Bringing Semantics to Service-Oriented Architecture: Ontology-based Mediation for eGovernment

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Topics covered

- Enterprise Architecture, Semantic Web, Service Oriented Architecture
- For successful EA - why SOA? Why Semantic Web?
- What is Semantic Web? How does it contribute to SOA and EA?
- Semantic Policy Engine and SOA
Semantic SOA and EA

Enterprise Architecture

Semantic Web

Service-Oriented Architecture
EA as “passive” repository

Who maintains this?
How does it provide value?
EA as “active” repository

Make EA part of the system!
- this requires SOA
What is RDF?

- RDF (Resource Description Framework) is an infrastructure for:
  - Encoding,
  - Exchange and
  - Distributing metadata

RDF Triple:

- Subject: Safety Harbor
- Predicate: offers
- Object: Massage
RDF: A distributed network of data!

RDF Files: “bags of triples”

Safety Harbor

offers

Massage

offeredBy

Facial

offers

Massage

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RDFS is RDF, too!

If the bags contain RDFS key symbols, then RDFS can infer certain conclusions...
OWL can specify rich relationships: equivalence, inverse, unique, ...
OWL can describe classes, and determine membership

- Solar System
  - type
  - revolvesAround = \forall \text{revolvesAround}
  - The Sun
  - Mercury
  - revolvesAround
  - Planets
## Why use RDF for an Enterprise Architecture?

<table>
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<tr>
<th>EA Requirements</th>
<th>RDF Features</th>
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<tr>
<td>- Flexible, expressive models</td>
<td>- General graph modeling</td>
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<tr>
<td>- Extensible in many different ways</td>
<td>- Graph merging is a primitive operation</td>
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<td>- Compatible with well-known modeling paradigms (e.g., OO)</td>
<td>- RDFS provides frame structure</td>
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<td>- Incremental Construction</td>
<td>- &quot;A little RDF goes a long way&quot;</td>
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<td>- Distribution of information</td>
<td>- RDF is natively &quot;of the web&quot;</td>
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## Why use RDF/OWL for a Service-Oriented Architecture?

<table>
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<tr>
<th><strong>SOA Requirements</strong></th>
<th><strong>OWL Features</strong></th>
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<td>Ability to describe entities for retrieval</td>
<td>DL Classification and Description Logic</td>
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<td>Well-defined semantics of a service offering</td>
<td>Formal graph-theoretic semantics</td>
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<td>Commonality and Variability analysis</td>
<td>“Tube map” combination</td>
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Incremental construction: A little RDF(S) goes a long way

A model of government agencies and departments. Such models are called Ontologies.
Challenge: Commonality and Variability

Organization Domain Modeling (ODM)*
http://www.domainmodeling.com/stars.html#odm

Methodology for engineering sets of reusable assets

Stakeholder analysis
Exemplar study
Commonality and Variability modeling
Asset-base engineering

*not to be confused with the Ontology Definition Metamode (ODM)
Challenge: Commonality and Variability

Exploit things in common . . .

... while respecting variation
Commonality I – object models

- Community
  - Building and Construction Machinery
    - Heavy construction machinery
    - Earth moving machinery
  - Apparel, Luggage and Personal Toiletry
    - Luggage, handbags, packs and cases
    - Business cases
    - Clothing
      - Business cases
      - Luggage
      - Hosiery
      - Suits
      - Paving Equipment
Commonality II – schema sharing

From Tim Berners-Lee, ISWC 2003
Distributed data

- RDF refers to Resources, identified by URLs.
- This means that information about a single resource can come from many sources.

Example adapted from Costello and Jacobs, from XML to RDF
Service Capabilities supported by RDF/OWL

- Service discovery (what service satisfies my needs?)
- Service composition (how do I combine services to get what I want?)
- Service publication (how do I let people know about my service?)
- Composition verification (how do I know that a combination of services does what I want?)
Service Policies

- Technology can be in place, but without policy, no interoperation will happen.

Privacy?

Policy is often more important than discovery, composition, description...
Case Study: Government Privacy Policy
Privacy Act of 1974

- The US Gov’t has lots of information about YOU! (tax records, passport registration, visa applications, census information, etc.

- Who is allowed to see this? Under what circumstances?

- Policy is specified by Legislation – the Privacy Act of 1974
This policy can be represented in OWL, e.g.

“Disclosures to FBI for a criminal investigation must be accompanied by a court order” or

“Disclosures to the Bureau of the Census are granted, as long as the data is used only for statistical purposes”
Capabilities for Privacy Model

- Extensible - allows new policies to be added, or policies to be used together

- Distributed - policy representation is not likely to be in the same place as any particular disclosure request

- Well-defined semantics - this is even better than most legislation!

- Automation - inferences can do classification
Questions and Answers

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