



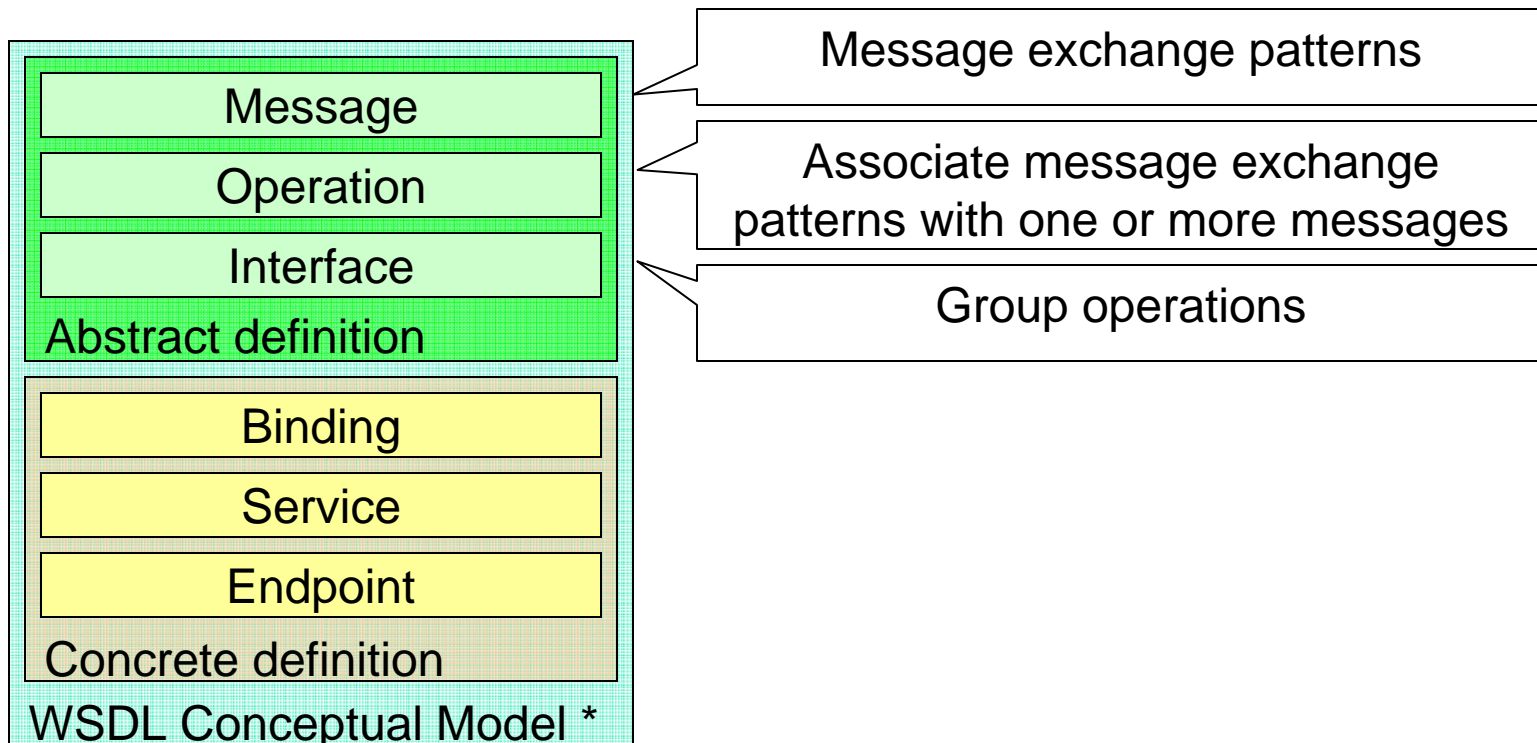
Bring Semantics into Web Service

OWL-S, WSDL-S, WSDL-RDF Mapping, and more

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CMSC 828W Class Presentation

Web Service Description (BRIEF)

- Web Service Description Language (WSDL 2.0)



* Based on the figure from <http://webservices.xml.com/pub/a/ws/2004/05/19/wsd2.html>

Still Not Clear?

```
public interface PurchaseOrder {                                Interface
    Response processPurchaseOrder (Request req);
    boolean checkPurchaseOrder (string order);
}
```

Still Not Clear?

```
public interface PurchaseOrder {  
    Response processPurchaseOrder (Request req);  
    boolean checkPurchaseOrder (string order);  
}
```

Operations

Still Not Clear?

```
public interface PurchaseOrder {  
    Response processPurchaseOrder (Request req);  
    boolean checkPurchaseOrder (string order);  
}
```

Messages

Background

- Unambiguity
- Machine-interpretability
- Useful in
 - Service discovery: find the “right” service
 - Service composition: mappings between data

Three Approaches

- Develop a SW version service description language, then map (ground) to WSDL (OWL-S)
- Annotate WSDL, provide additional information that defines semantics of a part of the document. (WSDL-S [1], Data Dictionary Link [2])
- Transform WSDL into a semantic language (WSDL-RDF Mapping [3])

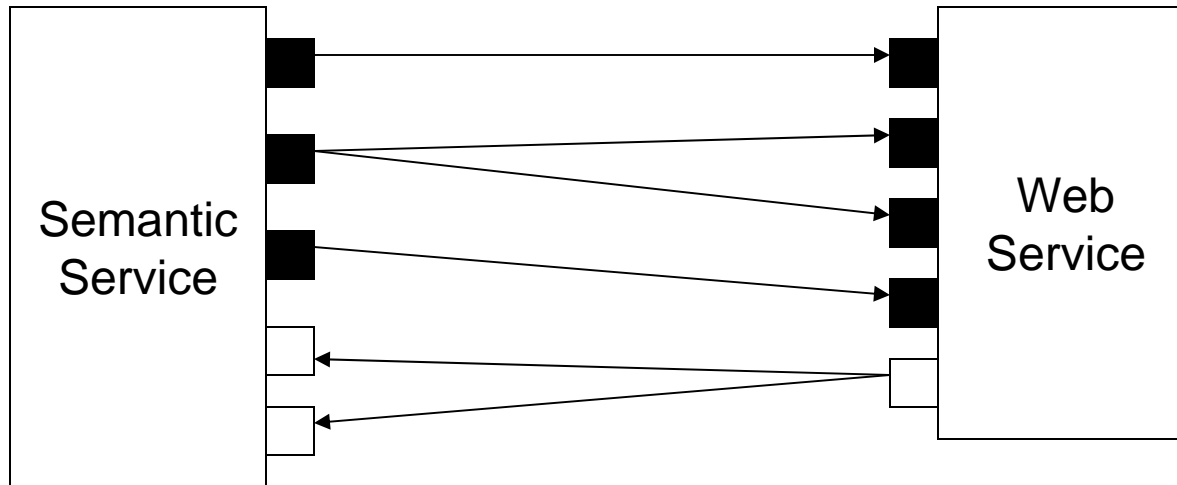
Approach 1

OWL-S*

- Profile: semantic view of the service
- Grounding: map OWL-S to WS or other types of services (e.g. UPnP by FLA, CP)
- Process: glue

* Based on OWL-S version 1.1 (11/2004)

In Defining Groundings



1. How to uniquely identify the web service operation (port, operation)
2. Mapping Parameters (many-to-many [?])
3. Defining transformation (if necessary) (e.g. XSLT script)

Issues

- Need Tools!!
 - OWL-S is too complex for non-expert to understand
 - Limitation on existing tools (OWL-S API, WSDL2OWL)
- Should allow multiple semantic parameters mapping to one syntactic parameter
- Should allow setting default value to syntactic parameter
- Need better transformation script
- An article about “pitfalls of OWL-S version 1.0” is available at <http://www.informatik.uni-ulm.de/ki/Liebig/papers/balzer-et-al-icsoc04.pdf>

Approach 2

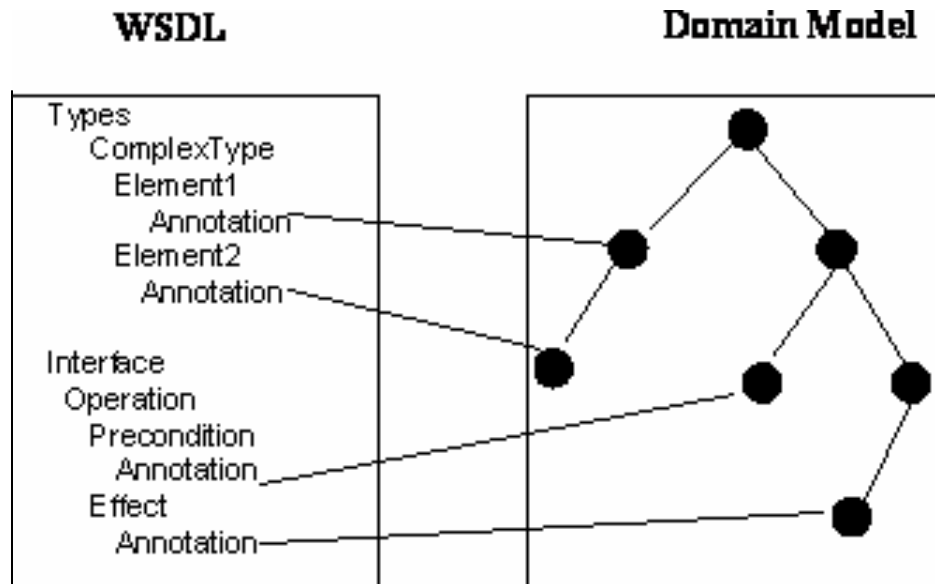
WSDL-S

- Why? Some people really “like” WSDL
- Incremental work on top of WSDL: annotate WSDL
- Flexibility: can use any ontology representation language, or the combination of multiple representation languages
 - Good or bad?
- Easy to update existing tools to support WSDL-S (for the same reason as 1)

Trivial Facts

- Proposed by IBM and University of Georgia LSDIS lab
- Initially from METEOR-S project
- Use namespace xmlns:wssem = “http://www.ibm.com/xmlns/Webservices/WSSemantics”

What to Annotate



- Parameters (input/output)
- Conditions (precondition/effect)

Figure is copied from WSDL-S W3C draft site
(<http://www.w3.org/Submission/WSDL-S/>)

Technical Details

- Mapping preconditions and effects
- Mapping parameters

Technical Details

- Mapping preconditions and effects
 - Within *operation*, add *wssem:precondition* and *wssem:effect* tag
 - Within *wssem:precondition* and *wssem:effect* tags, use *wssem:modelReference* to point to a class (OWL class)
- Mapping parameters

Mapping Preconditions and Effects

- At most one precondition and as many as possible effects
- “Developing markup languages for representing preconditions and effects is an area of active research.”
- Possible candidates
 - SWRL (Semantic Web Rule Language)
 - OCL (Object Constraint Language)

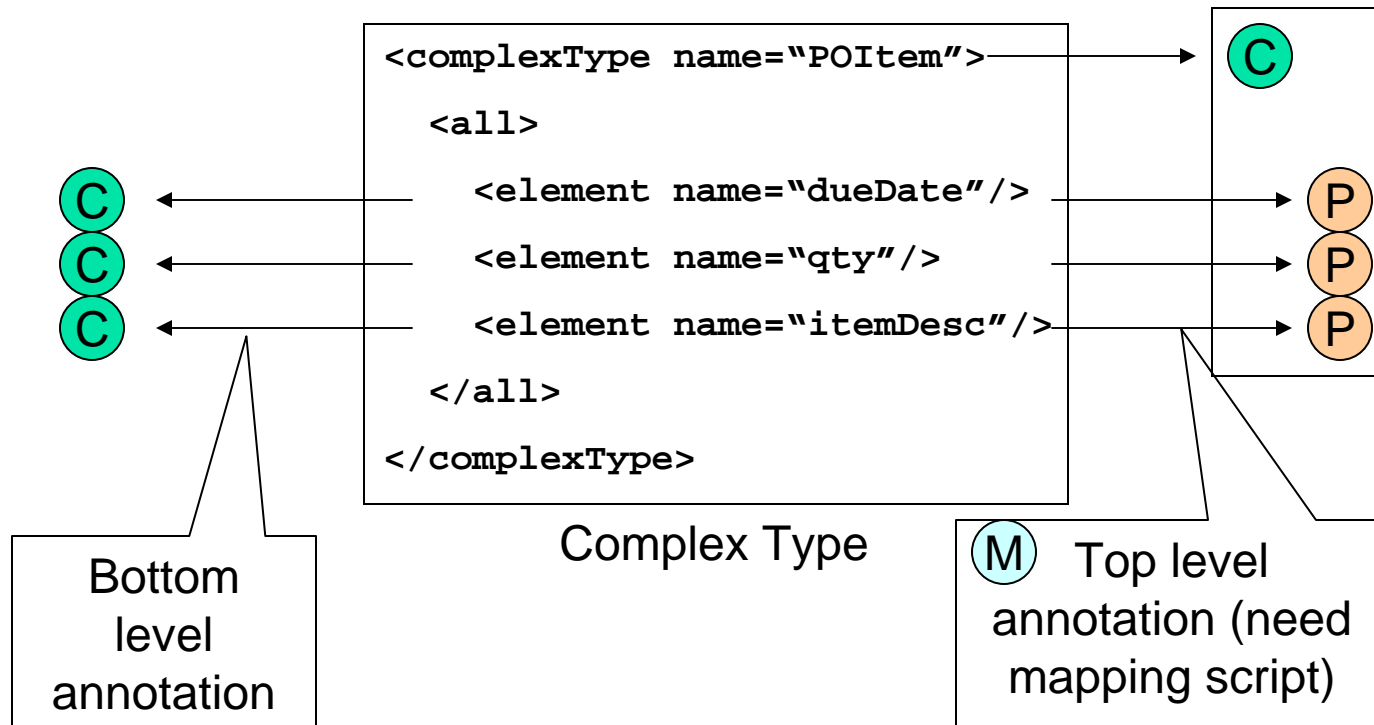
Technical Details

- Mapping preconditions and effects
- Mapping parameters
 - If a WSDL element uses a simple xs type (string, integer, etc.) use *wssem:modelReference* to point to a class (OWL class)
 - If a WSDL element uses a complex type
 - Bottom level annotation
 - Top level annotation

Mapping Complex Types

- Bottom level annotation
 - Only annotate leaf elements with semantic classes (*wssem:modelreference*)
- Top level annotation
 - Annotate the top level node with semantic class (*wssem:schemaMapping*)
 - Define script to map lower level nodes to semantic class attributes

Mapping Complex Types (cont.)



Mapping Complex Types (cont.)

- *wssem:schemaMapping* has higher priority than *wssem:modelreference*
- Both ways can be combined if dealing with complex types within a complex type

Service Categorization in WSDL-S

- Define *wssem:category* tag within WSDL to describe category name, taxonomy URI and taxonomy code
- Where in OWL-S, we use profile hierarchical structure to define service class

Possible Issues

- No mapping script for simple type mapping or bottom level annotation. However, values of semantic parameters are not always identical to values of syntactic parameters
- Does not support many (semantic parameters) to one (web service parameter)
- Too flexible (model, script, rule language)

Comments about WSDL-S

- Incremental approach is always easy to be accepted
- Similar approach can also be applied on other service description languages
 - We once considered UPnP-S
- Like OWL-S, it needs a good transformation script too

Demo

Data Dictionary Links

- Introduce *owl:samePropertyAs* and *owl:sameClassAs* into WSDL
- Map elements, services to OWL properties and OWL classes

Approach 3

WSDL-RDF Mapping

- Transform WSDL description to RDF
- Latest draft (draft 4) available at <http://www.w3.org/TR/wsdl20-rdf/>
- Mapping every WSDL tag to an OWL class or an OWL property

Finally

An Interesting Comparison*

	OWL-S	SWMO /FLOW S	WSMO	WSDL-S
Services	General		Web Service	
How semantics are given	From Semantic Service Description to (Web) Service			WS to Semantics
Interaction Model	Orchestration		Choreography Orchestration	No Model

* By Dr. Ryusuke Masuoka

Reference

1. Web Service Semantics – WSDL-S
(<http://lsdis.cs.uga.edu/library/download/WSDL-S-V1.html>)
2. Use data dictionary links for XML and Web services schemata (<http://www-128.ibm.com/developerworks/xml/library/x-tipdict.html>)
3. Web Service Description Language (WSDL) Version 2.0: RDF Mapping
(<http://www.w3.org/TR/wsdl20-rdf/>)