - More complex link types
 - Must capture, but not be limited by, structure and models
 - Must have a link "labeling" and ability to "reason" about those links



Compare Xlink

```
<advisor xlink:href="profs/jaysmith7.xml" ...>
  <advisorname xml:lang="en">
    <name>
      <honorific>Dr.</honorific>
      <given>Jay</given>
      <family>Smith</family>
    </name>
  </advisorname>
</advisor>
```

**Which provides some info around a link -
but no external referent to an entity (i.e. no
URI is assigned to this link information)**



To RDF

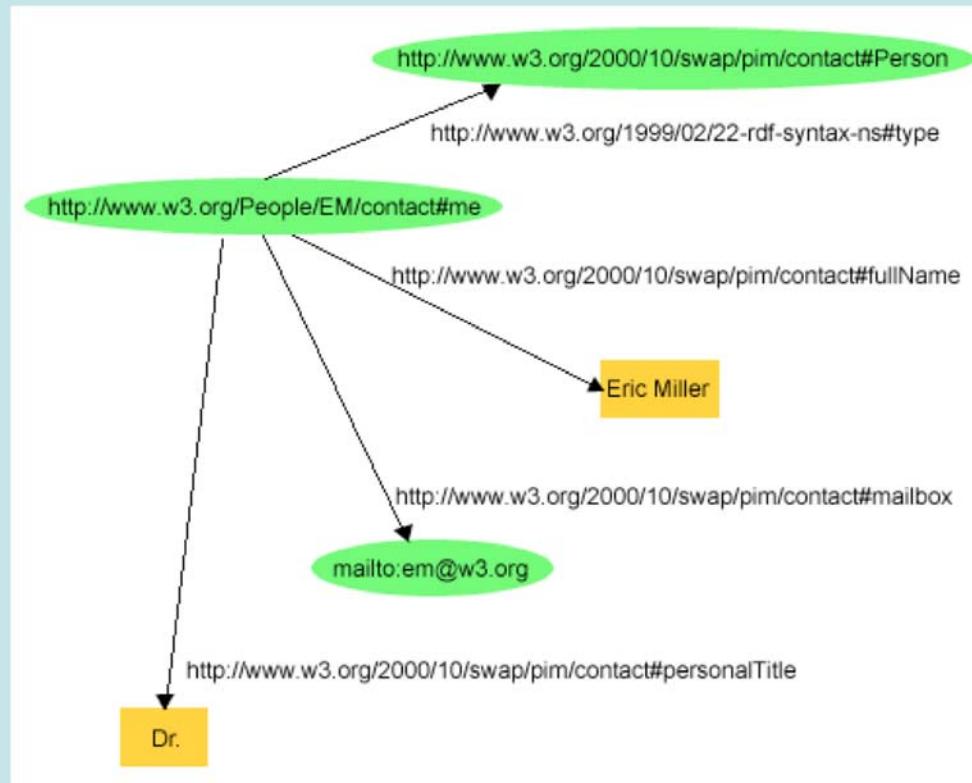
```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
           xmlns:contact="http://www.w3.org/2000/10/swap/pim/contact#">

  <contact:Person rdf:about="http://www.w3.org/People/EM/contact#me">
    <contact:fullName>Eric Miller</contact:fullName>
    <contact:mailbox rdf:resource="mailto:em@w3.org"/>
    <contact:personalTitle>Dr.</contact:personalTitle>
  </contact:Person>

</rdf:RDF>
```

Which assigns specific URIs to the individual fields (i.e. the URI in the rdf:about is a persistent and externally addressable URI) and each "property" (fullname, mailbox, etc.) is defined by a URI)

Or in graph (link!) form

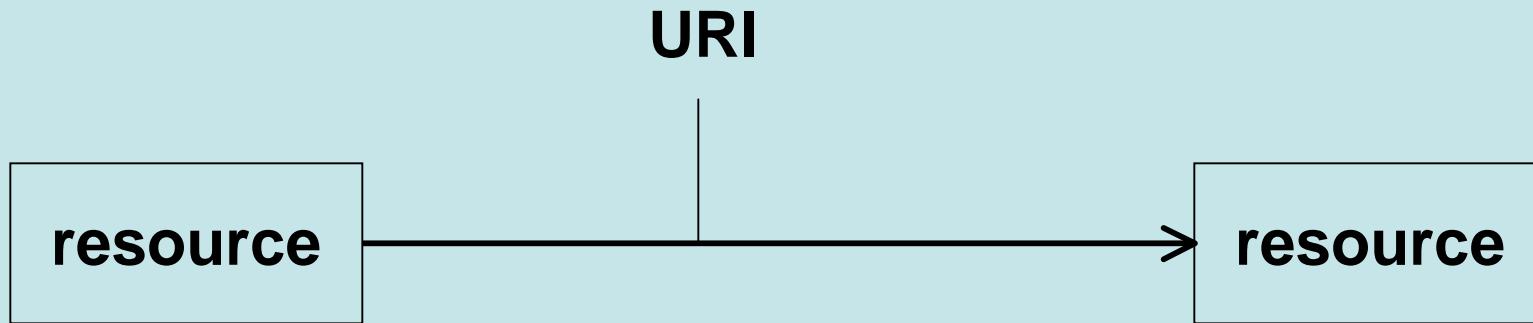


URIs for the relations is important

- common naming
- dereferencing!



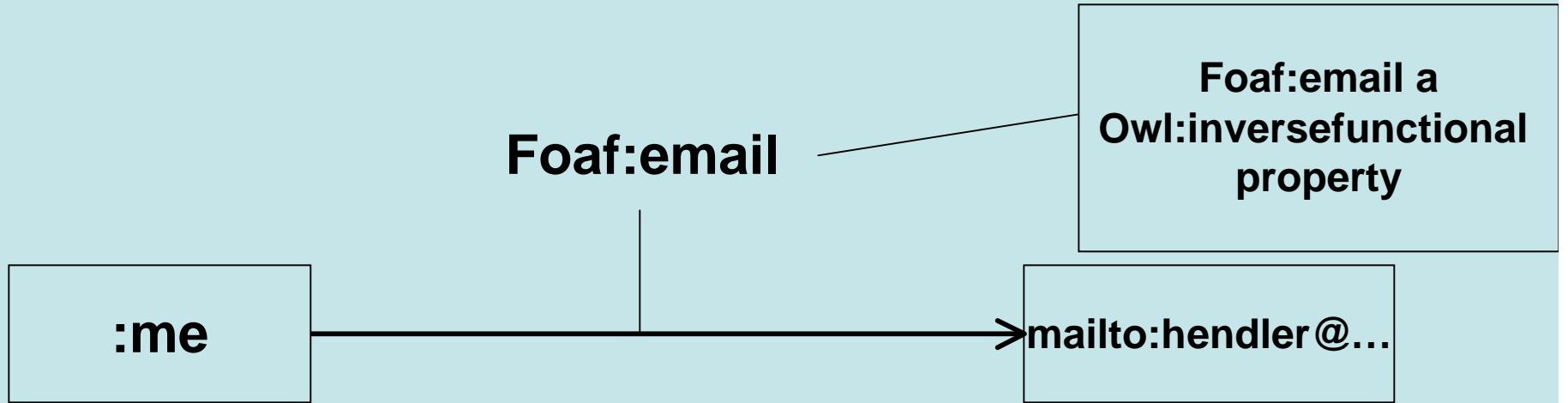
Adding the Semantics



- This is an RDF "Triple" (resources can also be URIs)
- Make the URI dereferencible for a machine-readable description
 - That is, put the ontology at that URI!
 - RDFS and OWL are basically XML dialects for this



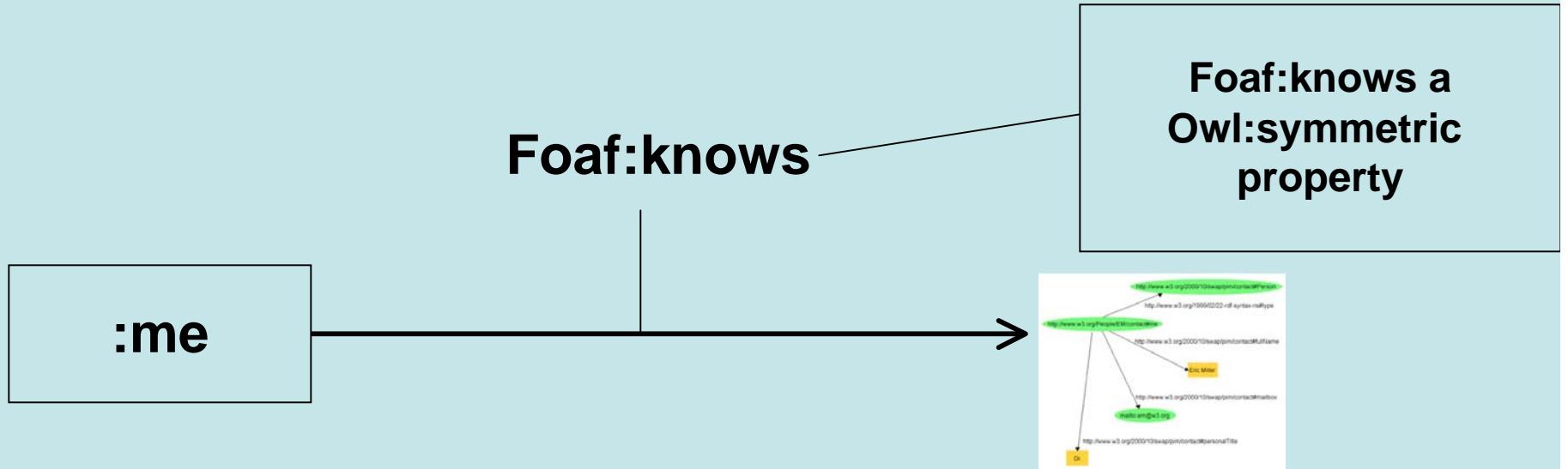
Adding the Semantics



- Ex: Asserts that email address is a many to one relation (i.e. different people with same email address will be considered equivalent)
 - Can merge multiple FOAF files describing same user from different applications



Adding the Semantics

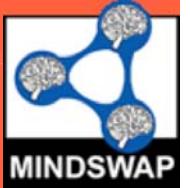


- RDFS and OWL provide other property restrictions as well
 - Which are properties needed for data modeling, domain vocabularies, etc.
- This is the heart of the Semantic Web
 - Why we talk links, not documents



Real Progress Occuring

- Increasing Semantic Web Uptake
 - Start ups in the space
 - Cerebra, Siderean, SandPiper, Data Grid...
 - Bigger players buying in
 - Adobe, Cisco, HP, IBM, Nokia, Oracle, Sun, Vodaphone... announcements/use in '05
 - Government Projects in and across agencies
 - US, EU, Japan
 - Life Sciences/Pharma an increasingly important market
 - Health Care and Life Sciences Interest Group at W3C
 - Many open source tools available
 - Kowari, RDFLib, Jena, Sesame, Protégé, SWOOP, Onto(xxx)



So...

- XML derives from a focus on the documents
 - Structuring the internals of the nodes of the Web graph (tree structure)
 - Providing structure documents for data description
- RDF/Sem Web derives from a focus on the links between them
 - Labeling the links
 - Adding "restrictions"
 - "Merging" the data from disparate descriptions



Applied to the Web



XML 2005 Conference & Exposition
Syntax to Semantics
November 14-18, 2005
Hilton Atlanta, Atlanta, GA



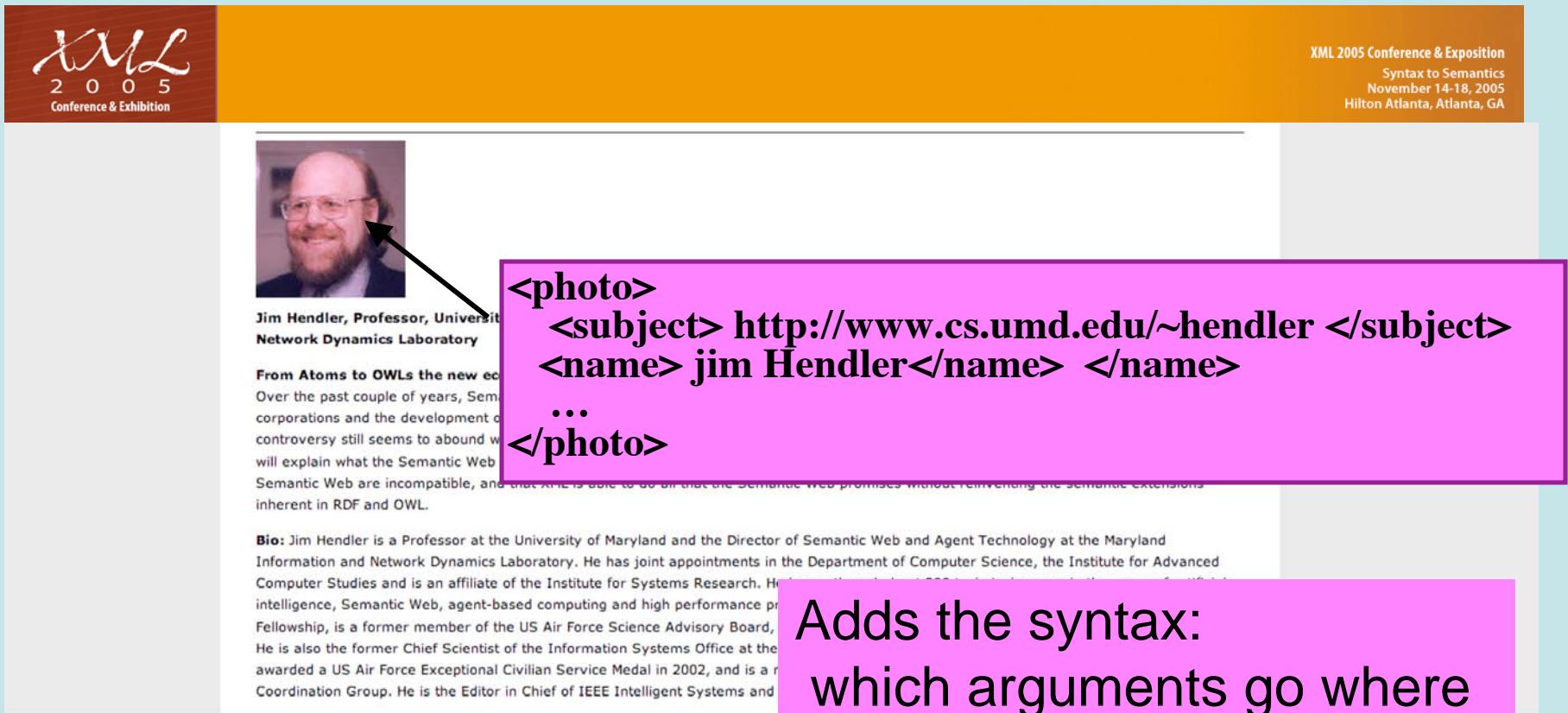
Jim Hendler, Professor, University of Maryland & Director of Semantic Web and Agent Technology, Maryland Information and Network Dynamics Laboratory

From Atoms to OWLs the new ecology of the Semantic Web

Over the past couple of years, Semantic Web deployment has really started rolling. Successes have included adoption of RDF by major corporations and the development of new ontology-based technologies of use for many enterprise and web applications. Despite this, controversy still seems to abound with respect to both the relationship of the Semantic Web to XML, and the use of these technologies. This talk will explain what the Semantic Web is all about and, perhaps more importantly, attempt to dispel two pervasive myths -- that XML and the Semantic Web are incompatible, and that XML is able to do all that the Semantic Web promises without reinventing the semantic extensions inherent in RDF and OWL.

Bio: Jim Hendler is a Professor at the University of Maryland and the Director of Semantic Web and Agent Technology at the Maryland Information and Network Dynamics Laboratory. He has joint appointments in the Department of Computer Science, the Institute for Advanced Computer Studies and is an affiliate of the Institute for Systems Research. He has authored about 200 technical papers in the areas of artificial intelligence, Semantic Web, agent-based computing and high performance processing. Hendler was the recipient of a 1995 Fulbright Foundation Fellowship, is a former member of the US Air Force Science Advisory Board, and is a Fellow of the American Association for Artificial Intelligence. He is also the former Chief Scientist of the Information Systems Office at the US Defense Advanced Research Projects Agency (DARPA), was awarded a US Air Force Exceptional Civilian Service Medal in 2002, and is a member of the World Wide Web Consortium's Semantic Web Coordination Group. He is the Editor in Chief of IEEE Intelligent Systems and is on the Board of Reviewing Editors for Science

XML Markup



The screenshot shows a slide from the XML 2005 Conference & Exposition. The slide title is "XML Markup". On the left, there's a photo of Jim Hendler with an arrow pointing to it. Below the photo is his bio: "Jim Hendler, Professor, University Network Dynamics Laboratory". To the right of the photo, there's XML code highlighting a photo element. The XML code is:

```
<photo>
  <subject> http://www.cs.umd.edu/~hendler </subject>
  <name> jim Hendler</name> </name>
  ...
</photo>
```

Below the XML code, there's a bio for Jim Hendler:

Bio: Jim Hendler is a Professor at the University of Maryland and the Director of Semantic Web and Agent Technology at the Maryland Information and Network Dynamics Laboratory. He has joint appointments in the Department of Computer Science, the Institute for Advanced Computer Studies and is an affiliate of the Institute for Systems Research. His research interests include Semantic Web, agent-based computing, high performance problem solving, machine learning, knowledge management, and artificial intelligence. He is a fellow of the American Association for the Advancement of Science, a member of the US National Academy of Engineering, and a fellow of the Association for the Advancement of Artificial Intelligence. He is a former member of the US Air Force Science Advisory Board, and is also a former member of the US Defense Science Board. He was awarded a US Air Force Exceptional Civilian Service Medal in 2002, and is a recipient of the US Air Force Distinguished Civilian Service Award. He is the former Chief Scientist of the Information Systems Office at the US Air Force Research Laboratory, and is currently a member of the US Air Force Science and Technology Coordination Group. He is the Editor in Chief of IEEE Intelligent Systems and a member of the IEEE Intelligent Systems Technical Committee on Semantic Web and Agent Technologies.

Adds the syntax:
which arguments go where
how to parse the elements
That define the DOCUMENT



Jim Hendler, Professor, University
Network Dynamics Laboratory

From Atoms to OWLs the new era
Over the past couple of years, Semantic Web technologies have transformed the way corporations and the development of the Semantic Web. The new era of the Semantic Web has arrived, and it is here to stay. In this presentation, Jim Hendler will explain what the Semantic Web is, how it works, and why it is important. He will also discuss the challenges of building a truly intelligent Semantic Web, and the role of XML in making it a reality.

Bio: Jim Hendler is a Professor at the University of Maryland and the Director of the Maryland Information and Network Dynamics Laboratory. He has joint appointments in the Department of Computer Science and the Department of Computer Studies and is an affiliate of the Institute for Systems Research. He is a member of the National Academy of Engineering and the National Academy of Sciences. He is a fellow of the Association for Computing Machinery and the Association for the Advancement of Artificial Intelligence. He is a former member of the US Air Force Science Advisory Board and the US Air Force Research Laboratory. He is also the former Chief Scientist of the Information Systems Office of the US Air Force. He has received numerous awards, including the US Air Force Exceptional Civilian Service Medal in 2002, a Distinguished Service Award from the US Air Force in 2004, and a Distinguished Achievement Award from the US Air Force in 2005. He is the Editor in Chief of IEEE Intelligent Systems and a member of the US National Committee for the International Federation for Information Processing.

```
<photo>
<subject> http://www.cs.umd.edu/~hendler </subject>
<name> jim Hendler</name> </name>
...
</photo>
```

But for the *semantics* we need
information about Talks, Subjects,
People, Events, etc. and the roles
this item plays in them

Thus, the *Semantic Web*



Jim Hendler, Professor, University Network Dynamics Laboratory

From Atoms to OWLs the new ecology
Over the past couple of years, Semantic Web technologies have become widely adopted in industry, government, and research. Despite the success of these technologies, there is still a significant amount of controversy surrounding their use. In this talk, Jim will explain what the Semantic Web is, how it works, and why it is incompatible with traditional RDF and OWL.

Bio: Jim Hendler is a Professor at the University of Maryland, College Park, and a Computer Studies and is an affiliate of the University of Maryland's Department of Computer Science. He is also a member of the University of Maryland's Institute for Advanced Computer Studies (UMIACS). Jim is a former member of the National Research Council's Committee on the Future of the Semantic Web. He is also the former Chief Scientist of the Semantic Web Consortium. Jim has received numerous awards, including the US Air Force Exceptional Civilian Service Medal in 2002, and is a member of the World Wide Web Consortium's Semantic Web Working Group. Jim is the Editor in Chief of IEEE Intelligent Systems and is on the Board of Reviewing Editors for Science

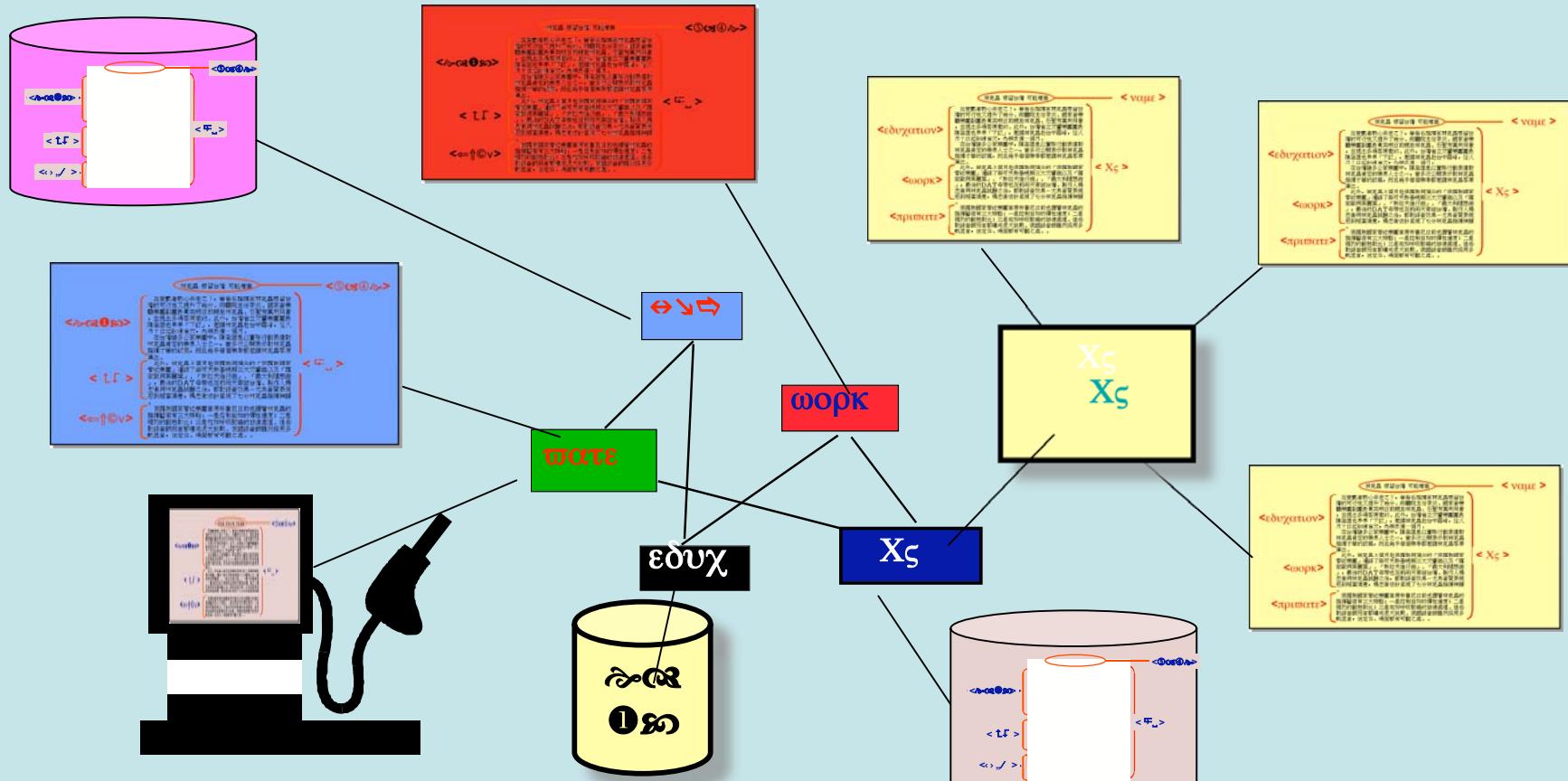
```
<> rdf:type photo:Photograph,  
Photo:File http://.../images#image1,  
Photo:topic :event1#event:speaker.  
  
Event1 a Event:event;  
date "2005-07-13",  
speaker http://...#hendler.html  
Title "IAAI 2005..."  
  
:JimH rdf:type foaf:person;  
name "Jim Hendler"
```

```
<daml:ObjectProperty rdf:ID="photograph">  
<rdfs:domain rdf:resource="#Picture"/>  
<rdfs:range rdf:resource="...#person"/>  
</daml:ObjectProperty>
```

```
<s:Class  
rdf:about="http://www.semanticweb.org/ontologies/swrc-onto-2000-09-10.daml#Conference">  
<s:comment>  
describes a generic concept about events  
</s:comment>  
<s:subClassOf  
rdf:resource="http://www.semanticweb.org/ontologies/swrc-onto-2000-09-10.daml#Event"/>  
<a:disjointFrom  
rdf:resource="http://www.semanticweb.org/ontologies/swrc-onto-2000-09-10.daml#Workshop"/>  
<a:restrictedBy  
rdf:resource="http://www.semanticweb.org/ontologies/swrc-onto-2000-09-10.daml#genid18"/>
```

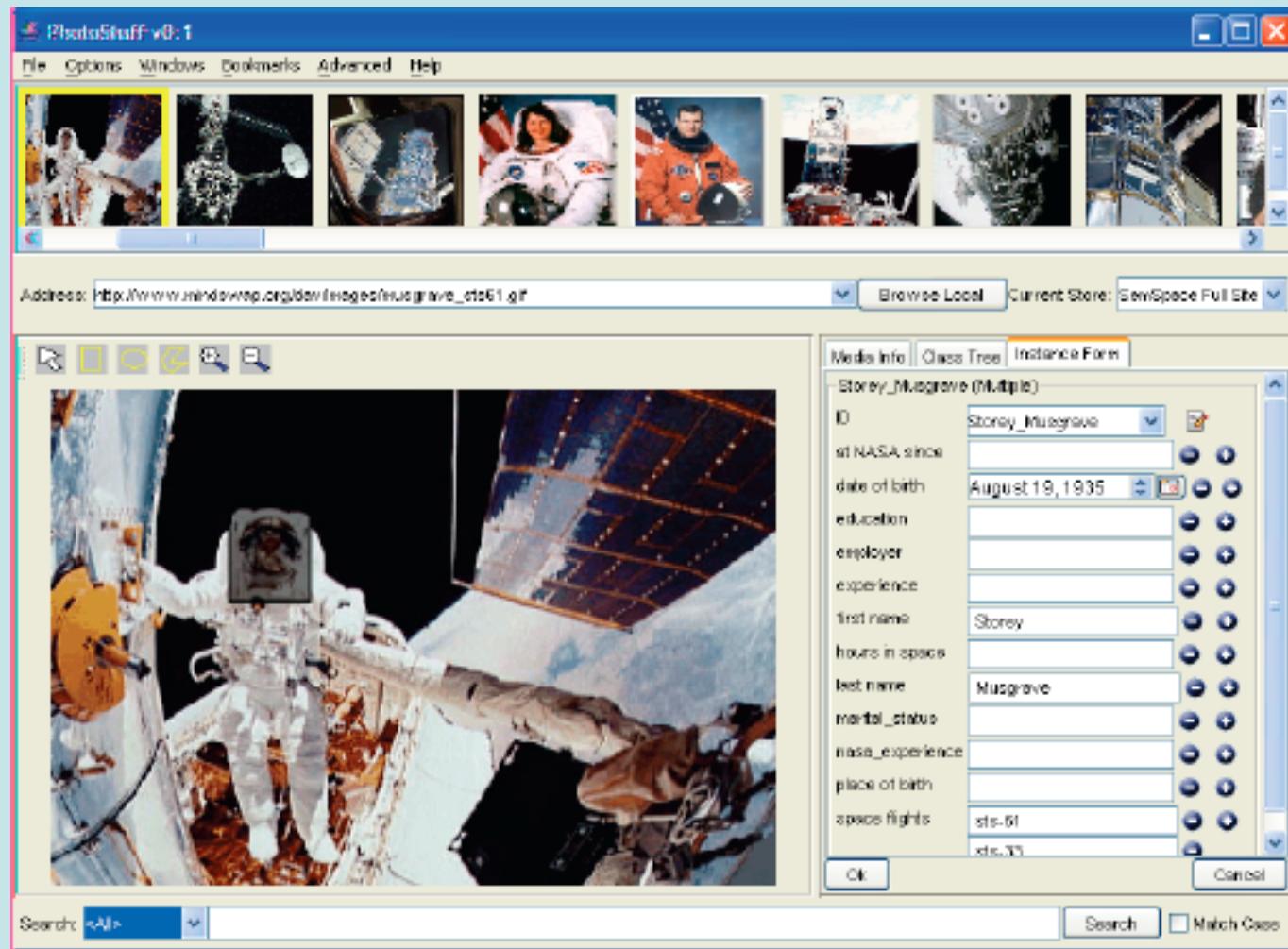
```
<rdf:Description rdf:about="http://www.w3.org/2001/03/earl/0.95#Person">  
<rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>  
<rdfs:subClassOf rdf:resource="http://www.w3.org/2001/03/earl/0.95#Assertor"/>  
</rdf:Description>
```

Not just annotation...



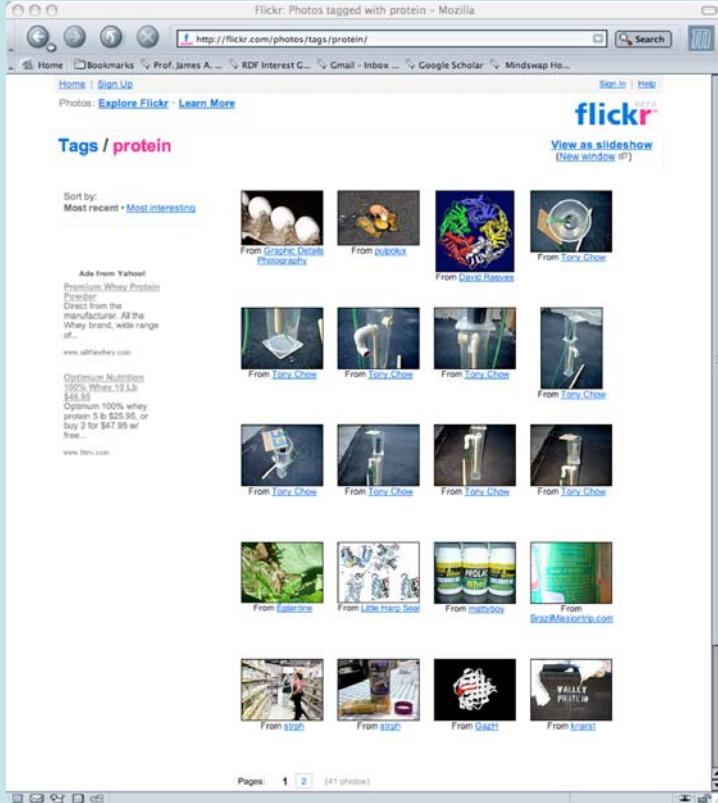
Media formats, Data, Web service descriptions, etc. can be merged via their "semantic relations"

Content-based metadata



<http://www.mindswap.org/2003/PhotoStuff/>

"Folksonomy" vs. Ontology



Flickr: Photos tagged with protein - Mozilla

Tags / protein

Sort by: Most recent + Most interesting

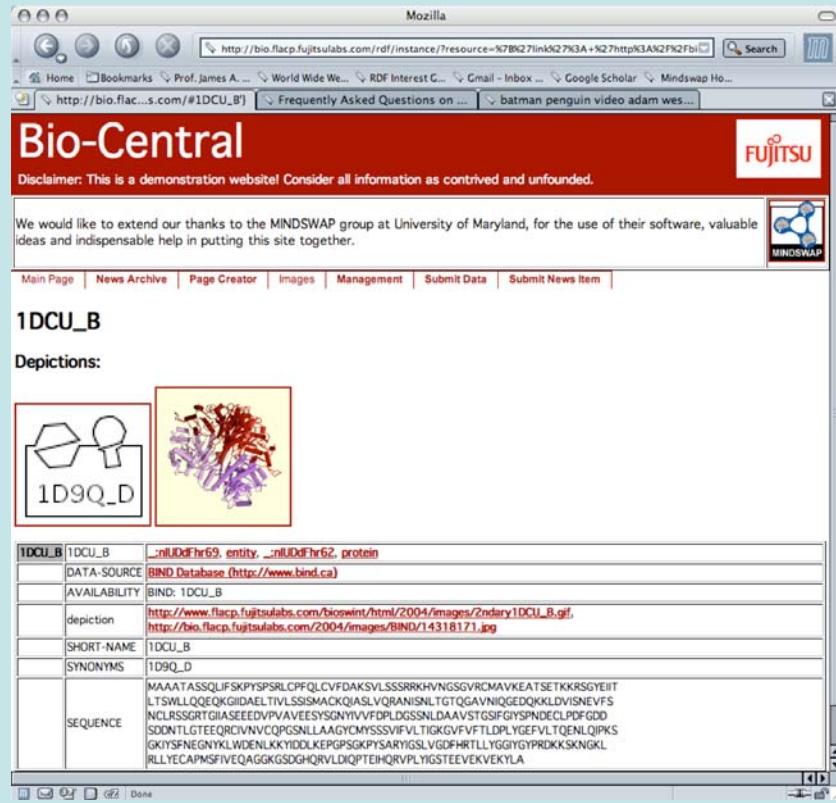
Ads from Yahoo!

Premium Whey Protein
Distributors Direct from the manufacturer. All the Whey brand, wide range off...
www.alltheshey.com

Optimum Nutrition
100% Whey 10 lb
\$48.88
Optimum 100% whey protein 5 lb \$25.95, or buy 2 for \$47.95 w/ free...
www.bninc.com

Pages: 1 2 (41 photos)

Flickr - protein



Bio-Central

Disclaimer: This is a demonstration website! Consider all information as contrived and unfounded.

We would like to extend our thanks to the MINDSWAP group at University of Maryland, for the use of their software, valuable ideas and indispensable help in putting this site together.

Main Page | News Archive | Page Creator | Images | Management | Submit Data | Submit News Item

1DCU_B

Depictions:

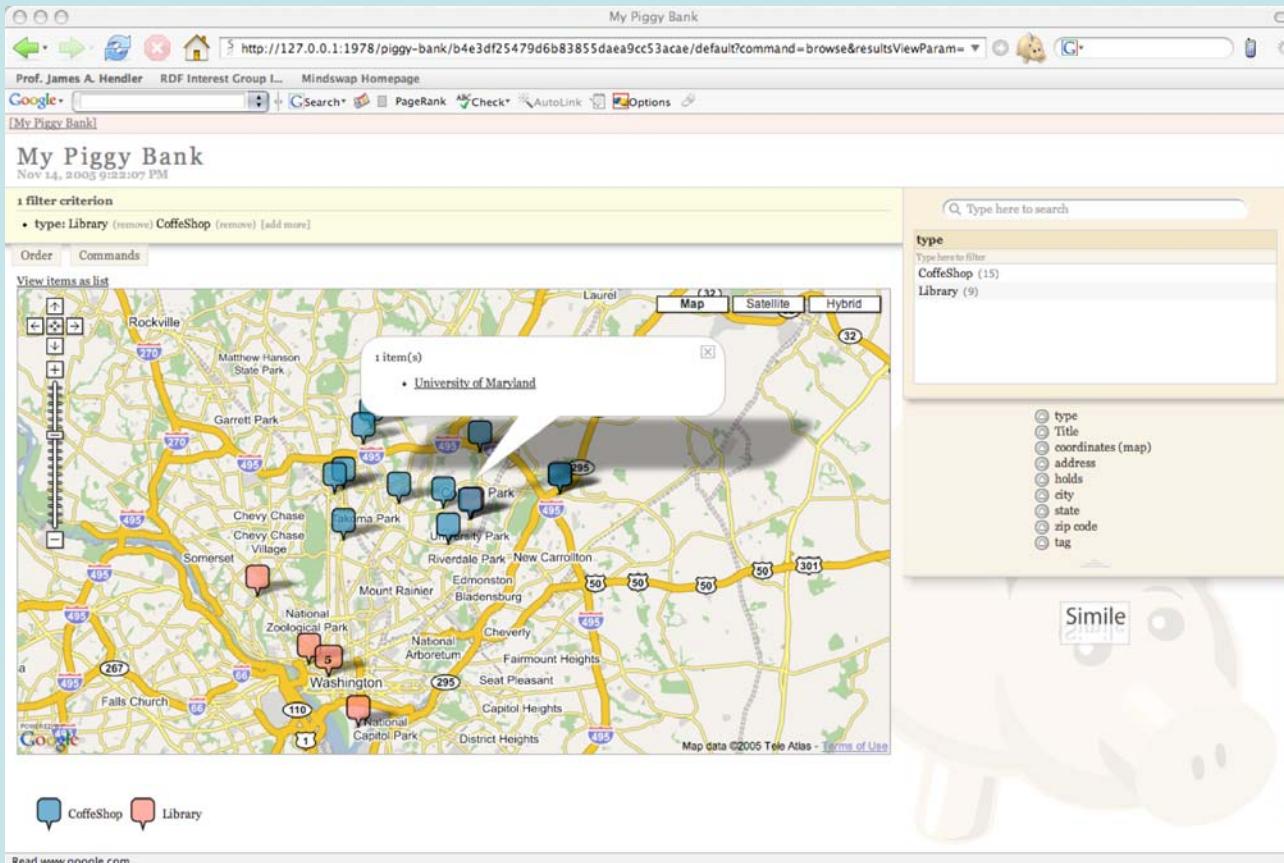
--	--

1DCU_B	_n1UDfhr69.entity , _n1UDfhr62.protein
DATA-SOURCE	BIND Database (http://www.bind.ca)
AVAILABILITY	BIND: 1DCU_B
depiction	http://www.flacp.fujitsulabs.com/bioswint/html/2004/images/2ndary1DCU_B.gif , http://bio.flacp.fujitsulabs.com/2004/images/BIND/14318171.jpg
SHORT-NAME	1DCU_B
SYNONYMS	1D9Q_D
SEQUENCE	<pre> MAAATASSQLFSKPYSPSRSLCPFLCVFDAKSVLSSRRKHVNNSGSVRCMAVKEATSETKKRSGYEIT LTSWLLQQEQKGIDAEITVLSSSMACKQJASLVORANISNLTGQAVNIQEDQKLDVNEVF NCLRSSGRTGQIASEEDPVAVEESGNIVVFDPDGSSNLDAVSTGSFQIYSPNDCLPFDGOD SDONLTCTEEQCRQVNVCOPGSNLAAAGCMYSSSIFVLTICKGVFTLDRLYGEVFTQENLQPKS GKYSPENEGNYKLHDENLKKYDDLKEPGPSGPSPSARYIGSLVGDFHRTLLYGIYGYPROKSKNGKL RLLYECAPMSFIVEQAGGKGSDGHQRVLDIQPTHEQRVPLYIgstEEVKEVYLA </pre>

Sem Web - protein

Different levels of precision needed for different users

Merging data



**Piggy Bank, MIT Simile project, is a Firefox addition
that allows the merging of RDF data on the fly**

Merging services

Service composition

File Options

Select a category: SensorService (14)

Location

Latitude	in the range	
Longitude	greater than	
Altitude	equals	

Quality: Excellent

Advanced...

SoundIntensity

RMS Calculator

InputWaveFile

SoundOutput

FIR Filter

WindowType

User input

Lower FreqLimit

User input

Upper FreqLimit

User input

SoundInput

- User Input -

Rectangular

Run

Services (4/5)

- Services (4/5) -
- User Input -
- Acoustic Sensor 1
- Acoustic Sensor 2
- Acoustic Sensor 3
- Acoustic Sensor 4

*Information management capabilities
Discovery, Filtering, Composition*

(Evren Sirin, Bijan Parsia)



Get a B&N price (In Euros)

Service Composition

File Options Help

Select a category: Service (30)

Advanced...

Output Price (Price)
Currency Converter

Input Price (Price) Output currency (Currency)
Book Price (Price) User input (Currency)

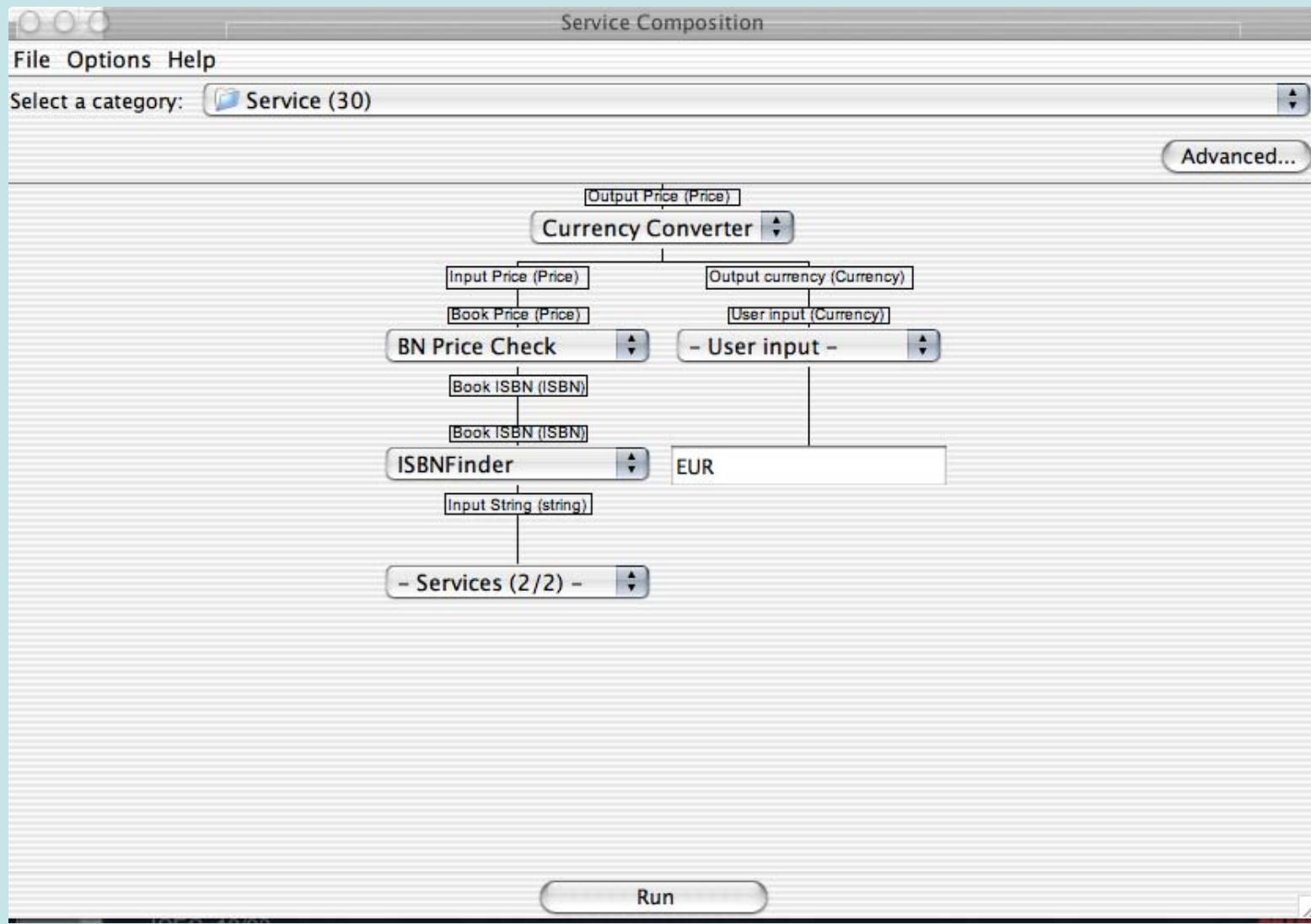
BN Price Check - User input -
Book ISBN (ISBN)

- Services (1/1) - EUR

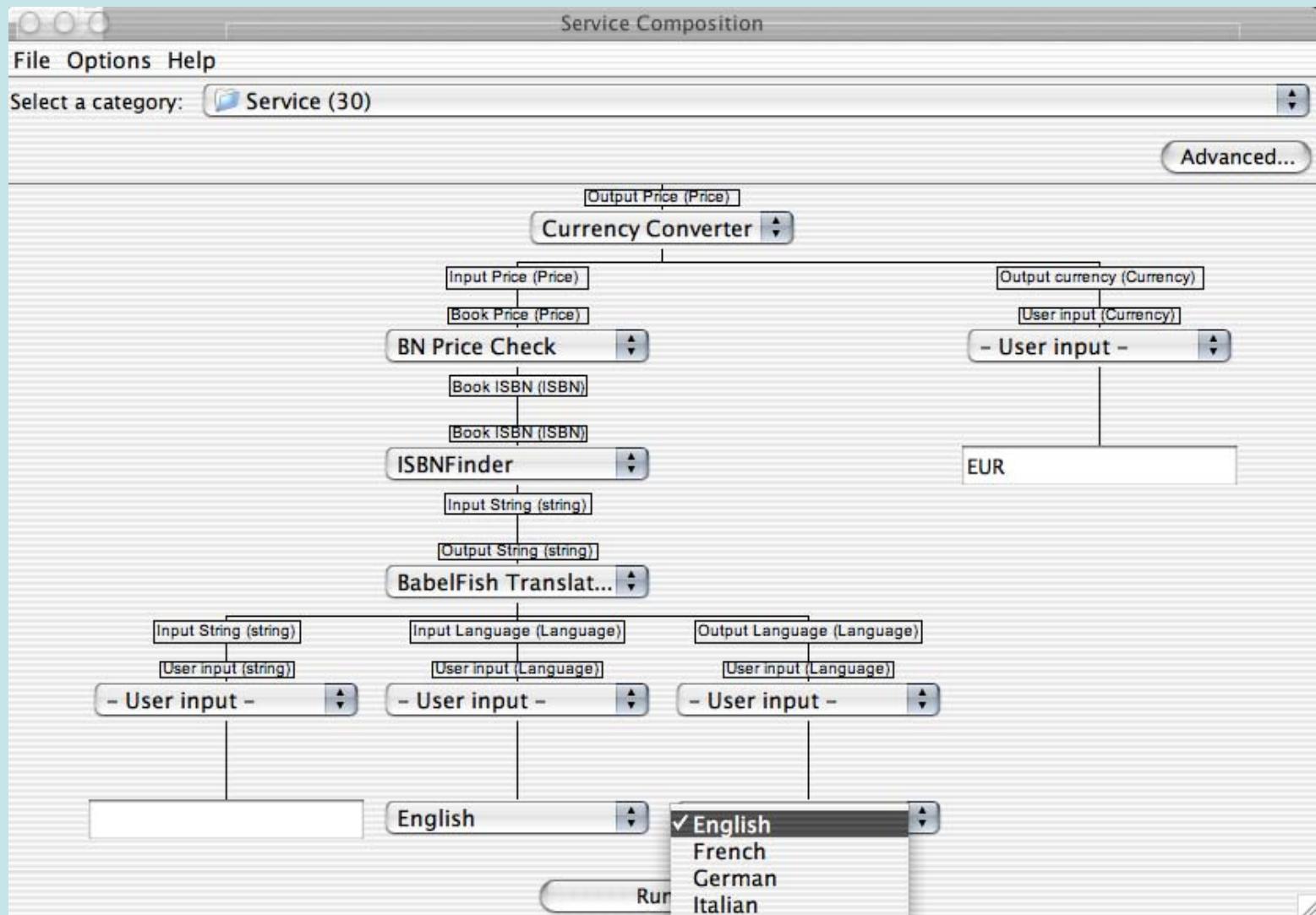
Run

The screenshot shows a service composition interface with a central workflow diagram. At the top, there's a menu bar with 'File', 'Options', 'Help', and a dropdown 'Select a category: Service (30)'. Below the menu is an 'Advanced...' button. The main area contains a hierarchical diagram of services. At the top level is 'Currency Converter' with two outgoing arrows: one to 'Input Price (Price)' and one to 'Output currency (Currency)'. These two services have their own sub-diagrams. The 'Input Price (Price)' service has an incoming arrow from 'Book Price (Price)'. The 'Output currency (Currency)' service has an incoming arrow from 'User input (Currency)'. Below these is a 'BN Price Check' service with an outgoing arrow to 'User input (Currency)'. This 'User input (Currency)' service has an incoming arrow from 'Book ISBN (ISBN)'. At the bottom left is a summary '- Services (1/1) -' and at the bottom right is the target currency 'EUR'. A large 'Run' button is located at the bottom center.

Of a particular book



In its German edition?



File Options Help

Select a category: Service (30)

Service

Execution results

Input parameters
Input String = Unix Programmierung

Invoke WSDL Operation findISBN...

Output parameters
Book ISBN = 1565922255

Execute sub-process 2

Execute atomic process CheckBookPrice

Input parameters
Book ISBN = 1565922255

BN Price Check

Current step: BN Price Check

Input Price (Price) → Book Price (Price)

Book ISBN (ISBN) → Book ISBN (ISBN)

ISBNFinder

BN Price Check → ISBNFinder

Input String (string) → Output String (string)

BabelFish Translate

BN Price Check → BabelFish Translate

Input String (string) → User input (string)

Input Language (Language) → User input (Language)

- User input -

Unix Programming English

Output currency = EUR

Invoke WSDL Operation convertPrice...

Output parameters
Output Price =

Price:
currency: EUR
amount: 29.948585100000003

ICEC, 10/03

100% Draft Close



Reasoning about access control

URI
variable



Alan:

- 1) If X is AC rep of Y, X can delegate W3C member access rights in Y.
- 2) *Kari* is AC rep of *Elisa* .



Kari:

- 1) If X is employee of Elisa, X has W3C member access rights.
- 2) *Tiina* is employee of *Elisa*.



Tiina: I have W3C member access rights
Proof: Alan 1, Alan 2, Kari 1, Kari 2

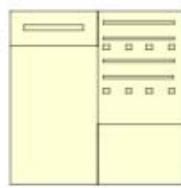




Which gets us back to protocols...



HTTP-Get(URI1)



(A) User requests a resource.



Error 401:
LogInAll $\pi y \exists z$
 $(\exists photoObjects y \ldots$
 $y \text{ me:familyMember } z)$
logImplies
 $(\exists WebAccess \text{ URI1})$



(B) 401 error provides access rules.



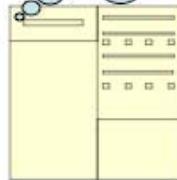
HTTP-Get(URI1);
proof "http://.../prf.n3"

```
PROOF:  
Pf1 a ProofStep;  
Proof StepAssertion  
[fa91 photoObjects :Pf1]  
Pf2 a ProofStep;  
Proof StepAssertion  
[Pf1 me:familyMember :Dad]  
Pf3 a ProofStep;  
Dad WebAccess URI1;  
Proof StepRule Log MP
```

(C) Proof is generated and pointer is sent in new HTTP-Get request.



Correct!



(D) Proof is checked, and confirmed, and the transaction succeeds.



But can't this just be done in XML?

- Yes, it can ... and it has
 - RDF/XML is legal XML
 - OWL has an XML Schema and XSLT to move that to the (normative) RDF/XML interchange format
 - SPARQL returns an XML (data) document
 - GRDDL and RDF/A provide XHTML to RDF mapping
- No need to reinvent the wheel, but...



Playing nice together

- Good news: Slash vs. Hash is over
 - The TAG has spoken
 - The armies are burying their dead and returning home as we speak
- And coordination improving
 - Cf. WSDL 2.0 OWL; SPARQL and XQuery, ...
- But, Semantic Web ***needs*** some URIs from the XML world
 - Example: OWL cannot use complex XML schema data types
 - Similarly Xlink and Xpath issues



Punch line

- We work towards a common goal
 - Raising the grade for data (and meta-data) on the Web
- XML and RDF/RDFS/OWL can and do coexist very well
 - XML for documents and structure
 - RDF for linking and merging
 - OWL for vocabularies and organization
 - RDF and XML forms
- The Semantic Web is here
 - don't reinvent it