Dealing with Interoperability:
An Agent–Oriented Perspective

Klaus Fischer
German Research Center for Artificial Intelligence
DFKI GmbH
Saarbrücken, Germany
Designing Service-Oriented Architectures

Production

Retail

Logistics

Taxes
Semantic Services vs. MDA/MDD

- **Precondition**
- **Service/Action**
- **Effects**

**Ontology**

**Metamodel**
Interactions in SOA

- $m_1$ = Request
- $m_2$ = Reply
- $m_3$ = Reply
FIPA Specifications for Agent Communication

One of the most relevant specifications for agent
- Message-exchange sequences
- Set of basic actions (structure + semantic)
- Message definition:
  - Structure
  - Representation
  - Transportation details

FIPA Communication Specification Stack:

<table>
<thead>
<tr>
<th>Interactions Protocols</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speech Acts</td>
</tr>
<tr>
<td>FIPA ACL Message</td>
</tr>
<tr>
<td>Transport Message</td>
</tr>
<tr>
<td>Message Contents</td>
</tr>
<tr>
<td>Representation</td>
</tr>
<tr>
<td>Message Envelope</td>
</tr>
<tr>
<td>Representation</td>
</tr>
</tbody>
</table>
A FIPA and WS–Addressing Mapping

**FIPA Message Properties**

- **Receiver**
  - name
  - address
  - resolvers

- **Sender**
  - name
  - address
  - resolvers

- **Reply-to**
  - name
  - address
  - resolvers

**Performative**

- **Reply-with**
- **Conversation-id**
- **In-Reply-to**
- **Language**
- **Encoding**
- **Ontology**
- **Protocol**
- **Reply-by**
- **User defined**
- **Content**

**WS-Addressing EPR**

- [destination]
- [TargetAID]
- [source endpoint]
- [reply endpoint]
- [fault endpoint]
- [action]
- [message id]
- [Conversation-ID]
- [relationship]
- [Language]
- [Encoding]
- [Ontology]
- [Protocol]
- [Reply-By]
- [User-Defined]

**BODY**

- **Strict relation**
- **Optional relation**

---

EISB June 2009
## Transformation of SOA into a Message-Oriented Architecture

### FIPA Interaction Protocols

<table>
<thead>
<tr>
<th>Collaboration Description (WS-CDL)</th>
<th>Service Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semantic Description (OWL-S, etc)</td>
<td>Semantic Description (OWL-S, etc)</td>
</tr>
<tr>
<td>Interface Description (WSDL)</td>
<td>Interface Description (WSDL)</td>
</tr>
</tbody>
</table>

### Contents

- FIPA- Speech act library (XML+Sem.desc.)
- FIPA- Message Envelope Specification
- WS- Envelope (WS-Addressing)

### Messaging (SOAP)

- Communication (HTTP, SMTP, FTP,...)
Semantics of Basic Communicative Acts

Inform(A)

Inform(is_true(A))

request(do_you_know(A))

Reply(yes)

request(is_true(A))

Reply(?)
Process Alignment

Flowchart:

- Send Order
  - Receive Product
  - Receive Invoice
  - Send Payment

- Receive Order
  - Send Product
  - Receive Invoice
  - Receive Payment

Diagram showing the process flow between different stages of order, product, invoice, and payment.
Proposal for Research Topics

- Integration of semantic service descriptions with model-driven development of service-oriented architectures
- Definition of an appropriate communication ontology and envelope language
- Representation of models and metamodels as well as formalisms to describe the semantics of models
- Automated test environments for checking model compliance and model compatibility
- Improve the implementation of tool chains for model-driven system development