The OASIS Applications Semantic (Inter-) Connection Framework

Dionisis Kehagias, CERTH/ITI
Contents of this presentation

• Interoperability problems in OASIS
• The OASIS application integration paradigm
• The Content Anchoring and Alignment Tool
• OASIS ontologies
OASIS Interoperability problems
Inter-domain group of services

- **INDEPENDENT LIVING**
- **SOCIALISATION**
- **AUTONOMOUS MOBILITY**
- **SMART WORKPLACES**
OASIS Independent Living Applications

- Nutritional Advisor
- Activity coach
- Brain and skills trainer
- Social communities platform
- Health monitoring
- Environmental Control
Motivation for Interoperability

• A wide range of target services and applications are available in different flavours
  ▪ One or more target Web services or family of WS may be provided by different service providers
  ▪ Many web applications exist by different vendors that provide the desired functionality
  ▪ Hardware devices

• How can we exploit all the available possibilities in the same development and integration framework?
The OASIS application integration paradigm
The OASIS approach

• **Goal:**
  - To create a framework that allows each interested party (service provider-application developer, hardware supplier) to register their assets in a common fashion.
  - Use service of different conceptual domains, e.g. an application can use and combine services of different providers transparently.

• **Approach**
  - “Functionality” of each asset to be exported in the form of (SOAP) web services
  - All assets are described by **ontologies** provided in an open way
  - Tools to allow **seamless integration** of services and devices
  - Each provider should adhere to the OASIS business model in order to be an OASIS-compliant provider
Why Web services?

- Language agnostic
- Can be called from any platform or client type
- Can be called remotely via HTTP requests
- Run on the web
- Easy to expose web methods to interested callers
- Designed to be consumed by machines
OASIS Conceptual Architecture

User-Space
- Applications
  - Activity Coach
  - Nutritional Advisor
  - Health Monitoring
  - Brain Trainer
  - Environmental Control
  - Social Network
  - Transport Information
  - Route Guidance
  - Personal Mobility
  - Smart Workplace
- UI Framework
- User Profile

OASIS Platform
- COF governs
- CAAT manages
- OR

Provider-Space
- Services
  - Health Monitoring
  - Emergency Center
  - Telematic
  - Map Update
  - Transport
  - Tourism
  - Leisure

AMI Framework

Trust & Security Framework
The Concept Anchoring and Alignment Tool
CAAT Purpose

• The purpose of Concept Anchoring and Alignment Tool (CAAT) is to
  ▪ align the functionality of the provided services and/or devices with the ontologies stored in the ontology repository (ORATE).

• What do we mean by “align” services?
  ▪ A service is “aligned” when it (and its structural components) are (semantically) matched with specific entities and components from the ontology.

• Why “align” services?
  ▪ Once a service and its components are aligned, they are visible in the OASIS architecture. They can be invoked transparently through appropriate API and participate in complex workflows.
Research challenge

• How to automatically recognise WS semantics by WS structure and elements (data types, parameter names, etc.)
  ▪ Semantic categorisation of a WS into application domains
  ▪ Semantic categorisation of WS operations into “ideal” operations defined in terms of an ontology
  ▪ Semantic categorisation of the WS operation i/o parameters into ontology concepts

• Web service categorisation is important for semantic annotation of services.

• This helps the dynamic creation of service catalogues and facilitates **service search and discovery**.
Services Alignment with Ontologies

ReserveAFlight

- originatingFrom
- destinationTo
- paymentMethod

MyService
Inside a WSDL file

Web service hierarchical structure

Service
- Operation
  - Inputs
    - primitive
  - Outputs
    - complex
Web service categorisation

In the 2\textsuperscript{nd} and 3\textsuperscript{rd} layers our goal is to classify WS operations and their i/o parameters with respect to the ontologically defined counterparts.
Service Ontology

- Associates an operation to its input parameter
- Associates an operation to its output parameter
- Associates an operation to an application domain
- Associates an i/o parameter to a data type
- Defines if an operation is ideal or real
Open Ontology Repository

http://orate.iti.gr/

Welcome to ORATE

Use ORATE (Ontology Repository for Assistive Technologies) to access and share ontologies that are actively used in OASIS project. You can search for terms in ontologies (try typing "Device" or "Sensor" in the "Search all ontologies" box in the left column), browse a list of ontologies in ORATE (type "Building" in the "Find an ontology" box in the middle column), link your own project that uses ontologies to the description of those ontologies, find and create relations between terms in different ontologies, review and comment on ontologies and their components as you browse them. Sign in to ORATE to submit a new ontology or ontology-based project, provide comments on ontologies or add ontology mappings.

Most Active Ontologies

<table>
<thead>
<tr>
<th>Ontology</th>
<th>Version</th>
<th>Notes</th>
<th>Mappings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trip</td>
<td>0.1</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>OS-Buildings-and-Places</td>
<td>1.1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Transportation</td>
<td>1.0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Building architecture</td>
<td>0.1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>General Purpose Ontology</td>
<td>1.0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Statistics

| Ontologies | 48 |

Latest Notes

levels of buildings
OS/Environment v1 Level (Building architecture) 11/04/09 normann
Second floor of an office building

gist Building (GIST) => Building (OS-Buildings and Places)
12/22/09 bateman

Building (OS-Buildings-and-Places) => gist Building (GIST)
12/22/09 bateman

gist Building (GIST) => BuildingArchitecture:Building (Building architecture)
12/22/09 bateman

BuildingArchitecture:Building (Building architecture) => gist Building (GIST)
12/22/09 bateman

gist Building (GIST) => BuildingArchitecture:Building (Building architecture)
12/22/09 bateman
Basic CAAT Functionalities
CAAT features

- Downloadable standalone Java application with auto update
- Semi-automatic web service semantic categorisation in domain/operation/parameter
- Creation of new service ontologies
- Business-rules editor for specifying business policies
- Business process editor for web service composition
- Invocation of services and business processes
Supported Functionalities

1. integrate services into the platform,
2. manually invoke one registered service,
3. edit information (meta data) about the aligned WSs,
4. edit already aligned services,
5. change personal information,
6. link “ideal” operations (i.e. operations defined in the ontology),
7. create new business processes,
8. download the latest ontology,
9. log out.
Adding a new service

Please type in the URL location of the WSDL that describes your Web service or choose a file:

http://10.50.51/WebServices/Service.asmx?WSDL

Current Classification Model: optimal

Available Classification Models:

| optimal |

Create New Classification Model

Details:

- Data Preparation Parameters
- Word Parsing Parameters
- Word Stemming: true
- Singularize: true
- Feature Occurrence Frequency
- Negative Dictionary: true
- Word Minimum Length: 2
New service domain classification

manually change the domain
Alignment of operations

• The user has three methods to choose from

Select Classification Method:

- Data Mining and Classification (2nd Level)
- Data Mining, Classification and Lexicographic (2nd Level)
- Data Mining, Classification and Lexicographic (2nd & 3rd Level)
Alignment of operations and i/o parameters
Service Invocation
Service composition
Service composition supported in CAAT

- A drawing canvas and a toolkit allows the graphical design of any business process
- Web services as well as devices can be connected within the same business process
Use case: Integrate a force sensor along with other web services in order to control home lights (or any other appliance) from distance
Graphical Representation of the Business Process

Start

Call WakeUpSensor

Call GetSensorValue

Wait 2 seconds

Is SensorValue Greater Than 10?

false

true

Call TurnOnLights service

Call ShutDownSensor

End
Live demonstration of CAAT during the break...
Outlook

• Increased classification accuracy
• Support more web service protocols (e.g. Restful)
• Automatic semantic web service composition
Relevant Publications

Contact Details

Dimitrios Tzovaras, PhD
Researcher A’ (Full Professor)
e-mail: Dimitrios.Tzovaras@iti.gr
t: +30-2311257777

Dionisis Kehagias, PhD
Senior Research Associate
e-mail: diok@iti.gr
t: +30-2311257716

http://www.iti.gr