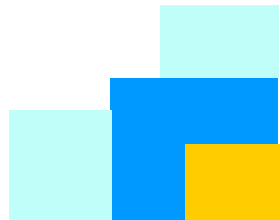


Workshop on Challenges and Promise of Semantic Web Services

School of Computing and Informatics, 6 September 2006



Semantic Web Services Research at NTU

□ Projects involving Semantic Web services

➤ Dynamic Services Composition (DYSEC)

- Bridging the Gap between Semantic and Non-Semantic standards for Web services Composition
- Semantic Case Based Reasoner for Web services composition (S- CBR)

➤ Semantic Geographic Information Service

- Semantic Spatial Web Services with Case-Based Reasoning

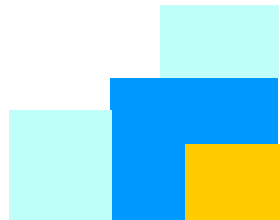
➤ Semantic Web based Image Retrieval (SWIR)

Using Case Based Reasoning for Intelligent Web Service Composition

A decorative horizontal brushstroke consisting of two overlapping layers, the top one in blue and the bottom one in yellow, with a textured, hand-painted appearance.

Dhaval Kumar Thakker
Dr Taha Osman

Challenges and Promise of Semantic Web Services Workshop, 6 September, 2006.



Synopsis

- ❑ State of Web services technology today- motivation
- ❑ Web services composition(WSC)- current approaches
- ❑ Semantic Case Based Reasoner (S-CBR) for Web services discovery and matchmaking
- ❑ S-CBR implementation highlights
- ❑ Conclusions



State of Web Services – Our Motivation

- Hype and Reality
 - A marketing initiative
 - Interoperability
 - Seamless publication beyond firewall
- Composition is future boost
 - Value-added services
 - Application integration : EAI, B2B
- Our Motivation: Pragmatic vision for Web services development
 - Consumer focused approach
 - Encouraging Adoption by Facilitation



Web Service Composition

- Web service Discovery and Matchmaking
 - Selecting Services that will fulfil the requirement in accumulation or will create value-added service
- Web service Flow Management
 - Formalize the Order in which the web services operations are invoked
[control flow]
 - Formalize the order in which the data is passed between web services operations
[dataflow]



Current Composition Approaches

□ Workflow-based

➤ Preferred by Industry

- Builds on
- Poss
- Ma

➤ Prac sele

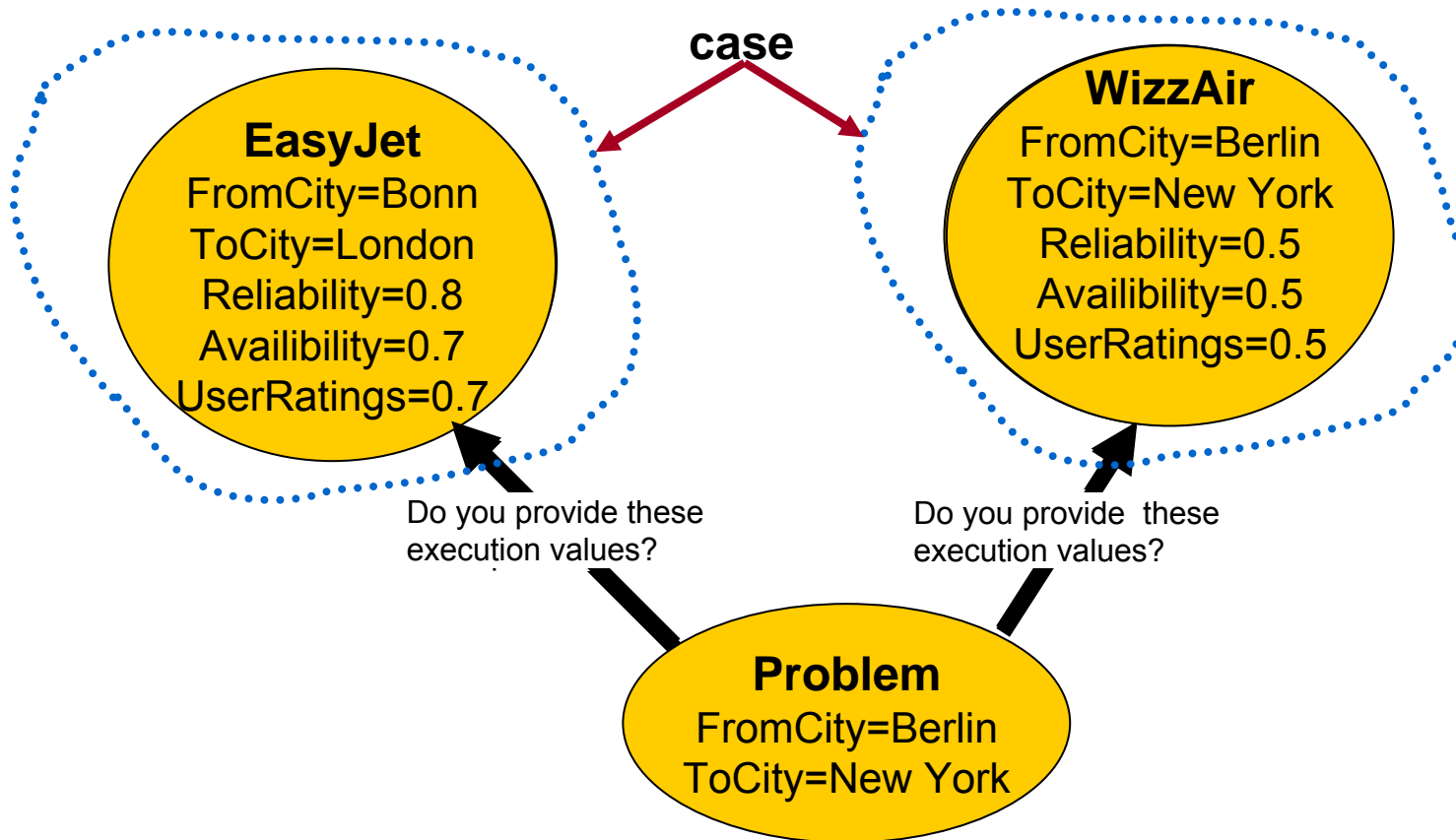
□ Semantic

➤ The S interf

-
- High develop. heterogeneity of proposed solutions desperate constraining practical adoption

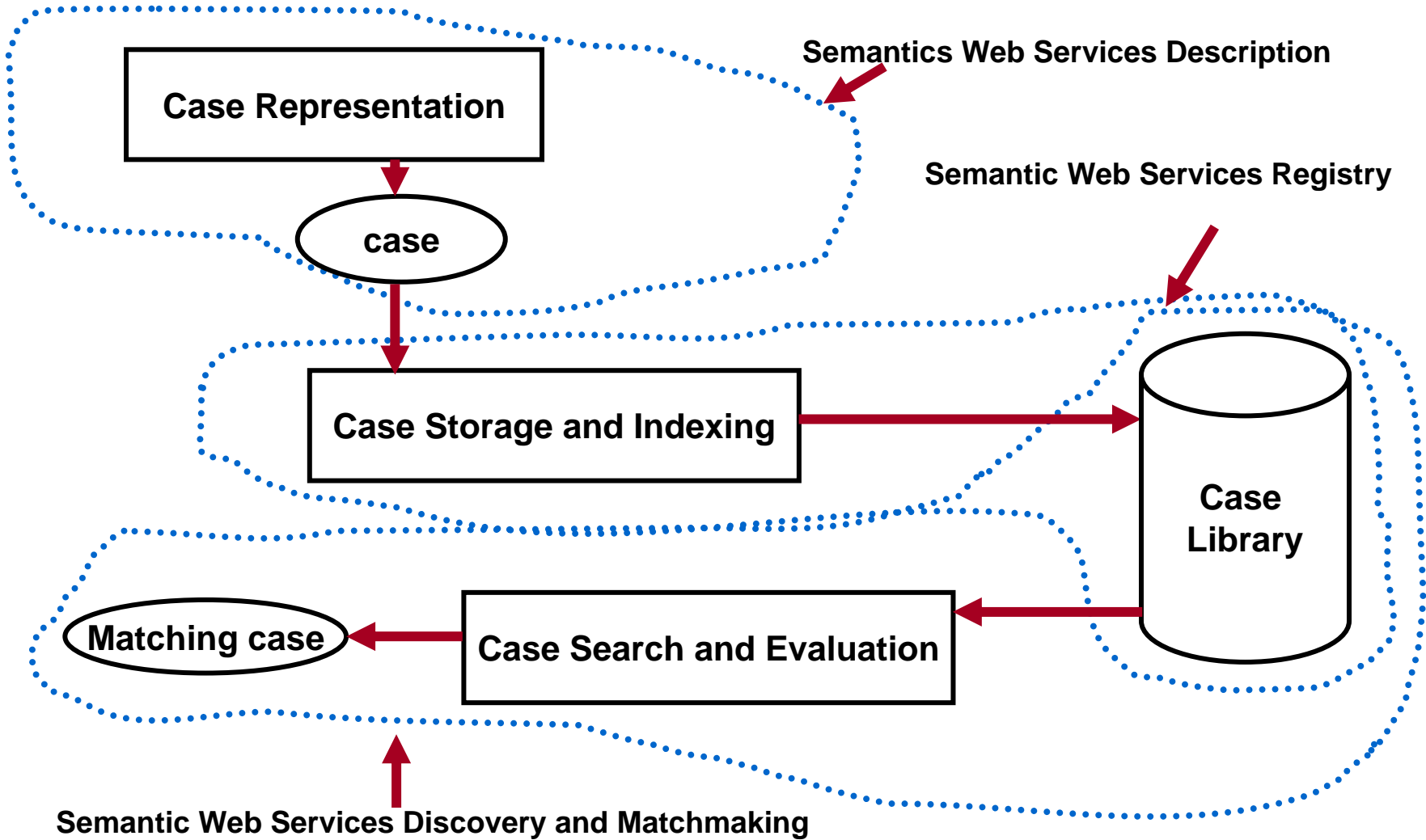
**Semantic Web based Approaches
Match Static Behaviour
of services**

S-CBR for Web Services Matchmaking



Web Services Discovery and Matchmaking - Our Approach

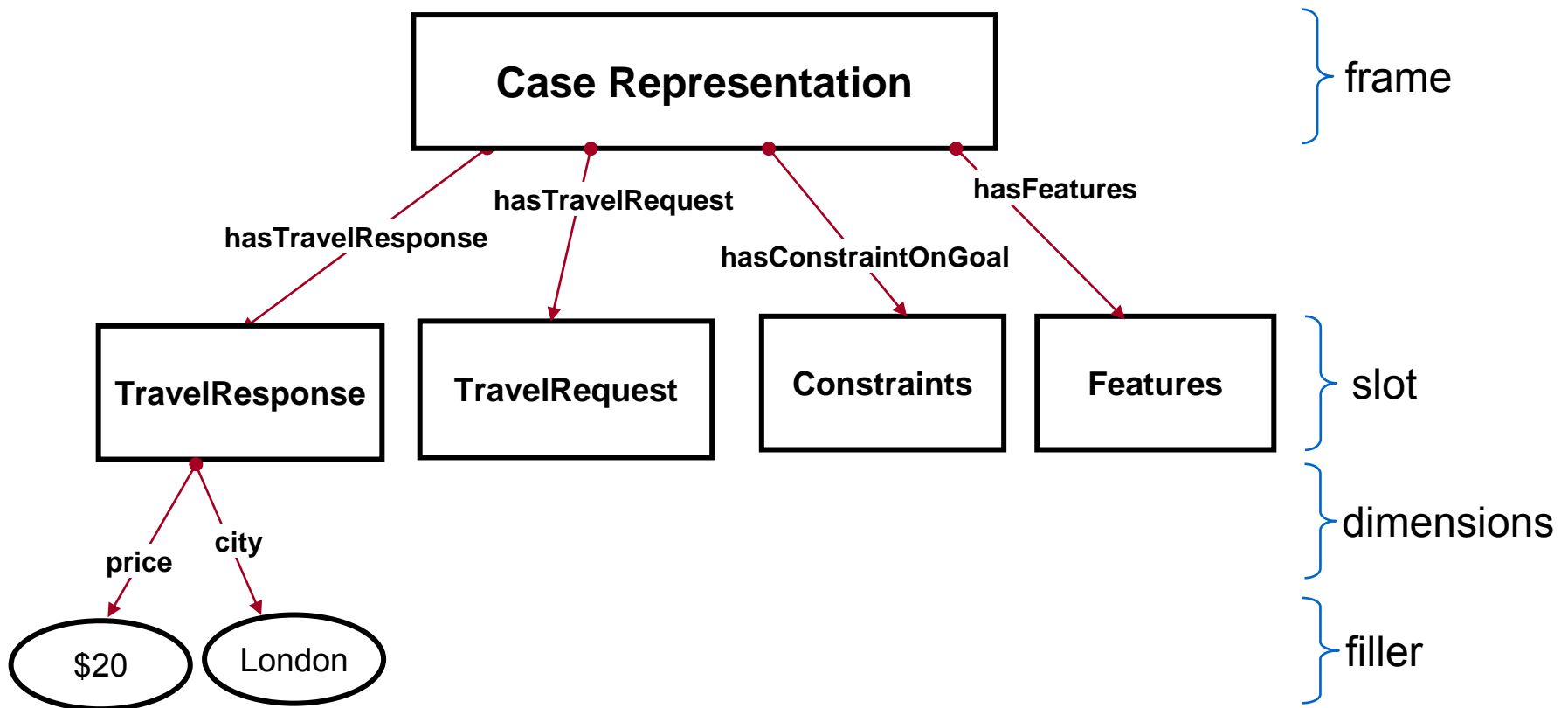
Case Based Reasoning Dynamics



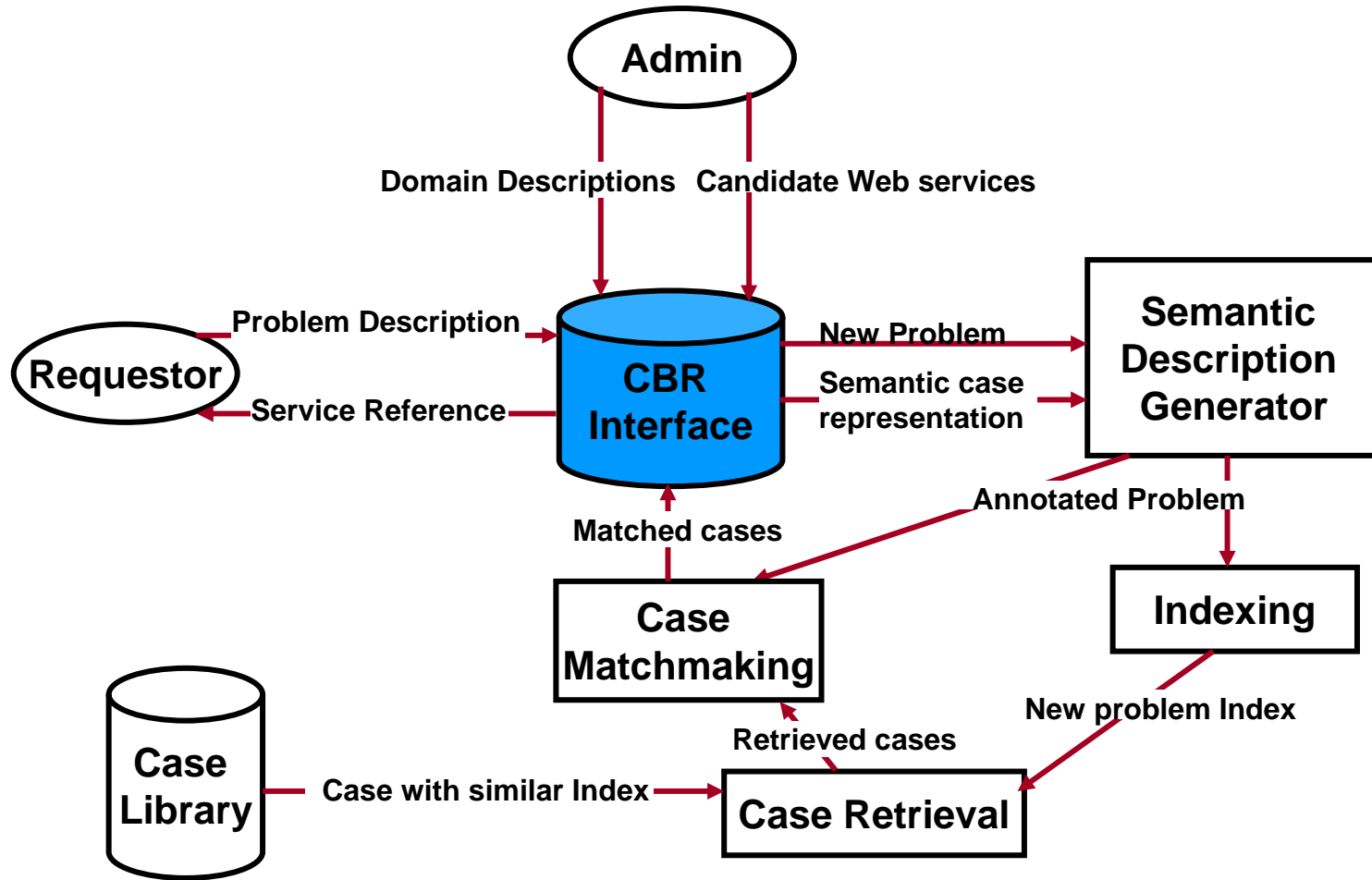
Case Representation

- Frame structures

 - Slots/Dimensions/Filler



Our Semantic CBR Framework



Semantic CBR Implementation

- Case representation using frame structures and ontologies
- Semantics based case storage and retrieval
- Preliminary results



I - Case Representation

□ Case Vocabularies

➤ Functional Parameters

- Inputs (Travel Details)
- Outputs (Travel Itinerary)

➤ Non-Functional Parameters

- Constraints on various values (exclusion of particular travel domain)
- Preferences (price range, currency, quality of service)

➤ Solution

➤ Success/Failure

I - Case Representation

□ Example Case Representation

Slot	Dimension	Filler
Travel Request	Name of passengers	Any text
	Date of Arrival	Any valid date
	City of Departure	Any valid city
Constraints	On Domain	Any Valid Travel Domain
	On Price range	Any positive Double
	On QoS parameter	Any possible QoS parameter(s)



I - Case Representation

Name of passengers	Lee	<TravelRequest:namePassengers>Lee</TravelRequest:namePassengers>
City of Arrival	Boston	<TravelRequest:cityArrival rdf:resource="http://localhost/ntu/ac/uk/2005/onto/City.owl#Boston"/>
Date of Arrival	01-03-2005	<TravelRequest:dateArrival>2005-03-01</TravelRequest:dateArrival>
Constraint on domain	Road	<Constraints:OnDomain rdf:resource="http://localhost/ntu/ac/uk/2005/onto/TravelDomain.owl#Airline"/>
Constraint on price	220	<Constraints:OnPrice>220</Constraints:onPrice>
Constraint on currency	USD	<Constraints:OnCurrency rdf:resource="http://www.daml.ecs.soton.ac.uk/ont/currency.daml#USD"/>
Constraint on QoS	1.5 s	<QoS:ExecutionDuration>1.5</QoS:ExecutionDuration>

II - Case Storage and Retrieval

□ Storage

- Indexing based on the functional/non-functional parameters
- Divides cases in number of sections for further analysis



□ Retrieval and Matchmaking

- Nearest Neighbour Matching and Ranking method
 - Compare similarity for each property, between the new problem and the cases retrieved.
 - Quantify the weight of the similarity. Ranking is assigned to each property in accordance with its importance. For example,

Slot	Dimension	Importance (0-1)
Travel Request	City Departure	0.1
	City Arrival	0.1
Constraints on Goal	On Instance	0.2



II - Case Storage and Retrieval

□ Similarity Measurement

➤ Data property comparisons

$$|V_r - V_c| \leq X \cdot |V_r|$$

- V = the value of the property in the request r or in the retrieved case c
- X = the factor of tolerance

➤ Object property comparisons

$$DoM = \frac{MN}{GN}$$

- MN is Total number of matching nodes in the selected traversal path, and
- GN Total number of nodes in the selected traversal path

II - Case Storage and Retrieval

□ Overall similarity measure

$$ADoM = \frac{\sum_{i=1}^n W_i \times sim(f_i^N, f_i^R)}{\sum_{i=1}^n W_i}$$

- Where, n is the number of ranked dimensions,
- W_i is the importance of dimension i ,
- sim is the similarity function for primitives, and
- f_i^N and f_i^R are the values for feature f_i in the new problem and the retrieved case respectively.

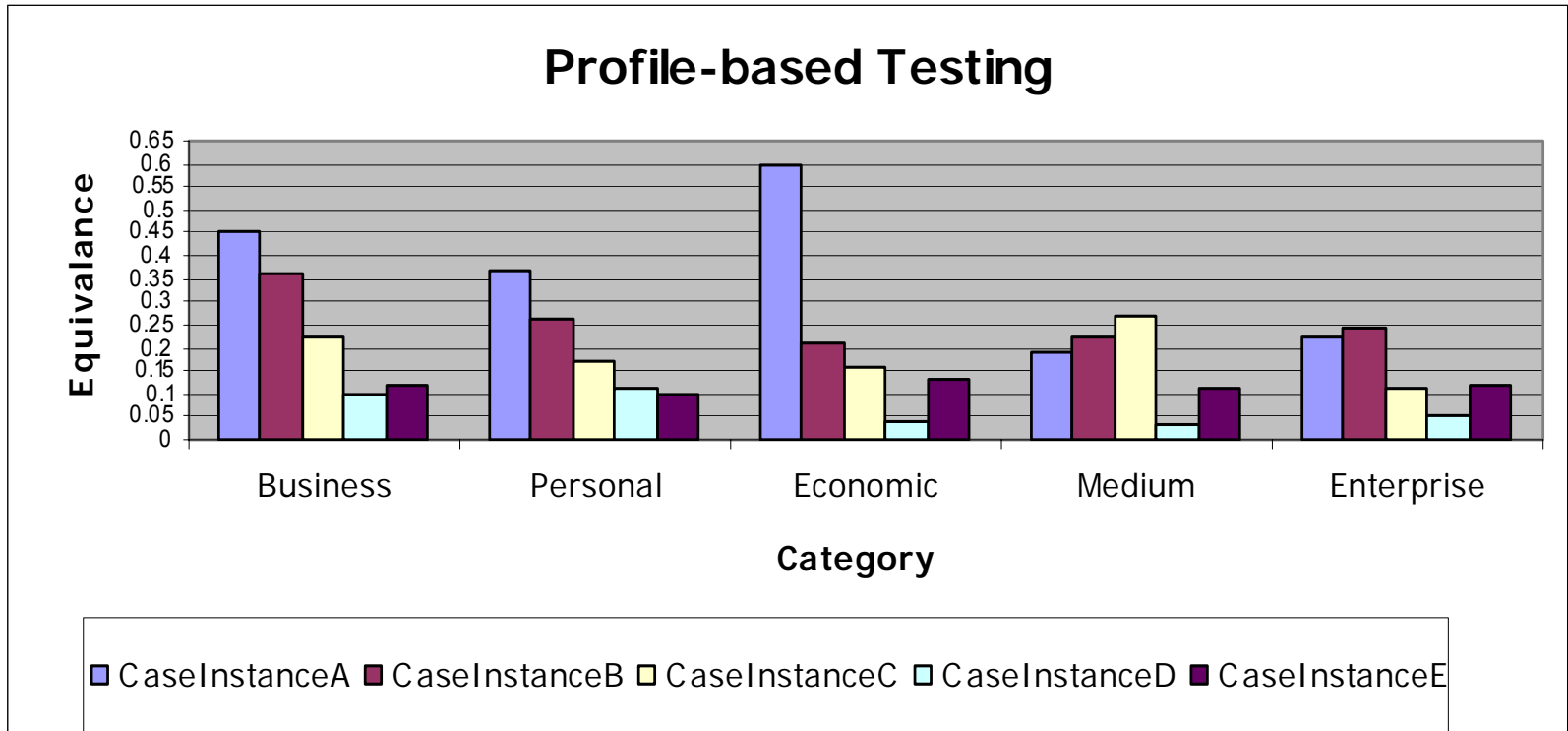
III - Preliminary Results

□ Profile of Users

- Business
- Personal
- Economic
- Travel Medium
- Enterprise

	<i>Property</i>				
<i>Profile</i>	<i>Category</i>	<i>Constraint on Domain</i>	<i>Constraint on Instance</i>	<i>Price</i>	<i>Quality of Service</i>
Business	0.6	0.6	0.4		0.5
Personal	0.2	0.4	0.7	0.5	0.2
Economic	0.2	0.4	0.2		0.1
Travel Medium	0.2	1	0.8	0.3	0.2
Enterprise	0.5	0.3	0.1	0.2	1

III - Preliminary Results



Conclusions

- ❑ Automatic over Static Composition
- ❑ S-CBR framework for service discovery and matchmaking
 - Use of past experience to discover best-suited Web service to the requestor needs
 - Semantic encoding of CBR rules and business logic
 - (Semi-) Automation aspects for requestor and administrator of the CBR registry/library
- ❑ Future work will extend the framework for service compositions.
 - Case Adaptation to exploit the existing framework