



On Reconciliation of Contractual Concerns of Web Services

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Talk outline

- Service contract - overview
- What is the problem?
- Issues
- Reconciliation and further investigation
- Our early results
- Conclusion and next steps

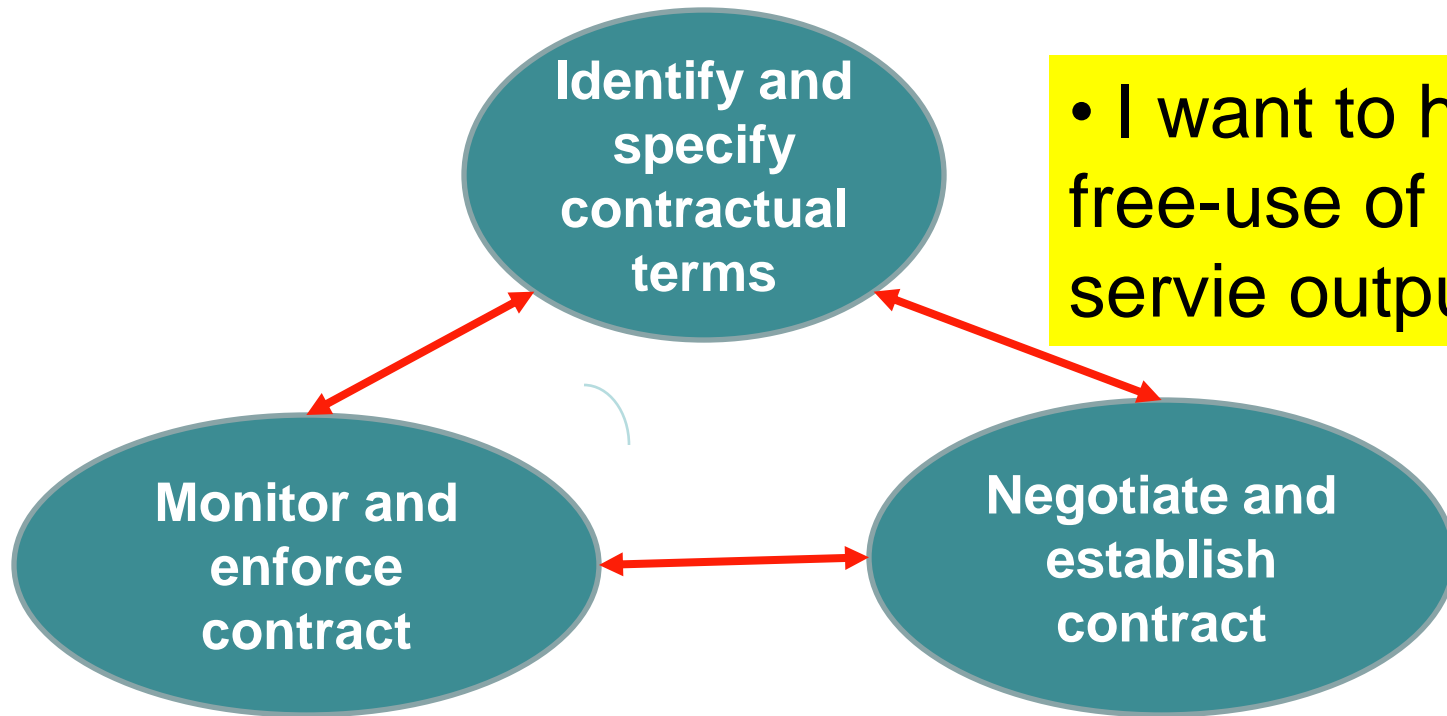
Service Contracts – The Context

- Impact of Web services, SaaS, DaaS and Service Utility
 - On demand service provisioning and usage, dynamic composition/mashup of services
 - Service Interoperation
 - Enterprise utilizes heterogenous services from different providers
 - A service may have different contracts
 - A service is implemented as Web service
- *Service usage is bound with service contracts, which are much more than QoS!*

Service Contract

- By definition (at operational level)
 - *a formal agreement between two or more involved parties*
- What is defined in a service contract
 - QoS (including security),
 - Business (e.g., cost)
 - Legal (e.g., warranty, limit of liability, law enforcement)
 - Intellectual Property Right (IPR) (e.g., commercial use, free, ownership)
- Not only for the use of services but also for the output of the services

Service Contract: basic phases



- I want to have free-use of the service output

- You provide incorrect data
- Your QoS is not met

- OK, we agree you pay 10K and we take no liability for a free-use of the service output

Existing works in Service Contracts

Approaches	QoS	Business	Legal	IPR	Phases
<i>WSLA</i> [4, 13]	+	+			specification, monitoring
<i>WS-Agreement</i> [5]	+	+	+		specification, monitoring, negotiation
<i>SLAng</i>	+	+			specification, monitoring
<i>WSOL</i> [7]	+	+	+		specification, negotiation
<i>WS-Policy</i> [8]	+				specification
<i>WSPL</i> [9]	+				specification
<i>ebXML CPP/CPA</i> [10]		+			specification
<i>ODRL-S</i> [11]	+	+	+	+	specification
<i>WSMO</i> [12]	+				specification

- Current works mainly support the specification phase
- Do not address the combination and interoperability among different types of specification

What is the problem actually?

- Play a customer role
- Try to compose/utilize software-as-a-service in a process
 - N services from different vendors
 - N services are heterogenous: they offers different functionalities
- What if (actually it is true)
 - Each service has different set of contract terms

Issue 1: Contract Specification in WS

ODRL-S

```
<sl:responsetime>  
  <o-dd:range>  
    <o-dd:max> 3 </o-dd:max>  
  </o-dd:range>  
</sl:responsetime>
```

WSLA

```
<Predicate xsi:type="Less">  
  <SLAParameter>ResponseTime  
  </SLAParameter>  
  <Value>3</Value>  
</Predicate>
```

ODRL-S

```
<o-dd:peruse>  
  <o-dd:payment>  
    <o-dd:amount o-  
dd:currency="`EUR">  
      2.00 </o-dd:amount>  
    </o-dd:payment>  
</o-dd:peruse>
```

WSOL

```
<wsol:price name="Cost" ">  
  <wsol:numberWithUnitConstant>  
    <wsol:value>2.00</wsol:value>  
    <wsol:unit type="Currency:EUR"/>  
  </wsol:numberWithUnitConstant>  
</wsol:price>
```

Issue 1: Contract Specifications in WS

- Not all service contracts are specified with the same specification
- Not well reusable (e.g., duplicate effort), not consistent (different syntaxs, vocabularies and terminologies)
 - Prevent automatic negotiation and establishment
 - Very hard to conduct contract compatibility analysis
- Specification typically focuses on a particular purpose
 - How to exploit their best features through the combination?

Issue 2: Contract Negotiation and Establishment

- Business, QoS and warranties (in legal) can be negotiated but how do we negotiate some aspects of IPRs, such as „no commercial use“
- Negotiation requires common understanding of contractual terms but terms are specified in different ways
 - Ontology and template-based negotiations are not fully applied to the case of composition
- Contract negotiation in composite services
 - Only point-to-point negotiation and establishment

Issue 3: Contract Monitoring and Enforcement

- Many QoS terms are measurable but are their measured values trusted ?
 - Need third parties playing as a certified authority
- How to monitor and enforce legal and IPR terms?
- Monitoring and enforcement of service contracts are not well researched and not strong enough to solve these issues
- WSLA (Keller et al., 2003), PANDA (Gimpel et al., 2003), Skene et al. (WOPS'07)

Reconciliation and Investigation

- Question 1: *can we have a single language to represent all contractual concerns?*
- It seems „no“ from service providers
 - Need a set of common vocabularies
 - Need a way to model and manage multiple specifications
- Play a consumer role:
 - We need a common language to ask for contracts
- How schema mapping, meta-model and domain-specific language can help?

Reconciliation and Investigation (cont.)

- Question 2: *Though there is no unified language, do the existing languages/standards satisfy the requirement of consumers for representing contractual concerns?*
- Most specs are low level for service consumers
- No simple, preference-based consumer-specified contract specifications
- How the consumer wants to specify its requests ?

Reconciliation and Investigation (cont.)

- Question 3: *Can we manage contracts associated with service instances separately from WSDL?*
- Existing works assume contracts included in service description
 - In real business it is not the case
- With SaaS, how to map from contracts to customer's service instances?

Reconciliation and Investigation (cont.)

- Question 3: *Can we use different contract negotiation/ compatibility algorithms, even though we do not have a unified approach?*
- Negotiation is still very much manual
 - We need fully or partially automatic negotiation
- Composition of services → composition of negotiation algorithms
 - An algorithm might work with a particular specification
- Composition of contracts for composite services requires ***contract compatibility checking***

Reconciliation and Investigation (cont.)

- Question 3: *Is real time monitoring and enforcement of the contractual concerns, in particular, legal and intellectual right terms, of dynamic Web services possible?*
- Providers and consumers involvement is not enough as usually assumed
 - SaaS model in third parties for monitoring and enforcement?, e.g., payment done through Amazon Flexible Payments Service
 - Joint control in virtual organizations (Smith et al., Grid 2003) might help
- Legal and intellectual rights terms cannot be fully automatically monitored

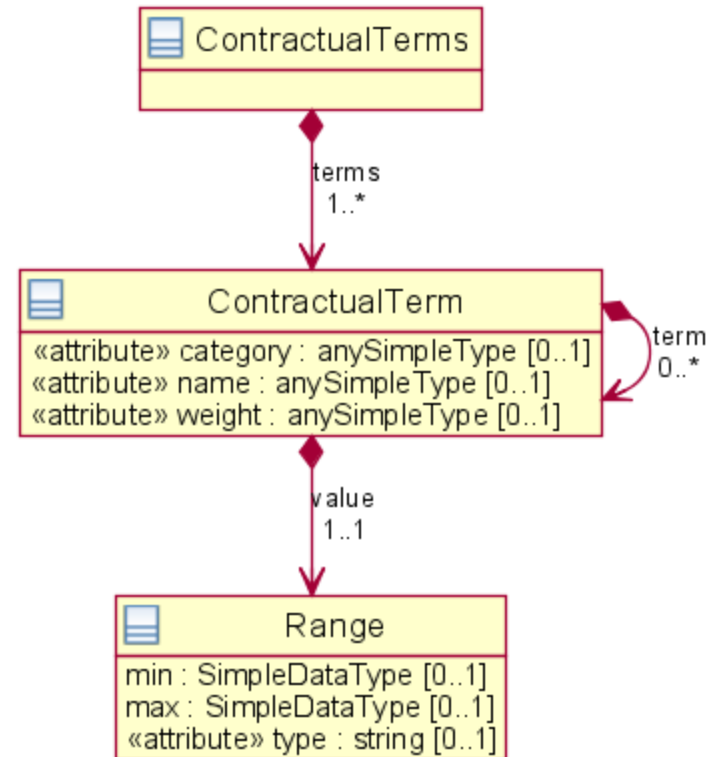
Some our early results: Contract Management

- WS contracts as a separate type of information of Web services, associated with Web services instance
- Support multiple types of specification
- Used in monitoring and enforcement, contract discovery and compatibility checking

```
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  <id>urn:uuid:7d9ff727-ee11-4c89-a4fc-
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  <entry>
    <title>Interface</title>
    ...
    <link href="http://.../Interface"
rel="alternate" type="application/wsd1+xml"/>
  </entry>
  <entry>
    <title>Licence</title>
    ...
    <link href="http://.../Contract1"
rel="alternate" type="application/atom+xml"/>
  </entry>
</feed>
```

Some of our early results: Consumer-specified contract request

- Consumer-specified contract specification
- Hierarchical model, organized into importance level
- XQuery with embedded SPARQL query support for matching



Summary and next challenges

- SaaS and service composition need to deal with the service contract interoperability
 - Not only at the specification level but also the operation level
 - Require service contract interoperability and compatibility solutions
- We have many open questions for you to research
 - Can we address some in NFPSLA-SOC 09 ☺ ?
- Our next steps: answer the questions
 - **Compatibility checking**
 - **SaaS model for contract enforcement for services**

Thanks for your attention!
Feedback, suggestion, research collaboration
are more than welcome!

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