Information Interchange on the Semantic Web

an interactive talk
by Piotr Kaminski, University of Victoria
www.ideanest.com
Getting machines to understand the contents of the web

I'd better talk to the bank before I spend it, because of what has happened to other people.

Your bank balance has jumped 8087% to $1234567.89

Semantic Web

World Wide Web

data

structure

information

reasoning

knowledge

actions

wisdom
Why is the World Wide Web valuable?

The Semantic Web:
- contains statements about things
- must be able to combine statements that talk about the same thing

Diagram:
- SEng 330 requires SEng 265
- Jane has taken SEng 265
- SEng 265 has taken SEng 265
A resource is anything that has an identity.

A URI identifies a single resource:
- decentralized, uniform syntax (RFC 2396)
- URL (Locator) and URN (Name) are legacy terms

If you go fetch a URI, do you retrieve its resource?

What does http://www.engr.uvic.ca/~seng330/ identify?
An ontology is a dictionary:

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Thing</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://www.ideanest.com/uvic">http://www.ideanest.com/uvic</a></td>
<td>UVic itself</td>
</tr>
<tr>
<td><a href="http://www.ideanest.com/uvic/seng330">http://www.ideanest.com/uvic/seng330</a></td>
<td>SEng 330 course</td>
</tr>
<tr>
<td><a href="http://www.ideanest.com/requires">http://www.ideanest.com/requires</a></td>
<td>one course having another as prereq</td>
</tr>
</tbody>
</table>

- resources identified well defined and agreed upon
- may also include relationships between resources, inference rules
- can be general (upper ontology) or specialized
- still decentralized!
A Semantic Web model proposal:
- simple set of subject–predicate–object triples
- many notations:

Graphs:

uvic/seng330 requires uvic/seng265

prefix: http://www.idealnest.com/

Notation3:
@prefix in: http://www.idealnest.com/
in:uvic/seng330 in:requires in:uvic/seng265

XML:

```xml
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
         xmlns:in="http://www.idealnest.com/"
  </rdf:description></rdf:RDF>
```
RDF Example

"piotr@ideanest.com"

email

"Piotr Kaminski"

name

homepage

creator

http://www.ideanest.com/

- literals are primitive values
- anonymous *bnodes* are identified by properties
Another Semantic Web model proposal:

- set of topics and associations
- a *topic* represents a *subject resource*
- an *association* relates a set of topics together
  - each topic plays one or more *roles*

Prefix: http://www.ideanest.com/
A topic can identify its subject by stating:

- the primitive value
  
  "http://www.uvic.ca/" = just a string

- the identifier of the resource
  
  http://www.uvic.ca/ = UVic home page / web site

- the identifier of a resource that indicates the subject
  
  http://www.uvic.ca/ = UVic itself

- can also be done using newly proposed URI scheme \textit{tdb}:
  
  \textit{tdb:http://www.uvic.ca/} = thing described by...
n-ary associations are allowed (and encouraged)

What's the obvious mapping to RDF?
The one point everybody agrees on:

<table>
<thead>
<tr>
<th>Thing</th>
</tr>
</thead>
</table>

...though not on its name

Our software is part of the domain, so we explicitly show software artifacts:

<table>
<thead>
<tr>
<th>Reality</th>
<th>Representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thing</td>
<td>Topic</td>
</tr>
</tbody>
</table>

RDF: Resource
TM: Subject

RDF: Topic
TM: Topic

Reifies

0..* ? 1..* ?
Relating Things

Reality

Thing
- RDF: Resource
  - TM: Subject
- * members

Topic
- RDF: Statement
  - TM: Association
- 1
- 0..*

Representation

Relationship
- RDF: Resource
  - TM: Subject
- * members

Association
- RDF: Statement
  - TM: Association
- 1
- 0..*
Identifying Things

- Identification is a complex problem:
  - may be indirect
  - may be scoped
  - might need to be reasoned about

- Let "identifies" be a normal relationship between Things

- define it in a standard upper ontology
We must bootstrap the identification chains:

- a literal is a thing that has a native representation within our software system.

```
1: Thing
0..*: Topic
```

- "Piotr Kaminski"
- "http://www.idealnest.com"

RDF: Literal
TM: Resource

Information Interchange on the Semantic Web 14
Recursive Relationships

- How to model Topic Map roles?
  - could make it a primitive in the model...
- Each member of a relationship implicitly participates in a binary "member of" relationship with it
- only one level necessary for assigning roles

Example diagram showing relationships between things and roles.
Last Thoughts

- We've only scratched the surface:
  - type hierarchies, classes vs. properties
  - collections, ordering of members
  - contexts / scopes
  - reflection / reification

- Why not XML?
  - no universal interpretation
  - no universal representation for arbitrary graphs

- Project in progress: Braque
  www.ideanest.com