A model driven approach for supporting the cloud target selection process

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Context of Cloud Target Selection

- **ARTIST** EU Project
- Aims at facilitating the transformation and migration to the Cloud
- CTS focus: *Selection of Cloud Target for the migration*
  - Load of information
  - Multi-criteria decision making
- Model Driven approach
Cloud Target Selection tool
Interactions

- CloudML@artist
  - UML profiles
  - Descriptions of Cloud Providers/Cloud Environments

- User input
  - Set the criteria
  - Set preferences
CTS tool
User Interface

- View the Candidate Selection Criteria
- Prioritize the criteria
- Choose the Candidate Cloud Providers
- Choose the Actual Selection Criteria
- View the RESULTS
CTS tool Overview (1)

User Interface

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CTS tool Overview (1)

User Interface

- View the Candidate Selection Criteria
- Prioritize the criteria
- Choose the Candidate Cloud Providers
- One Score for each Provider
- View the Actual Selection Criteria
- View the RESULTS
CTS tool Overview (2)

Methodology Steps

1. Dynamic Information Extraction
2. User’s inputs (Criteria, providers, priorities)
3. Model Queries: Which providers fulfill which criteria
4. Score Assignment
5. Weights/Conjoint Analysis

Model Driven part

Decision Making part
Model Driven part

- Extraction of criteria from UML Profiles
- Intermediate Data Model
- Model Queries (Three types identified)
- Query Execution on providers profiles
- Query Results processed for the decision making part
Model Driven part

Extraction of criteria from UML Profiles → Intermediate Data Model → Model Queries (Three types identified)

Query execution on providers profiles

Query results processed for the decision making part
Model Driven part

Extraction of criteria from UML Profiles → Intermediate Data Model → Model Queries (Three types identified)

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Extraction of criteria from UML Profiles → Intermediate Data Model → Model Queries (Three types identified)

Query Execution on providers profiles

Model Element

- Helper Element
- Leaf Element

Service Element
- Enumeration Property
- Leaf Property

Leaf High Level Evaluation Property
Model Driven part

Extraction of criteria from UML Profiles → Intermediate Data Model → Model Queries (Three types identified)

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Extraction of criteria from UML Profiles → Intermediate Data Model → Model Queries (Three types identified)

Query Execution on providers profiles → Query Results processed for the decision making part
Layer 1: One score for each group of criteria for each provider

<table>
<thead>
<tr>
<th></th>
<th>HLE query</th>
<th>Boolean query</th>
<th>Composite query</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>poor: $s_i = 0$</td>
<td>exists: $s_i = 1$</td>
<td>found n out of m ($n \leq m$): $s_i = n/m$</td>
</tr>
<tr>
<td></td>
<td>average: $s_i = 0.5$</td>
<td>does not exist: $s_i = 0$</td>
<td>$s_i = n/m$</td>
</tr>
<tr>
<td></td>
<td>extensive: $s_j = 1$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total score: $S = \Sigma s_i$
Layer 2

- A single score for each provider

Strategy a: Weighted Sum

- Each group has its own preference weight
Strategy b: Variation of Conjoint Analysis

- For large number of groups and providers
- Fuzzy logic combined with trade-off tables

<table>
<thead>
<tr>
<th>User 1</th>
<th>SG Perfect</th>
<th>SG Medium</th>
<th>SG Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFG Perfect</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>CFG Medium</td>
<td>3</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>CFG Low</td>
<td>6</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>
Non-functional requirements

Usability
- Graphical UI
- Process completed in 5 steps
- Can be repeated as many times as needed

Adaptability
- Changes in CloudML@artist are reflected directly (new services, new providers, new cloud features)

Extensibility
- New groups of criteria and query types
- New decision making strategies
- Minimum source code modification
Performance Evaluation

- Average Query Execution time (**QE**)  
  - Average Response Time for loading one Provider’s Profile (**PP**)  
  - Average Response Time for Candidate Selection Criteria Extraction (**TotalExt**)  
  - Average Response Time for loading the Core Profile (**CP**)  

<table>
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<th>QE</th>
<th>PP</th>
<th>TotalExt</th>
<th>CP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average RT</td>
<td>≤1ms</td>
<td>2.75s</td>
<td>7.33s</td>
<td>4.72s</td>
</tr>
</tbody>
</table>

**Comments**  
- Boolean Queries seem to be the fastest  
- Measured for experimental versions of the profiles  
- CP time is included. This RT will be increased when extending the tool adding more groups of criteria  
- TotalExt-CP produces the RT for the model parsing phase of the extraction of the criteria
Future Work

- Extensions in the decision making mechanisms
- Identification and integration of more groups of criteria
  - Legal aspects
  - Benchmarks
  - ...
- Evaluation of the results?
THANK YOU!