WSDir: a Federated Directory System of Semantic Web Services

Michael Schumacher, Tim van Pelt, Ion Constantinescu, Alexandre de Oliveira e Sousa, Boi Faltings

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michael.schumacher@epfl.ch
alexandre.deoliveiraesousa@epfl.ch
Web Services Discovery
Semantic interoperability is a major issue for
- Locating services
- Invoking services
- Understanding

It can lead to problems such as:
- A request may ask values in *Fahrenheit* and not in *Celsius*

The inclusion of ontologies can solve the interoperability problem
- Overcome differences in terminology
- Mapping between ontologies
Semantic WS Discovery

Need to support:

- Dynamic service composition
- Declarative service description
- Flexible service matching
- Secure Service Execution & monitor

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<tr>
<th>Dynamicity</th>
<th>Web Services</th>
<th>Intelligent Web Services</th>
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<td></td>
<td>UDDI, WSDL, SOAP</td>
<td>RDF, RDF(S), OWL</td>
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Introduction

- Distributed Web Services discovery system
- Developed by EPFL for the CASCOM project (EU funded)
- Open Source
- 100 % Java
- Web Service itself
- Configuration and Messages in FIPA SL0*
Requirements

- **Finding services:**
  - Register and Search service descriptions
  - Coarse-grained text or keyword search
  - Semantic search
  - Mechanisms for multiple service description

- **Distribution:**
  - Flexible directories (loosely coupled, extendable & robust)

- **Integration:**
Model

- WSDir consists of storing entities (Directory Services) that register both Service Descriptions and Directory Descriptions.
- Directory Services serves all operations.
- Service Description are expressed with FIPA SL0*.
  - Allowing different service description languages i.e.: owl-s.
- Directories Description are also expressed with FIPA SL0*.
XML SOAP messages encapsulate SL0 objects

sender

receiver

input

language

protocol

content

identity-info

directory-id

directory-token

structured-object

lease-time

Actor-identifier

Credentials

ServiceProfileURI

ServiceModelURI

ServiceGrounding

FullServiceDescription

ServiceCategories

ServiceCategory

name

code

value

taxonomy

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Directory Service VS Directory

- Directory service:
  - Unit of registration, both for functional & other directory services
  - Serves all operations

- Directory:
  - virtual cluster of service entries stored in one or more directory services:
    - Domain directories: content specific
    - Network directories: network specific
A Directory Service serves:

- **Registration** of a service description entry for a time period. Returns a unique index.
- **Deregistration** of a service given its index
- **Modification** of a registered service its index
- **Get Profile** gives meta-information on the directory service
- **Search** of services matching a template:
  - Category-based
  - Grounding-based
  - Semantic-based (using OWLS-MX)
Operations - Search

- Constraints can be associated to a Search:
  - Maximum time of the query
  - Maximum number of results
  - Maximum depth* of the search

- Returns an SL0 object containing either:
  - Services grounding
  - Service URI
Policies in Directory Services

Directory Service policies
(directory, operation, policy)

Hospitals : search : secAuth
Body : register : child
Body : search : policy-3
* (default) : register : policy-4
Policies in Directory Services

- **Network topology emerges from:**
  - Federation entries in one another
  - Directories Services interaction by application of the policies

- **Two types of policies:**
  - **Reactive policies** bind a behaviour to an operation-directory combination
  - **Proactive policies** are autonomous policies, independent of operations
Policies - hierarchy
Policies - hierarchy
WSDIR Federation I
WSDIR Federation I
WSDIR Federation I
WSDIR Federation I
9 Directory Services
3 Network Directories (A B C)
2 Domain Directories (A B)
Registrations of Directory Description
- In each network, all Directories Services registers in each others
- D3C, D3B and D3A Directories Services register in each other
  - Accessibility to all networks

Policies
- Sibling Search/registration/… forwards requests throughout the federation
CASCOM

Wireless Access Domain A

Applications

Agent Architecture

IP2P Network Environment

Wireline Access Domain

Wireless Access Domain B

www.ist-cascom.org
Use case

0. patient becomes sick
Use case

0. Patient becomes sick
1. PA calls 112
   1'. PA calls EMA
2. 112 calls ambulance
2'. Contacts HH for data
3. Sends data to ambulance
3'. Provides data for 112
Use case

0. Patient becomes sick

1. PA calls 112

1'. PA calls EMA

2. 112 calls ambulance

3. Sends data ambulance

3'. Provides data for 112

4. LH asks for patient data

5. LH asks for translation of patients symptoms

5'. EMA asks for further examinations

6. EMA arranges repatriation

2'. Contacts HH for data

4'. EMA calls insurance

6'. EMA admits patient to private LH

7. Repatriation of patient
Topology – IP2P layer

Outside world requests
Policies
Use case – search I

Introduction
Wsdir  Cascom  Conclusion
Use case – search II
Robustness

Directory Service on a server operating as a web service

Available access for the SDA

Registered in the SDA
Robustness II

Directory Service on a server operating as a web service

Registered in SDA

Available access for the SDA
Robustness III
Robustness IV
What’s next

- Scale WSDIR capacity
- Real-time re-configuration
- XML persistence storage and XQuery
- User friendly interface

http://liawww.epfl.ch/wsdir
Robustness V