Process Interoperability with Semantic Web Services

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DERI … About Us

- DERI = Digital Enterprise Research Institute
- established in 2002
- Director: Dieter Fensel
- Mission: “make semantic technologies a reality”
  - Ontologies
  - Semantic Web Services
  => Semantically Enabled Service-Oriented Architectures
- public funding & industrial cooperations
- 120 members world-wide
Content

• Semantic Web Services
  – Aim & Approach
  – The Web Service Modeling Ontology WSMO
  – Semantic SOA

• Process Interoperability
  – Web Service Interfaces
  – Process Level Mediation
  – Process Mediation Patterns
Web Services

Deficiencies of WS Technology

- current technologies allow usage of Web Services
- but:
  - only syntactical information descriptions
  - syntactic support for discovery, composition and execution

=> **Web Service usability, usage, and integration needs to be inspected manually**
  - no semantically marked up content / services
  - no support for the Semantic Web

=> current Web Service Technology Stack failed to realize the promise of Web Services as basis for SOA
Semantic Web Services

Request

Discoverer

Communication Conformance

Composer

Executor

Service Repository

Data Mediator

Process Mediator

if: directly usable
uses
if: composition needed
uses
if: composition (executable)
uses
if: compatible
uses
if: execution error
uses
if: successful
uses
else: try other WS
matchmaking R with all WS
if: needed
uses
if: usable
uses
if: compatible
uses
if: executable
uses
if: submission
uses
if: information lookup
uses
else: try other WS
if: successful
uses
else: try other WS

Objectives that a client wants to achieve by using Web Services

Formally specified terminology of the information used by all other components

Semantic description of Web Services:
- Capability (functional)
- Interfaces (usage)

Connectors between components with mediation facilities for handling heterogeneities

Core Elements for SESA

W3C Member Submission 04/2005
WSMO Web Service Description

Non-functional Properties
- complete item description
- quality aspects
- Web Service Management

Capability
- Advertising of Web Service
- Support for WS Discovery

Web Service Implementation
(not of interest in Web Service Description)

Realization of functionality by aggregating other Web Services
- functional decomposition
- WS composition

Choreography --- Service Interfaces --- Orchestration

VTA example:
- Choreography = how to interact with the service to consume its functionality
- Orchestration = how service functionality is achieved by aggregating other Web Services
Process Level Mediation

- Only if the two match precisely, a direct communication may take place
- not a priori compatible behavior interfaces for communication & information interchange => **behavioral incompatibility**

![Diagram of process level mediation](image)

- partially resolvable by **process mediation patterns**

Patterns for Resolvable Mismatches

- can resolve about 80% of process level mismatches
Unresolvable Mismatches

Process Mediation Example
Process Mediation Example

REQUEST
- itinerary[origin, destination, date]
- time
- price

Processes Mediator
- origin
- destination
- itinerary[origin, destination]
- date
- itinerary[route, date, time, price]

SERVICE

making semantics real.
Process Mediation Example

REQUEST
  itinerary[origin, destination, date]
  time
  price

Processes Mediator
  origin
  destination
  itinerary[origin, destination]
  date
  itinerary [route, date, time, price]

SERVICE

making semantics real.
Process Level Mediation in WSMO Mediators

Source → WSMO Mediator → Target

Specification layer
Implementation layer

Mediation Services

Process Mediation Service

design time
- analyzes formal interface descriptions
- defines process mediation schema

runtime
- executes process mediation
- integrated with data mediator

Properties
- implemented for WSMO interface description language (ontologized Abstract State Machines)
- computationally very expensive
  - EXP time
  - many reasoning steps

WSMX (WSMO Reference Implementation)

Open source code base at SourceForge: http://sourceforge.net/projects/wsmx/
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