

# 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

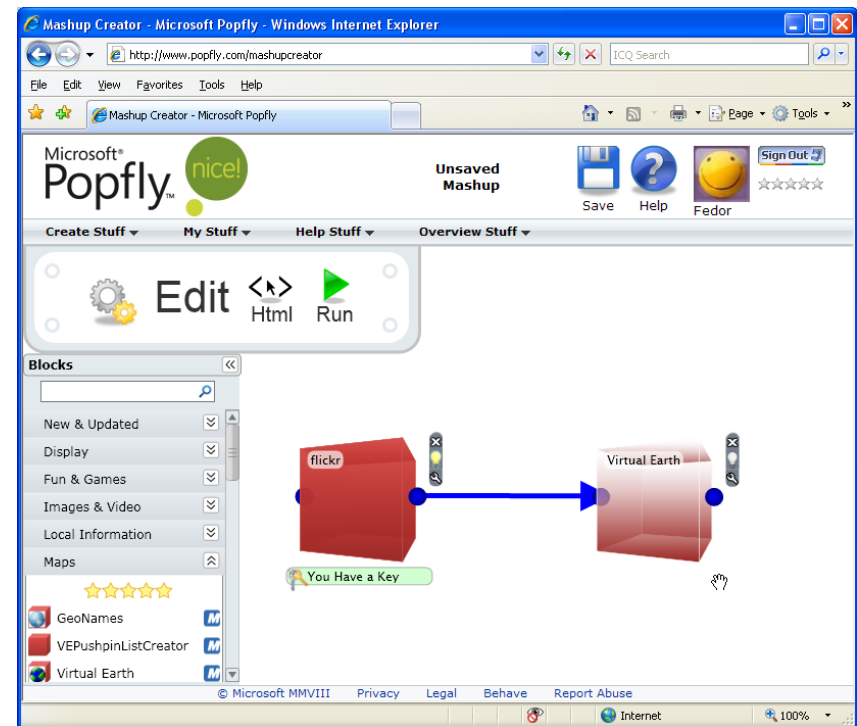
# Introduction to Mashups

- **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)

# Sample Mashup

## MyNewsPortal.com

Home Technology Finance Politics International Travel Entertainment

### China reopens Tibet to foreign tourists

Tibet reopened to foreign tourists on Wednesday, three months after the Chinese government banned such visits in the wake of violent anti-government riots and protests that tainted the image of the country ahead of the Olympics.

The first foreign tourists, a retired Swedish couple, arrived at the airport near the capital, Lhasa, on Wednesday, said Tibetan Tourism Bureau spokesman Liao Lisheng.

"Tibet is open now to all travelers from home and abroad," he said.

Kurt P... at the... additional Tibetan white silk scarves... News Agency said.

"We're fasci... monasteries and landscapes are

Their in... carries about the safety here," she said. "The onl... get the permission to come to Tibet."

The Himalayan region has been all but closed to the outside world since the biggest protests against Chinese rule in two decades exploded into rioting March 14 in Lhasa, leading Beijing to swiftly shut off the area.

Troops also flooded into predominantly Tibetan communities in nearby provinces, where sympathy demonstrations were occurring. They performed drills in town squares and set up checkpoints around sensitive areas. Officials said the restrictions were established for the safety of foreign tourists and journalists.

A notice on the tourism bureau... returned to normal.

"Tibet's society is stable and h... ul," it said.

But there are still signs of tens...

Buddhist monasteries seen as incub... government sentiment have been surrounded by security forces and closed off as se... anes were conducted and monks forced to undergo intensified political indoctrination against the Dalai Lama, Tibet's exiled spiritual leader. Drepung, one of Lhasa's main monasteries, remains shut.

**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](#)

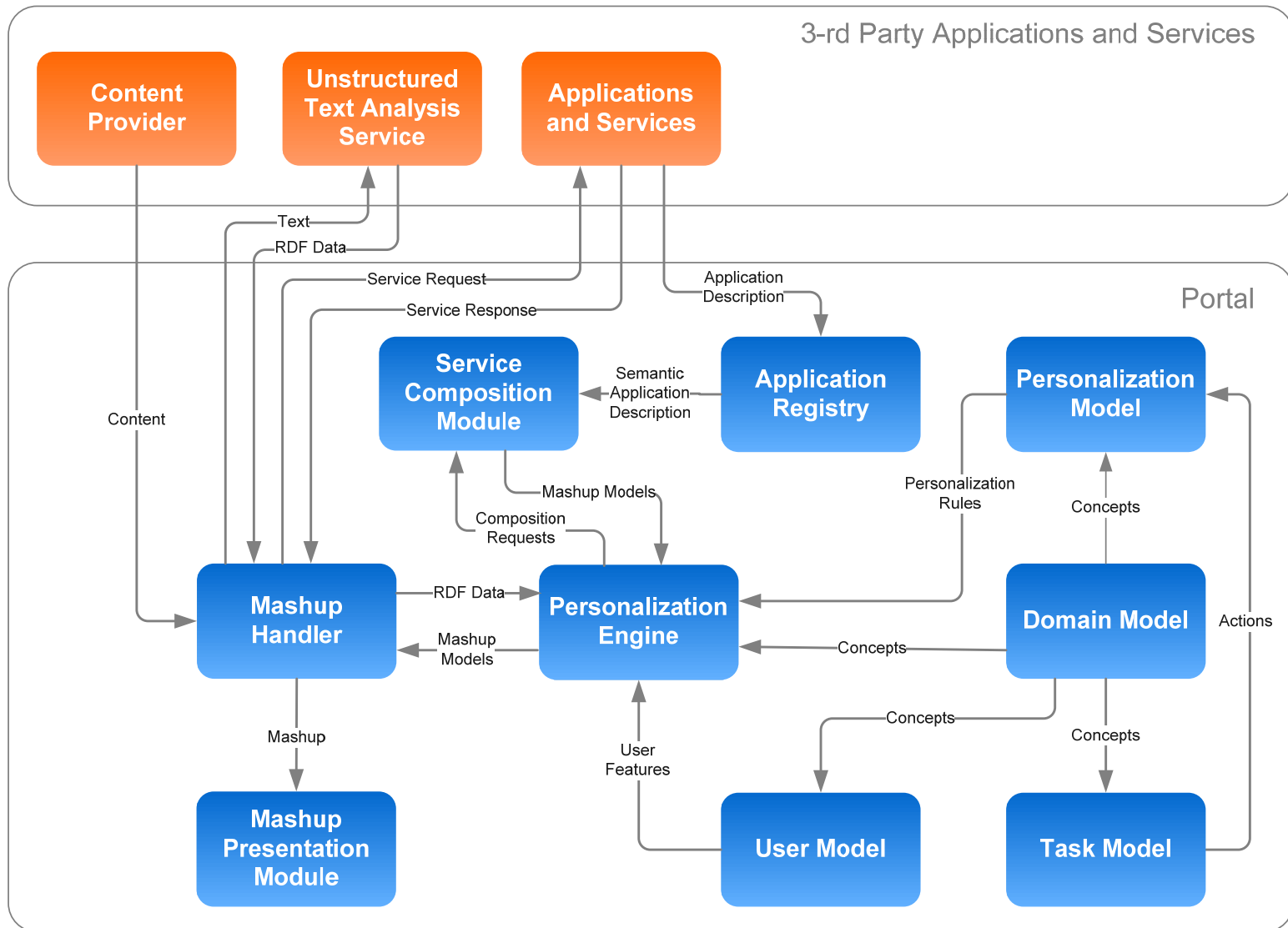


Flights: Frankfurt - Lhasa				
June 30, 2008				
€1205	Air China	FRA 14:15	LXA 10:40	
€1228	Multiple	FRA 16:25	LXA 13:41	
€1005	Air China	FRA 17:13	LXA 15:48	
€1310	Multiple	FRA 19:55	LXA 17:11	
€1310	Multiple	FRA 23:25	LXA 21:41	

[More flights](#)

News article retrieved from <http://www.msnbc.msn.com>

# Mashup Framework



# 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)

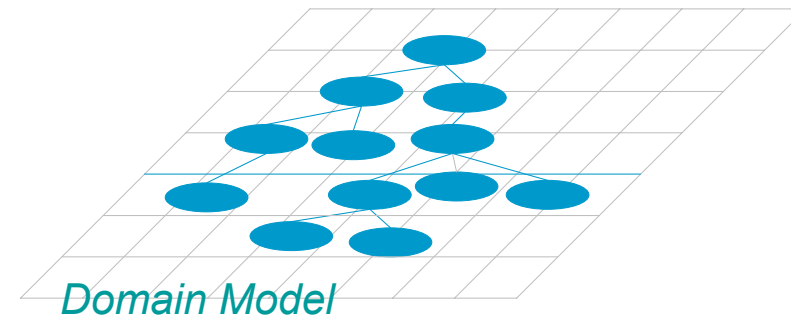
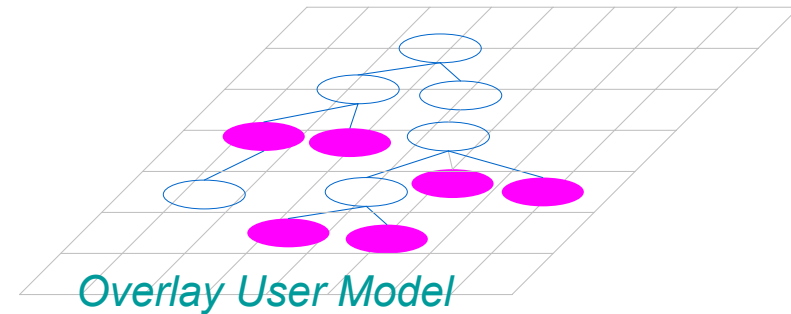


# Task Model

- 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

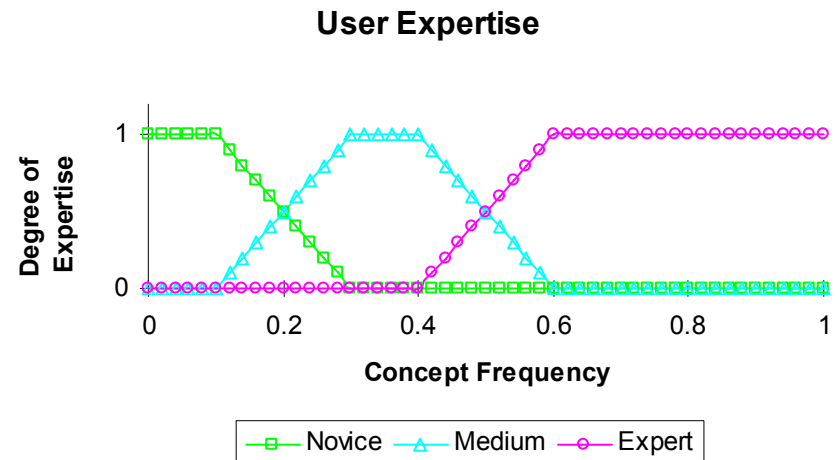
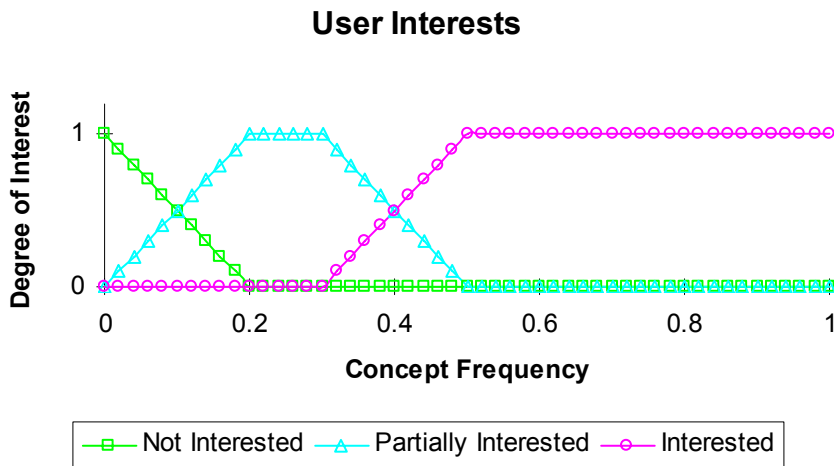


# Representation of User Interests and Expertise

Attribute	Description	Example
concept	a concept from domain ontology	<a href="http://www.finance.com/Banking#">http://www.finance.com/Banking#</a>
Interest	{not interested   partially interested   interested}	interested
expertise	{novice   average   expert}	novice

# Membership Functions

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



$$CF_{i,j} = \frac{c_{i,j}}{\sum_k c_{k,j}}$$

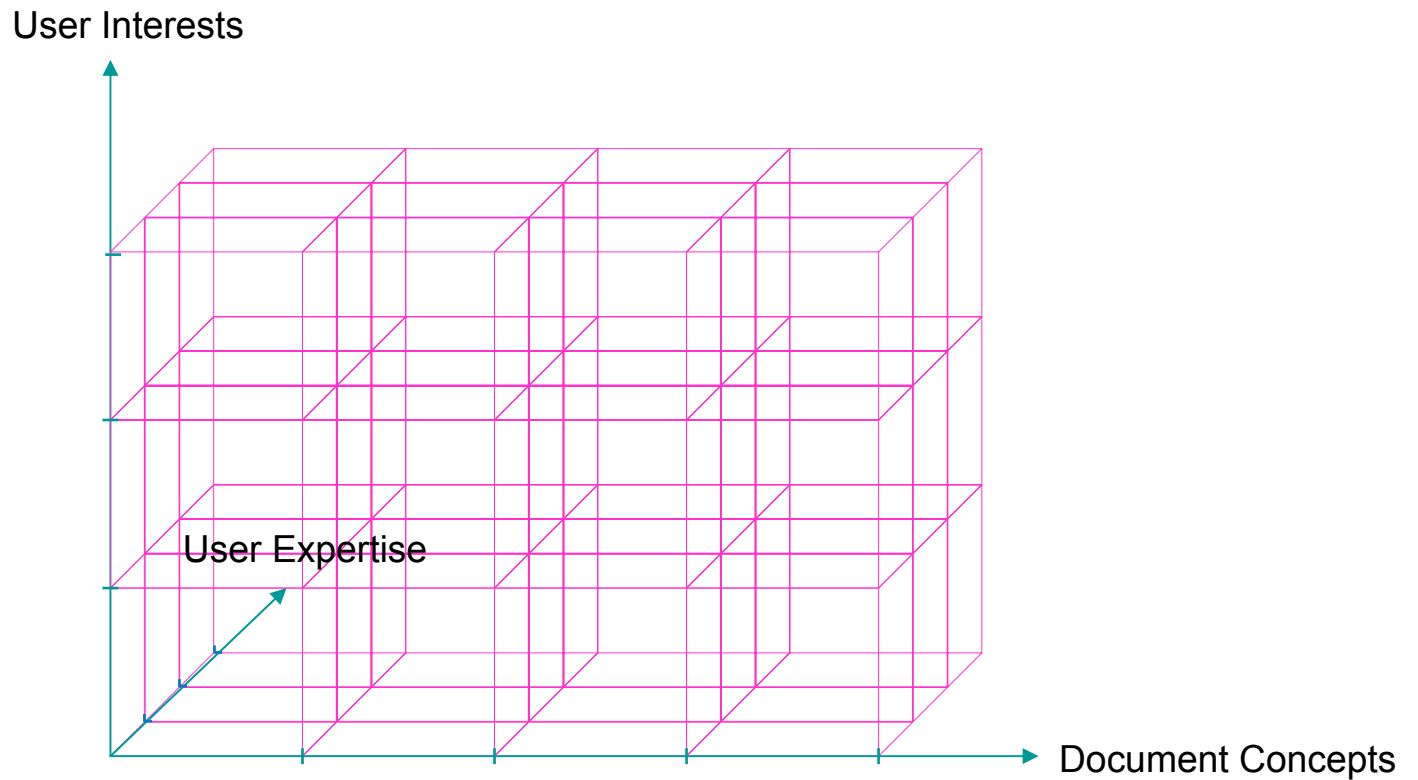
- **Numerator** – number of occurrences of *concept*<sub>*i*</sub> for *user*<sub>*j*</sub>
- **Denominator** – total number of occurrences of all concepts registered for *user*<sub>*j*</sub>

# Personalization Model

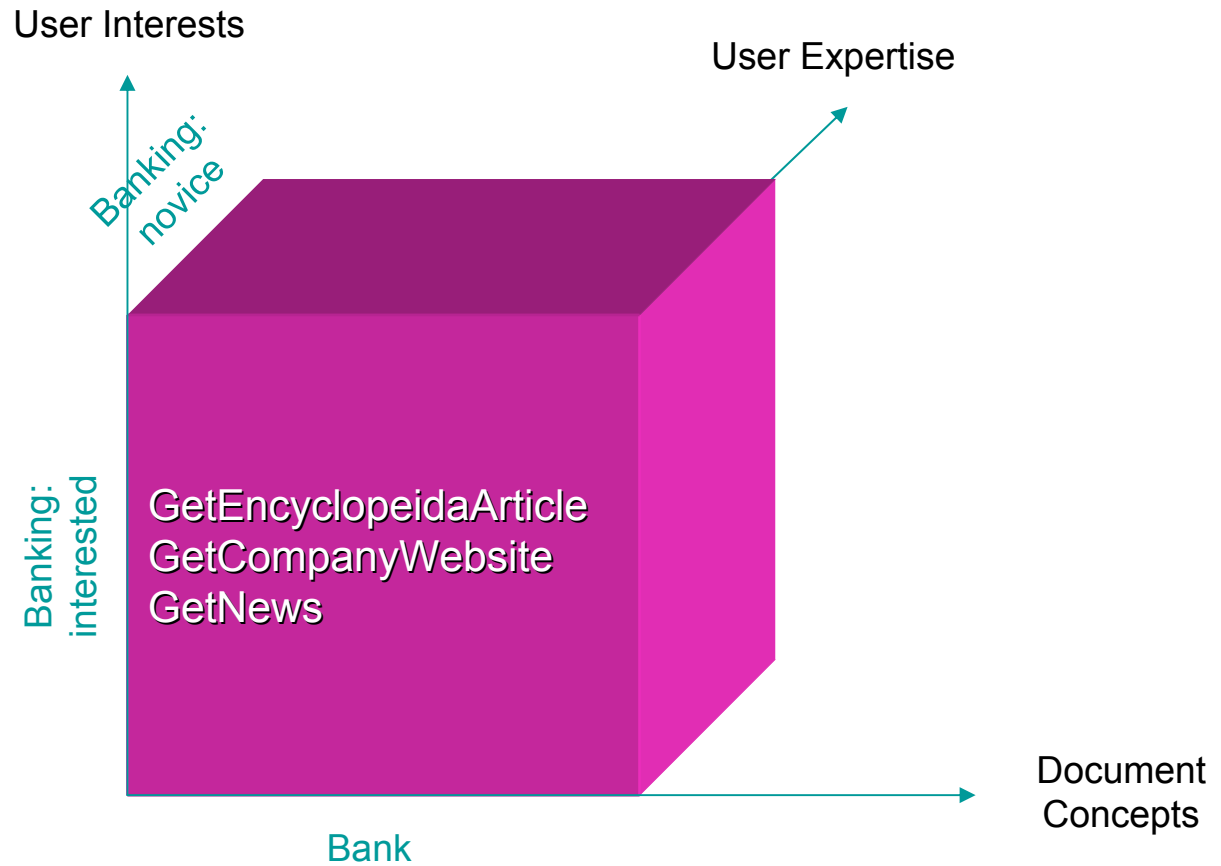
- ❑ Specifies personalization rules that govern how the mashup content is provided to the user
- ❑ Personalization rule is represented in the ECA form:

```
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

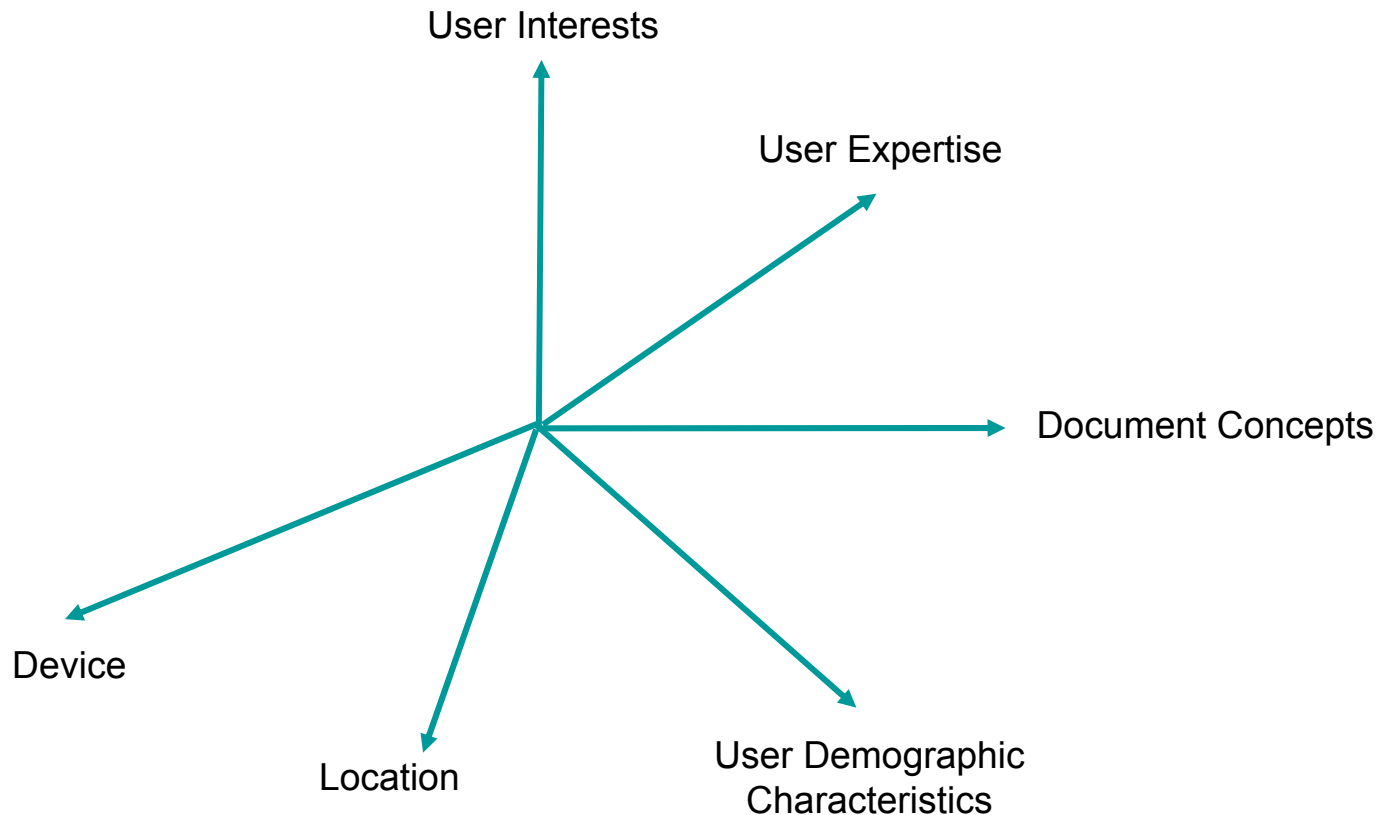
# Multidimensional Representation of the Personalization Model



# Intersection of Dimensions



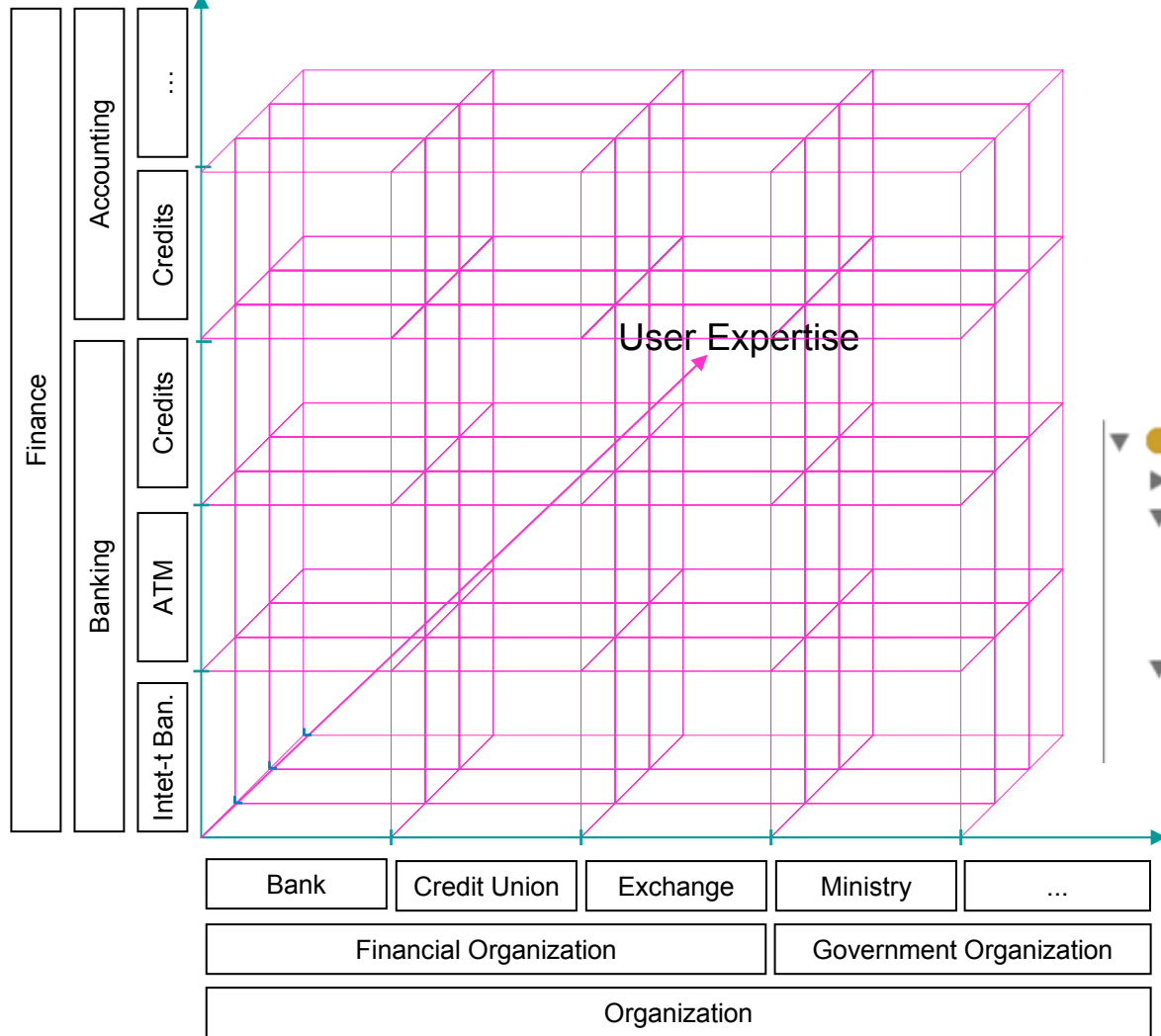
# Arbitrary Number of Dimensions





# Inheritance of Personalization Rules

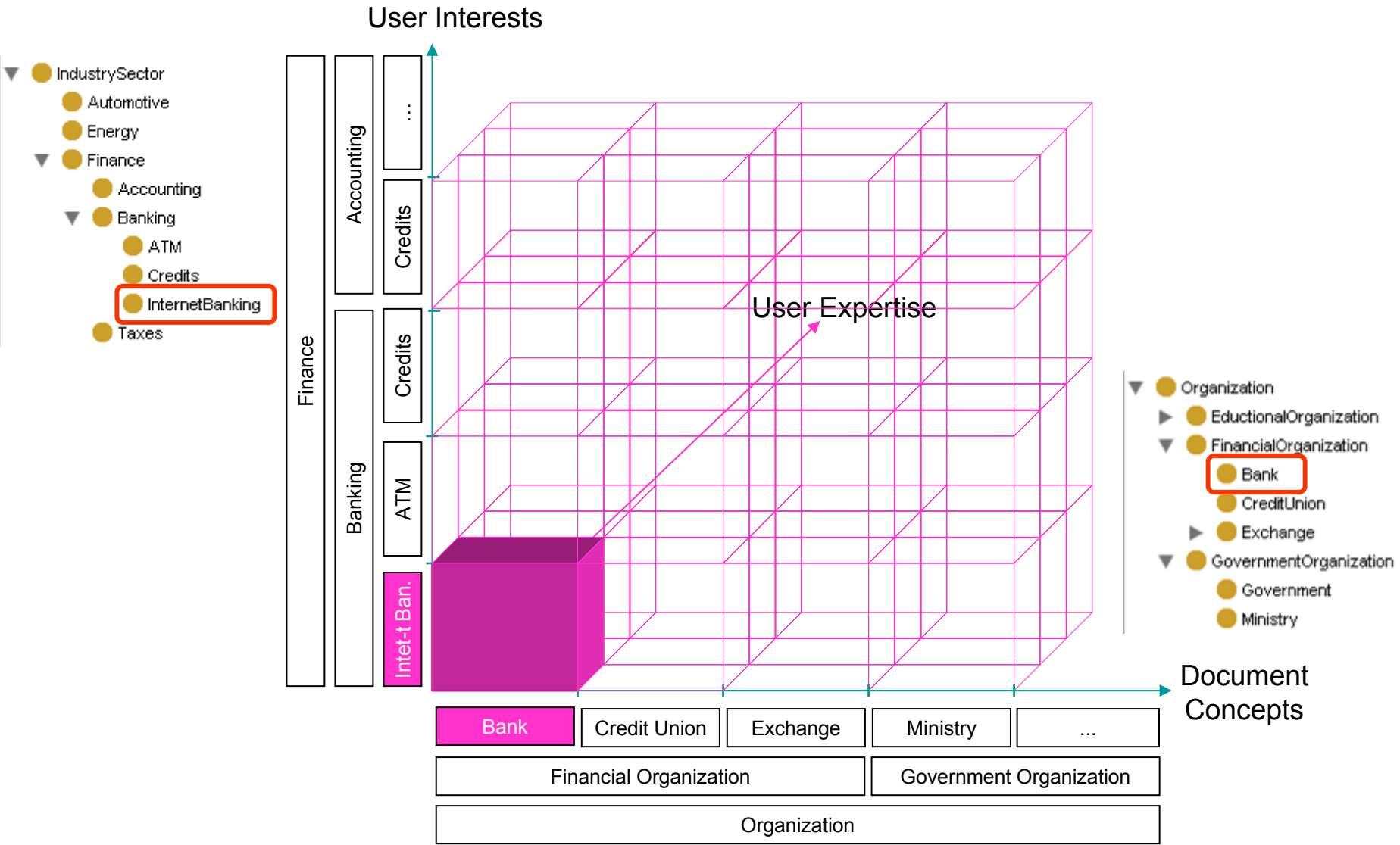
User Interests



- ▼ ● IndustrySector
  - Automotive
  - Energy
- ▼ ● Finance
  - Accounting
- ▼ ● Banking
  - ATM
  - Credits
  - InternetBanking
  - Taxes

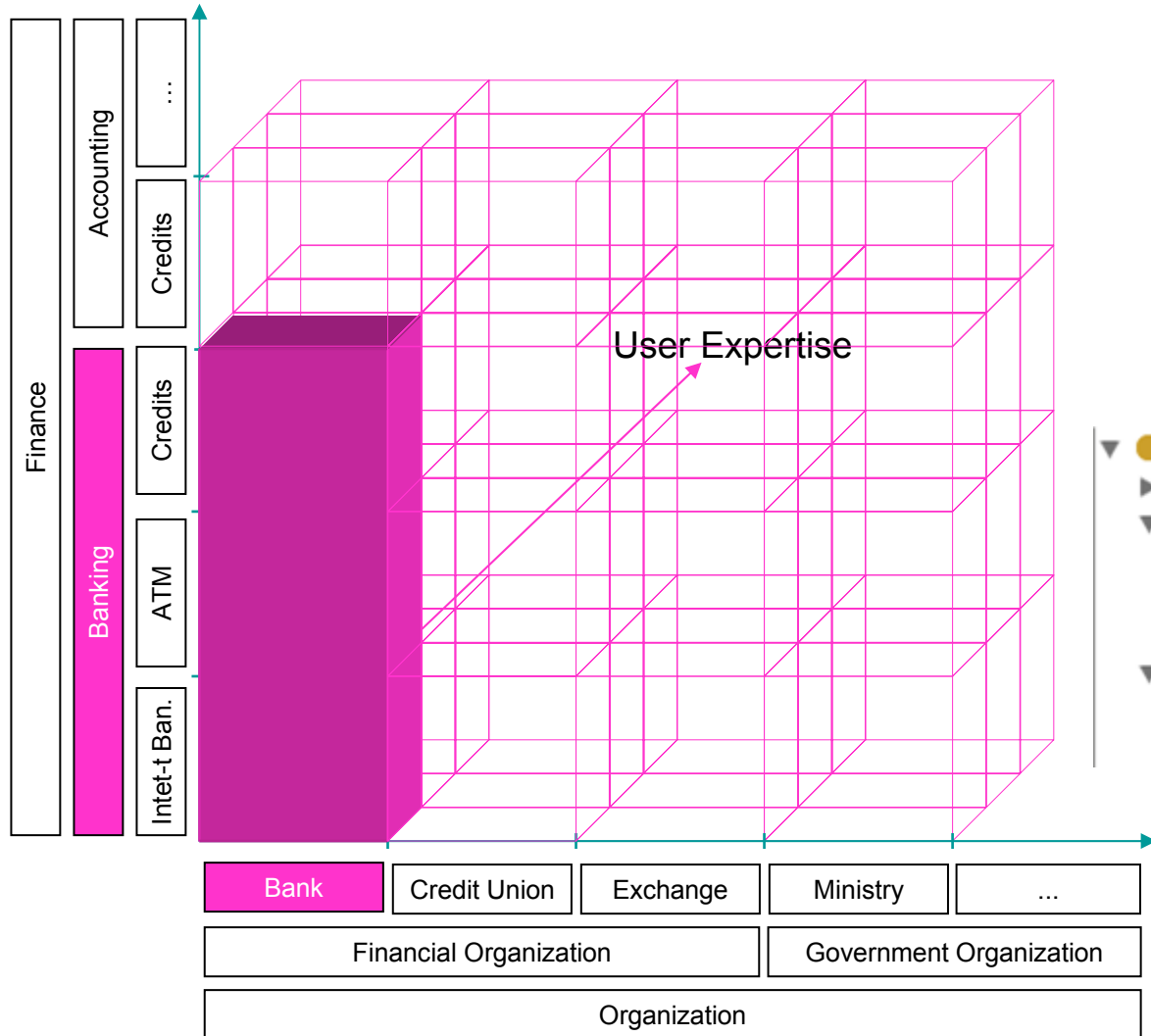
- ▼ ● Organization
  - ▶ ● EducationalOrganization
  - ▼ ● FinancialOrganization
    - Bank
    - CreditUnion
  - ▶ ● Exchange
  - ▼ ● GovernmentOrganization
    - Government
    - Ministry

# Inheritance of Personalization Rules



# Inheritance of Personalization Rules

User Interests



- ▼ ● IndustrySector
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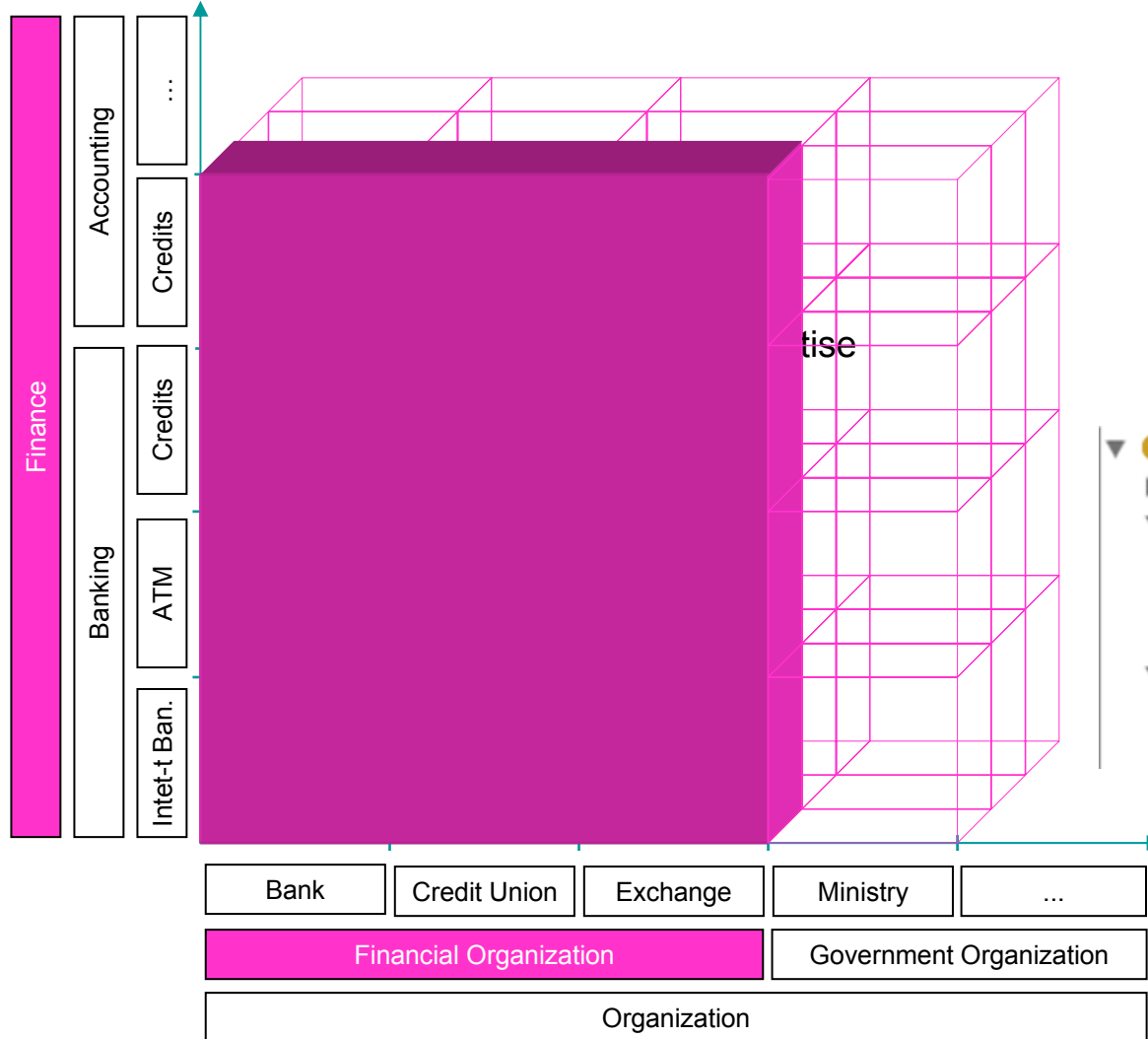
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    - CreditUnion
    - ▶ ● Exchange
    - ▼ ● GovernmentOrganization
      - Government
      - Ministry

Document Concepts

Bank	Credit Union	Exchange	Ministry	...
Financial Organization			Government Organization	
Organization				

# Inheritance of Personalization Rules

User Interests



- ▼ IndustrySector
  - Automotive
  - Energy
  - ▼ **● Finance**
  - Accounting
  - ▼ Banking
    - ATM
    - Credits
    - InternetBanking
  - Taxes

- ▼ Organization
  - ▶ EducationalOrganization
  - ▼ **● FinancialOrganization**
    - Bank
    - CreditUnion
    - ▶ Exchange
  - ▼ GovernmentOrganization
    - Government
    - Ministry

Document Concepts

# 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*