Contextual Service Interoperability

Thomas Strang <thomas.strang@dlr.de>
DLR Oberpfaffenhofen
Interoperability Levels

- What is Context
  - Definitions
  - Examples

- Why own level?

- Contextual Interoperability
  - Model View
  - Interface identification

- Context Ontology Language
  - Open Issues + Discussion
What is Context (1/2) ?

Definition of Context Information

“A context information is any information which can be used to characterize the state of an entity concerning a specific aspect”

“An entity is a person a place or in general an object”

“An aspect is a classification, symbol or value-range, whose subsets are a superset of all reachable states”

Example:

Entity: Telephone
Aspect: Call State
Context Information: specific state

\[
\text{CI}( \text{entity}=+4917912345, \text{aspect}=\text{callState} ) = \{ \text{off-hook} \} 
\]
What is Context (2/2) ?

Definition of Context

▶ “A context is the set of all context information characterizing the entities relevant for a specific task in their relevant aspects”
▶ “An entity is relevant for a specific task, if its state is characterized at least concerning one relevant aspect”
▶ “An aspect is relevant, if the state with respect to this aspect is accessed during a specific task or the state has any kind of influence on the task”

Example:

Task: traveller reaching plane using public transport

<table>
<thead>
<tr>
<th>Relevant Entities</th>
<th>Context: all CI of relevant aspects</th>
</tr>
</thead>
<tbody>
<tr>
<td>• traveller</td>
<td>➔ willingness to spend money</td>
</tr>
<tr>
<td>• carrier (taxi, train, bus...)</td>
<td>➔ duration/delay, cost</td>
</tr>
<tr>
<td>• infrastructure (roads...)</td>
<td>➔ delay</td>
</tr>
<tr>
<td>• plane to reach</td>
<td>➔ time of departure + buffer</td>
</tr>
</tbody>
</table>
Definition of **Context Awareness**:

“A system is *context aware* if it uses any kind of context information before or during service provisioning or service usage”

**Location Awareness** is special issue of Context Awareness (but by far not the only one!)

**Two main benefits from Context Awareness:**

- Adaptation of services to changes in environment reduces amount of interaction with user
- Improvement of UI (particularly on small mobile devices)
Context: Why own interoperability level?

-\textbf{eases separation of services} which are interoperable on classic levels, but not on context level (and vice versa)
  \begin{itemize}
  \item Example: electronic public transport timetable service
  \end{itemize}
- context is \textbf{not covered very well} in classic levels
- enables \textbf{thematic concentration} for correctness and integrity
Interoperability in Middleware

Middleware Task:

- Interoperability Evaluation during Service Discovery
  - service search (feed)
  - service selection (feed back)

- Interoperability Evaluation during Service Execution
  - lifecycle monitoring and management
  - notification about and adaptation to context changes
  - inter-provider handover

service A
compatible with
substitutable by
service B
MNM Service Model: Service View

Interoperability in Extended M2M S-Model

Context Ontology Language
Design of Context Ontology Language (CoOL)

- XML & XML schema based
  - probably based also on RDF

- used to model
  - aspects defining valid context information
  - relevance conditions
  - actors and dependencies

- enables dynamic (at runtime) multi-party service interoperability checks at new context level

- CoOL is employed during service discovery and execution to negotiate and monitor context to enable context awareness of middleware and services

- Middleware uses CoOL statements to link distributed object-associated context information with context un-aware objects and services
Open issues: Current Investigations on CoOL

- **Pure XML schema vs. RDF / RDF Schema**
  - complexity of RDF/RDFS vs. resource limited devices
  - some drawbacks of RDF have already been identified e.g. in [Haustein2001] [Furche2001] [Indulska2003]
  - but significant body of work has been done with RDF

- **“Plugin Model” to DAML-S vs. Standalone Model**
  - DAML-S / DAML+OIL adds additional complexity

- **WebOnt (OWL) vs. minimum language**
  - OWL in very early state
Summary

- **New context level** of service interoperability
  - advantages particularly in Ubiquitous Computing Environments

- **Clear definitions** what context is and what not
  - Introduction of the **aspect**
  - affiliated context awareness
  - Examples

- **Context extension** of the MNM service model
  - Identification of interoperability requirements

- **Outline** of Context Ontology Language (CoOL)
  - still some major open issues
Thank You!

Any Questions?

Dipl.-Inform. Thomas Strang
mailto:thomas.strang@dlr.de
http://www.dlr.de/kn/kn-s/strang

German Aerospace Center (DLR)
Site Oberpfaffenhofen
Institute of Communications and Navigation (KN-S)
PO Box 1116
82230 Wessling-Oberpfaffenhofen
Tel: +49-8153-28-1354
Fax: +49-8153-28-1871