Multidimensional Ontology-Based Personalization Modeling for Automatic Generation of Mashups in Next-Generation Portals

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Agenda

- Introduction to mashups
- Mashup framework overview
- Domain model
- Task model
- User model
- Personalization model
Introduction to Mashups

- **Mashup** is a web application that combines data and services from different sources into one integrated tool.
Existing Mashup Editors

- Provide a GUI environment to build and share mashups
- Examples:
  - Microsoft’s Popfly
  - Yahoo Pipes
- Limitations:
  - Require a certain level of technical knowledge
  - Time consuming
Framework for Automatic Generation of Mashups

- **Goal** – automatically generate personalized situational mashups
- **Personalized** – tailored to the needs of individual users or a certain group of users
- **Situational** – geared to a certain situation (e.g. trip planning)
Himalayas is a mountain range in Asia, separating the Indian subcontinent from the Tibetan Plateau. Read more from Wikipedia.

Dalai Lama is the spiritual and political leader of the Tibetan people. Read more from Wikipedia.

News article retrieved from http://www.msnbc.msn.com
Mashup Framework

3-rd Party Applications and Services

Content Provider
Unstructured Text Analysis Service
Applications and Services

Service Composition Module
Application Registry
Personalization Model

Mashup Handler
Personalization Engine
Domain Model

Mashup Presentation Module
User Model
Task Model

Portal

Content
Service Request
Service Response
Application Description
Semantic Application Description
Mashup Models
Composition Requests
RDF Data
Mashup Models
User Features

Text
RDF Data

www.minerva-portals.de
Finance Domain Model

- Defines concepts in financial domain
- Represented as an OWL ontology
- Reuses concepts from LSDIS Finance Ontology and XBRL Ontology [LSDIS, XBRL]
  - Domain-specific concepts: FinancialTransaction, BankStatement, Acquisition
- Grounded on the Proton Upper Level Module [Proton]
  - General concepts: Company, Address, Location
- Defines fine-grained categorization of industry sectors (partially based on the Yahoo Taxonomy)
Task Model

- Defines information-gathering actions that users might want to take on the portal
  - **Generic actions**: `getEncyclopediaArticle`, `getNews`, `getCompanyAddress`
  - **Domain-specific actions**: `getStockQuotes`, `getCurrencyExchangeRates`, `getMarketStatistics`

- Actions are represented as ontological concepts and described by their input and output parameters
  - `getEncyclopediaArticle`
    - Input data: concept, userInterest
    - Output data: encyclopediaArticle
User Model

- Reflects various user features
- Static part:
  - Date of birth
  - Gender
  - Mother tongue
- Dynamic part:
  - Interests
  - Expertise
  - Represented as an overlay model
## Representation of User Interests and Expertise

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>concept</td>
<td>a concept from domain ontology</td>
<td><a href="http://www.finance.com/Banking#">http://www.finance.com/Banking#</a></td>
</tr>
<tr>
<td>Interest</td>
<td>{not interested</td>
<td>partially interested</td>
</tr>
<tr>
<td>expertise</td>
<td>{novice</td>
<td>average</td>
</tr>
</tbody>
</table>
Membership Functions

- Membership functions are used to determine the degree of interest and expertise

\[ CF_{i,j} = \frac{c_{i,j}}{\sum_{k} c_{k,j}} \]

- **Numerator** – number of occurrences of concept \(i\) for user \(j\)
- **Denominator** – total number of occurrences of all concepts registered for user \(j\)
Personalization Model

- Specifies personalization rules that govern how the mashup content is provided to the user.
- Personalization rule is represented in the ECA form:
  
  on (event)
  if (condition)
  then (actions)

- **Event** denotes a situation when the user encounters a certain concept in the text.
- **Condition** is a combination of user features and context descriptors.
- **Actions** define the information gathering actions that should be delivered to the user if the event occurs.
Multidimensional Representation of the Personalization Model

User Interests

User Expertise

Document Concepts
Intersection of Dimensions

User Interests

User Expertise

Banking: novice

Banking: interested

Bank

Document Concepts

GetEncyclopeidaArticle
GetCompanyWebsite
GetNews
Arbitrary Number of Dimensions

- User Interests
- User Expertise
- Document Concepts
- User Demographic Characteristics
- Location
- Device
Inheritance of Personalization Rules

User Interests

User Expertise

Document Concepts

Bank Credit Union Exchange Ministry ...
Financial Organization Government Organization Organization
Inheritance of Personalization Rules

User Interests

User Expertise

Document Concepts

Financial Organization

Government Organization

Organization

Bank

Credit Union

Exchange

Ministry

...
Inheritance of Personalization Rules

User Interests

User Expertise

Document Concepts

www.minerva-portals.de
Inheritance of Personalization Rules

User Interests

Document Concepts

Financial Organization

Organization
Conclusion

- Augmenting the portal content with background information and related content through mashups
- Multidimensional ontology-based approach to personalization modeling for automatic generation of mashups
- The approach is currently being prototypically implemented in IBM’s WebSphere Portal
Questions & Answers